MINISTRY OF INTERIOR PROVINCIAL WATERWORKS AUTHORITY

FINAL REPORT FOR

DEVELOPMENT PLAN AND FEASIBILITY STUDY ON

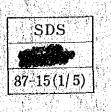
PROVINCIAL WATER SUPPLY PROJECTS

THE KINGDOM OF THAILAND

VOLUME I SUMMARY

MARCH 1987

JAPAN INTERNATIONAL COOPERATION AGENCY



No

1/0



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PREFACE

In response to the request of the Government of the Kingdom of Thailand, the Japanese Government has decided to conduct Development Plan and Feasibility Study on Provincial Water Supply Projects and entrusted the Study to the Japan International Cooperation Agency (JICA). JICA sent to the Thailand a study team headed by Mr. Osamu Wakamoto, Nihon Suido Consultants Co., Ltd. from December 1985 to December 1986.

The team had discussions with the officials concerned of the Government of the Thailand and conducted a field survey in the Study Areas and Bangkok. After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries. I wish to express my deep appreciation to the officials concerned of the Government of the Thailand for their close cooperation extended to the team.

March 1987

Keisuke ARITA President Japan International Cooperation Agency

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SUMMARY

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1. Introduction

1.1 Study

This report summarizes the results of the Development Plan and Feasibility Study prepared by a study team of the Japan International Cooperation Agency (JICA), from November 1985 to February 1987, on the Provincial Water Supply Projects in the Kingdom of Thailand, for the Provincial Waterworks Authority (PWA).

1.2 Study Area

The study covers the following four areas (see Fig-S.1).

Chiangmai and its five suburban Sanitary Districts of Mae Rim, San Kamphaeng, San Sai, Saraphi and Hang Dong

Ubon Ratchathani and Warin Chamrap Municipalities, Ubon Sanitary District, five villages of Ban Don Klang, Ban Pak Huai Wang Nong, Ban Tha Bong Mang, Ban Hat Suan Ya and Ban Mai Klang.

Suphanburi Municipality and Phophraya Sanitary District

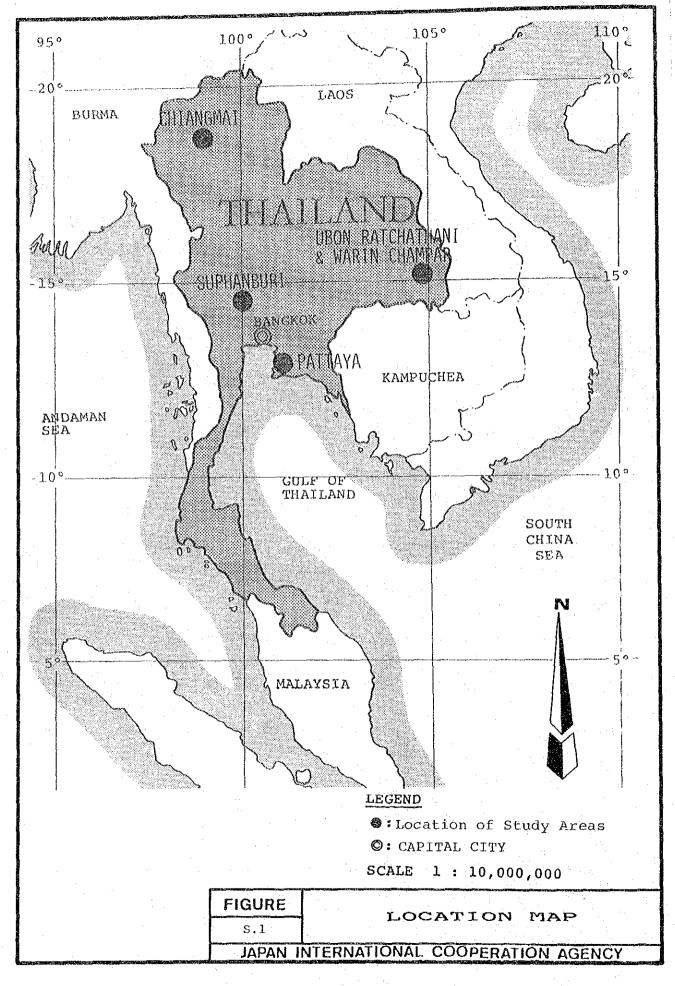
Pattaya city, Nong Preo Sanitary District and Ban Rong Po.

The current project will constitute part of 6th National Five-Year Economic and Social Development Program for 1986 - 1990 which is now being prepared.

1.3 Target Year of the Project

In accordance with the strategic policy of PWA, the Project is targeted at the year 2010 for master planning and at 2000 for feasibility study.





2. Population and Water Demand

As shown in Table-S.1, the combined total of populations in the four areas are projected to increase from 442 thousand in 1984 to 562 thousand in 2000 and further to 631 thousand in 2010, and that of served population likewise from 171 thousand to 346 thousand and further to 466 thousand. The incremental served population will thus need, as shown in Table-S.2, additional water supply of 67 thousand cu m/d up to 2000 and 117 thousand cu m/d up to 2010 on the top of 1985 supply of 55 thousand cu m/d. Demand comes from varied uses including domestic, public, institutional, commercial and industrial ones. In Chiangmai and Pattaya particularly, uses for tourism have a heavy weight on their future municipal development.

3. Water Supply System

The Development Plan proposes immediate improvement programs to rehabilitate the existing systems, together with immediate modification works to increase the production-supply capacity of the existing facilities. These immediate actions are required to be carried out prior to the Stage I expansion programs, or as part of their initial phases.

To satisfy the maximum day demand for each of the four areas as projected in Fig-S.2, the capacity expansions as presented in step-wise lines of the same Figure are planned in the facilities of the respective areas. The combined total of these capacity expansions in the four areas during the project period through 2010 will amount to 274 thousand cu m/day or 2.7 times as large as the 1985 capacity. Raw waters for the present and expanded supply will be provided from the water sources listed in Table-S.3.

4. Project Cost and Implementation Schedule

4.1 Project Cost

The combined project cost for the four areas is shown in Table-S.4. Of the total cost of 2,000 million Baht, 48 % is used for the Stage I and 52 % for the Stage II.

			1		
		Present(1984)	2000	2010	Remarks
	· · · · · · · · · · · · · · · · · · ·	· · ·	. · · ·		
					and an
1.	Chiangmai				
	Total Population	216,730	256,900	283,100	Chiangmai
	Service Ratio (%)				and 5 S.D.
	Chiangmai	48	70	75	and the second second
, i	Mae Rim	41	65	70	·
· · · · · ·	San Kamphaen	g 29	57	65	
	San Sai	-	- 1.	50	
	Saraphi		-	50	1.
	Hang Dong		- .	50	
	Served Population	82,900	147,700	198,100	
	Service Area (ha)	5,070	7,300	15,000	
	Service Area (ha)	5,010		•	
2	Ubon and Warin				
2.	UDOII anu warin				en en de la companya
		140 600	178,700	196,500	Ubon, Warin,
	Total Population	142,630	110,100	10,000	Ubon SD and
	Service Ratio (%)	10 ⁻¹	<u> </u>	76	5 Villages
	Ubon, Warin	40	61	75 75	JVILIAGES
	Ubon SD	· -	61		
	5 Villages		31	50	
	Served Population	51,500	107,400	146,000	
	Service Area (ha)	2,000	3,900	4,600	
3.	Suphanburi				an an an Anna a Anna an Anna an
	Suprimbul x			·	
	Total Population	26,890	34,000	37,600	Suphanburi and
	Service Ratio (%)	75	92	94	Phophraya SD
	Served Population		31,300	35,300	
		1,200	2,300	3,100	
	Service Area (ha)	1,200	2,500	5,100	
	5			•	
4.	Pattaya				
		FF: 000	~~~~~	114 000	
	Total Population	55,900	92,000	114,000	Pattaya, Nong
	Service Ratio (%)	30	65	76	Preo SD and
	Served Population		59,800	86,700	Ban Rong Po
	Service Area (ha)	1,330	2,700	3,100	
			· · · ·		a shekara shekara shekara shekara shekara shekara s
5,	Total			1	
5,			4 19 - 19 - 19 - 19 - 19 - 19 - 19 - 19 -		
5,	Total Population	442,150	561,600	631,200	
5.		442,150 39	561,600 62	631,200 74	
5,	Total Population	39			

Table-S.1 TOTAL AND SERVED POPULATION

		s 5			•
		5 5			
·			an an an Arran an Ar Arran an Arran an Arr		
		· · · · · · · · · · · · · · · · · · ·			
	Tab.	le-S.2 WAI	ER DEMAND		
·. · · ·		1985	2000	2010	
		<u> </u>	<u></u>		
1.	Chiangmai				
e te con	Water Consumption (m3/d)	26,300	53,000	74,800	
	Unaccounted-for Water Ratio (%)	32	23	20	
	Average Day Water	. 32	23	20	
·. ·	Demand (m3/d)	38,400	68,900	93,700	
	Peak Factor				
	Chiangmai	· ·	- 1.25 -		
	5 SDs		- 1.35 -		
•	Maximum Day Water	10.100	00.000	11000000	· · ·
	Demand (m3/d)	48,400	87,000	118,600	
2.	Ubon and Warin	· .	•		
. 2.	Construction interstate				
	Water Consumption (m3/d)	12,400	31,100	48,700	
:	Unaccounted for Water			+ 1 -	
	Ratio (%)	35	23	20	
	Average Day Water	10, 100	40, 200	60,000	
	Demand (m3/d) Peak Factor	19,100	40,300 - 1,30 -	60,900	
	Maximum Day Water		1.30		
	Demand (m3/d)	24,800	52,400	79,100	
			2 ⁻¹		
З.	Suphanburi			· .	
		2,000	6 200	8 600	
	Water Consumption (m3/d) Unaccounted-for Water	2,900	6,200	8,600	
	Ratio (%)	42	23	20	
	Average Day Water				
	Demand (m3/d)	5,000	8,100	10,800	
	Peak Factor	. .	- 1.35 -		
	Maximum Day Water	6 200	10.000	14 600	
	Demand (m3/d)	6,700	10,900	14,600	
4.	Pattaya		н. Т	1. The second	
••		-			
	Water Consumption (m3/d)	13,800	31,900	40,600	
	Unaccounted-for Water				
	Ratio (%)	15	15	15	
	Average Day Water	16 200	37,500	17 000	
	Demand (m3/d) Peak Factor	16,200	domestic and	47,800 others	
	LEAN FACLUE		tourism	Jenor O	
	Maximum Day Water			· .	· .
	Demand (m3/d)	21,500	48,900	61,800	
5.	Total				
	Makan dereningen (2/2)	EC 100	100 000	175 700	
	Water Consumption (m3/d)	55,400	122,200	172,700	
	Maximum Day Water			· · ·	
	Demand (m3/d)	101,400	199,200	274,100	

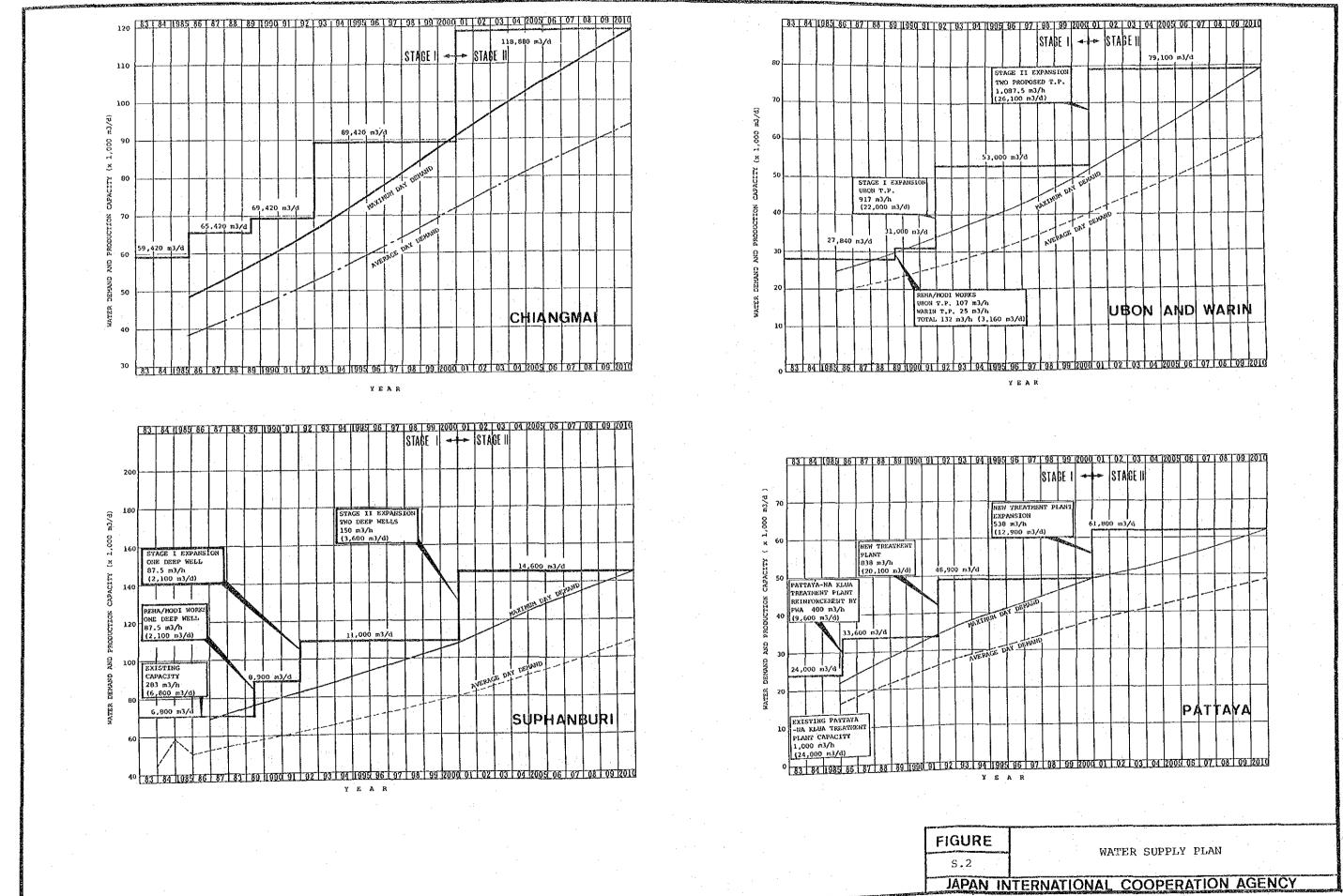




Table-S.3 WATER SOURCES

	ang ang satu sa sa sa sa			
		Present	2000	2010
1.	Chiangmai			
		:	*	
	Chiangmai	Ping River, Mae Tan	ng Ping River,	Ping River,
		Irrigation Canal	Canal	Canal
	Mae Rim	Mae Sa Rivulet	Mae Sa Rivulet	Mae Sa Rivulet
· ·	San Kamphaeng	Deep Wells	Deep Wells	Deep Wells
	San Sai		: - .	do
	Saraphi			do
÷	Hang Dong	-	-	do
2.	Ubon and Warin	Mun River,	Mun River,	Mun River,
		Mun Noi River	Mun Noi River	Mun Noi River
3.	Suphanburi	Deep Well,	Deep Wells,	Deep Wells,
J.	Bupilanour	Tha Chin River	Tha Chin River	Tha Chin River
	Dettern	Mah Dear ab an	Mah Dun - Lan Daa	Mah Dun bar Dan
4.	Pattaya	Mab Prachan	Mab Prachan Res.,	Mab Prachan Res.,
n an		Reservoir	Nong Kho Res.	Nong Kho Res., Nong Pla Lai Res.
	:			Hong the Her Root

Table-S.4 PROJECT COST

				Uni	it: 1,000 Baht
	S <u>Reha/Mo</u>	tage I <u>di Expansion</u>	Subtotal	Stage II Expansion	<u>Total</u>
l. Chi	angmai 30,0	00 279,500	309,500	532,100	841,600
2. Uboı War	1 and in 18,1	00 201,100	219,200	253,500	472,700
3. Sup	nanburi 32,5	00 29,900	62,400	53,500	115,900
4. Pat	aya 34,4	00 346,400	380,800	216,100	596,900
To	tal 115,0	00 856,900	971,900	1,055,200	2,027,100

The percentage of total cost for rehabilitation and modification works in Stage I will be approximately 10 % in cases of Chiangmai, Ubon-Warin, and Pattaya respectively. In case of Suphanburi, however, more than half of total cost is directed to the same purposes.

4.2 Implementation Schedule

Implementation will proceed as shown in Fig-S.3, which has been prepared, taking into consideration of the guidelines of OECF and the prevailing practices in Thailand.

5. Financing Plan for Stage I Implementation

As shown in Table-S.5, capital investment of Stage I for the four projects will amount to 972 million Baht, which will be financed by foreign loans (80 %) and local loans (20 %). The total funds requirements including debt service during the project period of Stage I on a cash flow basis will thus amount to 1,910 million Baht which can be covered by internal cash generation together with the foreign and local loans, without PWA internal finance or Government subsidies.

Table-S.6 below shows the combined cash flow forecast for the four waterworks based on the assumption that the water tariffs will be increased every three years at the rate of 3.3 % per annum. Also shown in Table-S.7 and S.8 are the combined cash flow of these waterworks forecast as sensitivity study on the assumptions (1) that the water tariffs will be increased every year at the rate of 3.3 % and (2) that the water tariffs will be kept unchanged up to the year 2000.

All these tables support the financial feasibility of the current project for these four waterworks, by showing positive accumulative operating surpluses through out the project period.

As for another sensitivity study, the combined cashflow of the four waterworks is forecast in Table-S.9 on the assumption that water sales will increase only half as much as originally projected in this Feasibility Study, with water tariffs increasing every three years at the rate of 3.3

Sk Bol 34 LEV 4 LE	STAGE I STAGE I Band Stad 31 Stad 51 Land Stad 31 Stad 51 Land Stad 51 Stad 51 Land 51 Stad 51 Land 51	E I I													a contraction of the second	COOPERATION AGENCY
2 33 34 1333 34 1333 36 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	86 37 88 1930 931 931 933 934 1995 935 936 935 936 935 936 935 936 935 936 935 936 935 936 935 936 935 936 935 936 935 936 935 936 93	H				SUP	for SUP					·····			TMPT.PMFNTATTON S	INTERNATIONAL
	86 87 88 89 1990 91 S T A G E S S T A G E S S T A G E S T A G E S S T A G E S S T A G E S T A G E S S T A G E S S T A G E S T A G E S S T A G E S T A G E S T A G E S S T A G E S T A G E S T A G E S T A G E S T A G E S T A G E S T A G E S T A G E S T A G E S T A G E S T A G E S T A G E S T A G E S T A G E S T A G E S T A G E S T A G E	<u> 33 34 1995 96 97 </u> I							25							s.3

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Table-S.5 TENTATIVE FINANCING PLAN FOR STAGE I IMPLEMENTATION Unit: 1,000 Baht

andar Aliantean Aliantean ann an Aliantean	СМ	UBW	SUP	PAT	TOTAL	(8)
1. Sources of Funds	· .					
Internal Cash Generation	395,500	179,900	54,300	308,300	938,000	(49.1%)
Outside Sources: - Foreign Financial Institution (OECF)	247,600	175,400	49,900	304,700	777 , 600	(40.7%)
- Local Financial Institution Total	61,900 705,000	43,800 399,100	12,500 116,700	76,200 689,200	194,400 1,910,000	

2. Application of Funds

Capital Expenditure		0 62,400 380,900	
Debt Service			938,000 (49.1%)
Total	705,000 399,10	0 116,700 689,200	1,910,000 (100.0%)

(Note) CM: Chiangmai, UBW: Ubon and Warin, SUP: Suphanburi, PAT: Pattaya

TablerS 6	CASH PLON PROJECTED (x	RULECTED (x 1,000 Baht) AT	CURRENT PRICE	円	Ð	FOUR CITIES	COMBINED			: :'		• •	
Description Text Ref.	1986	1987	1388	1589	1930	1991	1992	1593	1994	1995	1996	1997	1998	1999	2000
	30, 408	32, 330	34, 055	J5, 929	37, 757	39, 583	42,118	44,319	46, 419	48, 257	50, 012	51, 748	53, 394	54, 965	56, 562
(B) Unaccounted for Water (C)	នា	8	5	8	ន	ស	2	54	ន	ន	22	នា	ន	ស	ត
(C) Water Sales & 1000 m3)	21,597	228	24,846	26, 543	28, 215	29, 861	31, 355	33, 868	35, 538	37, 391	38 380	40, 394	41, 855	9°53	ж, 523
O) No. of Connections	40,169	42,702	45, 422	48, 140	56, 386	53° 53°	51, 225	60, 212	62, 913	65, 252	e1, 250	53, 073	70, 841	72,448	710, 117
(E) Average Mater Tariff (Baht/mOx*	36.7	7.36	7.36	8, 13	8.13	8.13	8.97	8.97	8.97	88.5	ස ස භ	88 01	10.87	10.87	10.87
1. Operating Revenue:	·	•				ut K								·	
1.1 Water Sales	158, 831	171,203	183,024	215, 729	229, 516	242, 947	286, 492	303, 639	319, 991	369, 377	383, 736		454, 999	459, 638	484, 719
1.2 Connection Fees	11,128	11, 956	12, 711	13, 994	14, 578	12, 348	21, 088	15, 469	14, 825	14,093	12,007		11, 792	10, 830	10, 551
1. 3 Service Charges	5, 387	5, 725	6, 087	7,110	7, 530	7, 878	9, 317	9,807	10, 251	11, 725	12,088		14,041	14,280	14, 672
1.4 Uther Revenue Total 1.	841 176, 199	905 189, 749	967 202, 747	1, 135	1, 205	1, 250	1, 522	1, 584 331, 426	1, 658 345, 648	108,1	1, 353 409, 700	2, USS 424, 063	483, 034	497,155	4 458 512, 278
2. Expenses:												: 1			
2.1 Operation & Maintenance								:					: •		
- Personnel Cost	18,425	20,060	22, 498	24, 741	27,627	33, 693	38, 765	42, 288	45, 885		54, 358	58, 294	63, 252	58, 435	73,442
- Electricity & Fuel Cost	17,949	19, 543	21, 053	22, 734	24,488	26, 218	28, 431	30, 500	32, 588	34, 585	36, 641	38,885	41, 133	43, 493	46, 063
- Gesical Cost	4, 900	2 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	5,845	8, 345	6, 88	1, 556	8, 196	8, 317	9, 565		11,100	11, 876	12, 564	13, 481	14,847
- Connection Cost	4,526	4,638	5,134	5, 323	5, 710	5, 036		6, 501 202	5, 050 5		4, 720		4, 432	4, 275	522 4
- Raw Water Cost	50 fr	3, 559	4,004	3, 846	4°	4, 912	3, 875 200	8, 304	10, 281		13, 123	15, 458 252 252	11, 138	18,565	ZU, 882
- Other Cost	5, 328	5, 722	6, ZZI	6, 696 20, 200	, 264	1, 558 1	950 S	3, bb5 - 20, 200	10, 2/3		11, 505	12, 29/	780 FT	14,853	14, 5Ub 201 - 20
Sub-total 2.1	54, 223	58, 945	54, 754	59, 580	16, 372	85, 313	104,253	108,809	111, 944		136,521	146, 212	157,051	158, 443	160, 5.38
2.2 Share of Head & Regional Office Overhead Expenses	26, 272	23, 206	32, 213	35, 371	38, 792	41, 873	47, 238	50, 752	54, 817	58, 827	62, 718	81,060	71, 620	76, 161	81, 083
2.3 Debt Service	12,050	11,960	14, 267	18, 101	31,127	51, 211	55, 389	88, 520	32, 085	87, 988	83, 890	110, 987	106, 244	101,501	73, 585
Total 2.	32, 545	100,111	111, 234	123, 157	145, 292	178, 397	217, 910	248, 181	264, 846	274, 412	283, 135	324, 258	334, 956	346, 105	335, 307
3. Met Cash Flow Surplus:		00	5	111 704	100 500	Lon Do	100 490	100	010	190 EQA		60 00	140 070	970 131	010 211
3.2 Cumulative	83 , 654	03, 020 173, 292	31, 315 264, 805	379, 566	485, 151	ou, 302 572, 133	512, 572	755, 817	837, 519	960, 212 1	.086, 777 1	1, 186, 581		1,485,707 1	552, 578
4. Unit Cost of Water after Debt	3.86	3.88	4.04	4.21	4.71	5.49	6.14	6.71	52 52	E. 83	6. 82	7.55	7.54	7.56	7.11
Service (Baht/#3) =				• •											

Note: * [CTotal 2.) × {CL.1 Mater Sales) / CTotal 1.)}] / CR.Mater Sales m2D ** Based upon the assumption that the water tariff increases every 3 years at the rate of 3.3 % per annum.

1

le-S.7 CASH FLOW PROJECTED (x 1,000 Bant) AT CURRENT PRICE			
) (x 1,000 Baht) AT CURREN		PRICE	
) (× 1, 000	-		
) (× 1, 000		Į,	
) (× 1, 000		\sim	
(×) (Baht	
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Le-S.7 CASH FLOW PROJECTED (×	
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le-S.7 CASH		F. OF	
le-S.7		CASH	
Tab		Table-S. 7	

(b) There Production \$(100) a(3) 30, 405 35, 323 37, 35 35, 55 21 45, 413 45, 413 45, 413 45, 413 45, 413 45, 413 45, 413 45, 413 45, 413 45, 413 45, 413 45, 413 45, 413 45, 413 45, 413 36, 313 55, 313 55, 313 55, 313 55, 313 55, 313 55, 313 55, 313 55, 313 55, 313 55, 313 55, 313 55, 313 55, 313 55, 313 55, 313 55, 313 55, 313 314 32, 325 35, 313 31, 31 31, 313 31, 313 31, 313 31, 313 31, 313 31, 313 31, 313 31, 313 11, 313 11, 325 11, 325 11, 325 11, 325 11, 325 11, 325 11, 32 11, 325 11, 325 11, 325 11, 325 11, 325 11, 325 11, 325 13, 313 11, 31, 313 11, 325 325 11, 325 13, 313 11, 313 13, 325 11, 325 133 14, 333 11, 325 325 11, 325 133 14, 325 14, 325 14, 325 14, 325 14, 325 14, 325 14, 325	
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Matrix Sales 6000 a.D 21,571 27,258 28,945 28,540 29,551 31,955 31,955 32,955 55,951	35,558 37,331 38,869 40,334 41,855 43,225 43 9,57 9,88 10,20 10,53 10,87 11,22 448 9,57 9,88 10,20 10,53 10,87 11,22 448 9,57 9,88 10,20 10,53 10,87 11,22 448 15,820 14,033 12,403 11,852 11,722 11,121 11,122 10,338 11,725 12,403 11,852 11,722 11,137 11,187 10,338 11,725 12,403 11,852 11,122 11,187 10,338 11,725 12,403 11,852 11,187 11,876 1,766 1,301 2,023 452,513 482,034 454 454 10,337,006 422,523 452,513 482,034 454 454 10,765 5,356 5,433 4,452 4,555 454 10,535 11,100 11,876 12,252 68,435
No. of Connections 40,15 47,02 48,40 50,955 57,255 60,722 25,935 9.57 9.56 0.53 9.56 0.53 9.56 0.53 9.56 0.53 9.56 0.53 9.56 0.53 9.56 0.51 1.76 9.56 0.53 9.56 0.53 9.56 0.51 9.56 0.53 9.56 0.53 9.56 0.53 9.56 0.53 9.56 0.53 9.56	52, 913 55, 522 57, 250 59, 073 70, 841 72, 448 9, 57 9, 88 10, 20 10, 53 10, 87 11, 22 341, 455 389, 377 396, 399 425, 364 454, 953 485, 198 5 15, 820 14, 033 12, 403 11, 822 11, 722 11, 187 11, 187 10, 338 11, 725 12, 487 13, 253 14, 041 14, 834 1, 766 1, 301 2, 023 455, 513 483, 034 54, 454 1, 763 11, 725 13, 253 14, 041 14, 834 1, 782 1, 766 1, 301 2, 037 3551 2, 464 54, 553 54, 654 305, 904 397, 005 422, 513 483, 034 513, 551 5 45, 885 54, 356 58, 234 51, 252 58, 435 5 32, 588 34, 553 36, 661 38, 886 41, 133 43, 431 6, 050 5, 338 4, 720 4, 720 4, 720
Average Vater Tariff Galt/A034 7.55 7.50 7.56 8.13 8.40 8.63 9.25 9.57 Operating Nermue: 11.1128 12,550 13,556 13,557 25,116 13,528 15,528 15,528 15,528	9.57 9.88 10.20 10.53 10.87 11.22 341,455 359,377 395,399 425,354 454,395 485,198 5 15,820 14,093 12,403 11,822 11,722 11,187 16,938 11,755 12,487 13,253 14,041 14,834 1,769 1,901 2,028 2,159 2,317 2,464 1,769 1,901 2,028 2,159 2,317 2,464 1,769 1,901 2,028 2,159 2,317 2,464 1,769 1,901 2,028 2,159 2,317 2,464 369,904 397,005 423,220 452,513 432,034 54,64 368,904 397,005 423,220 452,513 432,034 54,64 368,904 397,005 423,220 452,513 432,034 54,64 32,558 34,585 56,503 452,513 432,034 436 9,645 10,353 11,100 11,875 12,252 58,435 9,645 10,353 11,100 11,875 12,493 432,433 10,272 12,938 11,100 11,875 13,493 4,775 10,272
Deraring Revenue: 11,128 12,560 35,728 277,050 259,246 285,422 313,650 34,453 17,012 15,820 1.1 Nater Sales 1.1 Nater Sales 1.1 Nater Sales 1.1,128 12,550 13,554 13,934 15,152 13,177 21,069 17,012 15,820 1.2 Connection Fees 1.1,128 12,550 13,554 13,954 15,152 13,177 21,069 15,930 30,459 1,701 1778 8,407 9,017 10,120 10,533 16,610 10,333 16,610 10,333 16,610 10,333 16,610 10,333 16,610 10,333 16,610 10,333 16,610 10,333 16,610 10,333 16,610 10,333 16,610 10,333 16,610 10,333 16,610 10,333 16,610 10,333 16,610 10,333 16,610 10,333 16,713 16,733 16,733 16,733 16,733 16,733 16,733 16,733 16,733 16,733 16,733 16,733	341, 453 369, 377 396, 339 425, 364 454, 393 485, 198 5 15, 820 14, 033 12, 403 11, 832 11, 732 11, 187 10, 538 11, 725 12, 487 13, 253 14, 041 14, 834 10, 538 11, 725 12, 487 13, 253 14, 041 14, 834 1, 763 1, 301 2, 028 2, 183 2, 317 2, 463 1, 769 1, 301 2, 020 451, 183 2, 413 2, 445 369, 904 397, 006 423, 220 452, 513 483, 034 513, 551 5, 453 32, 588 58, 234 58, 234 51, 133 43, 433 43 45, 885 56, 335 56, 61 38, 886 41, 133 43, 43 6, 650 5, 336 4, 720 4, 720 4, 53 43 43 10, 272 10, 363 11, 875 15, 443 17, 109 18, 975 10, 272 10, 383 11, 505 12, 234 432
1.1 Nater Sales 158,881 17,882 155,723 277,90 258,422 313,660 34,453 17,012 15,820 1.2 Connection Fees 11,1128 12,356 13,564 13,964 15,152 13,177 21,068 17,012 15,820 1.3 Service Charges 5,387 5,316 34,556 13,564 13,934 15,152 13,177 21,068 17,012 15,820 1.4 Othier Revenue 17,012 355 1,355 1,355 1,355 1,355 1,357 1,357 1,357 1,359 342,358 369,904 366 1.4 Othier Revenue 176,112 315 217,395 277,318 21,355 1,572 21,587 1,572 21,582 1,763 342,388 45,885 1,763 342,388 45,885 <td< td=""><td>341,459 363,377 396,397 396,396 455,354 455,353 485,198 5 15,820 14,003 12,403 11,822 11,722 11,187 10,9308 11,725 12,403 11,822 11,182 11,187 10,9308 11,725 12,403 11,822 11,182 11,187 1,766 1,901 2,028 2,189 2,317 2,464 1,766 1,901 2,028 2,189 2,317 2,464 369,904 397,005 422,520 452,513 483,034 546 54,355 45,885 56,326 56,326 58,294 51,551 5 54,455 32,588 34,568 58,294 51,252 58,455 5 32,493 32,588 34,568 56,1336 4,720 4,533 43,493 43,493 32,588 34,750 11,875 12,223 6,492 4,375 10,277 10,983 11,100 11,876 12,493</td></td<>	341,459 363,377 396,397 396,396 455,354 455,353 485,198 5 15,820 14,003 12,403 11,822 11,722 11,187 10,9308 11,725 12,403 11,822 11,182 11,187 10,9308 11,725 12,403 11,822 11,182 11,187 1,766 1,901 2,028 2,189 2,317 2,464 1,766 1,901 2,028 2,189 2,317 2,464 369,904 397,005 422,520 452,513 483,034 546 54,355 45,885 56,326 56,326 58,294 51,551 5 54,455 32,588 34,568 58,294 51,252 58,455 5 32,493 32,588 34,568 56,1336 4,720 4,533 43,493 43,493 32,588 34,750 11,875 12,223 6,492 4,375 10,277 10,983 11,100 11,876 12,493
I.2 Connection Fees II.1.128 I.2.369 I.5.162 I.5.172 I.6.168 I.7.012 I.5.82 1.3 Service Charges 5,387 5,914 6,456 7,110 7,778 8,407 9,317 10,130 10,938 1.4 Other Revenue 1.3 Service Charges 5,387 5,914 6,456 7,110 7,778 8,407 9,317 10,130 10,938 1.4 Other Revenue 1.8 435 1.032 1.032 2.135 1,245 2.357 1.533 38,756 45,385 1,701 1,763 Berarion 8 Maintenance 1.7,943 19,543 2.7,703 2.441 27,527 23,533 38,756 45,393 45,895 16,504 15,568 15,568 45,865 5,364 5,585 45,865 5,568 45,865 5,568 45,865 5,5194 5,656 10,273 36,551 9,566 10,273 5,566 10,273 5,566 5,566 10,273 5,566 10,273 5,566 10,273 5,566 5,566 10,273 5,566 5,566 5,666 10,273 5,566 5,666<	15, 820 14, 933 12, 403 11, 822 11, 722 11, 187 10, 338 11, 725 12, 483 13, 253 14, 041 14, 834 1, 763 1, 301 2, 028 2, 153 2, 317 2, 464 1, 763 1, 301 2, 028 2, 153 2, 317 2, 464 1, 763 1, 301 2, 028 2, 153 2, 317 2, 464 16, 904 397, 005 423, 220 452, 513 483, 034 513, 551 5 669, 904 397, 005 423, 220 452, 513 483, 034 513, 551 5 32, 588 56, 513 56, 651 38, 886 41, 133 43 43 9, 645 10, 358 11, 103 11, 875 12, 254 13, 481 43 6, 050 5, 338 36, 661 38, 886 41, 133 43 43 10, 272 10, 358 11, 103 11, 875 13, 481 43 43 10, 272 10, 983 11, 103
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1.4 Other Revenue 841 535 1,022 1,135 1,245 1,522 1,537 1,753 Total 1. Total 1. 176,193 196,010 216,349 277,918 281,222 282,116 318,346 342,385 269,904 365,904 Expenses: 2.1 Derration & Maintenance 18,425 20,060 22,498 24,741 27,527 33,553 38,756 42,386 45,385 2.1 Derration & Maintenance 17,943 13,553 21,050 22,174 24,468 28,433 30,500 32,588 - Electricity & Fuel Cost 17,943 13,553 21,050 23,166 6,050 36,501 6,050 - Connection Cost 17,943 13,553 5,134 5,225 5,770 5,036 6,501 6,050 - Raw Water Cost 3,945 6,275 6,221 6,335 5,035 7,566 7,938 9,035 9,6501 6,050 - Raw Water Cost 5,035 5,770 5,036 7,335 5,134 5,335 7,556 7,335 5,036 1,0,273 - Raw Water Cost 5,325 5,770 5,036 7,356 7,336 5,036 5,050 1,0,273 - Raw Water Cost <	1, 769 1, 901 2, 028 2, 159 2, 317 2, 464 369, 904 397, 005 423, 220 452, 513 483, 034 513, 551 5 45, 885 50, 325 54, 358 58, 294 51, 252 58, 435 9 9, 645 10, 353 11, 100 11, 875 12, 554 13, 481 431 10, 272 13, 100 11, 875 12, 554 4, 492 4, 275 10, 272 10, 363 11, 100 11, 875 12, 554 13, 481 10, 272 10, 983 11, 100 11, 875 12, 554 4, 375 10, 272 10, 983 11, 100 11, 875 12, 493 4, 375 10, 272 10, 983 11, 505 12, 293 4, 375 4, 375 10, 271 10, 983 11, 505 12, 293 13, 383 14, 370 13, 383
Total 1. 1/6,199 136,010 216,399 237,518 261,222 262,116 316,308 367,568 45,886 Expenses: 2.1 Beration 8 Maintenance 18,425 20,060 22,498 24,741 27,527 33,533 38,756 42,288 45,886 - Dersonnel Cost 17,943 19,563 21,053 21,704 24,488 28,213 39,756 42,288 45,886 - Electricity 8 Fuel Cost 17,943 19,563 21,704 24,488 28,213 30,756 42,288 45,865 - Chanical Cost 4,500 5,565 5,305 5,305 5,316 74,55 8,317 10,272 - Ray Mater Cost 3,055 5,104 5,325 5,770 5,056 5,61 6,65 - Ray Mater Cost 3,055 6,175 86,537 33,538 30,756 5,61 6,65 - Ray Mater Cost 5,422 5,565 7,254 8,317 10,272 - Ray Mater Cost 5,4,223 5,565 7,254	45, 885 50, 726 54, 758 58, 294 53, 252 68, 435 45, 885 50, 726 54, 758 58, 294 53, 252 68, 435 32, 588 34, 585 36, 641 38, 886 41, 133 43, 483 9, 645 10, 353 11, 103 11, 876 12, 564 13, 481 6, 050 5, 358 4, 720 4, 533 4, 492 4, 275 10, 272 12, 130 13, 752 15, 448 11, 109 18, 975 10, 272 10, 983 11, 505 12, 297 13, 082 13, 833
Expenses: Style 42 29, 458 24, 741 27, 627 33, 553 38, 756 42, 238 45, 835 - - 45, 835 - 45, 835 - 45, 835 - 56, 83 - 56, 83, 51 30, 550 32, 583 57, 70 5, 036 7, 983 17, 948 24, 458 24, 418 27, 657 30, 550 32, 533 5, 345 6, 834 7, 455 8, 917 9, 645 73, 545 5, 770 5, 036 7, 988 6, 501 6, 050 32, 58 5, 770 5, 036 7, 988 6, 501 6, 050 32, 272 6, 233 5, 770 5, 036 7, 988 6, 501 6, 050 32, 273 5, 770 5, 036 7, 988 6, 501 6, 050 32, 273 5, 770 5, 036 7, 988 6, 501 6, 050 32, 273 5, 770 5, 036 7, 988 7, 213 8, 317 10, 273 9.01 6.1 5, 325 5, 770 5, 035 6, 531 10, 273 86, 310, 273 86, 310, 273 </td <td>45,885 50,325 54,358 58,234 53,252 58,435 32,588 34,585 36,641 38,886 41,133 43,493 9,645 10,359 11,103 11,876 12,654 13,491 6,050 5,338 4,720 4,523 4,492 4,775 10,272 12,130 13,752 15,448 17,109 18,975 10,277 10,983 11,605 12,297 13,092 13,833</td>	45,885 50,325 54,358 58,234 53,252 58,435 32,588 34,585 36,641 38,886 41,133 43,493 9,645 10,359 11,103 11,876 12,654 13,491 6,050 5,338 4,720 4,523 4,492 4,775 10,272 12,130 13,752 15,448 17,109 18,975 10,277 10,983 11,605 12,297 13,092 13,833
st 18, 425 20, 060 22, 498 24, 741 27, 627 33, 593 38, 766 42, 288 45, 885 17, 945 19, 543 21, 053 21, 053 21, 053 21, 134 28, 488 28, 213 30, 500 32, 586 4, 900 5, 365 5, 845 6, 345 6, 884 7, 456 8, 195 8, 917 9, 645 4, 526 4, 604 3, 846 4, 339 4, 912 8, 8317 10, 272 3, 055 5, 134 5, 323 5, 770 5, 036 7, 939 6, 501 3, 055 6, 704 3, 846 7, 264 7, 998 6, 055 10, 273 5, 3228 5, 772 6, 236 7, 636 7, 264 7, 998 6, 5501 6, 050 5, 3228 5, 772 6, 325 7, 264 7, 998 9, 650 10, 273 5, 2205 58, 945 6, 775 85, 013 102, 340 106, 131 114, 712 5, 220 58, 531 38, 732 85, 013 102, 340 106, 106, 106, 123 114, 712 56, 210 14, 257	45, 885 50, 326 54, 358 58, 294 53, 252 58, 435 32, 588 34, 585 36, 641 38, 886 41, 133 43, 483 9, 645 10, 359 11, 103 11, 875 12, 554 13, 481 6, 050 5, 368 4, 720 4, 533 4, 492 4, 275 10, 272 12, 130 13, 752 15, 448 11, 109 18, 975 10, 272 10, 983 11, 505 12, 297 13, 082 13, 833 114, 770 107 757 10, 103 759 10, 363
18,425 24,060 24,436 24,141 21,027 35,521 24,566 43,500 45,500 45,500 45,500 45,500 45,500 45,500 45,500 45,500 45,500 45,500 45,500 45,500 45,500 45,500 45,500 45,500 45,500 35,500 35,500 35,500 35,500 35,500 35,500 35,500 35,500 35,500 35,500 35,500 36,501 6,500 35,503 5,501 6,500 37,508 5,517 9,912 9,645 45,500 32,565 5,700 5,036 7,503 8,317 10,272 9,645 5,501 6,500 27,228 5,517 9,696 9,645 6,501 6,500 27,228 5,517 10,272 9,550 10,272 9,550 10,272 5,516 6,550 10,272 5,517 10,272 5,517 10,272 5,517 10,272 5,516 6,550 10,272 5,516 5,516 5,516 5,516 5,516 5,516 5,516 5,516 5,516 5,516 5,516 5,516 5,516 5,516	45, 663 30, 525 36, 661 38, 886 41, 133 43, 483 9, 645 10, 355 11, 103 11, 876 12, 654 13, 481 6, 050 5, 358 4, 720 4, 533 4, 492 4, 275 10, 272 12, 130 13, 752 15, 448 11, 109 18, 976 11, 273 10, 983 11, 605 12, 297 13, 082 13, 893 11, 107 107 770 150 560 560
17,945 19,543 21,053 22,734 24,488 25,218 23,411 34,500 32,358 4,526 4,533 5,845 6,345 6,345 6,346 7,455 8,196 8,917 9,665 4,528 4,533 5,845 6,345 6,345 6,346 6,536 7,938 6,501 6,050 3,095 3,559 4,004 3,865 4,333 4,912 3,831 10,273 5,328 5,722 6,221 6,686 7,564 7,998 9,096 9,659 10,273 5,328 5,722 6,221 6,686 7,564 7,998 9,096 9,699 10,273 5,328 5,722 6,221 6,586 7,572 85,311 10,272 8,717 10,273 5,328 5,722 5,313 102,313 10,273 85,317 10,273 5,4,223 58,945 64,756 89,857 75,398 50,752 54,817 26,272 29,282 35,311 38,792 41,873 47,238 50,752 54,817	UZ, 588 04, 555 36, 561 38, 866 41, 143 43, 454 9, 645 10, 359 11, 103 11, 876 12, 654 13, 481 8, 050 5, 358 4, 720 4, 533 4, 492 4, 275 10, 272 12, 130 13, 752 15, 448 11, 109 18, 975 10, 273 10, 983 11, 605 12, 297 13, 082 13, 833 111, 770 107 759 100 173 759 159 484
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5,328 5,722 6,221 6,586 7,264 7,998 9,095 9,683 10,273 54,223 58,945 64,756 59,685 76,372 85,313 102,340 106,131 114,712 26,272 29,206 32,213 35,371 38,792 41,873 47,238 50,752 54,817 26,272 29,206 32,213 35,371 38,792 41,873 47,238 50,752 54,817 12,050 11,950 14,257 18,101 31,127 51,211 66,389 88,620 92,085 92,545 100,111 111,234 123,157 146,292 178,397 215,958 245,553 261,614	10, 273 10, 963 11, 505 12, 287 13, 062 13, 533 314 719 197 759 179 176 147 707 155 709 353 694
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Table-S.8

GOUR CITIES COMBINED

Description Text Ref.	ef. 1986	1987	1988	1389	1330	1991	1992	1933	1994	1995	1995	1997	1998	1999	2000
 (4) Water Production (x1000 mJ) (5) Unaccounted for Water (3) (C) Water Sales (x1000 mJ) (D) No. of Connections (D) Average Water Tariff Gaht/mJ)# 	30, 408 23 21, 597 40, 169 7. 26	32, 330 28 23, 258 42, 702 7. 25	34,055 27 24,845 45,422 7.25	35, 929 26, 543 28, 140 7. 26	37, 757 25 28, 215 50, 996 7. 26	39, 583 25 29, 861 7. 26 7. 26	42,118 24 31,955 57,225 7.26	44, 319 24 33, 868 60, 212 7. 26	46, 419 23 35, 698 62, 913 7. 25	48, 257 23 37, 391 55, 252 7. 26	50, 012 22 38, 869 67, 250 7. 26	51, 748 22 40, 334 53, 079 53, 079 7, 25	53, 394 22 41, 855 70, 841 7.26	54, 965 21 43, 225 72, 448 7. 25	56, 552 21 44, 522 74, 017 7.26
 Operating Revenue: I.1 Water Sales 2 Connection Fees 1.2 Service Charges 1.4 Other Revenue 1.4 Other Revenue 	156, 795 11, 128 5, 387 821 174, 104	168, 852 11, 956 5, 725 895 187, 387	180, 379 12, 711 5, 087 956 200, 090	192, 701 12, 695 5, 450 1, 018 212, 817	204, 837 13, 315 5, 831 1, 081 226, 015	216, 788 11, 202 7, 147 1, 130 236, 215	231, 393 17, 356 7, 667 1, 238 1, 238 258, 194	245, 879 13, 554 8, 071 1, 289 268, 729	259, 168 12, 201 8, 436 1, 349 281, 088	271, 458 10, 522 8, 754 1, 403 292, 067	282, 191 8, 965 9, 025 1, 449 301, 556	233, 262 8, 279 9, 273 1, 501 312, 237	303, 859 7, 987 9, 510 1, 552 322, 838	313, 814 7, 335 9, 726 1, 598 332, 392	323, 964 7, 146 9, 937 1, 647 342, 609
 2. Expenses: 2.1 Gperation & Maintenance - Personnel Cost - Electricity & Fuel Cost - Chemical Cost - Connection Cost - Raw Mater Cost - Other Cost Sub-total 2.1 	18, 425 17, 948 4, 900 4, 526 5, 328 54, 223	20, 060 5, 363 5, 363 3, 553 5, 370 5, 755 56 770	22, 498 21, 714 5, 845 5, 134 4, 004 6, 277 65, 471	24, 741 23, 643 6, 345 5, 323 3, 846 6, 773 70, 672	27, 627 25, 743 5, 770 5, 770 4, 339 7, 733	33, 693 26, 878 7, 456 5, 036 4, 912 86, 029	38, 756 30, 568 6, 156 6, 156 9, 875 9, 875 9, 234	42, 288 33, 292 8, 917 6, 501 6, 501 8, 304 9.04 111, 818	45, 885 35, 944 9, 645 6, 050 6, 050 10, 281 10, 556 121, 596	50, 326 38, 533 38, 533 10, 359 5, 368 5, 368 11, 316 11, 316 131, 912	54, 358 41, 295 11, 103 4, 720 4, 720 13, 723 141, 531	58, 234 44, 218 11, 876 4, 533 15, 468 15, 468 12, 747 152, 023	63, 252 63, 252 47, 187 12, 664 4, 492 17, 150 13, 592 183, 716	68, 435 50, 249 13, 481 4, 275 18, 965 18, 965 14, 400	73, 442 53, 524 14, 847 4, 295 20, 882 188, 558 188, 558
 2.2 Share of Head & Regional Office Overhead Expenses 2.3 Debt Service Total 2. 	25, 929 12, 050 92, 202	27, 305 11, 960 93, 235	29, 798 14, 267 109, 536	31, 675 18, 101 120, 448	33, 633 31, 127 142, 492	35, 138 51, 211 172, 378	38, 390 66, 389 211, 506	39, 924 88, 520 240, 352	41, 742 92, 085 255, 423	43, 364 87, 988 263, 264	44, 755 83, 890 270, 175	46, 323 110, 987 309, 333	47, 852 105, 244 317, 853	49, 302 101, 501 326, 558	59, 812 73, 686 313, 166
 Net Cash Flow Surplus: Annual 2. Cumulative 4. Unit Cost of Mater after Debt Service Gaht/#33* 	81, 902 81, 902 3. 84	88, 152 170, 054 3. 84	90, 554 260, 608 3. 97	92, 358 352, 976 4. 11	83, 522 436, 498 4. 58	53, 837 500, 334 5. 30	46, 588 547, 022 5. 95	28, 367 575, 389 6. 49	25, 684 601, 054 6. 60	28, 800 629, 857 6. 54	31,330 561,235 6.50	2, 904 664, 140 7. 18	4,986 669,126 7.15	5, 834 674, 950 7.13	29, 444 704, 404 6. 54

Note: * [(Total 2.) × {(1.1 Water Sales) / (Total 1.)}] / (3.Water Sales m3) # Based upon the assumption that the water tariff remains unchanged up to 2000.

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Description Te	Text Ref. 1985	1387	1 1988	1989	1990	1991	1992	1933	1994	1995	1996	1997	1998	1939	2000	
(A) Water Production (x1000 m3)	30, 418	8 31,374	4 32, 237	33,174	34,087	35,000	36, 268	37, 369	38,419	39, 338	40, 215	41, 983	41, 906	42, 592	43, 490	
(B) Unaccounted for Water (20)		8 8		27	12	26	26	26	53	53	52	52	24	24	24	
(C) Hater Sales (x1000 m20 att	21,597			24,070	24, 906	25, 729	26, 776	27, 732	28,648	29, 494	30, 233	30, 995	31, 726	32,411	33, 110	
CD No. of Connections	40, 169			44, 155	45, 583	46, 776	48, 697	50, 191	51,541	52, 711	53,710	54, 624	55, 505	56, 309	57,093	
E Average Mater Tariff Baht/2022	7.36			8.13	8.13	8.13	8.97	8.57	8. 97	6 88 7	88 57	88 19	10.87	10.87	10. 87	
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J. UPEFALINE REVENUE: T 1 Mater Salar	152 OFA	CA 1CC ACC	170 000	105 520	NDN 000	200.175	940 121	748 750	956 469	701 AN1	702, 702	305 237		359 309	EQ QUE	
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1.4 UCABE REVERUE Total 1.	176,310	183,	189,		222, 869	228, 597	264, 822	271, 367	279,014	313, 939	320, 411	327,685	367, 515	374, 774	382, 425	
2. Exophses:				- 44 	· .											
2.1 Borration & Maintenance							÷									
- Personnel Cost	18,4	25 19,242		21, 583	23,026	26, 059	28, 595	30, 356	32, 155	34,375	36, 392	38, 353	40, 838	43, 430	45, 533	
- Electricity & Fuel Cost	17, 949			20, 341	21, 218	22, 083	23, 190	24, 224	25, 268	25, 267	27, 295	28,417	29,541	30, 721	32,006	5
- Chemical Cost	4, 900		11 5,372	5, 622	5, 892	5,178	6, 548	6,908	7,273	7,629	8, 001	8,388	8, 782	3,190	9, 874	
- Connection Cost	5°			4, 925	5,148	4, 781	6, 257	5, 513	5, 288	4,947	4, 623	4, 523	4, 509	4,401	4,411	
- Raw Water Cost	3, 095			3,471	3,717	4, 003	6,485	5, 700	6, 588	7,622	8,409	9,281	10,122	11,030	11, 388	-1
- Other Cost	5.3			6,012	6, 296	6, 663	7,212	7, 498	108,1	8, 156	8, 466	8,813	3, 205	3,580	3, 917	
Sub-total 2.1	54, 223			61,954	65, 297	63, 768	78, 288	80, 200	84, 472	88, 997	93, 187	97, 788	102, 998	108, 353	114, 129	
											101 11		00.00	54 943	10	
2.2 Share of Head & Regional	26, 272	72 27, 739	39 29, 243	30, 821	32, 532	34,073	36, 755	38, 512	40, 545	17, 243	44, 455	4 b, 5 60	46, 440	177,16	33, 515	
Uffice Overhead Expenses	·	1		. •				:" .	· .		• .				. •	
2.3 Debt Service	12, 050	50 11,950	50 14,267	18, 101	31,127	51,211	66, 389	88, 620	32,085	81, 988	83, 890	110, 987	105,244	101, 501	73, 586	۰.
Total 2	32, 545	45 96, 283	83 102, 998	110,877	128, 957	155, 052	181, 432	207, 332	217, 101	219, 533	221, 572	255, 441	258, 188	261, 071	241,493	
3. Net Cash Flow Surplus:						1. 1.		:	:.		• . •	•			•	
3.1 Annual	83, 7		54 86,472	104,609	93, 912	73, 545	83, 390	64,035	61, 913	94,405	38, 833 19	72,244	109,428	113, 703	140, 932	÷
3.2 Cumulative	83, 766		· .	1	ម្នាំ រ	529, 058	612, 448	676, 483	738, 395	832, 800	331, 533	. 003 . 883	1, 113, 311 1	. 227, 014	, 361, 341	
4. Unit Cost of Water after Debt	ri	3.86 3.87	s7 4.00	4.18	4.70	5.51	6. 15	6 8	6.38	6.9	6. SJ	02.1	1. 83	7.57	88 87	
Service (Baht/#3)#				;		. *										
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Note: # [Gotal 2.) x (G.1 Mater Sales) / Gotal 1.))] / (3. Mater Sales #3) ## Based upon the assumption that the mater tariff increases every three years at the rate of 3.3 % per annum ### Based upon the assumption that the increase in mater sales is half as originally forecast. (see Table-5.5)

% per annum. Even on this assumption, the forecast supports the financial feasibility of the project by registering positive accumulative operating surpluses throughout the project period.

6. Project Justification

The project for Stage I is technically feasible and provides the least cost solution for providing water supply as needed in the four project areas through the year 2000.

As discussed in Section 5 above, each of the four waterworks will produce no adverse cash flow effects on PWA accounts during the project period. Table-S.10 reveals that the combined effects of the project on the four waterworks calculated in terms of FIRR and EIRR are extremely favorable, particularly for the three large-sized waterworks, Chiangmai, Ubon-Warin and Pattaya.

The capital investment under the current project will thus contribute to further enhancement of the already high operating returnability of these three waterworks. This kind of investment will doubtless strengthen the financial status of PWA, which will in turn facilitate capital investment of other waterworks with poorer returnability, by way of cross-subsidies among its member waterworks.

Table-S.10	FINANCIAL AND ECONOMIC EFFECTS OF THE PROJECTS
	IN TERMS OF FIRR AND EIRR

	1
FIRR	EIRR
10.8 %	16.6 %
8.8 %	14.4 %
3.3 %	9.4 %
5.6 %	11.4 %
	10.8 % 8.8 % 3.3 %

Though such indicators as FIRR and EIRR for Suphanburi do not look so favorable, it is to be noted that capital investment for the waterworks under the current project has to be directed largely to rehabilitation and modification of the facilities.

Implementation of the project will, as referred to above, improve the water supply and other environmental situation and health of the people in the four project areas on one hand, and will strengthen PWA's financial and operating status on the other hand.



S - 17

CHIANGMAI

S - 18

A. Introduction

This report summarizes the results of a comprehensive master plan and feasibility study conducted by a study team of the Japan International Cooperation Agency (JICA), which are presented in this volume of the Report entitled "DEVELOPMENT PLAN AND FEASIBILITY STUDY ON PROVINCIAL WATER SUPPLY PROJECTS IN THE KINGDOM OF THAILAND, CHIANGMAI".

The study area covers Chiangmai Municipality and its neighboring Sanitary Districts, Mae Rim, San Kamphaeng, San Sai, Saraphi and Hang Dong, located some 700 km north of Bangkok. Chiangmai is a well known tourist spot in Asia and the second largest city in Thailand, and also serves as a center of administration, education, commerce and traffic in the northern districts. The city is expanding steadily and expected to absorb the surrounding five sanitary districts in the future. Of these five sanitary districts, those connected to PWA System are only two, Mae Rim and San Kamphaeng. Among the rest three, Hang Dong has a public water system not belonging to PWA, but other two have no water supply.

The current project purports to prepare a comprehensive development plan of water supply in the study area mentioned above up to the year 2010, and to study the feasibility of the early stage of the plan for implementation.

The population and water supply service ratio of Chiangmai and each of the five sanitary districts are forecast as in Table-ES.1.

In view of the uncertainties in the future development of Chiangmai and five sanitary districts as well as of the internal administrative reasons of PWA, project implementation is planned to be divided into two stages, i.e., Stage I up to the year 2000 and Stage II through 2010.

	19	85	20	10
Area	Popu-	Service	Popu-	Service
	lation	Ratio	lation	Ratio
Chiangmai	155,000	52 %	199,000	75 %
Mae Rim	11,100	42 %	13,600	70 %
San Kamphaeno	17,000	34 %	26,100	65 %
San Sai	22,200	-	24,700	50 %
Saraphi	8,800	keta .	13,000	50 多
Hang Dong	5,200	•••	6,700	50 %
Total	219,300		283,100	•

Table-ES.1 POPULATION AND SERVICE RATIO FORECAST

The Development Plan also proposes an immediate improvement program to rehabilitate the existing system, together with immediate modification works to increase the production-supply capacity of the existing facilities. These immediate actions are required to be carried out prior to the Stage I expansion program, or as part of its initial phase.

This is because the existing production facilities of Chiangmai, Mae Rim and San Kamphaeng whose nominal capacity exceeds demand are failing to supply safe water unceasingly, hindered by deteriorations in treatment facilities and damages in pipelines.

B. Strategies to the Targets

Of the five Sanitary Districts, Stage I implementation will be extended only to Mae Rim and San Kamphaeng which are already PWA member waterworks. Both of them are proposed to be merged with Chiangmai Waterworks, the reason being that Mae Rim service area actually crosses over a part of Chiangmai jurisdiction, and San Kamphaeng has a high prospect to be connected with Chiangmai in future because of an industrial zone planned to be developed in their midway. In addition, merger will reduce their operation expenses in total. Because of their unreadiness, the development of water supply in San Sai, Saraphi and Hang Dong sanitary districts is planned to be postponed to Stage II of the Development Plan.

Composite water consumption is projected to be increased up to two times as large as the present level in coming 13 years, from 26,200 cu m/day in 1985 to 53,000 cu m/day in 2000, and further to 74,900 cu m/day in 2010. Domestic demand will increase reflecting both population growth and per capita consumption increase (from 143 lpcd in 1985 to 185 lpcd in 2000), and tourism demand is projected to expand at a higher rate than the domestic one.

The estimated costs are summarized in Table-ES.2 for implementing the strategic plans as shown in Fig-ES.1.

Table-ES.2 TOTAL COST FOR DEVELOPMENT PLAN

Unit:1,000 Baht

		Stage I		Stage II	Total
	Rehabili	•	Sub-	(2000~2010)	Stages
Item	and	Expansio	n Total	Expansion	I and II
	Modifi.		u.		
Land and Facilities	22,400	202,400	224,800	260,000	484,800
Engineering Service	2,500	22,200	24,700	28,200	52,900
Administration Cost	200	2,300	2,500	2,900	5,400
Physical Contingencies	1,800	15,800	17,600	20,400	38,000
Price Contingencies	3,100	36,800	39,900	220,600	260,500
Total	30,000	279,500	309,500	532,100	841,600

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ģ			ź		210-	<u>.</u>	ŕ	, 81		-ost		8		8		8	ICHE	CONSTRUCTION SCHEDULE	· · · ·		POPULATION (x 1,000)	3	SERVED POPULATION (x	UNACCOUNTED-FOR HATER RATIO (1)	AVERAGE DAY DEMAND (x 1,000)	KAXIMUN DAY DEMAND (x 1,000)	Note : Chiangmai Waterworks Combined		· .	
-				-														CONSTRE			X) NOLI	SERVICE RATIO (1)	POPULA	INTED-F	C DAY D	A DAY L	Châan			
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C. Proposed Water Supply, 1987-2000

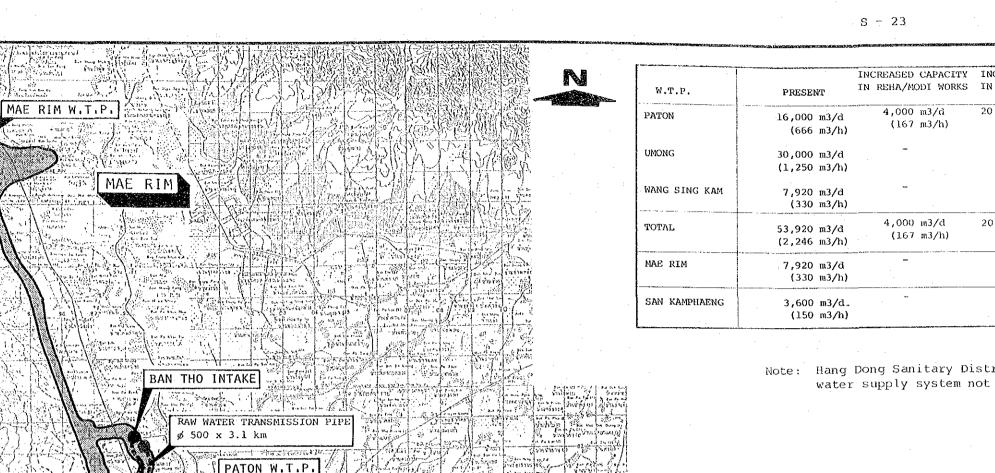
The components of the proposed water supply system for Stage I together with the service area to be covered are illustrated in Fig-ES.2. Rehabilitation and modification works will provide needed improvement of the existing facilities, particularly to increase the supply capacity to meet water demand which is expected to intensify around 1990.

The Stage I Expansion for Chiangmai, Mae Rim and San Kamphaeng is designed as shown on Table-ES.3, with implementation proposed to proceed as Fig-ES.3.

Item	Chiangmai	<u>Mae Rim</u>	<u>San</u> <u>Kamphaeng</u>	Total
Service Area (ha)	50,400	9,200	13,400	73,000
Served Population	126,700	8,200	12,800	147,658
Water Source	Ping River	Lam Nam	Groundwater	
	& Irrigation	Me Sa		
	Canal		:	· .
Max. Day Demand (m3/d)	76,500	6,700	3,800	87,000
Distribution Pipeline (k	m) 105	21	9.	135
Service Connection	4,900	310	1,000	6,210

Table-ES.3 SUMMARY OF STAGE I EXPANSION

The proposed project and its costs are summarized in Table-ES.4. The estimated capital investment cost of the project, totaling 309,500 thousand Baht at current prices allowing for price increases of 3.3 percent per annum is realistic, based on preliminary designs plus an allowance of 7 % for physical contingencies.



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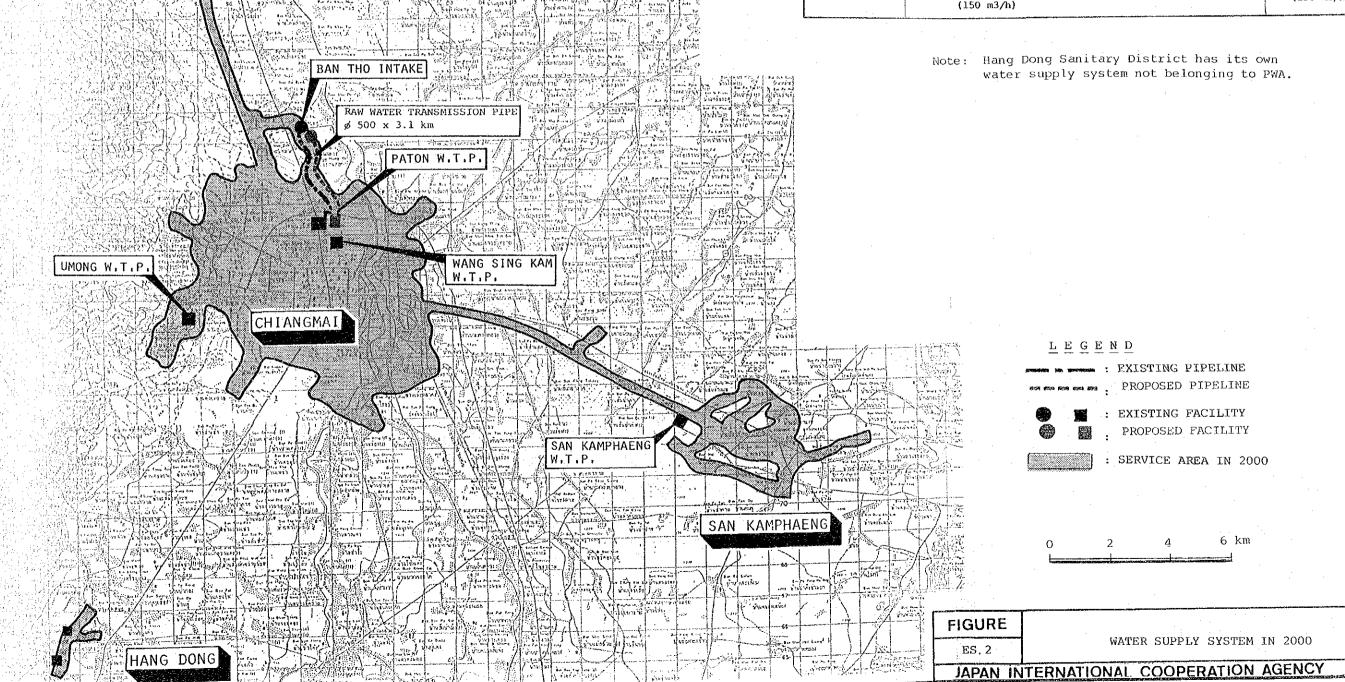
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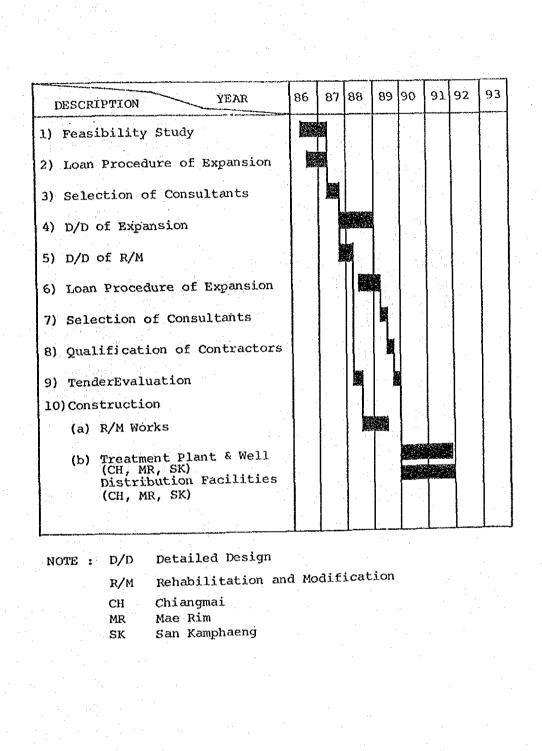
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CHIANGMAI - 6

CAPACITY	INCREASED CAPACITY	
ODI WORKS	IN EXPANSION WORKS	TOTAL
) m3/d	20,000 m3/d	40,000 m3/d
/ m3/h)	(833 m3/h)	(1,666 m3/h)
	-	30,000 m3/d (1,250 m3/h)
	-	7,920 m3/d (330 m3/h)
) m3/d	20,000 m3/d	77,920 m3/d
/ m3/h)	(833 m3/h)	(3,246 m3/h)
		7,920 m3/d
		(330 m3/h)
		3,600 m3/d
		(150 m3/h)

CHIANGMAI - 7



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FIGURE		
ES.3	IMPLEMENTATION SCHEDULE	
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Tabl	e-ES.4 ESTIMATED PROJECT COSTS FOR STAG	E I IMPLEMENTATION
		(x 1,000 Baht)
Α,	Rehabilitation and Modification	22,400
		en de la companya de La companya de la comp
	Chiangmai	22,000
	Mae Rím	200
	San Kamphaeng	200
В.	Expansion	202,400
	Land Acquisition	1,800
	Chiangmai	176,100
	Mae Rim	18,200
	San Kamphaeng	6,300
с.	Engineering Services	24,700
D.	Administration Cost	2,500
E.	Physical Contingencies	17,600
F.	Price Contingencies	39,900
	Total	309,500

The tentative financing plan, summarized in Table-ES.5, assumes loans from a foreign financial institution such as OECF totaling 247,600 thousand Baht, or 80 % of capital expenditure, and local loans totaling 61,900 thousand Baht, or 20 % of capital expenditure. The total fund requirement through the project period is projected to amount to 705,000 thousand Baht on a cash-flow basis (inclusive of debt service) of which 56.1 % will be covered by internal cash generation and the rest(43.9 %) will be financed with foreign and local loans, and with no internal financial help of PWA.

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Table-ES.5 TENTATIVE FINANCING PLAN FOR STAGE I IMPLEMENTATION [CHIANGMAI WATERWORKS] x 1,000 Baht

Item	Before	% of
	Depreciation	Total
1. Sources of Funds		en del de la composición de la composi La del de la composición
Internal Cash Generation	395,500	56.1%
Outside Sources:		
- Foreign Financial Institution		
such as OECF	247,600	35.1%
- Local Financial Institution	61,900	8.8%
		·
Total	705,000	100.0%
	.*	
2. Application of Funds		
Capital Expenditure	309,500	43.98
Debt Service	395,500	56.1%
	·	
Total	705,000	100.0%

The above financial conditions, together with the Financial Internal Rate of Return and the Economic Internal Rate of Return as high as 10.8 % and 16.6 % respectively demonstrate the financial and economic justification of the project.

Several key actions are necessary if the project is to succeed.

1.

Financing for project implementation must be confirmed. This confirmation includes the checking of a possibility of obtaining Government subsidies for project capital investment, which are now being suspended temporarily for Government budgetary reasons. Such subsidies will ease the financial conditions of waterworks in making capital investment. Changes in structure of PWA's water tariff, as recommended in the Main Report, are needed together with periodic increases in tariffs (to cover the effects of price escalation).

2.

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- 3. Arrangements should be made with RID to secure in the dry seasons the necessary volumes of raw water from the Ping River and the irrigation canal, both of which are under the control of RID.
- 4. Suitable land site should be secured at the earliest time possible for the Ban Tho intake facilities which are proposed to be constructed in the Stage I.
- 5. A leakage team should be formed in the waterworks to pursue a program of reducing water leakage in accordance with the Framework prepared by JICA Team.
- 6. PWA should campaign the enlightenment of the residents in San Sai, Saraphi and Hang Dong on the necessity of potable piped water and the benefits of PWA service, as to pave a way for the planned Stage II implementation in these districts.

The project is technically feasible and provides the least cost solution for providing water supply as needed in the project area through the year 2000. The project is also significant to improve the existing facilities which are deteriorating. Implementation of the project will significantly improve the water supply and other environmental situation and health of the people in Chiangmai.

UBON RATCHATHANI AND WARIN CHAMRAP

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UBON RATCHATHANI AND WARIN CHAMRAP

S - 29

A. Introduction

This report summarizes the results of a comprehensive master plan and feasibility study conducted by a study team of the Japan International Cooperation Agency (JICA), which are presented in this volume of the Report entitled "DEVELOPMENT PLAN AND FEASIBILITY STUDY ON PROVINCIAL WATER SUPPLY PROJECTS IN THE KINGDOM OF THAILAND, UBON RATCHATHANI AND WARIN CHAMRAP".

Ubon Ratchathani and Warin Chamrap located approximately 500 km northeast of Bangkok, are neighboring municipalities which almost constitute one township served by a single water-supply system operated by Ubon-Warin Waterworks. The project area covers, other than these two municipalities, their adjacent districts including Ubon Sanitary District and five villages where no water supply services are provided and 74 % of the residents there are willing to be connected to PWA system.

The combined population of the study area is projected to increase from 152,000 in 1985 to 196,400 by 2010, the target year of the current project.

The current project purports to mitigate such immediate requirements, as well as to improve the service ratio in the long-run from 40 % at present to 75 % in 2010.

In view of the uncertainties in the future development of the study area as well as of the internal administrative reasons of PWA, project implementation is planned to be divided into two stages, i.e., Stage I up to the year 2000 and Stage II through 2010.

The existing facilities are suffering from deterioration which is reducing operation efficiency and increasing the unaccounted-for ratio. 'To cope with this situation, the Development Plan proposes an immediate improvement program to rehabilitate the existing system, together with immediate modification works to promptly increase the production-supply capacity of the existing facilities. These immediate actions are required to be carried out prior to the Stage I expansion program, or as a part of its initial phase.

B. Strategies to the Targets

Water consumption will be increased to two and half times as large as the present level in the coming 13 years, from 12,400 cu m/day in 1985 to 31,100 cu m/day in 2000, and further to 48,700 cu m/day in 2010. Domestic demand will increase reflecting both population growth and per-capita consumption increase (from 142 lpcd in 1985 to 177 lpcd in 2000), and public demand is projected to expand at a slightly higher rate than the domestic one.

Strategic plans are illustrated in Fig-ES.1 and the estimated costs - therefor are summarized in Table-ES.1.

Table-ES.1 TOTAL COST FOR MASTER PLAN

Unit:1,000 Baht

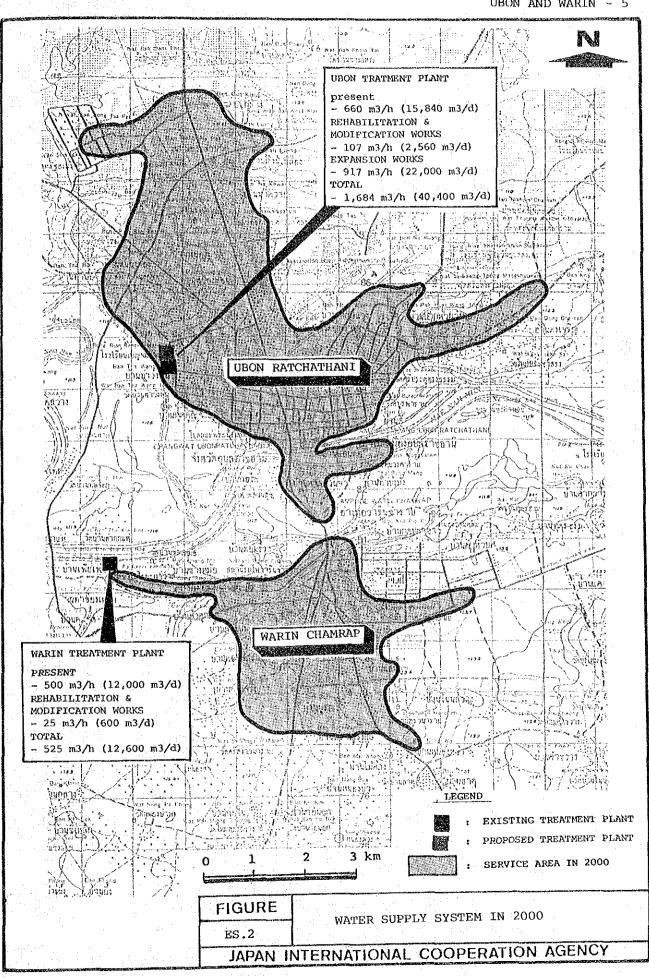
		Stage I	- 	Stage II	Total
	Rehabili		Sub-	(2000-2010)	
Item	and	Expansio	n Total	Expansion	I and II
	Modifi.				د.
Land and Facilities	13,400	145,900	159,300	139,100	298,400
Engineering Services	1,500	15,800	17,300	14,700	32,000
Administration Cost	100	1,600	1,700	1,500	3,200
Physical Contingencies	1,100	11,400	12,500	10,900	23,400
Price Contingencies	2,000	26,400	28,400	87,300	115,700
			4		
Total	18,100	201,100	219,200	253,500	472,700

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REHA/MODI WORKS UBON T.P. 107 m WARIN T.P. 25 m TOTAL 132 m3/h	6										
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		CONSTRUCTION SCHEDULE	POPULATION (× 1,000)	SERVICE RATIO (3)	SERVED POPULATION (X	UNACCOUNTED-FOR WATER RATIO	AVERAGE DAY DEMAND (x	MAXIMUM DAY I	•		
FOPULATION (x 1,000)			ULAT	VICE	La La	Т С С С С С	RAGE	40MH			

C. Proposed Water Supply, 1987-2000

The proposed water supply system for Stage I will cover the service area shown in Fig-ES.2. The rehabilitation and modification will provide needed improvement of existing facilities. The Stage I Expansion is designed to meet projected maximum day demand of 52,400 cu m/d, to serve 107,400 people by 2000, and to expand the service area to 3,900 ha. Additional 53 km distribution pipelines will be installed, with approximately 7,300 service connections. Implementation is proposed to proceed as Fig-ES.3.

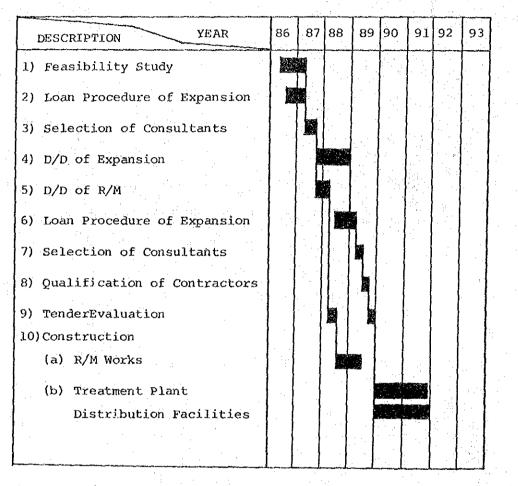
The proposed project and its costs are summarized in Table-ES.2. The estimated capital investment cost of the project, totaling 219,200 thousand Baht at current prices allowing for price increases of 3.3 percent per annum is realistic, based on preliminary designs plus an allowance of 7 % for physical contingencies.



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UBON AND WARIN ~ 5



NOTE : D/D

Detailed Design

R/M Rehabilitation and Modification

FIGURE	
**************************************	IMPLEMENTATION SCHEDULE
ES 3	

-		(x 1,000 Baht)
Α.	Rehabilitation and Modification	13,400
	Land Acquisition	~ `
•	Ubon Treatment Plant	5,800
	Warin Treatment Plant	3,400
	Distribution Facilities	4,200
B.	Expansion	145,900
		•
	Land Acquisition	2,900
	Ubon No.4 Treatment Plant	89,100
	Warin Treatment Plant	5,600
	Distribution Facilities	48,300
c.	Engineering Services	17,300
~••		
D.	Administration Cost	1,700
L •		
Е.	Physical Contingencies	12,500
ц .	Thy of our concerns of the	
	Price Contingonaics	28,400
r.	Price Contingencies	

The tentative financing plan, summarized in Table-ES.3, assumes loans from a foreign financial institution such as OECF totaling 175,400 thousand Baht, or 80 % of capital expenditure, and local loans totaling 43,800 thousand Baht, or 20 % of capital expenditure. The total fund requirement through the project period is projected to amount to 399,100 thousand Baht, on a cash-flow basis, of which 45.1 % will be covered by internal cash generation and the rest (54.9 %) will be financed with foreign and local loans, and with no internal financial help of PWA.

Table-ES.3	TENTATIVE FINANCING PLAN FOR STAGE I IMPLEMENTATION	
	[UBON-WARIN WATERWORKS] x 1,000 Baht	

	1. A.		
Item	Before	% of	
	Depreciation	Total	
1. Sources of Funds			
Internal Cash Generation	179,900	45.1%	
Outside Sources:			
- Foreign Financial Institution			
such as OECF	175,400	43.9%	
- Local Financial Institution	43,800	11.0%	+ (
		· · ·	- - -
Total	399,100	100.0%	• .
		на стали стали. На стали с	
2. Application of Funds			
Capital Expenditure	219,200	54.9%	
Debt Service	179,900	45.1%	· · · ·
Total	399,100	100.0%	

This financial situation, together with the Financial Internal Rate of Return of 8.8 % and the Economic Internal Rate of Return of 14.4 %, demonstrates financial and economic justification of the project, in view of the terms of finance applicable to the project and the prevailing cost of capital in Thailand.

Several key actions are necessary if the project is to succeed.

1. Financing for project implementation must be confirmed. This confirma tion includes the checking of a possibility of obtaining Government subsidies for project capital investment, which is now being suspended temporarily for Government budgetary reasons. Such subsidy will reduce the capital cost of the project.

- Changes in structure of PWA's water tariff, as recommended in the Main Report, are needed, together with periodic increases in tariffs (to cover the effects of price escalation).
- 3. PWA should secure the land proposed as a site for the treatment plant which is located next to the Ubon Treatment Plant and make necessary arrangements for the use of land, including evacuation of resident houses and relocation of the raw water pipe there now being used by the Air Force.
- 4. A leakage team should be formed in the waterworks to pursue a program of reducing water leakage in accordance with the Framework prepared by JICA Team.

The project is technically feasible and provides the least cost solution for providing water supply as needed in the project area through the year 2000. The project is also significant to improve the existing facilities which are deteriorating. Implementation of the project will significantly improve the water supply and other environmental situation and health of the people in Ubon and Warin.

SUPHANBURI

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SUPHANBURI

A. Introduction

This report summarizes the results of a comprehensive master plan and feasibility study conducted by a study team of the Japan International Cooperation Agency (JICA), which are presented in this volume of the Report entitled "DEVELOPMENT PLAN AND FEASIBILITY STUDY ON PROVINCIAL WATER SUPPLY PROJECTS IN THE KINGDOM OF THAILAND, SUPHANBURI".

The study area covers Suphanburi Municipality and its neighboring Sanitary District, Phophraya, both located approximately 100 km northwest of Bangkok. Suphanburi is an administrative, educational and commercial center serving agricultural districts surrounding the municipality.

The combined population of Suphanburi and Phophraya is projected to increase from 28,600 in 1985 to 37,600 by 2010, the target year of the current project.

The service ratio of the area is comparatively high to register 79 % in 1985, but this is due chiefly to the hydrogeological features of the area, where potable water is unavailable from shallow wells. Despite the high rate of service ratio, the necessity to expand water supply in this area is urgent, as the unserved residents are forced to depend upon unsanitary rain and river water or to purchase unreasonable expensive water from vendors.

The current project purports to mitigate such immediate requirements, as well as to improve the service ratio in the long-run from 79 % at present to 94 % in 2010.

In view of the uncertainties in the future development of Suphanburi and Phophraya as well as of the internal administrative reasons of PWA, project implementation is planned to be divided into two stages, i.e., Stage I up to the year 2000 and Stage II through 2010. It is also to be noted that the unaccounted-for water ratio is increasing rapidly these years, with the water supply facilities deteriorating. Because of the increasing unaccounted-for ratio, recent expansion in production has not resulted in purported increase in supply.

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In view of the above, the Development Plan proposes an immediate improvement program to rehabilitate the existing system, together with immediate modification works to increase the production-supply capacity of the existing facilities. These immediate actions are required to be carried out prior to the Stage I expansion program, or as part of its initial phase.

B. Strategies to the Targets

As a step to achieve the service ratio of 94 % in 2010, a ratio of 92 % will be targeted for the year 2000, probably one of the highest ratio among PWA Waterworks. For this purpose the share of public, commercial, industrial and other large-scale consumers are required to be increased.

The field survey and the questionnaire survey conducted in January 1986 revealed that the unstableness of water supply due to the deterioration of the production-supply facilities was pointed out as one of the main reasons why large-scale consumers evaded the use of PWA water. This unstableness of supply together with high priced water tariffs were iterated by largescale consumers as the points to be rectified in PWA water-supply service.

It is projected that the share of large-scale consumers will gradually increase with improvement in services, as shown in Table-ES.1, i.e., from 36 % of the total consumers in 1985 to 41 % in 2000 and to 43 % in 2010. Such improvement in the share of large-scale consumers will doubtless contribute to the betterment of the waterworks' rate of return, as the average water-tariff level will be improved.

SUPHANBURI-3

Item	1985	2000	2010
1. Total Population	28,600	34,000	37,600
Suphanburi	24,300	29,100	32,300
Phophraya	4,300	4,900	5,300
2. Population Served	22,600	31,300	35,300
Suphanburi	19,200	26,800	30,300
Phophraya	3,400	4,500	5,000
		·	
3. Water Sales : (m ³ /day)	2,880	6,200	8,630
		a e	•
a) Domestic	1,840	3,660	4,940
Suphanburi	1,570	3,130	4,240
Phophraya	270	530	700
b) Public and Other Large-Scales	1,040	2,540	3,690
Suphanburi	1,000	2,330	3,340
Phophraya	40	210	350
		· · ·	
4. Water Production (m ³ /day)	4,970	8,050	10,800
		a ^{ta} n an a	- - -
5. Unaccounted-for as % of Production	42	23	20

Table-ES.1 PROJECTED WATER DEMAND FOR SUPHANBURI WATERWORKS

The use of groundwater as raw water source should be encouraged from the viewpoint of cost-consciousness. This not only reduces chemical and electricity cost but also cut down personnel expenses drastically. The number of personnel is projected to increases from 32 in 1986 only to 48 in 2000, while water sales will increases from 1,095 thousand cu m to 2,263 thousand cu m during the project period.

The domestic per-capita consumption is also projected to increase almost linearly from 82 lpcd in 1985 to 117 lpcd in 2000, and further to 140 lpcd in 2010. Strategic plans are illustrated in Fig-ES.1 and the estimated costs therefor are summarized in Table-ES.2.

		· · · · ·		Unit:1	,000 Baht
		Stage I		Stage II	Total
Item	Rehabili. and	Expansion	Sub- Total	(2000-2010) Expansion	Stages I and II
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Land and Facilities	25,100	21,400	46,500	29,500	76,000
Engineering Service	2,600	2,300	4,900	3,000	7,900
Administration Cost	300	200	500	300	800
Physical Contingencies	1,900	1,700	3,600	2,300	5,900
Price Contingencies	2,600	4,300	6,900	18,400	25,300
Total	32,500	29,900	62,400	53,500	115,900

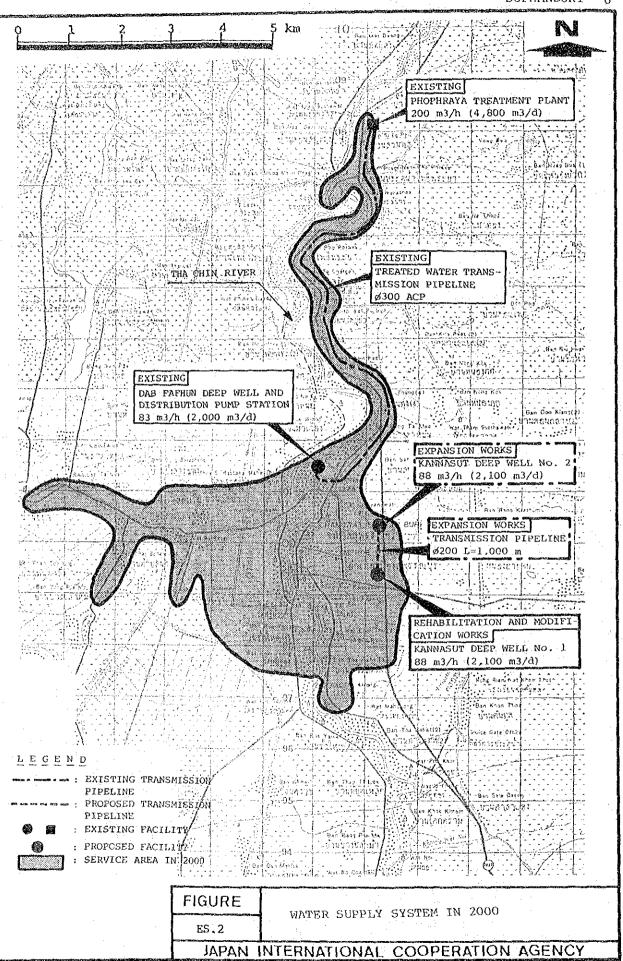
Table-ES.2 TOTAL COST FOR MASTER PLAN

C. Proposed Water Supply, 1987-2000

The proposed water supply system for Stage I will cover the service area shown in Fig-ES.2. The rehabilitation and modification will provide needed improvement of existing facilities and to construct a 2,100 cu m/d deep well to meet the urgent water demand which is expected to intensity around 1988. The Stage I Expansion is designed to meet projected maximum day demand of 10,900 cu m/d, to serve 31,300 people by 2000, and to expand the service area to 2,300 ha. Additional 33 km distribution pipelines will be installed, with approximately 1,000 service connections. Implementation is proposed to proceed as Fig-ES.3.

The proposed project and its costs are summarized in Table-ES.3. The estimated cost of the project, totaling 62,400 thousand Baht at current prices allowing for price increases of 3.3 percent per annum is realistic, based on preliminary designs plus an allowance of 7 % for physical contingencies.

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SUPHANBURI - 6

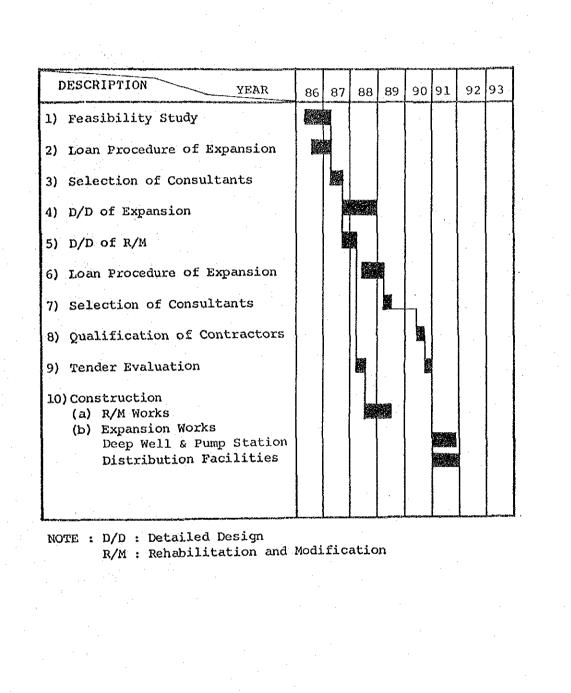


	FIGURE	IMPLEMENTATION SCHEDULE			
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	ES.3				
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Table-ES.3ESTIMATED PROJECT COSTS FOR STAGE I IMPLEMENTATION (x 1,000 Baht)A. Rehabilitation and Modification25,100Land Acquisition2,000Land Acquisition2,350Clear Water Transmission Pipeline650Dab Fafhun Deep Well and Distribution Fump Station2,100Kannasut Deep Well (No.1) and Pump Station10,000	
 A. Kenabilitettion and accurate and acquisition Land Acquisition Phophraya Treatment Plant Clear Water Transmission Pipeline Dab Fafhun Deep Well and Distribution Fump Station Kannasut Deep Well (No.1) and 	
 A. Kenabilitettion and accurate and acquisition Land Acquisition Phophraya Treatment Plant Clear Water Transmission Pipeline Dab Fafhun Deep Well and Distribution Fump Station Kannasut Deep Well (No.1) and 	
Phophraya Treatment Plant 2,350 Clear Water Transmission Pipeline 650 Dab Fafhun Deep Well and Distribution Fump Station 2,100 Kannasut Deep Well (No.1) and	
Phophraya Treatment Plant2,350Clear Water Transmission Pipeline650Dab Fafhun Deep Well and Distribution2,100Fump Station2,100Kannasut Deep Well (No.1) and	
Clear Water Transmission Pipeline 650 Dab Fafhun Deep Well and Distribution Pump Station 2,100 Kannasut Deep Well (No.1) and	· · · · · · · · · · · · · · · · · · ·
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Fump Station2,100Kannasut Deep Well (No.1) and	
Kannasut Deep Well (No.1) and	
· · · · · · · · · · · · · · · · · · ·	
	÷
Distribution Pipeline 8,000	
B. Expansion 21,400	
B. Expansion 21,400	
Land Acquisition 200	
Kannasut Deep Well (No.2) 2,200	
Clear Water Transmission Pipeline 1,000	
Distribution Facilities:	
- Distribution Pump 200	
- Pipelines 17,800	
C. Engineering Services 4,900	
D. Administration Cost 500	
	÷ .t
E. Physical Contingencies 3,600	
F. Price Contingencies 6,900	
Total 62,400	

The tentative financing plan, summarized in Table-ES.4, assumes loans from a foreign financial institutions totaling 49,900 thousand Baht, or 80 % of capital expenditure, and local loans totaling 12,500 thousand Baht, or 20 % of capital expenditure. The total fund requirement through the project period is projected to amount to 116,700 thousand Baht on a cash-flow basis , of which 46.5 % will be covered by internal cash generation and the rest (53.5 %) will be financed with foreign and local loans, and with no internal financial help of PWA.

Table-ES.4 TENTATIVE FINANCING PLAN FOR STAGE I IMPLEMENTATION [SUPHANBURI WATERWORKS] x 1,000 Baht

	Item		• • •
		Before	% of
:		Depreciation	Total
1.	Sources of Funds	•	
	Internal Cash Generation	54,300	46.5%
	Outside Sources:	· · ·	
	- Foreign Financial Institution	49,900	42.8%
	such as OECF		
	- Local Financial Institution	12,500	10.7%
	Total	116,700	100.0%
:			•
2.	Application of Funds		
	Capital Expenditure	62,400	53.5%
	Debt Service	54,300	46.5%
•••			· · ·
·	Total	116,700	100.0%

The Financial Internal Rate of Return which is calculated as 3.3 % and the Economic Internal Rate of Return of 9.4 % are not considered so favorable. One of the reasons is that capital investment of this project has to be directed largely to the improvement of the deteriorated facilities.

Another consideration to be paid in this respect is the unfairness of the calculation formula of allocating Head and Regional Office Overhead expenses to waterworks, which is placing undue financial burdens on small-scale waterworks.

This report suggests a new trial formula of share calculation which may work more fair both to large and small sized waterworks.

If this trial formula is applied, FIRR and EIRR of the current project for Suphanburi Waterworks will register 4.0 % and 11.1 %, respectively.

Moreover, there are indications that all such data as unit cost and rate of return are showing improvement toward the target year 2000. It is well assumed that Suphanburi Waterworks will demonstrate more favorable indicators in the coming Stage II period.

Several key actions are necessary if the project is to succeed.

- 1. Financing for project implementation must be confirmed. This confirmation includes the checking of a possibility of obtaining Government subsidies for project capital investment, which is now being suspended temporarily for Government budgetary reasons. Such subsidy will ease the financial conditions of waterworks in making capital investment, particularly for such waterworks as Suphanburi whose earning positions should yet to be strengthened.
- Changes in structure of PWA's water tariff, as recommended in the Main Report, are needed together with periodic increases in tariffs (to cover the effects of price escalation).
- 3. The formula of allocating Head and Regional Office overhead expenses to waterworks is recommended to be revised to be more fair particularly to small waterworks still poor in their rates of return.

- 4. Suitable land sites should be secured at the earliest time possible for the deep wells and distribution pumping station which are proposed to be constructed in Stage I.
- 5. A leakage survey team should be formed in the waterworks to pursue a program of reducing water leakage in accordance with the Framework prepared by JICA Team.

The project is technically feasible and provides the least cost solution for providing water supply as needed in the project area through the year 2000. The project is also significant to improve the existing facilities which are deteriorating. Implementation of the project will significantly improve the water supply and other environmental situation and health of the people in Suphanburi and Phophraya.