

TECHNICAL NOTE

ON THE BASIC DESIGN STUDY

ON THE PROJECT FOR IMPROVEMENT OF

WATER SUPPLY SYSTEM IN SIEM REAP TOWN

IN THE KINGDOM OF CAMBODIA

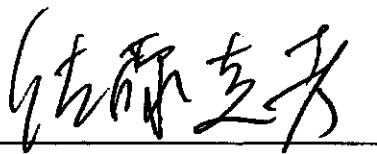
AGREED UPON BETWEEN

MINISTRY OF INDUSTRY, MINES AND ENERGY

AND

JICA STUDY TEAM

4 APRIL 2003



Mr. Yoshihiko Sato
Chief Consultant
JICA Study Team



H.E. Mr. Phork Sovanrith
Undersecretary of State
Ministry of Industry, Mines and Energy

After a series of discussions during the field survey in Cambodia from 2nd March 2003 through 4th April 2003, the following points were agreed between the Ministry of Industry, Mines and Energy (MIME) and the JICA Study Team (Team). Based on the agreement, the Team will further analyze the results of field survey in consultation with JICA and concerned parties in Japan and will prepare a draft final report which includes the layout and design of facilities and/or equipment for the Project.

1. Target Year

The target year for the Project will be 2008, taking into consideration the implementing schedule of the Project, however the Royal Government of Cambodia (RGC) requested a grant in aid program to implement the Project based on the feasibility study conducted by JICA in 2000 (2000 FS) which set the target year in 2006.

2. Service areas

RGC requested to add some 30 ha of Trapeang Sess, Taksen Tbong, and Veal villages in the Kouk Chak Commune and 50 ha stretch along with National Road No. 6 into the Project service area as shown in **Appendix I**. A total service area will be 425 ha. The population in the Kouk Chak Commune is sharply increased due to the recent change of land use plan from military zone to residential zone.

3. Service population

According to the proposed service areas and their population projection studied by the Team in reference to the latest population census prepared in 2001 by the planning department of Siem Reap Provincial Government, a total population in the service areas is estimated to be approximately 40,000 in the target year 2008 as shown in **Appendix II**.

4. Tourists

The yearly number of tourist arrivals to Siem Reap Town is estimated to be approximately 1.11 million in the target year 2008 as shown in **Appendix III** based on the data issued by the Ministry of Tourism in 2002. The average stay of tourists is assumed to be 3 days, one day longer than the 2000 FS. A daily total numbers of tourist visit to Siem Reap Town is estimated approximately 9,000.

5. Water demand projection

In projection of water demand, the same design basis including unit consumption rate by

categories of uses (domestic, tourist, and special) and peak factors set in the 2000 FS will be considered. At present only a population of 3,300 in the Study Area has access to the existing water supply. The 2000 FS assumes that it takes five years to expand the coverage from 30 to 65 percent. A staged target level is then utilized in preparation of the Basic Design, taking into consideration the current state of coverage and schedule of the Project implementation. This aims to increase coverage up to 65 percent by the target year 2008. While, the coverage for tourism water demand in the target year 2008 will be set at 40 percent due to delay in their connection to the Project as well as the limited potential groundwater source without serious impact to the Angkor heritage. As a result of the Project, service population will be increased from 3,300 to 26,000 or eight times of the current coverage in the target year 2008. A preliminary water demand projection is attached in **Appendix IV**.

6. Process design

A preliminary water quality analysis conducted by the Team in the field indicates that raw water contains iron more than 0.3mg/l, the WHO Drinking Water Standards. The water quality analysis data of WT4 in the 2000 FS varies seasonally from 0 to 1.0 mg/l. Therefore, iron removal facilities are recommended to be considered in the process design. Preliminary general plot plan is referred to **Appendix V**.

7. Water supply system

MIME understood that the distribution system using an elevated water tank, which is predominant in Cambodia, is easier in operation and maintenance than that of the proposed direct pumping system in the 2000 FS.

8. Well capacity and location

The pumping test conducted by the Team shows that a nominal well capacity should be reduced from 800m³/d designed in the 2000FS to 600m³/d. The required numbers of well is possibly increased to 15 wells including one stand-by well to ensure the 8,000m³/d nominal design capacity of water treatment plant. The proposed typical well station is shown in **Appendix VI**.

9. Related laws/regulations clearance for land procurement, construction and EIA

MIME will carry out the required clearance for the relevant laws and regulations in Cambodia in connection to procurement of the proposed land and the construction works for the Project including the proposed wells, water treatment plant, and pipelines without delay. The proposed site location will be referred to **Appendix V, VI, and VII**. Likewise, EIA should be cleared in accordance with the relevant laws by MIME. Those progresses for clearance should

be reported monthly to the Team.

10. Archaeological survey and mine investigation

MIME will conduct archaeological survey and mine investigation at his own cost in cooperate with the relevant agencies concerned in Cambodia if the proposed sites are confirmed as the project site as soon as possible. The investigation results should be reported to the Team.

11. Monitoring station for LTa-1 and LTa-2

The Team found that the site of monitoring station LTa-1 and LTa-2 is now planned to be a football ground for a school, SOS Children's Villages of Cambodia. MIME will investigate the SOS project and inform of the issue and measures to the Team by the end of April 2003.

Attachments:

Appendix I: Service area

Appendix II: Population projection

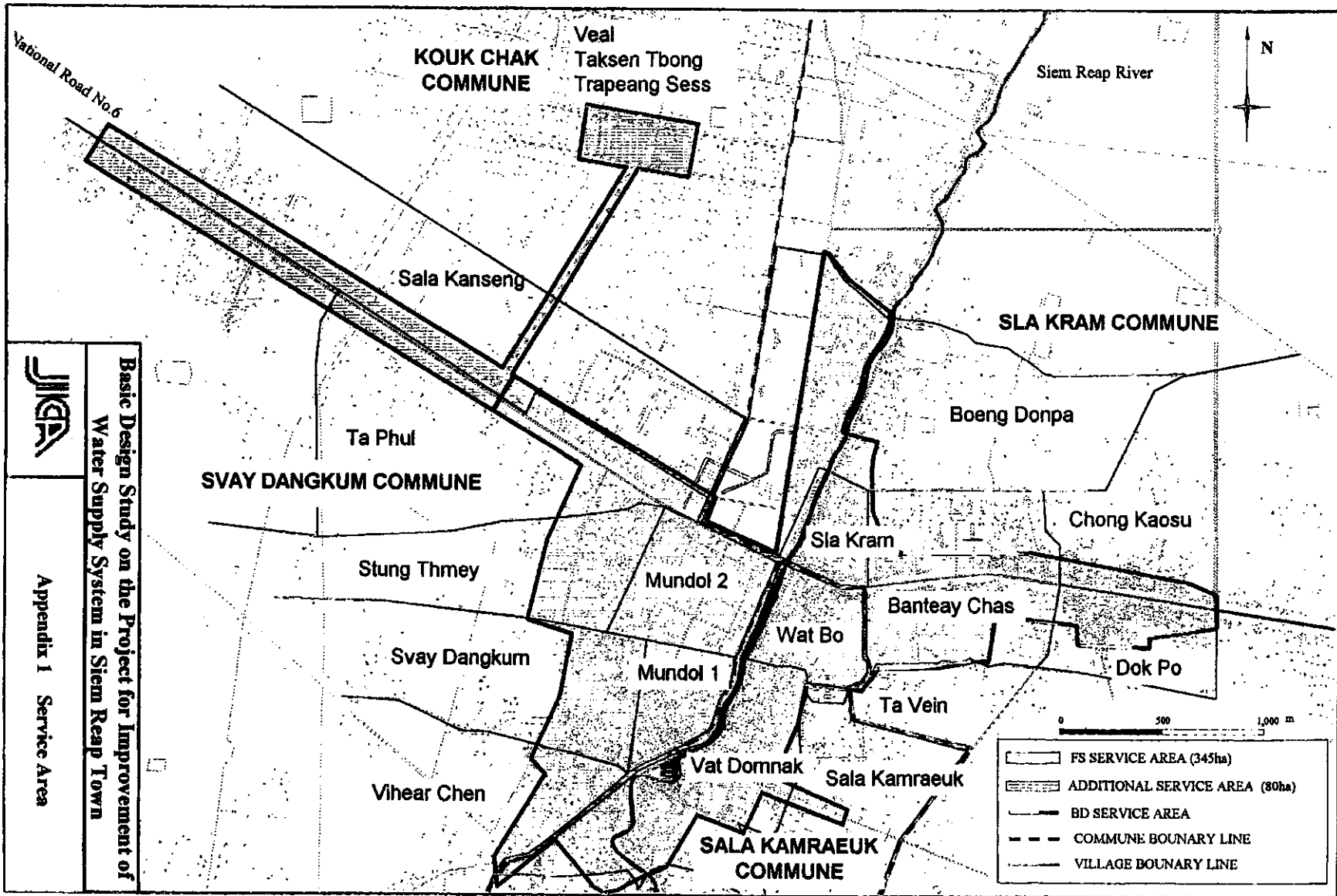
Appendix III : Tourist projection

Appendix IV: Water demand projection

Appendix V: Preliminary plan of WTP

Appendix VI: Typical plan of well station

Appendix VII: Location of well stations



JICA

Basic Design Study on the Project for Improvement of Water Supply System in Siem Reap Town

Appendix 1 Service Area



Appendix II
Population Projection

Basic Design Study on the Project for Improvement of
Water Supply System in Siem Reap Town

Communes	Villages	Estimated Total Population in the Service Areas																		
		TTL Population		Population Coverage ¹	Population served/area			Growth rate (%)		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
		1998	2001		FS	BD	(ha)	FS	BD ²											
1. Svay Dangkm																				
	i Svay Dangkm	1,124	1,299	0.7	787	22	7.0	4.9	842	901	964	1,031	1,104	1,181	1,263	1,352	1,446	1,556	1,656	
	ii Vihear Chen	3,528	3,743	0.1	359	8	7.0	2.0	377	404	432	462	495	529	567	606	649	743	743	
	iii Mundol 1	1,723	2,144	1.0	1,723	19	7.0	7.6	1,844	1,973	2,111	2,259	2,417	2,586	2,767	2,960	3,168	3,627	3,627	
	iv Sirung Thmey	2,459	2,469	0.8	1,967	27	7.0	3.2	2,105	2,252	2,410	2,579	2,759	2,952	3,159	3,380	3,617	4,141	4,141	
	v Mundol 2	480	539	1.0	480	35	7.0	3.9	514	550	588	629	673	720	771	825	882	1,010	1,010	
	vi Ta Phul	2,478	2,529	0.8	1,982	24	7.0	3.2	2,121	2,270	2,429	2,599	2,780	2,975	3,183	3,406	3,643	4,173	4,173	
	vii Sala Kanseng	3,448	4,259	0.1	345	4	7.0	7.3	369	395	422	452	484	517	554	592	634	726	726	
	Sub total FS	14,348	16,984	0.6	7,627	139			8,173	8,744	9,356	10,011	10,711	11,461	12,263	13,123	14,088	16,878	16,878	
	Sub total BD				8,291				8,291	8,787	9,405	10,068	10,788	11,564	12,394	13,274	14,214	17,256	17,256	
2. Sala Kamraek																				
	i Wat Bo	3,916	4,675	1.0	3,916	24	8.1	6.1	4,233	4,576	4,800	4,800	4,800	4,800	4,800	4,800	4,800	4,800	4,800	4,800
	ii Vat Domnak	2,360	3,210	0.9	2,304	39	8.1	7.8	2,491	2,692	2,910	3,146	3,401	3,677	3,974	4,296	4,644	5,427	5,427	
	iii Sala Kamraek	957	1,298	0.1	96	3	8.1	10.7	103	112	121	131	141	153	165	178	193	225	225	
	Sub total FS	7,433	9,833	0.85	6,316	66			6,827	7,388	7,833	8,277	8,742	9,229	9,739	10,278	10,877	12,456	12,456	
	Sub total BD				7,694				7,694	8,259	8,823	9,388	9,953	10,518	11,083	11,648	12,213	14,213	14,213	
3. Siem Kram																				
	i Siem Kram	2,043	1,994	1.0	2,043	14	7.0	5.1	2,186	2,339	2,503	2,678	2,800	2,800	2,800	2,800	2,800	2,800	2,800	
	ii Banteay Chas	4,629	4,370	0.9	4,166	45	7.0	5.1	4,458	4,770	5,104	5,461	5,843	6,252	6,690	7,158	7,659	8,769	8,769	
	iii Boeng Donga	2,059	2,529	0.5	1,030	40	7.0	7.1	1,102	1,179	1,261	1,349	1,444	1,545	1,653	1,769	1,893	2,167	2,167	
	iv Dok Po	2,361	2,234	0.8	1,889	30	10.0	5.1	2,078	2,285	2,514	2,765	3,042	3,346	3,681	4,049	4,454	5,389	5,389	
	v Chong Keasu	6,236	7,772	0.1	624	11	7.0	7.6	667	714	764	817	875	936	1,001	1,071	1,146	1,313	1,313	
	Sub total FS	17,328	18,899	0.56	9,781	140			10,498	11,287	12,146	13,071	14,064	15,129	16,282	17,523	18,857	21,438	21,438	
	Sub total BD				9,786				9,786	10,296	10,811	11,331	11,856	12,386	12,921	13,461	14,006	16,006	16,006	
4. Kokchek																				
	1. Trapeang Seas	3,269	4,575	0.4	1,308	30			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
	2. Tukon Tbong	1,326	1,895	0.5	763	4			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
	3. Veal	2,229	2,121	0.2	446	4			n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
	Sub total FS	7,824	8,591	0.36	3,516															
	Sub total BD				3,202						3,282	3,339	3,463	3,601	3,746	3,895	4,051	4,213	4,213	
Grand Total		47,823	53,687	0.59	26,328	345			25,489	27,411	29,333	31,255	33,257	35,269	37,281	39,283	41,285	46,368	46,368	
					29,843	379			n/a	n/a	29,843	30,872	31,901	32,930	33,959	34,988	36,017	41,100	41,100	
		Coverage in 2001: 29,043/53687=			34%			Figures top shows FS ³ bottom shows BD ²												

Notes:
 1. Population coverage is set at 2000FS based on priority analysis.
 2. BD growth rate is of between the year 1998 to 2001 based on the 2001 Census conducted by the Department of Planning of Siem Reap Province.
 3. Figures shown in top is FS data and bottom is BD adopted based on the updated population data provided.
 4. Saturated population is assumed in the max. population density of 200/ha.
 5. Kokchek commune is requested to added to the service area by SRW SS in BD study.

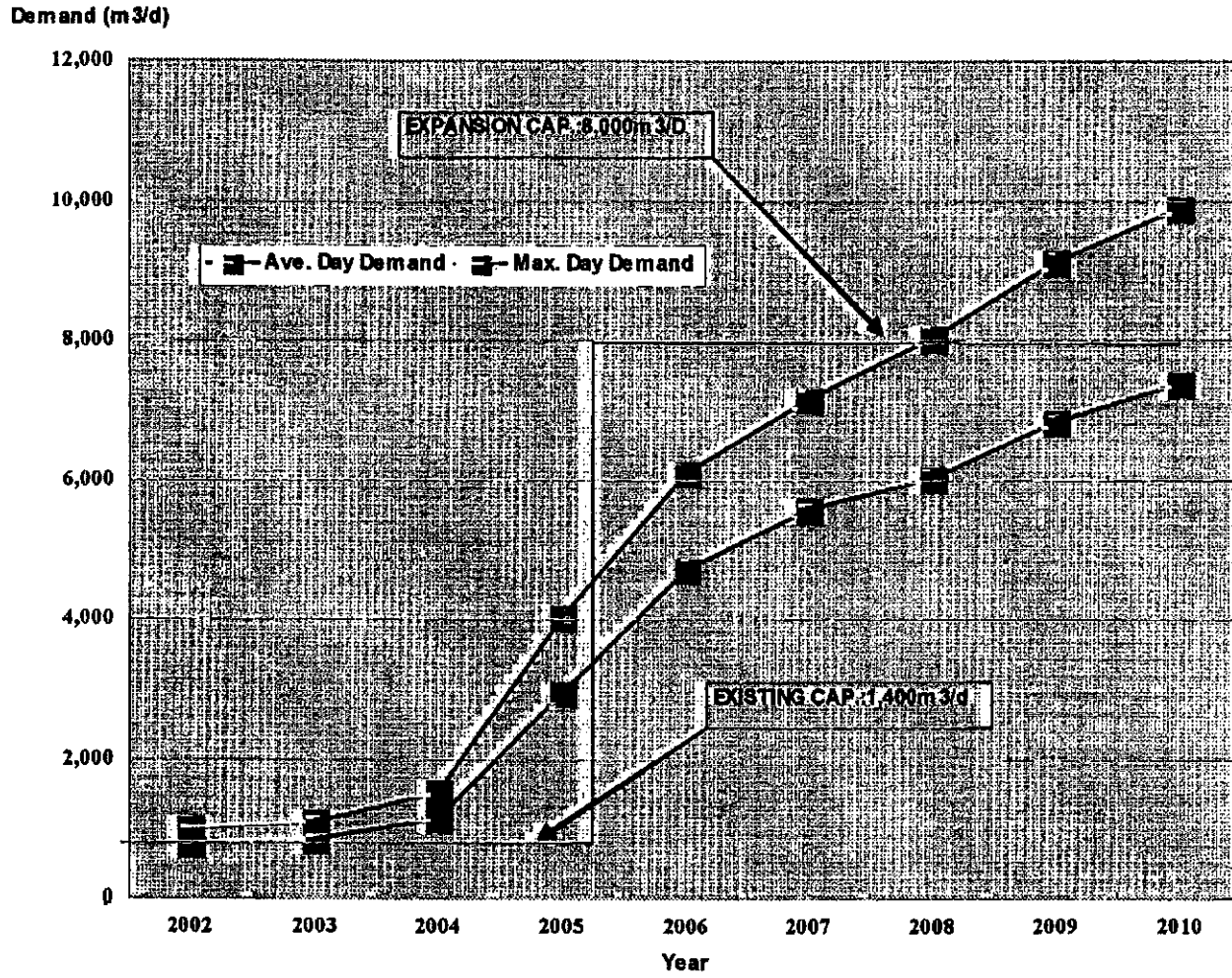
Tourists/Visitors Projection in Siem Reap												
Year	Visitors arrival to Cambodia ¹	Increase ratio	Average length of stay	Hotel occupancy rate	Foreign visitors arrival to Siem Reap	Foreign visitors share to Siem Reap	Cambodian visitors to Siem Reap	Cambodian visitors increase rate to Siem Reap	TTL visitors to Siem Reap	Average stay in Siem Reap	Daily Nos of Visitors	
			(days)									
1993	118,183	N/A	N/A	N/A								
1994	176,617	49.4%	N/A	N/A								
1995	219,680	24.4%	8	37.0%								
1996	260,489	18.6%	7.5	40.0%								
1997	218,843	-16.0%	6.4	30.0%								
1998	286,524	30.9%	5.2	30.0%								
1999	367,743	28.3%	5.5	44.0%								
2000	466,365	26.8%	5.5	45.0%						2		
2001	604,919	29.7%	5.5	48.0%						2		
2002	786,524	30.0%	5.8	50.0%	453,148	58%	93,942	5.0%	547,090	3	4,497	
2003	1,022,649	30.0%	5.8		589,189	58%	98,639	5.0%	687,828	3	5,653	
2004	1,329,444	15.0%	5.8		765,946	58%	103,571	5.0%	869,517	3	7,147	
2005	1,528,861	7.5%	5.8		880,838	58%	108,750	5.0%	989,588	3	8,134	
2006	1,643,523	2.0%	5.8		946,901	58%	114,187	5.0%	1,061,088	3	8,721	
2007	1,676,396	2.0%	5.8		965,839	58%	119,896	5.0%	1,085,735	3	8,924	
2008	1,709,924	2.0%	5.8		985,156	58%	125,301	5.0%	1,111,047	3	9,132	
2009	1,744,122	2.0%	5.8		1,004,859	58%	132,186	5.0%	1,137,045	3	9,346	
2010	1,779,005		5.8		1,024,956		138,795		1,163,751	3	9,565	
Notes:												
1. Visitors increase ratio to Cambodia is assumed to be 30%, 15%, 7.5%, and 2% in year 2003, 2004, 2005, and afterwards, in reference to the existing hotel capacity in Cambodia. The visitors increase will be depend on the hotel capacity and transportation such as air flight.												
Therefore, The visitors arrivals to Cambodia will sharply reach at the 786,524 x2 = approx. 1.6 million, the existing hotel capacity in the Project target year.												
2. Based on the record in 2002, 58% of visitors to Cambodia visited Siem Reap.												
3. Cambodian visitors to Siem Reap is assumed to grow 5% annually in reference to the GDP.												
4. Average stay in Siem Reap Town is increased to 3 days from 2 days in FS based on interview from the hotels.												



Basic Design Study on the Project for Improvement of Water Supply System in Siem Reap Town

Appendix III

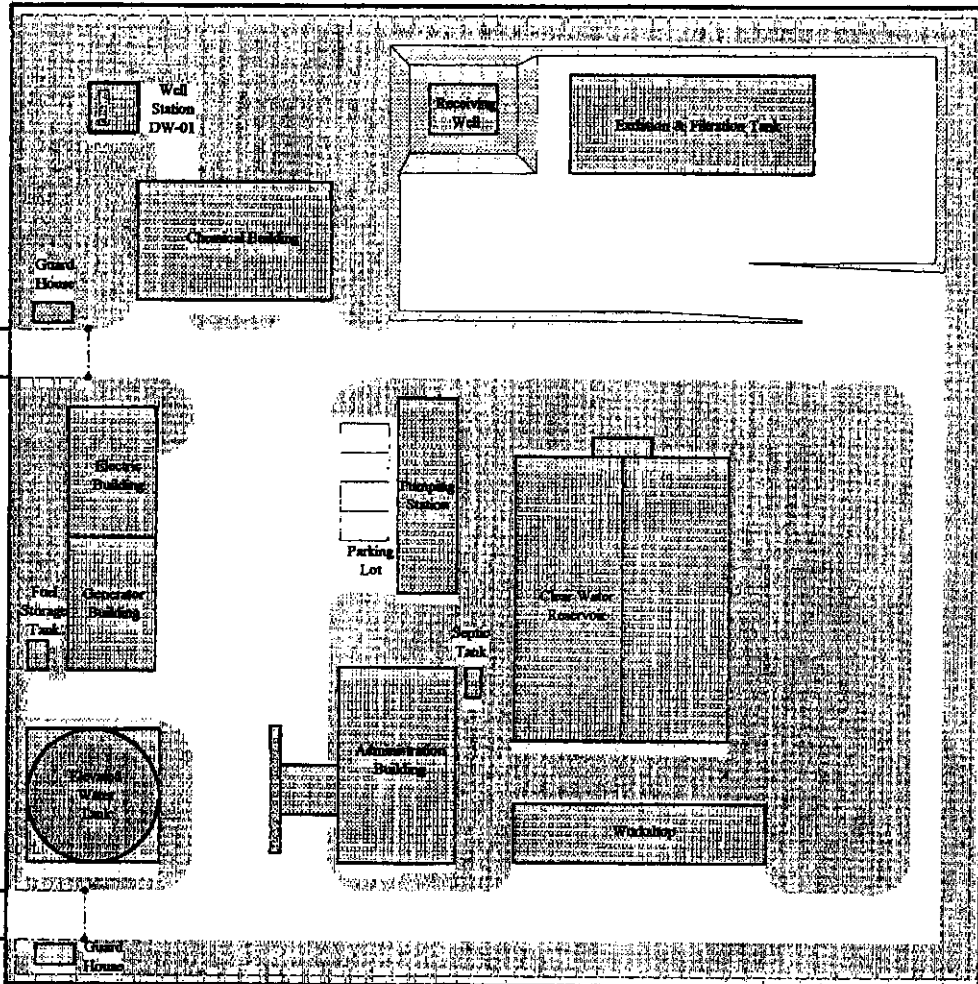
Tourist Projection



to Taishou
Elementary School

Not to Scale
(approximate s=1:750)

100m



100m

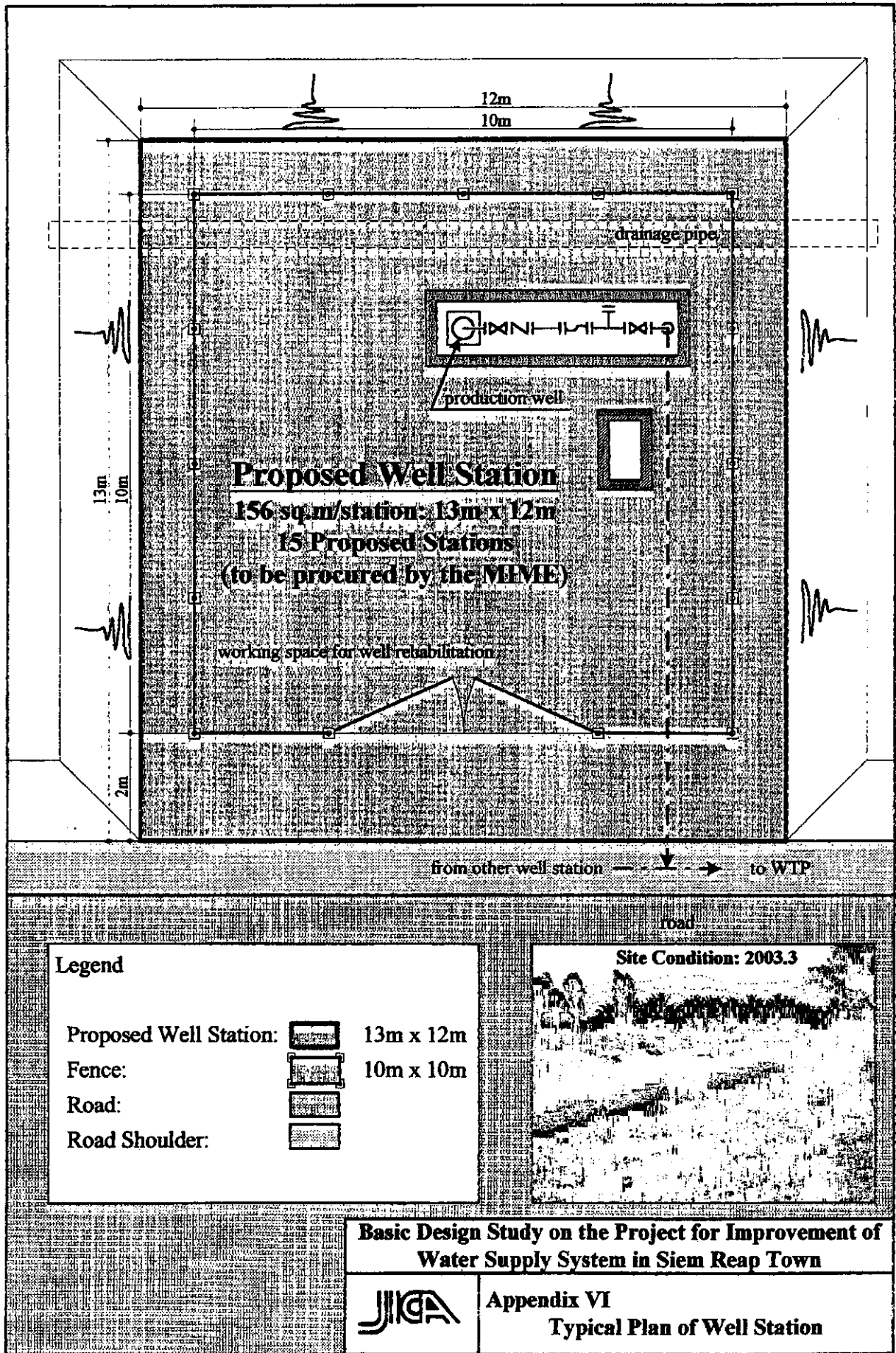


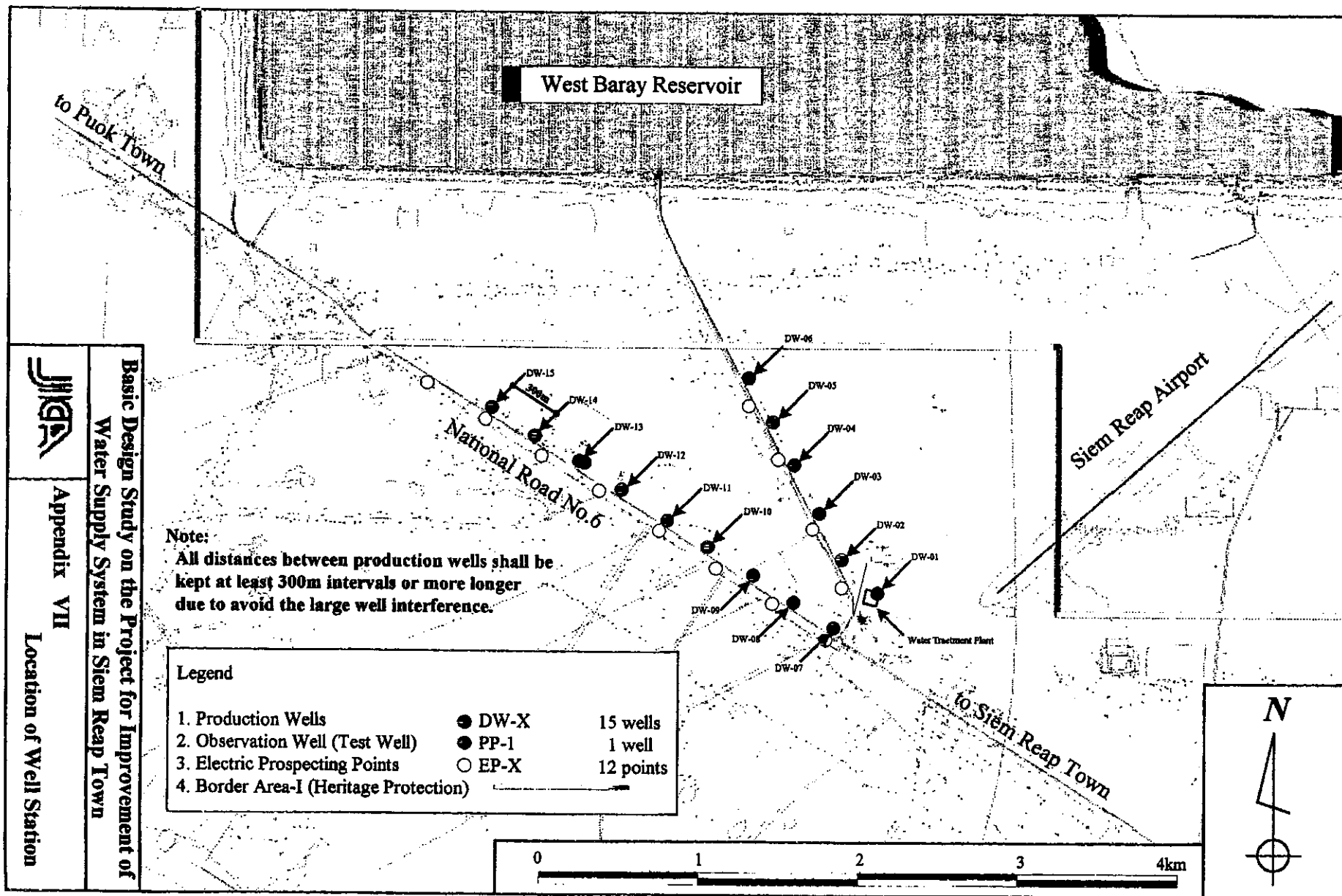
to National Road No.6


**Basic Design Study on the Project for Improvement of
Water Supply System in Siem Reap Town**



Appendix V
Preliminary Plan of WTP






 Basic Design Study on the Project for Improvement of
 Water Supply System in Siem Reap Town
 Appendix VII
 Location of Well Station

Note:
 All distances between production wells shall be kept at least 300m intervals or more longer due to avoid the large well interference.

Legend		
1. Production Wells	● DW-X	15 wells
2. Observation Well (Test Well)	● PP-1	1 well
3. Electric Prospecting Points	○ EP-X	12 points
4. Border Area-I (Heritage Protection)	-----	

THE PROJECT FOR IMPROVEMENT OF WATER SUPPLY SYSTEM IN SIEM REAP TOWN

(JICA STUDY TEAM)

PROJECT OFFICE: C/O SIEM REAP WATER SUPPLY SYSTEM
038, VIHEARECHEN VILLAGE, SVAYDANGGOM COMMUNE, SIEM REAP, CAMBODIA
Tel/Fax: (855)-63-964023, Mobile Phone: (855)-12-605907

Minutes of Meeting

Date: from 8:00 to 9:30, 4 March 2003

Place: Conference room, MIME

Participants: as attached

Recorded by: the Team

The Team explained the design basis and issues concerned for the Project, including target year, service area, service population, tourists, water demand projection, process design, water supply system, well capacity and location, related laws/regulations clearance for land procurement, construction and EIA, archaeological and mine investigation, and monitoring station for LTa-1 and LTa-2 as signed the Technical Note. The following issues were discussed before signing the Technical Note.

(1) Aviation control

MIME has submitted an inquiry for clearance on the construction of the proposed elevated water tank near the Siem Reap International Airport to the relevant authority in response to a request made by the Team on 18th March 2003. MIME is now waiting for the decision of the relevant agency.

(2) Tourist projection

MIME pointed out that the projection prepared by the Team is too conservative due to the current depressed conditions of tourism industry caused by the Iraq War. The Team replied that the projection is reasonable for design of the facilities/equipment. The projection will be realistic if the Iraq War would be ended.

(3) Action taken by MIME

MIME expressed the following action plan to facilitate the project implementation.

- A joint committee will be organized, which consists of the Siem Reap Water Supply System, Siem Reap Provincial Government, APSARA, and MIME.
- MIME will commence the land acquisition based on the draft final report to be prepared in

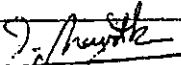
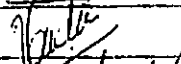
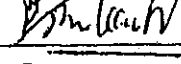
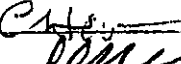
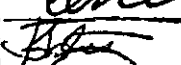

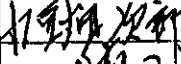
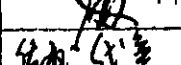
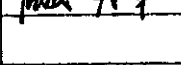

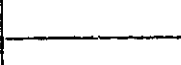
early July 2003 by the Team.

- MIMÉ will process the required EIA based on the FS report prepared in 2000.
- MIMÉ will conduct mine investigation in cooperate with CMAC.
- MIMÉ will investigate the current situation of the project for SOS Children's Village of Cambodia in cooperate with the Siem Reap Provincial Government.

-----Following blank-----

Kingdom of Cambodia
Nation Religion King

MEETING BETWEEN MIME and JICA
ON 04 APRIL, 2003

No	NAME	POSITION	INSTITUTION	Fax / Phon	SIGN
1.	H.E Phark Savarith	Under Secretary of State	HITHE		
2.	Mr. Peng Nanyuth	Director of DPWS	MIME		
3.	Mr. Sim Vaidia	Deputy Director of DPWS	MIME		
4.	Mr. ANN CHAN RONG	Staff Project office	MIME		
5.	Mr. CHEAV CHANNY	Vice Chief officer	MIME		
6.	Mr. CHAN SETHA LOA	SAWS			
7.	Kenji Takaguchi	JICA Study Team Environment Assistant	JICA Study Team		
8.	T. Suetake	JICA Study Team	"		
9.	Jiro Azuhata	JICA Study Team	"		
10.	Y. SATO		"		
11.	Mr. Koizumi	JICA	JICA		
12.					
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