SOCIALIST REPUBLIC OF VIETNAM
CAN THO PEOPLE'S COMMITTEE
CAN THO WATER SUPPLY AND SEWERAGE COMPANY, LTD.

PREPARATORY STUDY
ON
CAN THO CITY WATER SUPPLY IMPROVEMENT PROJECT

FINAL REPORT
(APPENDICES)

March 2013

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
NIPPON KOEI CO., LTD.
SWING CORPORATION
MITSUBISHI CORPORATION
PRICEWATERHOUSECOOPERS CO.,LTD.

Exchange Rate

1 USD = 77.92 Yen

1 Yen = 266.36 VND

1 USD = 20,890 VND

(As of End of May 2012)

PREPARATORY STUDY
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CAN THO CITY WATER SUPPLY IMPROVEMENT PROJECT

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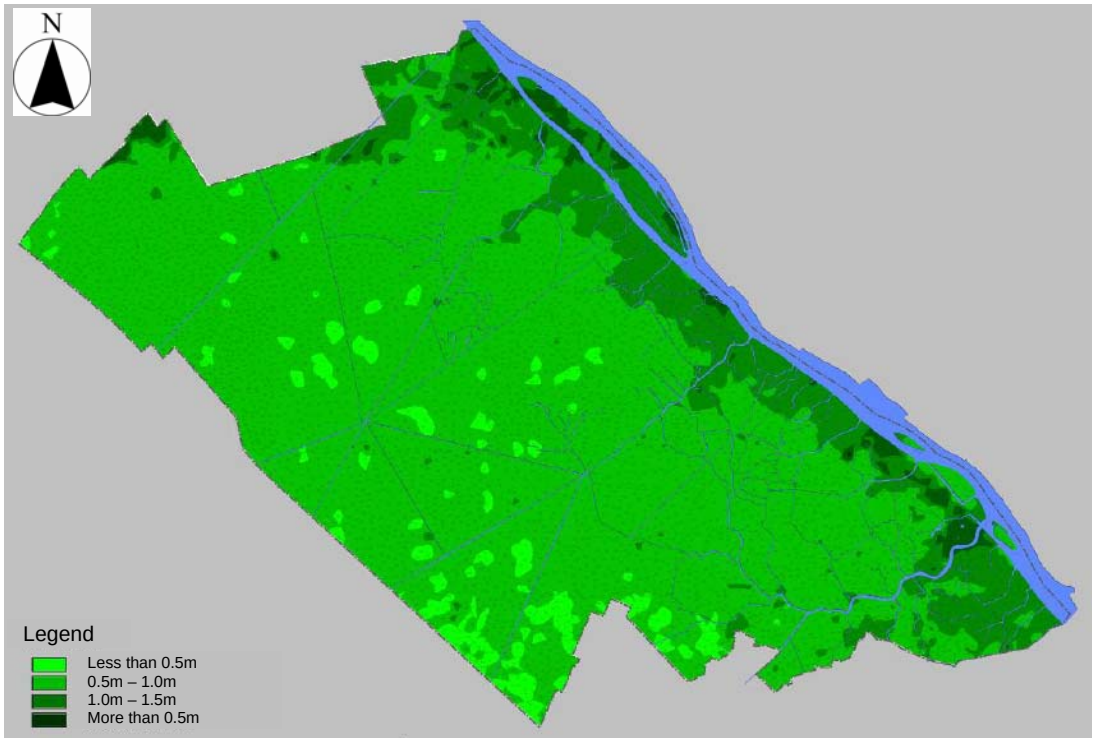
(APPENDICES)

LIST OF APPENDICES

Appendix A

APPENDIX A1 NATURAL CONDITIONS

A1.1 Topography



Source: Proposal for Adjustment of Can Tho City Master Plan 2030

Figure A1.1 Altitude of Can Tho City

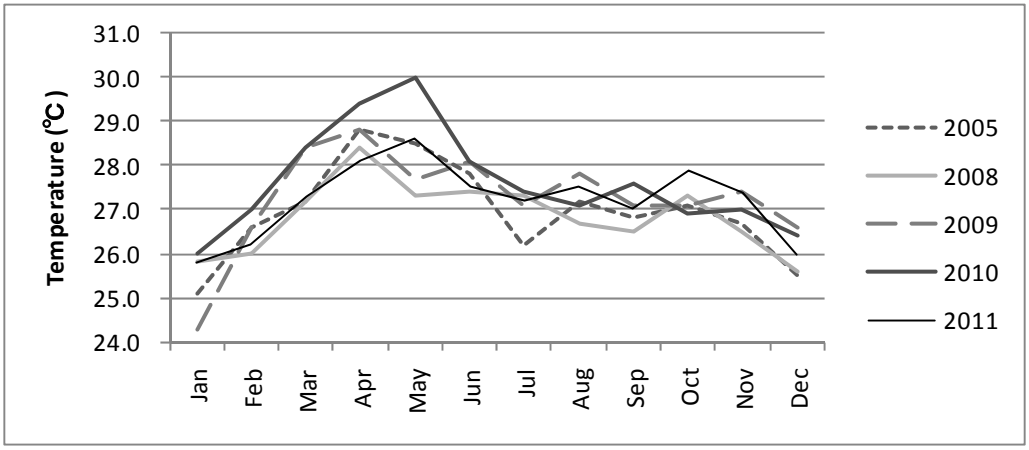
A1.2 Meteorology

Table A1.1 Monthly Mean Temperature of Can Tho City

(Unit: ℃)

	2005	2008	2009	2010	2011	Mean
January	25.1	25.8	24.3	26.0	25.8	25.4
February	26.6	26.0	26.6	27.0	26.2	26.5
March	27.2	27.2	28.4	28.4	27.3	27.7
April	28.8	28.4	28.8	29.4	28.1	28.7
May	28.5	27.3	27.7	30.0	28.6	28.4
June	27.8	27.4	28.1	28.1	27.5	27.8
July	26.2	27.3	27.1	27.4	27.2	27.0
August	27.2	26.7	27.8	27.1	27.5	27.3
September	26.8	26.5	27.1	27.6	27.0	27.0
October	27.1	27.3	27.1	26.9	27.9	27.3
November	26.7	26.5	27.4	27.0	27.4	27.0
December	25.5	25.6	26.6	26.4	26.0	26.0
Mean	27.0	26.8	27.3	27.6	27.2	27.2

Source: Statistical Yearbook of Can Tho city 2011



Source: Statistical Yearbook of Can Tho city 2011

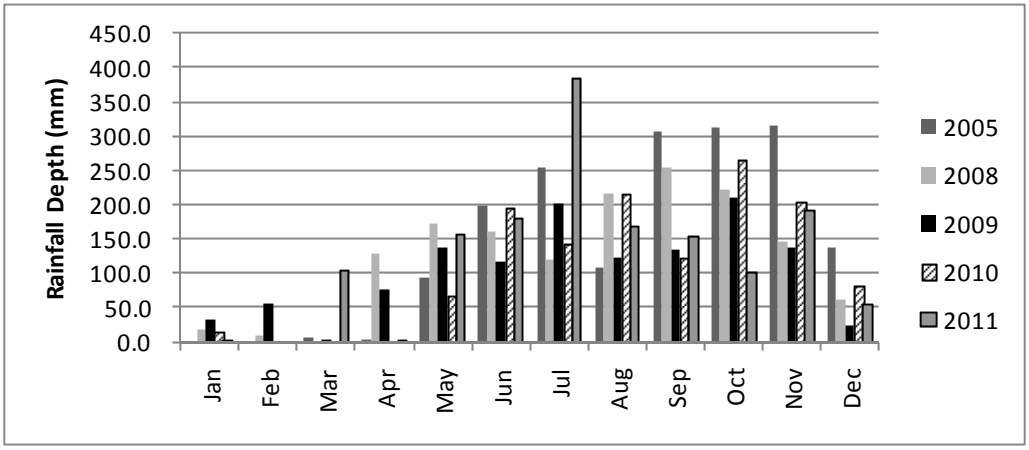
Figure A1.2 Monthly Mean Temperature of Can Tho City

Table A1.2 Monthly Rainfall Depth of Can Tho City

(Unit: mm)

	2005	2008	2009	2010	2011	Mean
January	-	17.8	31.3	14.7	1.8	16.4
February	-	8.0	55.6	0.0	0.0	15.9
March	4.8	-	2.9	0.6	103.9	28.1
April	0.5	128.4	76.0	1.1	1.1	41.4
May	93.7	173.2	136.0	66.5	155.7	125.0
June	197.8	159.5	116.0	195.9	181.1	170.1
July	254.6	119.8	200.6	143.8	384.5	220.7
August	108.8	216.5	122.5	214.5	167.7	166.0
September	307.4	254.5	133.8	120.9	152.2	193.8
October	311.5	223.1	209.5	265.4	101.3	222.2
November	315.1	147.6	138.8	204.0	191.1	199.3
December	137.7	61.3	24.2	82.4	55.1	72.1
Sum	1731.9	1509.7	1247.2	1309.8	1495.5	1458.8

Source: Statistical Yearbook of Can Tho city 2011



Source: Statistical Yearbook of Can Tho city 2011

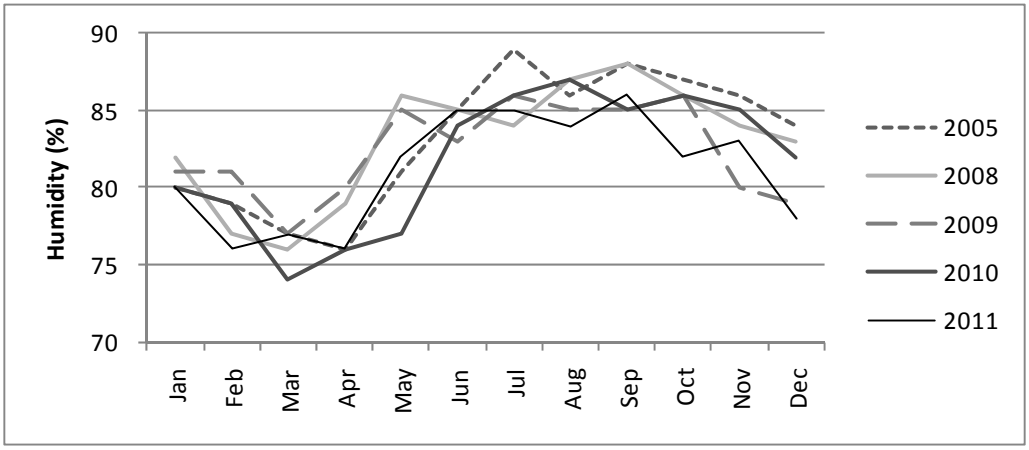
Figure A1.3 Monthly Rainfall Depth of Can Tho City

Table A1.3 Monthly Mean Humidity of Can Tho City

(Unit: %)

	2005	2008	2009	2010	2011	Mean
January	80	82	81	80	80	80.6
February	79	77	81	79	76	78.4
March	77	76	77	74	77	76.2
April	76	79	80	76	76	77.4
May	81	86	85	77	82	82.2
June	85	85	83	84	85	84.4
July	89	84	86	86	85	86.0
August	86	87	85	87	84	85.8
September	88	88	85	85	86	86.4
October	87	86	86	86	82	85.4
November	86	84	80	85	83	83.6
December	84	83	79	82	78	81.2
Mean	83.2	83.1	82.3	81.8	81.2	82.3

Source: Statistical Yearbook of Can Tho city 2011



Source: Statistical Yearbook of Can Tho city 2011

Figure A1.4 Monthly Mean Humidity of Can Tho City

A1.3 Hydrology

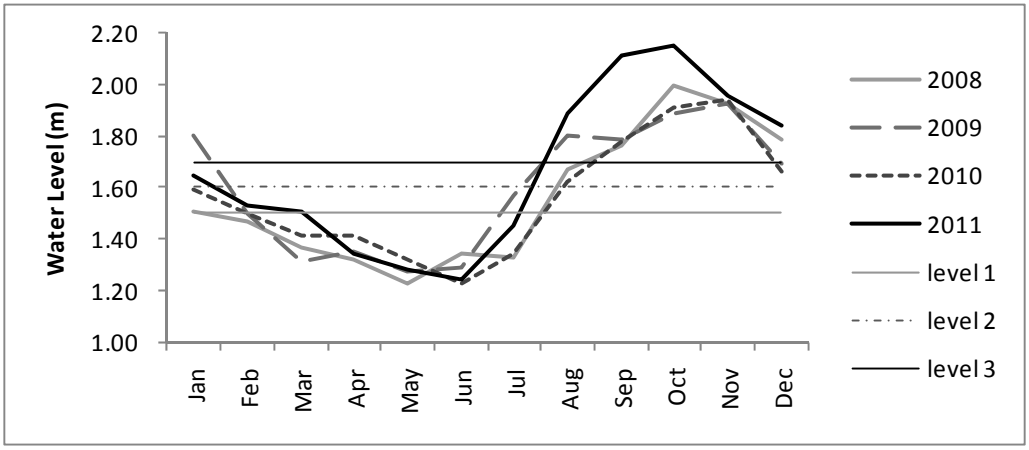
A1.3.1 Collected Hydrological Information

Table A1.4 Monthly Highest Water Level at Can Tho Station

(Unit: m)

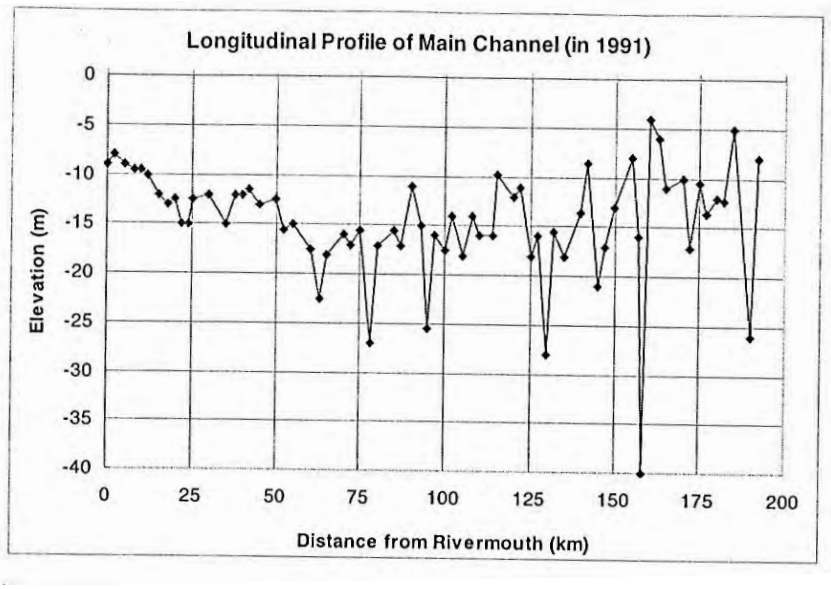
	2008	2009	2010	2011	Mean
January	1.51	1.80	1.59	1.65	1.64
February	1.47	1.50	1.50	1.53	1.50
March	1.37	1.31	1.41	1.51	1.40
April	1.32	1.35	1.41	1.34	1.36
May	1.23	1.27	1.32	1.28	1.28
June	1.34	1.29	1.23	1.24	1.28
July	1.33	1.57	1.34	1.45	1.42
August	1.67	1.80	1.62	1.89	1.75
September	1.76	1.79	1.78	2.11	1.86
October	2.00	1.89	1.91	2.15	1.99
November	1.93	1.93	1.94	1.96	1.94
December	1.79	1.69	1.66	1.84	1.75
Maximum	2.00	1.93	1.94	2.15	2.01

Source: Statistical Yearbook of Can Tho city 2011



Source: Statistical Yearbook of Can Tho city 2011

Figure A1.5 Monthly Highest Water Level at Can Tho Station



Source: Effect of Configuration Changes on Flow Distribution and Salt Water Intrusion, Program of Salinity Intrusion Studies in the Mekong Delta Phase Ⅲ, SIWRPM, 1992

Figure A1.6 Longitudinal Profile of the Hau River (1/2)

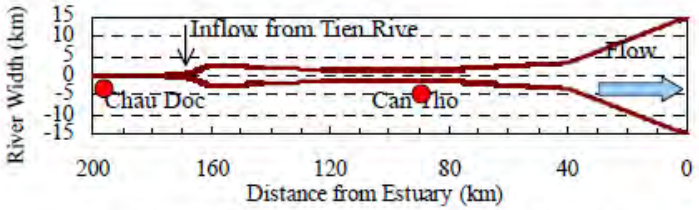


Figure 2. Frame format of the Hau River

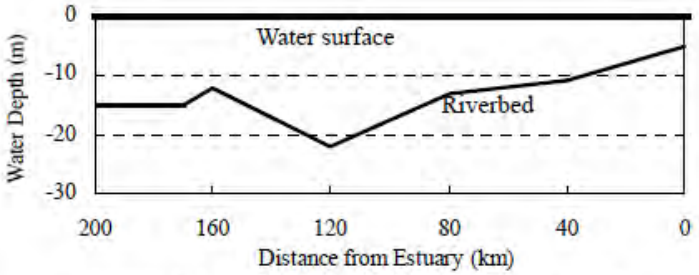
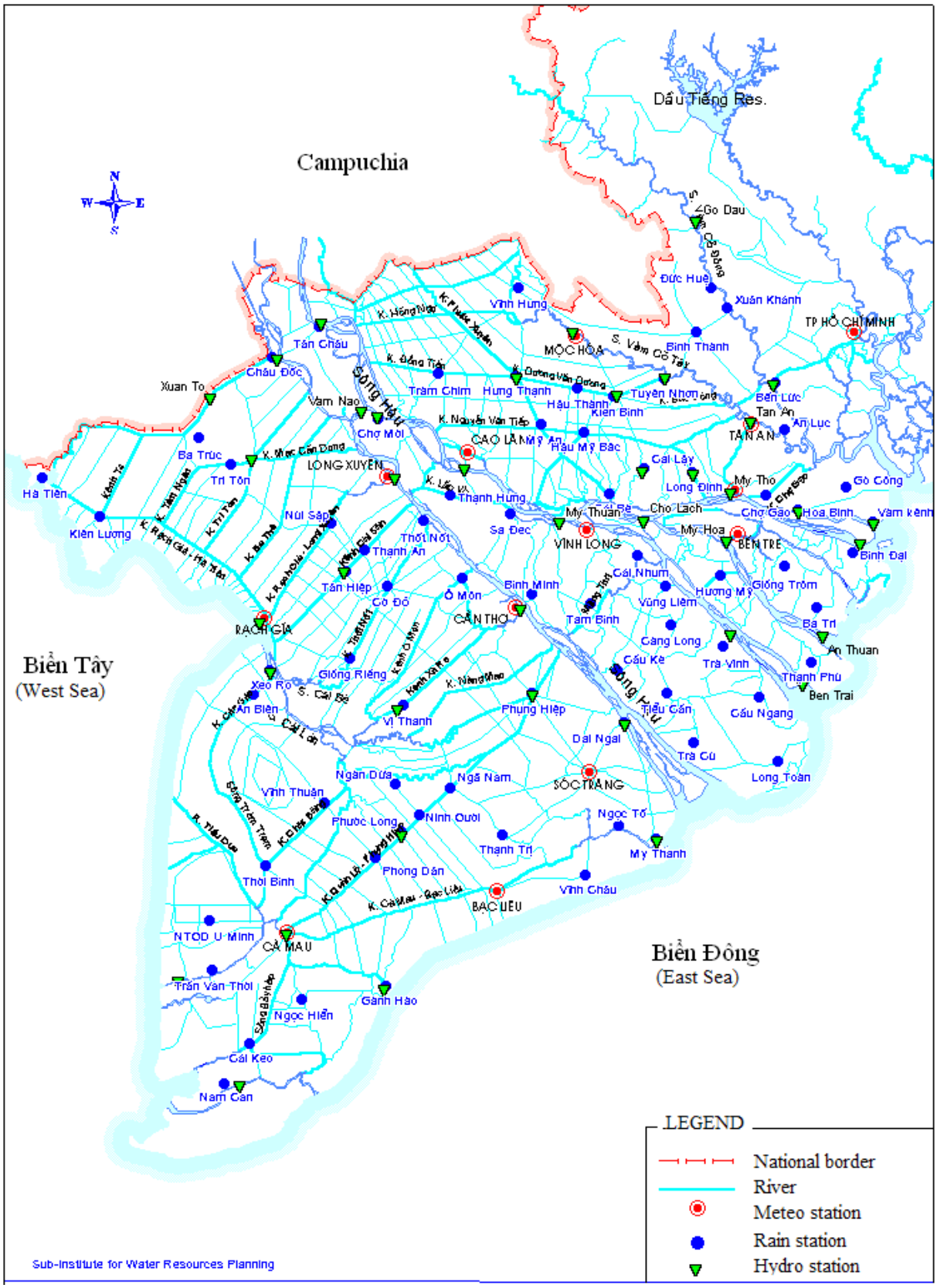


Figure 3. Longitudinal profile of the Hau River

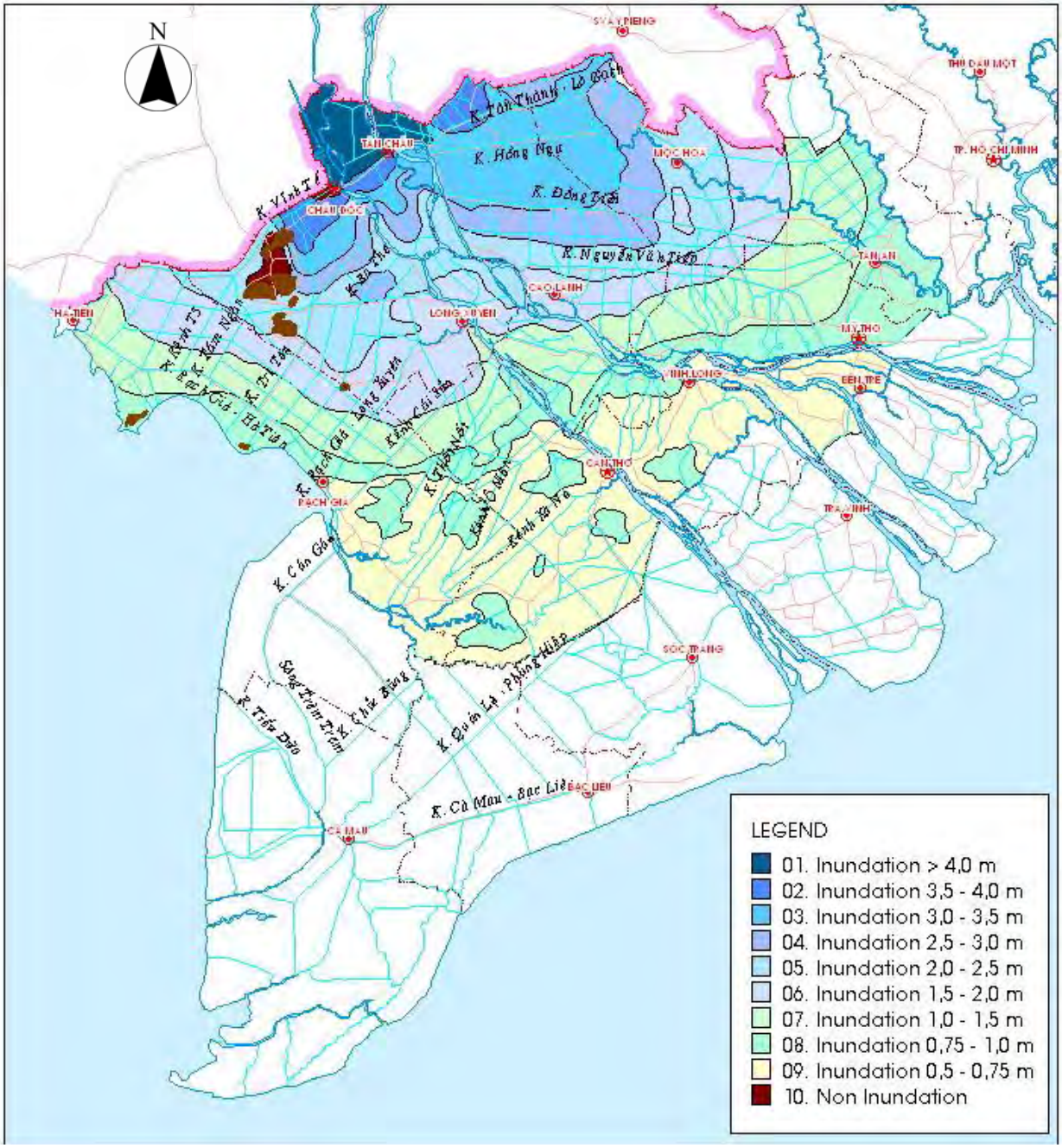
Source: Yoshifumi Fujimori, Fumitake Nishimura, Pandit Saroj Kumar and Masahiro Watanabe, *Fundamental Study on the River Water Behavior and the Water Quality in Two Main Channels of the Mekong River Delta Area in Vietnam*, International Symposium on Geo-Disasters, Infrastructure Management and Protection of World Heritage Sites

Figure A1.6 Longitudinal Profile of the Hau River (2/2)



Source: Mekong Delta Water Resources Assessment Studies, Vietnam-Netherlands Mekong Delta Master Plan Project, January 2011.

Figure A1.7 Hydrological and Meteorological Monitoring Network in South Vietnam



Source: *Draft Report on Spatial Planning Assessment Study in the Mekong Delta*, Vietnam-Netherlands Mekong Delta Master Plan Project, Southern Institute for Water Resources Planning

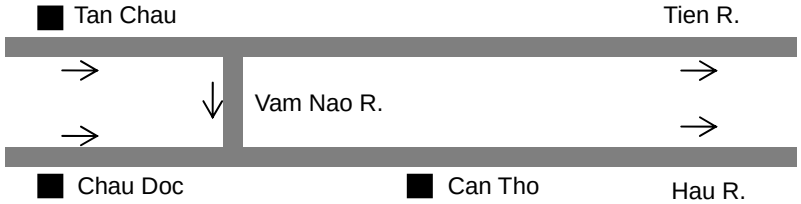
Figure A1.8 Map of Maximal Inundating Depth during Flood Season 2000 (1/2)

Source: *Survey on Perception of Risks in Can Tho City*, World Bank Regional GFDRR Grant Number TF 098599, Development Workshop / France

Figure A1.8 Map of Maximal Inundating Depth during Flood Season 2000 (2/2)

A1.3.2 Estimation of the Discharge in the Hau River

There are two hydrological stations at the upstream of the Can Tho City, which are the Tan Chau station and the Chau Doc station, as shown in Figure A1.9.



Source: JICA Study Team

Figure A1.9 Schematic Illustration of Location of Hydrological Stations

Hourly discharge records at Tan Chau and Chau Doc for the period of 1997 to 2001 were collected in the study of JICA (2004), and mean monthly discharge was calculated. The calculated mean monthly discharge is shown in Table A1.5.

Table A1.5 Mean Monthly Discharge at Tan Chau and Chau Doc (1997-2001)

Unit: m^3/s

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
Tan Chau	6,411	4,132	2,624	2,280	3,569	8,209	14,213	19,172	20,720	19,278	14,996	10,386	10,499
Chau Doc	1,472	863	579	509	793	1,902	3,424	4,754	5,626	5,291	4,102	2,711	2,669
Total	7,883	4,995	3,203	2,789	4,362	10,111	17,637	23,926	26,346	24,569	19,098	13,097	13,168

Source: Vietnam National Mekong Committee
Note: Data is collected in the following study, "JICA (2004) The Study on Hydro-meteorological Monitoring for Water Quality Rules in Mekong River Basin, Final Report Volume Ⅱ Supporting Report (2/2)"

According to JICA (2004), the ratio of the discharge of the Tien River and the Hau River at the downstream of the Vam Nao River is 50% : 50%. Hence, the discharge at Can Tho was estimated by following equation.

Discharge at Can Tho = (Discharge at Tan Chau + Discharge at Chau Doc) / 2

The estimated mean monthly discharge at Can Tho is shown in Table A1.6.

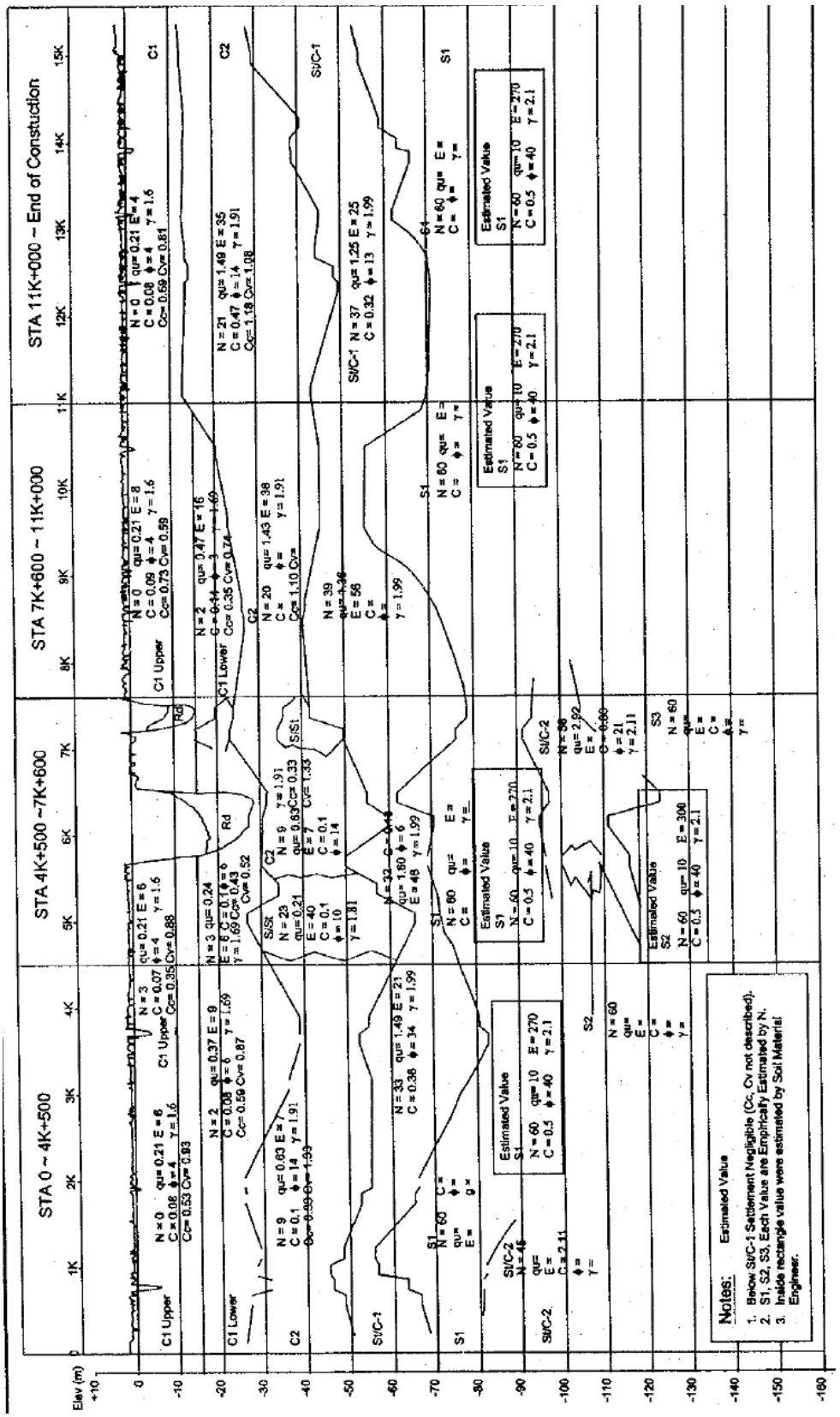
Table A1.6 Estimated Mean Monthly Discharge at Can Tho (1997-2001)

Unit: m^3/s

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
Can Tho	3,900	2,500	1,600	1,400	2,200	5,100	8,800	12,000	13,200	12,300	9,500	6,500	6,600

Source: JICA Study Team

A1.4 Geology



Source: the Detail Design on the Can Tho Bridge Construction in Socialist Republic of Viet Nam, JICA

Figure A1.10 Engineering Properties in the Soil Layer

A1.5 Water Quality

The results of water quality survey are shown below.

Sampling location: Thoi An Ward, O Mon District, Can Tho City.

Coordinate: X : 0188004 - Y : 1123542 (USR Vietnam VN 2000 Coordinate)

Sampling date: 10AM - 29/05/2012

Weather: cloudy

Table A1.7 Results of Water Quality Test at Omon Proposed Site

No	Specification	Units	Test Results	Standard (A1 Class)	MLOD	Test Method
1	Color	Pt - Co	73			TCVN 6185:1996
2	Taste	-	Tasteless			-
3	Odor	-	Odorless			-
4	Turbidity (20℃)	NTU	22			TCVN 6184:1996
5	pH (20℃)	-	6.60	6-8.5		TCVN 6942:2011
6	Dissolved Oxygen	mgO_2/L	8.42	≥ 6		TCVN 5499:1995
7	Total Suspended Solid (TSS)	mg/L	39	**20**		TCVN 6625:2000
8	COD	mgO_2/L	18	**10**		SMEWW 5220C:2005
9	BOD_5 (20℃)	mgO_2/L	8	**4**		SMEWW 5210D:2005
10	Ammonia Nitrogen (NH4)	mg/L	0.22	**0.1**		TCVN 5988:1995
11	Chloride (Cl)	mg/L	25.60	250		TCVN 6194:1996
12	Fluoride (F)	mg/L	NT	1	0.5	HACH METHOD 8029
13	Nitrite (NO_2)	mg/L	NT	0.01	0.005	TCVN 6178:1996
14	Nitrate (NO_3)	mg/L	0.058	2		TCVN 6180:1996
15	Phosphate (PO_4)	mg/L	0.071	0.1		TCVN 6202:2008
16	Cyanide (CN)	mg/L	NT	0.005	0.05	HACH METHOD 8027
17	Arsenic (As)	µg/L	0.26	10		ACIAR-AAS 001-2007
18	Cadmium (Cd)	mg/L	NT	0.005	0.001	ACIAR-AAS 004-2007
19	Lead (Pb)	mg/L	NT	0.02	0.005	ACIAR-AAS 015-2007
20	Chromium III (Cr^3+)	mg/L	NT	0.05	0.01	Reference: SMEWW2005 (3120B) & SMEWW2005 (3500 – Cr B)
21	Chromium VI (Cr^6+)	mg/L	NT	0.01	0.01	
22	Copper (Cu)	mg/L	NT	0.1	0.0015	ACIAR-AAS 007-2007
23	Zinc (Zn)	mg/L	0.064	0.5		ACIAR-AAS 015-2007
24	Nickel (Ni)	mg/L	NT	0.1	0.005	ACIAR-AAS 014-2007
25	Iron (Fe)	mg/L	1.69	**0.5**		TCVN 6177:1996
26	Mercury (Hg)	µg/L	NT	1	0.1	ACIAR-AAS 009-2007
27	Detergent	mg/L	NT	0.1	0.06	SMEWW 5540C : 2005
28	Total oils & grease	mg/L	2	**0.01**		SMEWW 5520B : 2005
29	Phenol (Total)	µg/L	NT	5	1	QTTN/KT3 035:2005

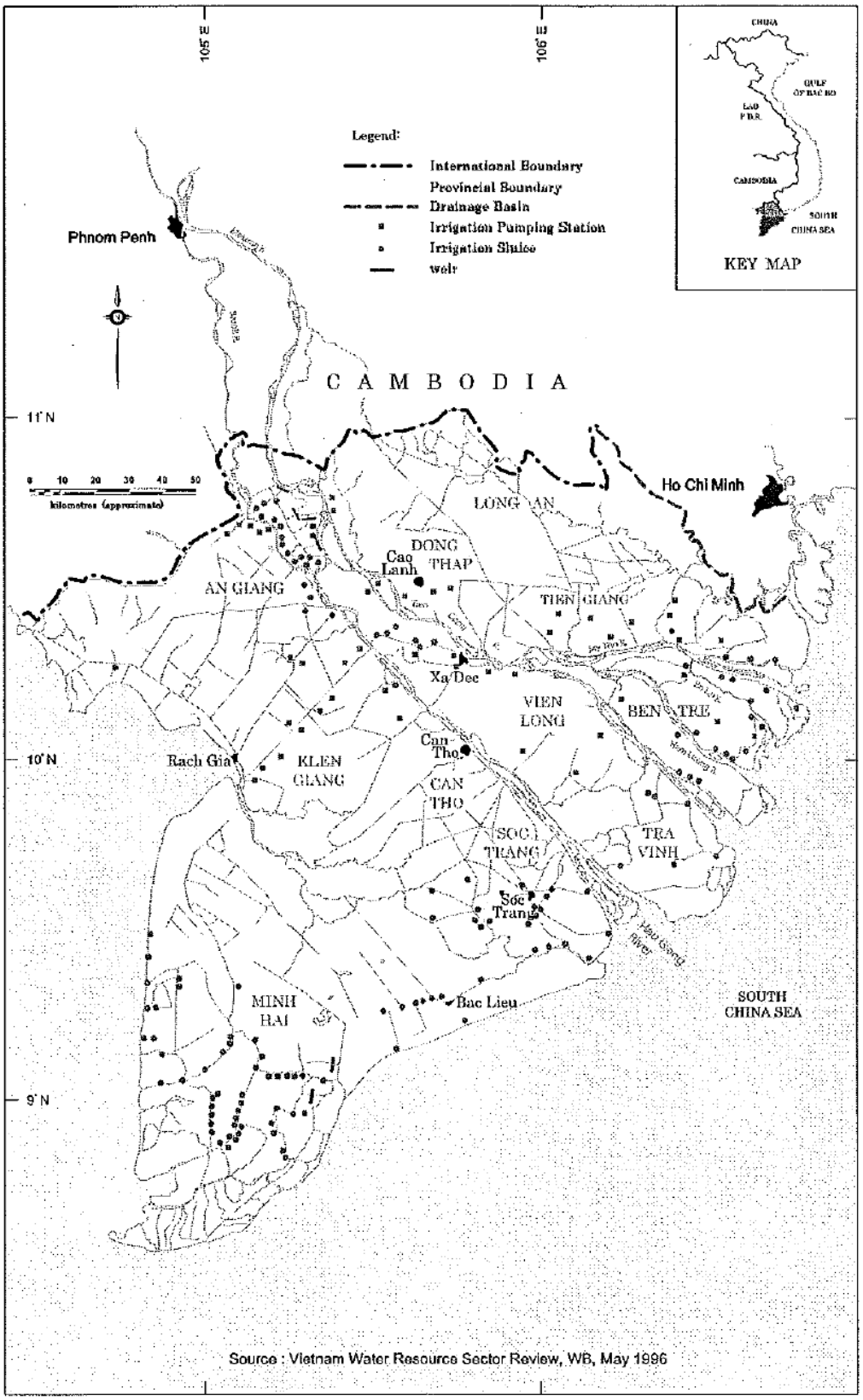
30	[Chlorine Compounds]					
	Aldrin + Dieldrin	µg/L	NT	0.002	10	GC 08 - 2007
	Endrin	µg/L	NT	0.01	0.5	
	BHC	µg/L	NT	0.05	0.5	
	DDT	µg/L	NT	0.001	0.5	SMEWW 2005 (6630 B)
	Endosunfan (Thiodan)	µg/L	NT	0.005	20	GC 08
	Lindan	µg/L	NT	0.3	10	GC 08
	Chlordane	µg/L	NT	0.01	10	SMEWW 2005 (6630 B)
	Heptachlor	µg/L	NT	0.01	0.5	
31	[Phosphorous compounds]					
	Parathion	µg/L	NT	0.1	2	SMEWW(*)2005 (6630 B)
	Malathion	µg/L	NT	0.1	2	GC 08 - 2007
32	[Herbicide]					
	2.4D	µg/L	NT	100	2	SMEWW 2005 (6640 B)
	2.4.5T	µg/L	NT	80	2	
	Paraquat	µg/L	NT	900	2	
33	*E. Coli*	MPN/100mL	< 3	20		TCVN 6846:2007
34	Total *Coliform*	MPN/100mL	4.3×10^2	2500		TCVN 4882:2007
35	Electrical Conductivity	μ S/cm	180.8			APHA 2510

Note: NT: not detected, MLOD: minimum limit of detection
Source: JICA Study Team

A1.6 Saltwater Intrusion

A1.6.1 Related Information to Agricultural Projects

Figure A1.11 Existing Irrigation Facilities in the Mekong Delta



Appendix B

■Planning Condition

		Class	Category	WTP 2010		Population in 2009					Service Ratio (WSSC)			Unit Water Demand (Domestic)			NRW Ratio (WSSC)		
						Served in 2009 by WSSC	Served by 2020 by WSSC	sub-total	Water Supply by DARD	Total	2012	2020 (target)	2030	2012	2020 (target)	2030	2010	2020 (target)	2030
						thousand	thousand	thousand	thousand	thousand	%	%	%	L/c/d	L/c/d	L/c/d	%	%	%
1	**Ninh Kieu**					**242.6**	**1.5**	**244.1**	**0.0**	**244.1**									
1-1	Cai Khe	I	Urban	4	CT-No.2	28.6	0.0	28.6		28.6	95%	99%	99%	140	180	200	34	20	18
1-2	An Hoa	I	Urban	4	CT-No.2	27.0	0.0	27.0		27.0	95%	99%	99%	140	180	200	34	20	18
1-3	Thoi Binh	I	Urban	4	CT-No.2	18.7	0.0	18.7		18.7	95%	99%	99%	140	180	200	34	20	18
1-4	An Nghiep	I	Urban	1	CT-No.1	10.2	0.0	10.2		10.2	95%	99%	99%	140	180	200	34	20	18
1-5	An Cu	I	Urban	1	CT-No.1	24.1	0.0	24.1		24.1	95%	99%	99%	140	180	200	34	20	18
1-6	An Hoi	I	Urban	1	CT-No.1	11.0	0.0	11.0		11.0	95%	99%	99%	140	180	200	34	20	18
1-7	Tan An	I	Urban	1	CT-No.1	12.5	0.0	12.5		12.5	95%	99%	99%	140	180	200	34	20	18
1-8	An Lac	I	Urban	1	CT-No.1	16.4	0.0	16.4		16.4	95%	99%	99%	140	180	200	34	20	18
1-9	An Phu	I	Urban	1	CT-No.1	15.0	0.0	15.0		15.0	95%	99%	99%	140	180	200	34	20	18
1-10	Xuan Khanh	I	Urban	1	CT-No.1	29.1	0.0	29.1		29.1	95%	99%	99%	140	180	200	34	20	18
1-11	Hung Loi	I	Urban	1	CT-No.1	27.7	0.0	27.7		27.7	95%	99%	99%	140	180	200	34	20	18
1-12	An Khan	I	Urban	4	CT-No.2	14.4	0.0	14.4		14.4	95%	99%	99%	140	180	200	34	20	18
1-13	An Binh	I	Suburban	1	CT-No.1	4.2	0.0	4.2		4.2	95%	95%	95%	125	150	180	34	20	18
		I	Suburban	3	Bong Vang	3.7	0.3	4.0		4.0	93%	95%	95%	125	150	180	34	20	18
		I	Suburban	14	Con Khuong	0.0	1.2	1.2		1.2	0%	95%	95%	125	150	180	16	15	15
2	**Binh Thuy**					**71.4**	**14.2**	**85.6**	**0.0**	**85.6**									
2-1	Tra Noc	I	Urban	6	Tra Noc	9.8	0.0	9.8		9.8	67%	99%	99%	140	180	200	34	20	18
2-2	Tra An	I	Urban	4	CT-No.2	8.3	0.0	8.3		8.3	95%	99%	99%	140	180	200	34	20	18
2-3	An Thoi	I	Urban	4	CT-No.2	17.6	0.0	17.6		17.6	95%	99%	99%	140	180	200	34	20	18
2-4	Bui Huu Nghia	I	Urban	4	CT-No.2	10.6	0.0	10.6		10.6	95%	99%	99%	140	180	200	34	20	18
2-5	Thoi An Dong	I	Suburban	4	CT-No.2	0.0	0.9	0.9		0.9	0%	95%	95%	125	150	180	34	20	18
2-6	Binh Thuy	I	Urban	4	CT-No.2	17.2	0.0	17.2		17.2	95%	99%	99%	140	180	200	34	20	18
2-7	Long Tuyen	I	Suburban	14	Con Khuong	0.0	0.8	0.8		0.8	0%	95%	95%	125	150	180	16	15	15
		I	Suburban	5	Long Hoa	5.2	0.0	5.2		5.2	95%	95%	95%	125	150	180	34	20	18
		I	Suburban			0.0	0.0	0.0		0.0	0%	95%	95%	125	150	180			
2-8	Long Hoa	I	Suburban	4	CT-No.2	0.0	9.7	9.7		9.7	0%	95%	95%	125	150	180	34	20	18
		I	Suburban	5	Long Hoa	2.7	2.8	5.5		5.5	49%	95%	95%	125	150	180	34	20	18
3	**Cai Rang**					**36.8**	**31.0**	**67.8**	**0.0**	**67.8**									
3-1	Le Binh	I	Urban	7	Ba Lang	4.3	10.1	14.4		14.4	80%	99%	99%	140	180	200	34	20	18
3-2	Thuong Thanh	I	Suburban																
3-3	Phu Thu	I	Suburban	2	Hung Phu	8.7	4.1	12.8		12.8	34%	95%	95%	125	150	180	34	20	18
3-4	Tan Phu	I	Suburban	2	Hung Phu	2.5	2.5	5.0		5.0	25%	95%	95%	125	150	180	34	20	18
3-5	Ba Lang	I	Urban	7	Ba Lang	0.0	6.4	6.4		6.4	0%	99%	99%	140	180	200	34	20	18
3-6	Hung Phu	I	Urban	2	Hung Phu	18.5	0.0	18.5		18.5	48%	99%	99%	140	180	200	34	20	18
3-7	Hung Thanh	I	Suburban	2	Hung Phu	2.8	7.9	10.7		10.7	13%	95%	95%	125	150	180	34	20	18
4	**O Mon**					**25.0**	**22.1**	**47.1**	**0.0**	**47.1**									
4-1	Chau Van Liem	I	Urban	8	O Mon	18.1	4.5	22.6		22.6	35%	99%	99%	140	180	200	34	20	18
4-2	Thoi Hoa	I	Suburban	8	O Mon	0.0	2.8	2.8		2.8	0%	95%	95%	125	150	180	34	20	18
4-3	Thoi An	I	Urban																
4-4	Phuoc Thoi	I	Suburban	6	Tra Noc	6.9	6.9	13.8		13.8	52%	95%	95%	125	150	180	34	20	18
4-5	Truong Lac	I	Suburban	6	Tra Noc	0.0	3.9	3.9		3.9	0%	95%	95%	125	150	180	34	20	18
4-6	Thoi Long	I	Suburban																
4-7	Long Hung	I	Suburban	8	O Mon	0.0	4.0	4.0		4.0	0%	95%	95%	125	150	180	34	20	18
5	**Thot Not**					**30.5**	**20.5**	**51.0**	**0.0**	**51.0**									
5-1	Thoi Thuan	I	Suburban	11	Thot Not	6.3	0.0	6.3		6.3	86%	95%	95%	125	150	180	34	20	18
5-2	Thuan An, Thot Not	I	Suburban	11	Thot Not	5.6	0.0	5.6		5.6	86%	95%	95%	125	150	180	34	20	18
5-3	Thanh Hoa, Thot Not	I	Suburban	11	Thot Not	0.0	5.3	5.3		5.3	0%	95%	95%	125	150	180	34	20	18
5-4	Trung Kien, Thot Not	I	Suburban	11	Thot Not	4.7	1.4	6.1		6.1	69%	95%	95%	125	150	180	34	20	18
5-5	Tan Hung, Thot Not	I	Suburban	8	O Mon	0.0	3.4	3.4		3.4	0%	95%	95%	125	150	180	34	20	18
5-6	Tan Loc, Thot Not	I	Suburban																
5-7	Thot Not	I	Suburban	11	Thot Not	13.9	6.6	20.5		20.5	61%	95%	95%	125	150	180	34	20	18
5-8	Trung Nhut	I	Suburban	11	Thot Not	0.0	3.8	3.8		3.8	0%	95%	95%	125	150	180	34	20	18
5-9	Thuan Hung, Thot Not	I	Suburban					0.0		0.0	0%	95%	95%	125	150	180	34	20	18
6	**Phong Dien**					**4.4**	**11.8**	**16.2**	**0.0**	**16.2**									
6-1	Thi Tran Phong Dien	V	-	14	Con Khuong	0.0	10.6	10.6		10.6	0%	90%	90%	60	80	100	16	15	15
6-2	Nhon Ai	V	-																
6-3	Giai Xuan	V	-																
6-4	Tan Thoi	V	-																
6-5	Truong Long	V	-																
6-6	My Khanh	V	-	3	Bong Vang	4.4	0.0	4.4		4.4	90%	90%	90%	60	80	100	34	20	18
		V	-	14	Con Khuong	0.0	1.2	1.2		1.2	0%	90%	90%	60	80	100	16	15	15
6-7	Nhon Nghia	V	-																
7	**Co Do**					**5.5**	**5.7**	**11.2**	**0.0**	**11.2**									
7-1	Thi Tran Co Do	V	-	10	Co Do	5.5	5.7	11.2		11.2	49%	90%	90%	60	80	100	16	15	15
7-2	Trung An	V	-																
7-3	Trung Thanh	V	-																
7-4	Thanh Phu	V	-																
7-5	Trung Hung	V	-																
7-6	Thoi Hung	V	-																
7-7	Dong Hiep	V	-																
7-8	Dong Thang	V	-																
7-9	Thoi Dong	V	-																
7-10	Thoi Xuan	V	-																
8	**Thoi Lai**					**6.3**	**8.8**	**15.1**	**0.0**	**15.1**									
8-1	Thi Thoi Lai	V	-	9	Thoi Lai	2.8	7.7	10.5		10.5	27%	90%	90%	60	80	100	16	15	15
8-2	Thoi Thanh	V	-	8	O Mon	0.0	1.1	1.1		1.1	0%	90%	90%	60	80	100	34	20	18
8-3	Tan Thanh	V	-	9	Thoi Lai	0.7	0.0	0.7		0.7	90%	90%	90%	60	80	100	16	15	15
8-4	Xuan Thang	V	-																
8-5	Dong Binh	V	-																
8-6	Dong Thuan	V	-																
8-7	Thoi Tanh	V	-	9	Thoi Lai	2.6	0.0	2.6		2.6	90%	90%	90%	60	80	100	16	15	15
8-8	Truong Thang	V	-																
8-9	Dinh Mon	V	-	9	Thoi Lai	0.2	0.0	0.2		0.2	90%	90%	90%	60	80	100	16	15	15
8-10	Truong Thanh	V	-																
8-11	Truong Xuan	V	-																
8-12	Truong Xuan A	V	-																
8-13	Truong Xuan B	V	-																
9	**Vinh Thanh**					**23.4**	**10.3**	**33.7**	**0.0**	**33.7**									
9-1	Thi Tran Vinh Thanh	V	-	12	Vinh Thanh	3.0	1.2	4.2		4.2	71%	90%	90%	60	80	100	16	15	15
9-2	Thi Tran Thanh An	V	-	13	Thanh An	7.2	2.0	9.2		9.2	78%	90%	90%	60	80	100	16	15	15
9-3	Xa Thanh My	V	-	12	Vinh Thanh	7.5	0.0	7.5		7.5	90%	90%	90%	60	80	100	16	15	15
9-4	Vinh Trinh	V	-																
9-5	Thanh An	V	-																
9-6	Thanh Thang	V	-																
9-7	Thanh Loi	V	-																
9-8	Thanh Quoi	V	-	12	Vinh Thanh	4.0	2.8	6.8		6.8	59%	90%	90%	60	80	100	16	15	15
9-9	Thanh Loc	V	-																
9-10	Thanh Tien	V	-	13	Thanh An	0.7	4.3	5.0		5.0	14%	90%	90%	60	80	100	16	15	15
		V	-	12	Vinh Thanh	1.0	0.0	1.0		1.0	90%	90%	90%	60	80	100	16	15	15
9-11	Vinh Binh	V	-																
	Total / Average					**445.9**	**125.9**	**571.8**	**0.0**	**571.8**									
	Note					GIS	GIS		GIS			TCXD VN 33: 2006	TCXD VN 33: 2006						

■2009 CENSUS Data

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Middle	1,188	1,200	1,214	1,231	1,250	1,272	1,286	1,301	1,318	1,336	1,355	1,370	1,387	1,404	1,422	1,441	1,456	1,471	1,486	1,502	1,517	1,529	1,541	1,553	1,565	1,577
High	1,188	1,201	1,218	1,238	1,261	1,289	1,308	1,328	1,348	1,369	1,391	1,409	1,428	1,449	1,471	1,496	1,515	1,534	1,553	1,572	1,591	1,606	1,622	1,637	1,653	1,669
Low	1,188	1,199	1,211	1,223	1,238	1,254	1,263	1,273	1,286	1,301	1,319	1,332	1,345	1,358	1,372	1,386	1,397	1,408	1,420	1,432	1,445	1,453	1,461	1,469	1,477	1,486

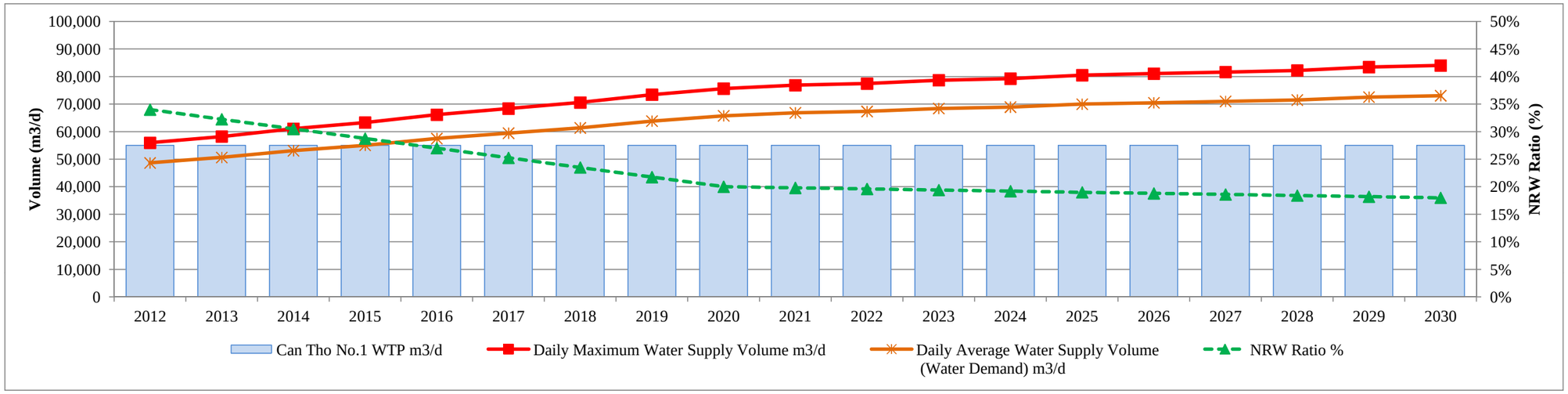
■Population Projection

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Population	1.00	1.01	1.02	1.04	1.05	1.07	1.08	1.10	1.11	1.12	1.14	1.15	1.17	1.18	1.20	1.21	1.23	1.24	1.25	1.26	1.28	1.29	1.30	1.31	1.32	1.33

■**Population Projection**

		WTP		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
1	**Ninh Kieu**			**244.1**	**246.5**	**249.0**	**253.9**	**256.3**	**261.2**	**263.6**	**268.5**	**271.0**	**273.4**	**278.3**	**280.7**	**285.6**	**288.0**	**292.9**	**295.4**	**300.2**	**302.7**	**305.1**	**307.6**	**312.4**	**314.9**	**317.3**	**319.8**	**322.2**	**324.7**
1-1	Cai Khe	4	CT-No.2	28.6	28.9	29.2	29.7	30.0	30.6	30.9	31.5	31.7	32.0	32.6	32.9	33.5	33.7	34.3	34.6	35.2	35.5	35.8	36.0	36.6	36.9	37.2	37.5	37.8	38.0
1-2	An Hoa	4	CT-No.2	27.0	27.3	27.5	28.1	28.4	28.9	29.2	29.7	30.0	30.2	30.8	31.1	31.6	31.9	32.4	32.7	33.2	33.5	33.8	34.0	34.6	34.8	35.1	35.4	35.6	35.9
1-3	Thoi Binh	4	CT-No.2	18.7	18.9	19.1	19.4	19.6	20.0	20.2	20.6	20.8	20.9	21.3	21.5	21.9	22.1	22.4	22.6	23.0	23.2	23.4	23.6	23.9	24.1	24.3	24.5	24.7	24.9
1-4	An Nghiep	1	CT-No.1	10.2	10.3	10.4	10.6	10.7	10.9	11.0	11.2	11.3	11.4	11.6	11.7	11.9	12.0	12.2	12.3	12.5	12.6	12.8	12.9	13.1	13.2	13.3	13.4	13.5	13.6
1-5	An Cu	1	CT-No.1	24.1	24.3	24.6	25.1	25.3	25.8	26.0	26.5	26.8	27.0	27.5	27.7	28.2	28.4	28.9	29.2	29.6	29.9	30.1	30.4	30.8	31.1	31.3	31.6	31.8	32.1
1-6	An Hoi	1	CT-No.1	11.0	11.1	11.2	11.4	11.6	11.8	11.9	12.1	12.2	12.3	12.5	12.7	12.9	13.0	13.2	13.3	13.5	13.6	13.8	13.9	14.1	14.2	14.3	14.4	14.5	14.6
1-7	Tan An	1	CT-No.1	12.5	12.6	12.8	13.0	13.1	13.4	13.5	13.8	13.9	14.0	14.3	14.4	14.6	14.8	15.0	15.1	15.4	15.5	15.6	15.8	16.0	16.1	16.3	16.4	16.5	16.6
1-8	An Lac	1	CT-No.1	16.4	16.6	16.7	17.1	17.2	17.5	17.7	18.0	18.2	18.4	18.7	18.9	19.2	19.4	19.7	19.8	20.2	20.3	20.5	20.7	21.0	21.2	21.3	21.5	21.6	21.8
1-9	An Phu	1	CT-No.1	15.0	15.2	15.3	15.6	15.8	16.1	16.2	16.5	16.7	16.8	17.1	17.3	17.6	17.7	18.0	18.2	18.5	18.6	18.8	18.9	19.2	19.4	19.5	19.7	19.8	20.0
1-10	Xuan Khanh	1	CT-No.1	29.1	29.4	29.7	30.3	30.6	31.1	31.4	32.0	32.3	32.6	33.2	33.5	34.0	34.3	34.9	35.2	35.8	36.1	36.4	36.7	37.2	37.5	37.8	38.1	38.4	38.7
1-11	Hung Loi	1	CT-No.1	27.7	28.0	28.3	28.8	29.1	29.6	29.9	30.5	30.7	31.0	31.6	31.9	32.4	32.7	33.2	33.5	34.1	34.3	34.6	34.9	35.5	35.7	36.0	36.3	36.6	36.8
1-12	An Khan	4	CT-No.2	14.4	14.5	14.7	15.0	15.1	15.4	15.6	15.8	16.0	16.1	16.4	16.6	16.8	17.0	17.3	17.4	17.7	17.9	18.0	18.1	18.4	18.6	18.7	18.9	19.0	19.2
1-13	An Binh	1	CT-No.1	4.2	4.2	4.3	4.4	4.4	4.5	4.5	4.6	4.7	4.7	4.8	4.8	4.9	5.0	5.0	5.1	5.2	5.2	5.3	5.3	5.4	5.4	5.5	5.5	5.5	5.6
		3	Bong Vang	4.0	4.0	4.1	4.2	4.2	4.3	4.3	4.4	4.4	4.5	4.6	4.6	4.7	4.7	4.8	4.8	4.9	5.0	5.0	5.0	5.1	5.2	5.2	5.2	5.3	5.3
		14	Con Khuong	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.4	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.6	1.6	1.6	1.6
2	**Binh Thuy**			**85.6**	**86.5**	**87.3**	**89.0**	**89.9**	**91.6**	**92.4**	**94.2**	**95.0**	**95.9**	**97.6**	**98.4**	**100.2**	**101.0**	**102.7**	**103.6**	**105.3**	**106.1**	**107.0**	**107.9**	**109.6**	**110.4**	**111.3**	**112.1**	**113.0**	**113.8**
2-1	Tra Noc	6	Tra Noc	9.8	9.9	10.0	10.2	10.3	10.5	10.6	10.8	10.9	11.0	11.2	11.3	11.5	11.6	11.8	11.9	12.1	12.2	12.3	12.3	12.5	12.6	12.7	12.8	12.9	13.0
2-2	Tra An	4	CT-No.2	8.3	8.4	8.5	8.6	8.7	8.9	9.0	9.1	9.2	9.3	9.5	9.5	9.7	9.8	10.0	10.0	10.2	10.3	10.4	10.5	10.6	10.7	10.8	10.9	11.0	11.0
2-3	An Thoi	4	CT-No.2	17.6	17.8	18.0	18.3	18.5	18.8	19.0	19.4	19.5	19.7	20.1	20.2	20.6	20.8	21.1	21.3	21.6	21.8	22.0	22.2	22.5	22.7	22.9	23.1	23.2	23.4
2-4	Bui Huu Nghia	4	CT-No.2	10.6	10.7	10.8	11.0	11.1	11.3	11.4	11.7	11.8	11.9	12.1	12.2	12.4	12.5	12.7	12.8	13.0	13.1	13.3	13.4	13.6	13.7	13.8	13.9	14.0	14.1
2-5	Thoi An Dong	4	CT-No.2	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.2	1.2
2-6	Binh Thuy	4	CT-No.2	17.2	17.4	17.5	17.9	18.1	18.4	18.6	18.9	19.1	19.3	19.6	19.8	20.1	20.3	20.6	20.8	21.2	21.3	21.5	21.7	22.0	22.2	22.4	22.5	22.7	22.9
2-7	Long Tuyen	14	Con Khuong	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1
		5	Long Hoa	5.2	5.3	5.3	5.4	5.5	5.6	5.6	5.7	5.8	5.8	5.9	6.0	6.1	6.1	6.2	6.3	6.4	6.4	6.5	6.6	6.7	6.7	6.8	6.8	6.9	6.9
				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-8	Long Hoa	4	CT-No.2	9.7	9.8	9.9	10.1	10.2	10.4	10.5	10.7	10.8	10.9	11.1	11.2	11.3	11.4	11.6	11.7	11.9	12.0	12.1	12.2	12.4	12.5	12.6	12.7	12.8	12.9
		5	Long Hoa	5.5	5.6	5.6	5.7	5.8	5.9	5.9	6.1	6.1	6.2	6.3	6.3	6.4	6.5	6.6	6.7	6.8	6.8	6.9	6.9	7.0	7.1	7.2	7.2	7.3	7.3
3	**Cai Rang**			**67.8**	**68.5**	**69.2**	**70.5**	**71.2**	**72.5**	**73.2**	**74.6**	**75.3**	**75.9**	**77.3**	**78.0**	**79.3**	**80.0**	**81.4**	**82.0**	**83.4**	**84.1**	**84.8**	**85.4**	**86.8**	**87.5**	**88.1**	**88.8**	**89.5**	**90.2**
3-1	Le Binh	7	Ba Lang	14.4	14.5	14.7	15.0	15.1	15.4	15.6	15.8	16.0	16.1	16.4	16.6	16.8	17.0	17.3	17.4	17.7	17.9	18.0	18.1	18.4	18.6	18.7	18.9	19.0	19.2
3-2	Thuong Thanh			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-3	Phu Thu	2	Hung Phu	12.8	12.9	13.1	13.3	13.4	13.7	13.8	14.1	14.2	14.3	14.6	14.7	15.0	15.1	15.4	15.5	15.7	15.9	16.0	16.1	16.4	16.5	16.6	16.8	16.9	17.0
3-4	Tan Phu	2	Hung Phu	5.0	5.1	5.1	5.2	5.3	5.4	5.4	5.5	5.6	5.6	5.7	5.8	5.9	5.9	6.0	6.1	6.2	6.2	6.3	6.3	6.4	6.5	6.5	6.6	6.6	6.7
3-5	Ba Lang	7	Ba Lang	6.4	6.5	6.5	6.7	6.7	6.8	6.9	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.7	7.9	7.9	8.0	8.1	8.2	8.3	8.3	8.4	8.4	8.5
3-6	Hung Phu	2	Hung Phu	18.5	18.7	18.9	19.2	19.4	19.8	20.0	20.4	20.5	20.7	21.1	21.3	21.6	21.8	22.2	22.4	22.8	22.9	23.1	23.3	23.7	23.9	24.1	24.2	24.4	24.6
3-7	Hung Thanh	2	Hung Phu	10.7	10.8	10.9	11.1	11.2	11.4	11.6	11.8	11.9	12.0	12.2	12.3	12.5	12.6	12.8	12.9	13.2	13.3	13.4	13.5	13.7	13.8	13.9	14.0	14.1	14.2
4	**O Mon**			**47.1**	**47.6**	**48.0**	**49.0**	**49.5**	**50.4**	**50.9**	**51.8**	**52.3**	**52.8**	**53.7**	**54.2**	**55.1**	**55.6**	**56.5**	**57.0**	**57.9**	**58.4**	**58.9**	**59.3**	**60.3**	**60.8**	**61.2**	**61.7**	**62.2**	**62.6**
4-1	Chau Van Liem	8	O Mon	22.6	22.8	23.1	23.5	23.7	24.2	24.4	24.9	25.1	25.3	25.8	26.0	26.4	26.7	27.1	27.3	27.8	28.0	28.3	28.5	28.9	29.2	29.4	29.6	29.8	30.1
4-2	Thoi Hoa	8	O Mon	2.8	2.8	2.9	2.9	2.9	3.0	3.0	3.1	3.1	3.1	3.2	3.2	3.3	3.3	3.4	3.4	3.4	3.5	3.5	3.5	3.6	3.6	3.6	3.7	3.7	3.7
4-3	Thoi An			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-4	Phuoc Thoi	6	Tra Noc	13.8	13.9	14.1	14.4	14.5	14.8	14.9	15.2	15.3	15.5	15.7	15.9	16.1	16.3	16.6	16.7	17.0	17.1	17.3	17.4	17.7	17.8	17.9	18.1	18.2	18.4
4-5	Truong Lac	6	Tra Noc	3.9	3.9	4.0	4.1	4.1	4.2	4.2	4.3	4.3	4.4	4.4	4.5	4.6	4.6	4.7	4.7	4.8	4.8	4.9	4.9	5.0	5.0	5.1	5.1	5.1	5.2
4-6	Thoi Long			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-7	Long Hung	8	O Mon	4.0	4.0	4.1	4.2	4.2	4.3	4.3	4.4	4.4	4.5	4.6	4.6	4.7	4.7	4.8	4.8	4.9	5.0	5.0	5.0	5.1	5.2	5.2	5.2	5.3	5.3
5	**Thot Not**			**51.0**	**51.5**	**52.0**	**53.0**	**53.6**	**54.6**	**55.1**	**56.1**	**56.6**	**57.1**	**58.1**	**58.7**	**59.7**	**60.2**	**61.2**	**61.7**	**62.7**	**63.2**	**63.8**	**64.3**	**65.3**	**65.8**	**66.3**	**66.8**	**67.3**	**67.8**
5-1	Thoi Thuan	11	Thot Not	6.3	6.4	6.4	6.6	6.6	6.7	6.8	6.9	7.0	7.1	7.2	7.2	7.4	7.4	7.6	7.6	7.7	7.8	7.9	7.9	8.1	8.1	8.2	8.3	8.3	8.4
5-2	Thuan An, Thot Not	11	Thot Not	5.6	5.7	5.7	5.8	5.9	6.0	6.0	6.2	6.2	6.3	6.4	6.4	6.6	6.6	6.7	6.8	6.9	6.9	7.0	7.1	7.2	7.2	7.3	7.3	7.4	7.4
5-3	Thanh Hoa, Thot Not	11	Thot Not	5.3	5.4	5.4	5.5	5.6	5.7	5.7	5.8	5.9	5.9	6.0	6.1	6.2	6.3	6.4	6.4	6.5	6.6	6.6	6.7	6.8	6.8	6.9	6.9	7.0	7.0
5-4	Trung Kien, Thot Not	11	Thot Not	6.1	6.2	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.8	7.0	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.6	7.7	7.8	7.9	7.9	8.0	8.1	8.1
5-5	Tan Hung, Thot Not	8	O Mon	3.4	3.4	3.5	3.5	3.6	3.6	3.7	3.7	3.8	3.8	3.9	3.9	4.0	4.0	4.1	4.1	4.2	4.2	4.3	4.3	4.4	4.4	4.4	4.5	4.5	4.5
5-6	Tan Loc, Thot Not			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5-7	Thot Not	11	Thot Not	20.5	20.7	20.9	21.3	21.5	21.9	22.1	22.6	22.8	23.0	23.4	23.6	24.0	24.2	24.6	24.8	25.2	25.4	25.6	25.8	26.2	26.4	26.7	26.9	27.1	27.3
5-8	Trung Nhut	11	Thot Not	3.8	3.8	3.9	4.0	4.0	4.1	4.1	4.2	4.2	4.3	4.3	4.4	4.4	4.5	4.6	4.6	4.7	4.7	4.8	4.8	4.9	4.9	4.9	5.0	5.0	5.1
5-9	Thuan Hung, Thot Not			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	**Phong Dien**			**16.2**	**16.4**	**16.5**	**16.8**	**17.0**	**17.3**	**17.5**	**17.8**	**18.0**	**18.1**	**18.5**	**18.6**	**19.0**	**19.1**	**19.4**	**19.6**	**19.9**	**20.1**	**20.3**	**20.4**	**20.7**	**20.9**	**21.1**	**21.2**	**21.4**	**21.5**
6-1	Thi Tran Phong Dien	14	Con Khuong	10.6	10.7	10.8	11.0	11.1	11.3	11.4	11.7	11.8	11.9	12.1	12.2	12.4	12.5	12.7	12.8	13.0	13.1	13.3	13.4	13.6	13.7	13.8	13.9	14.0	14.1
6-2	Nhon Ai			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6-3	Giai Xuan			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6-4	Tan Thoi			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6-5	Truong Long			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6-6	My Khanh	3	Bong Vang	4.4	4.4	4.5	4.6	4.6	4.7	4.8	4.8	4.9	4.9	5.0	5.1	5.1	5.2	5.3	5.3	5.4	5.5	5.5	5.5	5.6	5.7	5.7	5.8	5.8	5.9
		14	Con Khuong	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.4	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.6	1.6	1.6	1.6
6-7	Nhon Nghia			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	**Co Do**			**11.2**	**11.3**	**11.4**	**11.6**	**11.8**	**12.0**	**12.1**	**12.3**	**12.4**	**12.5**	**12.8**	**12.9**	**13.1**	**13.2**	**13.4**	**13.6**	**13.8**	**13.9**	**14.0**	**14.1**	**14.3**	**14.4**	**14.6**	**14.7**	**14.8**	**14.9**
7-1	Thi Tran Co Do	10	Co Do	11.2	11.3	11.4	11.6	11.8	12.0	12.1	12.3	12.4	12.5	12.8	12.9	13.1	13.2	13.4	13.6	13.8	13.9	14.0	14.1	14.3	14.4	14.6	14.7	14.8	14.9
7-2	Trung An			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7-3	Trung Thanh			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7-4	Thanh Phu			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7-5	Trung Hung			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7-6	Thoi Hung			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7-7	Dong Hiep			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7-8	Dong Thang			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7-9	Thoi Dong			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7-10	Thoi Xuan			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	**Thoi Lai**			**15.1**	**15.3**	**15.4**	**15.7**	**15.9**	**16.2**	**16.3**	**16.6**	**16.8**	**16.9**	**17.2**	**17.4**	**17.7**	**17.8**	**18.1**	**18.3**	**18.6**	**18.7**	**18.9**	**19.0**	**19.3**	**19.5**	**19.6**	**19.8**	**19.9**	**20.1**
8-1	Thi Thoi Lai	9	Thoi Lai	10.5	10.6	10.7	10.9	11.0	11.2	11.3	11.6	11.7	11.8	12.0	12.1	12.3	12.4	12.6	12.7	12.9	13.0	13.1	13.2	13.4	13.5	13.7	13.8	13.9	14.0
8-2	Thoi Thanh	8	O Mon	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.5	1.5
8-3	Tan Thanh	9	Thoi Lai	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
8-4	Xuan Thang			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8-5	Dong Binh			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8-6	Dong Thuan			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8-7	Thoi Tanh	9	Thoi Lai	2.6	2.6	2.7	2.7	2.7	2.8	2.8	2.9	2.9	2.9	3.0	3.0	3.0	3.1	3.1	3.1	3.2	3.2	3.3	3.3	3.3	3.4	3.4	3.4	3.4	3.5
8-8	Truong Thang			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8-9	Dinh Mon	9	Thoi Lai	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
8-10	Truong Thanh			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8-11	Truong Xuan			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8-12	Truong Xuan A			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8-13	Truong Xuan B			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	**Vinh Thanh**			**33.7**	**34.0**	**34.4**	**35.0**	**35.4**	**36.1**	**36.4**	**37.1**	**37.4**	**37.7**	**38.4**	**38.8**	**39.4**	**39.8**	**40.4**	**40.8**	**41.5**	**41.8**	**42.1**	**42.5**	**43.1**	**43.5**	**43.8**	**44.1**	**44.5**	**44.8**
9-1	Thi Tran Vinh Thanh	12	Vinh Thanh	4.2	4.2	4.3	4.4	4.4	4.5	4.5	4.6	4.7	4.7	4.8	4.8	4.9	5.0	5.0	5.1	5.2	5.2	5.3	5.3	5.4	5.4	5.5	5.5	5.5	5.6
9-2	Thi Tran Thanh An	13	Thanh An	9.2	9.3	9.4	9.6	9.7	9.8	9.9	10.1	10.2	10.3	10.5	10.6	10.8	10.9	11.0	11.1	11.3	11.4	11.5	11.6	11.8	11.9	12.0	12.1	12.1	12.2
9-3	Xa Thanh My	12	Vinh Thanh	7.5	7.6	7.7	7.8	7.9	8.0	8.1	8.3	8.3	8.4	8.6	8.6	8.8	8.9	9.0	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.8	9.9	10.0
9-4	Vinh Trinh			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9-5	Thanh An			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9-6	Thanh Thang			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9-7	Thanh Loi			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9-8	Thanh Quoi	12	Vinh Thanh	6.8	6.9	6.9	7.1	7.1	7.3	7.3	7.5	7.5	7.6	7.8	7.8	8.0	8.0	8.2	8.2	8.4	8.4	8.5	8.6	8.7	8.8	8.8	8.9	9.0	9.0
9-9	Thanh Loc			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9-10	Thanh Tien	13	Thanh An	5.0	5.1	5.1	5.2	5.3	5.4	5.4	5.5	5.6	5.6	5.7	5.8	5.9	5.9	6.0	6.1	6.2	6.2	6.3	6.3	6.4	6.5	6.5	6.6	6.6	6.7
		12	Vinh Thanh	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
9-11	Vinh Binh			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TOTAL			571.8	577.5	583.2	594.7	600.4	611.8	617.5	629.0	634.7	640.4	651.9	657.6	669.0	674.7	686.2	691.9	703.3	709.0	714.8	720.5	731.9	737.6	743.3	749.1	754.8	760.5

Can Tho No.1 (Water Demand and Capacity)

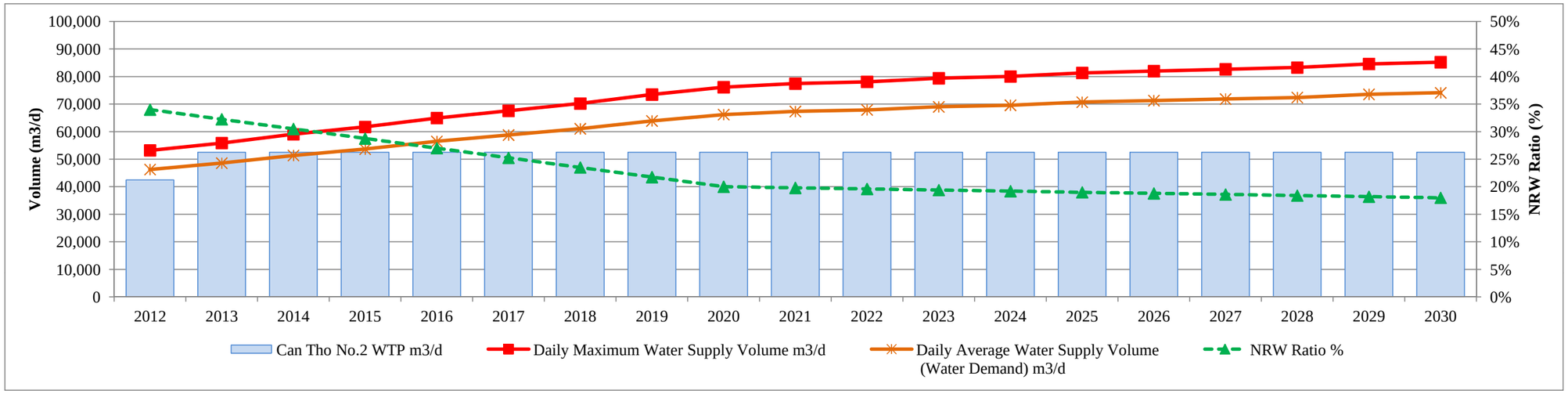


*Target Year

Can Tho No.1				2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Note
A. Demand Projection																							
1	Domestic	Population	thousand	156	158	161	162	165	167	168	171	173	176	177	180	182	185	186	188	189	192	194	
		Service Ratio	%	95%	96%	96%	96%	97%	97%	98%	98%	99%	99%	99%	99%	99%	99%	99%	99%	100%	100%	100%	
		Served Population	thousand	148	151	154	156	160	162	165	168	171	174	176	179	181	184	185	187	189	192	194	
		Unit Water Demand	L/c/d	140	147	155	162	169	177	184	192	198	199	198	199	198	199	200	199	199	199	199	Class I (Ubn, S-Ubn)
		Water Demand	m3/d	20,713	22,131	23,806	25,305	27,086	28,669	30,289	32,227	33,932	34,575	34,923	35,568	35,919	36,568	36,921	37,275	37,630	38,285	38,643	
2	Institutional	Ratio per Domestic	%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	QCVN 07: 2010
		Water Demand	m3/d	2,486	2,656	2,857	3,037	3,250	3,440	3,635	3,867	4,072	4,149	4,191	4,268	4,310	4,388	4,430	4,473	4,516	4,594	4,637	
3	Public	Ratio per Domestic	%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	QCVN 07: 2010
		Water Demand	m3/d	1,657	1,770	1,904	2,024	2,167	2,294	2,423	2,578	2,715	2,766	2,794	2,845	2,873	2,925	2,954	2,982	3,010	3,063	3,091	
4	Commercial	Ratio per Domestic	%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	QCVN 07: 2010
		Water Demand	m3/d	7,250	7,746	8,332	8,857	9,480	10,034	10,601	11,280	11,876	12,101	12,223	12,449	12,572	12,799	12,922	13,046	13,171	13,400	13,525	
5	Industrial Zone	Area	ha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Unit Water Demand	m3/ha/d	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	QCVN 07: 2010
		Coverage	%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
		Water Demand	m3/d	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6	**Total Water Demand**		m3/d	**32,106**	**34,303**	**36,899**	**39,223**	**41,983**	**44,437**	**46,948**	**49,952**	**52,595**	**53,591**	**54,131**	**55,130**	**55,674**	**56,680**	**57,227**	**57,776**	**58,327**	**59,342**	**59,896**	
7	NRW	Ratio	%	34%	32%	31%	29%	27%	25%	24%	22%	20%	20%	20%	19%	19%	19%	19%	19%	18%	18%	18%	
		Volume	m3/d	16,540	16,329	16,193	15,827	15,528	15,011	14,422	13,884	13,149	13,231	13,196	13,270	13,229	13,295	13,250	13,202	13,152	13,203	13,148	
8	**Daily Average Water Supply Volume (Water Demand)**		m3/d	**48,646**	**50,632**	**53,092**	**55,050**	**57,511**	**59,448**	**61,370**	**63,836**	**65,744**	**66,822**	**67,327**	**68,400**	**68,903**	**69,975**	**70,477**	**70,978**	**71,479**	**72,545**	**73,044**	
	Daily Peak Factor		-	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	TCXD VN 33: 2006
9	**Daily Maximum Water Supply Volume**		m3/d	**55,943**	**58,227**	**61,056**	**63,308**	**66,138**	**68,366**	**70,575**	**73,412**	**75,606**	**76,845**	**77,426**	**78,660**	**79,238**	**80,471**	**81,048**	**81,624**	**82,201**	**83,427**	**84,001**	
B. Water Treatment Plant Capacity																							
10	**Can Tho No.1 WTP**		m3/d	**55,000**	**55,000**	**55,000**	**55,000**	**55,000**	**55,000**	**55,000**	**55,000**	**55,000**	**55,000**	**55,000**	**55,000**	**55,000**	**55,000**	**55,000**	**55,000**	**55,000**	**55,000**	**55,000**	

		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Deficit (Daili Max - Capacity)	m3/d	943	3,227	6,056	8,308	11,138	13,366	15,575	18,412	20,606	21,845	22,426	23,660	24,238	25,471	26,048	26,624	27,201	28,427	29,001

Can Tho No.2 (Water Demand and Capacity)

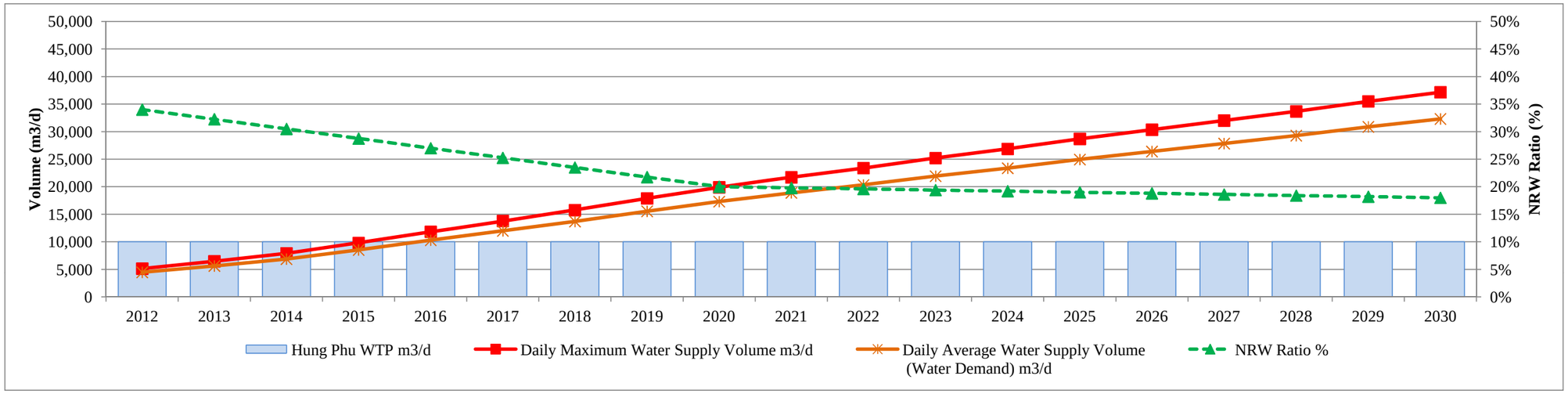


*Target Year

Can Tho No.2				2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Note
A. Demand Projection																							
1	Domestic	Population	thousand	159	161	164	165	168	170	171	174	176	179	181	184	185	188	190	191	193	196	197	
		Service Ratio	%	89%	89%	91%	92%	93%	95%	96%	98%	99%	99%	99%	99%	99%	99%	99%	100%	99%	100%	100%	
		Served Population	thousand	141	144	149	152	157	161	165	170	174	177	179	182	184	187	189	191	192	196	197	
		Unit Water Demand	L/c/d	140	147	155	162	169	176	183	190	196	197	197	197	197	198	198	198	199	198	199	Class I (Ubn, S-Ubn)
		Water Demand	m3/d	19,697	21,231	23,026	24,665	26,591	28,337	30,131	32,256	34,162	34,834	35,211	35,888	36,270	36,953	37,338	37,725	38,114	38,807	39,201	
2	Institutional	Ratio per Domestic	%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	QCVN 07: 2010
		Water Demand	m3/d	2,364	2,548	2,763	2,960	3,191	3,400	3,616	3,871	4,099	4,180	4,225	4,307	4,352	4,434	4,481	4,527	4,574	4,657	4,704	
3	Public	Ratio per Domestic	%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	QCVN 07: 2010
		Water Demand	m3/d	1,576	1,698	1,842	1,973	2,127	2,267	2,410	2,580	2,733	2,787	2,817	2,871	2,902	2,956	2,987	3,018	3,049	3,105	3,136	
4	Commercial	Ratio per Domestic	%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	QCVN 07: 2010
		Water Demand	m3/d	6,894	7,431	8,059	8,633	9,307	9,918	10,546	11,290	11,957	12,192	12,324	12,561	12,695	12,934	13,068	13,204	13,340	13,582	13,720	
5	Industrial Zone	Area	ha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Unit Water Demand	m3/ha/d	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	QCVN 07: 2010
		Coverage	%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
		Water Demand	m3/d	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6	**Total Water Demand**		m3/d	**30,531**	**32,908**	**35,690**	**38,231**	**41,216**	**43,922**	**46,703**	**49,997**	**52,951**	**53,993**	**54,577**	**55,627**	**56,219**	**57,277**	**57,874**	**58,474**	**59,077**	**60,151**	**60,761**	
7	NRW	Ratio	%	34%	32%	31%	29%	27%	25%	24%	22%	20%	20%	20%	19%	19%	19%	19%	19%	18%	18%	18%	
		Volume	m3/d	15,728	15,665	15,663	15,427	15,244	14,837	14,347	13,897	13,238	13,330	13,305	13,389	13,359	13,435	13,399	13,361	13,321	13,383	13,338	
8	**Daily Average Water Supply Volume (Water Demand)**		m3/d	**46,259**	**48,573**	**51,353**	**53,658**	**56,460**	**58,759**	**61,050**	**63,894**	**66,189**	**67,323**	**67,882**	**69,016**	**69,578**	**70,712**	**71,273**	**71,835**	**72,398**	**73,534**	**74,099**	
	Daily Peak Factor		-	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	TCXD VN 33: 2006
9	**Daily Maximum Water Supply Volume**		m3/d	**53,198**	**55,859**	**59,056**	**61,707**	**64,929**	**67,573**	**70,208**	**73,478**	**76,117**	**77,421**	**78,064**	**79,368**	**80,015**	**81,319**	**81,964**	**82,610**	**83,258**	**84,564**	**85,214**	
B. Water Treatment Plant Capacity																							
10	**Can Tho No.2 WTP**		m3/d	**42,500**	**52,500**	**52,500**	**52,500**	**52,500**	**52,500**	**52,500**	**52,500**	**52,500**	**52,500**	**52,500**	**52,500**	**52,500**	**52,500**	**52,500**	**52,500**	**52,500**	**52,500**	**52,500**	

		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Deficit (Daili Max - Capacity)	m3/d	10,698	3,359	6,556	9,207	12,429	15,073	17,708	20,978	23,617	24,921	25,564	26,868	27,515	28,819	29,464	30,110	30,758	32,064	32,714

Hung Phu (Water Demand and Capacity)

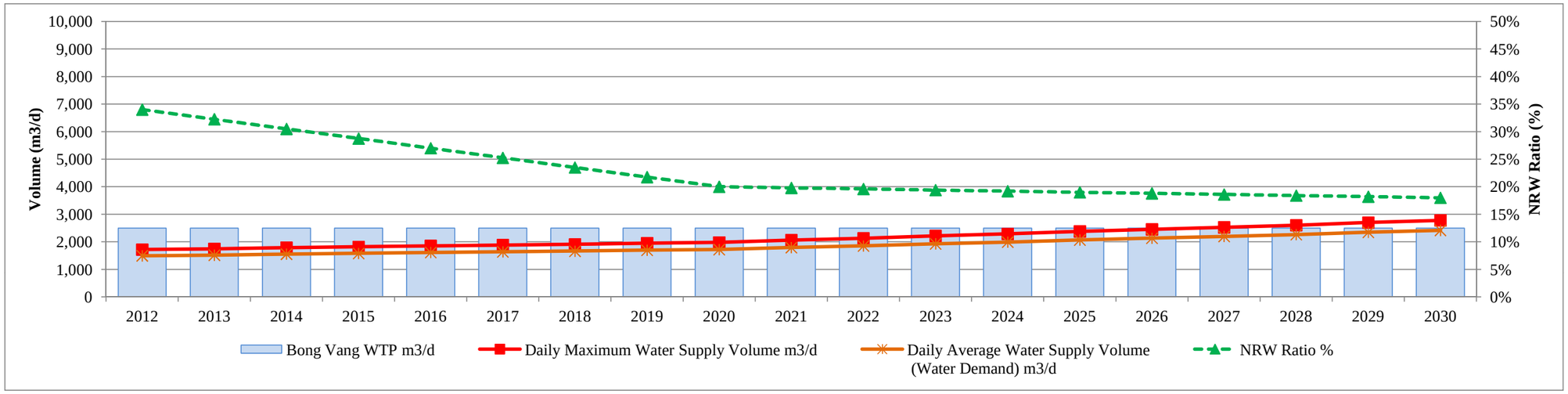


*Target Year

Hung Phu				2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Note
A. Demand Projection																							
1	Domestic	Population	thousand	49	49	50	51	52	52	53	54	54	55	55	56	57	58	58	59	59	60	61	
		Service Ratio	%	33%	41%	50%	57%	65%	73%	81%	89%	96%	96%	98%	98%	98%	98%	98%	98%	100%	100%	100%	
		Served Population	thousand	16	20	25	29	34	38	43	48	52	53	54	55	56	57	57	58	59	60	61	
		Unit Water Demand	L/c/d	137	141	142	147	150	157	159	164	171	173	173	176	176	178	182	183	184	186	187	Class I (Ubn, S-Ubn)
		Water Demand	m3/d	2,189	2,824	3,540	4,277	5,110	5,955	6,852	7,871	8,883	9,162	9,368	9,656	9,869	10,168	10,388	10,612	10,839	11,156	11,391	
2	Institutional	Ratio per Domestic	%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	QCVN 07: 2010
		Water Demand	m3/d	219	282	354	428	511	596	685	787	888	916	937	966	987	1,017	1,039	1,061	1,084	1,116	1,139	
3	Public	Ratio per Domestic	%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	QCVN 07: 2010
		Water Demand	m3/d	109	141	177	214	256	298	343	394	444	458	468	483	493	508	519	531	542	558	570	
4	Commercial	Ratio per Domestic	%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	QCVN 07: 2010
		Water Demand	m3/d	438	565	708	855	1,022	1,191	1,370	1,574	1,777	1,832	1,874	1,931	1,974	2,034	2,078	2,122	2,168	2,231	2,278	
5	Industrial Zone	Area	ha	463	463	463	463	463	463	463	463	463	463	463	463	463	463	463	463	463	463	463	
	(Hung Phu)	Unit Water Demand	m3/ha/d	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	QCVN 07: 2010
		Coverage	%	0%	0%	0%	2%	3%	5%	7%	8%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	
		Water Demand	m3/d	0	0	0	309	617	926	1,235	1,543	1,852	2,778	3,704	4,630	5,556	6,482	7,408	8,334	9,260	10,186	11,112	
6	**Total Water Demand**		m3/d	**2,955**	**3,812**	**4,779**	**6,083**	**7,517**	**8,966**	**10,485**	**12,169**	**13,844**	**15,146**	**16,351**	**17,666**	**18,879**	**20,209**	**21,432**	**22,660**	**23,893**	**25,247**	**26,490**	
7	NRW	Ratio	%	34%	32%	31%	29%	27%	25%	24%	22%	20%	20%	20%	19%	19%	19%	19%	19%	18%	18%	18%	
		Volume	m3/d	1,522	1,815	2,097	2,454	2,780	3,029	3,221	3,383	3,461	3,739	3,986	4,252	4,486	4,740	4,962	5,178	5,388	5,617	5,815	
8	**Daily Average Water Supply Volume (Water Demand)**		m3/d	**4,477**	**5,627**	**6,876**	**8,537**	**10,297**	**11,995**	**13,706**	**15,552**	**17,305**	**18,885**	**20,337**	**21,918**	**23,365**	**24,949**	**26,394**	**27,838**	**29,281**	**30,864**	**32,305**	
	Daily Peak Factor		-	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	TCXD VN 33: 2006
9	**Daily Maximum Water Supply Volume**		m3/d	**5,148**	**6,471**	**7,907**	**9,817**	**11,841**	**13,795**	**15,762**	**17,885**	**19,901**	**21,718**	**23,387**	**25,206**	**26,870**	**28,691**	**30,353**	**32,013**	**33,673**	**35,494**	**37,150**	
B. Water Treatment Plant Capacity																							
10	**Hung Phu WTP**		m3/d	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	

		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Deficit (Daili Max - Capacity)	m3/d	-4,852	-3,529	-2,093	-183	1,841	3,795	5,762	7,885	9,901	11,718	13,387	15,206	16,870	18,691	20,353	22,013	23,673	25,494	27,150

Bong Vang (Water Demand and Capacity)

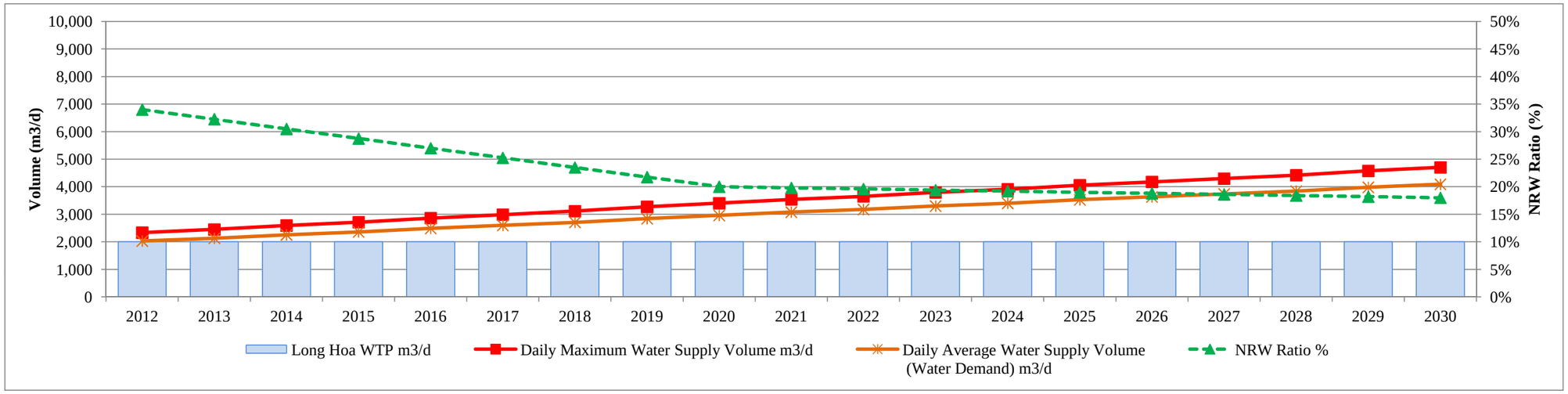


*Target Year

Bong Vang				2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Note
A. Demand Projection																							
1	Domestic	Population	thousand	9	9	9	9	9	9	9	10	10	10	10	10	10	10	10	11	11	11	11	
		Service Ratio	%	89%	89%	89%	89%	89%	100%	100%	90%	90%	90%	90%	90%	100%	100%	100%	91%	91%	91%	100%	
		Served Population	thousand	8	8	8	8	8	9	9	9	9	9	9	9	10	10	10	10	10	10	11	
		Unit Water Demand	L/c/d	91	95	100	104	109	101	105	109	113	118	123	128	119	124	128	133	137	142	133	Class I (S-Ubn),V
		Water Demand	m3/d	731	762	801	833	874	907	941	984	1,020	1,066	1,104	1,152	1,192	1,242	1,283	1,326	1,368	1,423	1,468	
2	Institutional	Ratio per Domestic	%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	QCVN 07: 2010
		Water Demand	m3/d	73	76	80	83	87	91	94	98	102	107	110	115	119	124	128	133	137	142	147	
3	Public	Ratio per Domestic	%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	QCVN 07: 2010
		Water Demand	m3/d	37	38	40	42	44	45	47	49	51	53	55	58	60	62	64	66	68	71	73	
4	Commercial	Ratio per Domestic	%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	QCVN 07: 2010
		Water Demand	m3/d	146	152	160	167	175	181	188	197	204	213	221	230	238	248	257	265	274	285	294	
5	Industrial Zone	Area	ha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Unit Water Demand	m3/ha/d	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	QCVN 07: 2010
		Coverage	%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
		Water Demand	m3/d	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6	**Total Water Demand**		m3/d	**987**	**1,028**	**1,081**	**1,125**	**1,180**	**1,224**	**1,270**	**1,328**	**1,377**	**1,439**	**1,490**	**1,555**	**1,609**	**1,676**	**1,732**	**1,790**	**1,847**	**1,921**	**1,982**	
7	NRW	Ratio	%	34%	32%	31%	29%	27%	25%	24%	22%	20%	20%	20%	19%	19%	19%	19%	19%	18%	18%	18%	
		Volume	m3/d	508	489	474	454	436	414	390	369	344	355	363	374	382	393	401	409	417	427	435	
8	**Daily Average Water Supply Volume (Water Demand)**		m3/d	**1,495**	**1,517**	**1,555**	**1,579**	**1,616**	**1,638**	**1,660**	**1,697**	**1,721**	**1,794**	**1,853**	**1,929**	**1,991**	**2,069**	**2,133**	**2,199**	**2,264**	**2,348**	**2,417**	
	Daily Peak Factor		-	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	TCXD VN 33: 2006
9	**Daily Maximum Water Supply Volume**		m3/d	**1,719**	**1,744**	**1,788**	**1,816**	**1,858**	**1,884**	**1,909**	**1,952**	**1,979**	**2,063**	**2,131**	**2,218**	**2,289**	**2,379**	**2,453**	**2,528**	**2,604**	**2,701**	**2,780**	
B. Water Treatment Plant Capacity																							
10	**Bong Vang WTP**		m3/d	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	

		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Deficit (Daili Max - Capacity)	m3/d	-781	-756	-712	-684	-642	-616	-591	-548	-521	-437	-369	-282	-211	-121	-47	28	104	201	280

Long Hoa (Water Demand and Capacity)

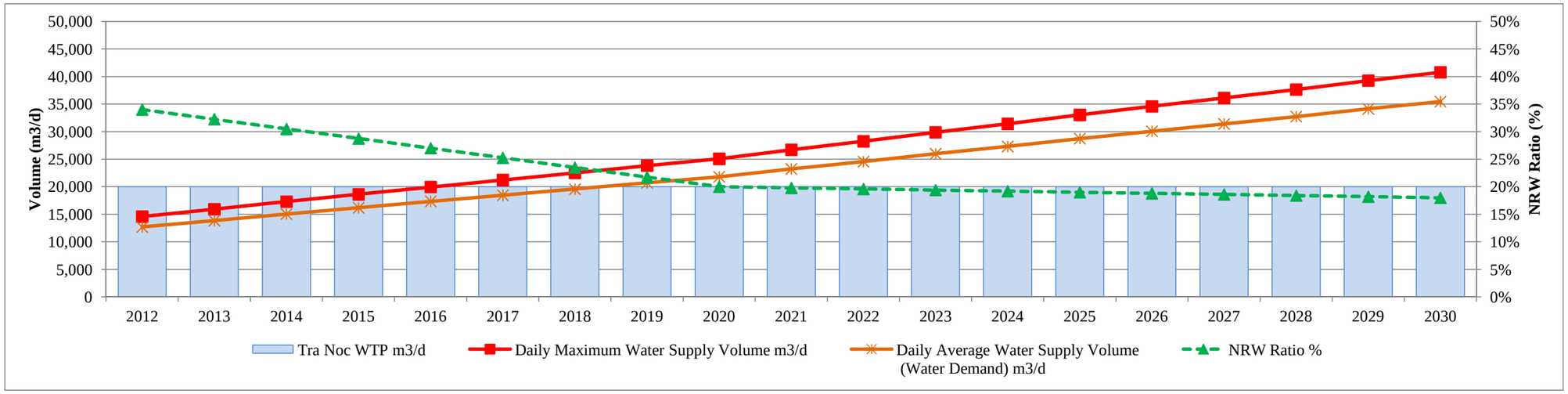


*Target Year

Long Hoa				2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Note
A. Demand Projection																							
1	Domestic	Population	thousand	11	11	11	12	12	12	12	12	12	13	13	13	13	13	13	13	13	14	14	
		Service Ratio	%	73%	73%	82%	75%	83%	83%	92%	92%	100%	92%	92%	92%	100%	100%	100%	100%	100%	100%	100%	
		Served Population	thousand	8	8	9	9	10	10	11	11	12	12	12	12	13	13	13	13	13	14	14	
		Unit Water Demand	L/c/d	124	134	129	138	135	144	140	150	146	152	158	164	156	163	168	173	179	172	177	Class I (Suburban)
		Water Demand	m3/d	993	1,070	1,161	1,246	1,346	1,439	1,535	1,649	1,753	1,829	1,891	1,970	2,034	2,117	2,184	2,253	2,322	2,412	2,485	
2	Institutional	Ratio per Domestic	%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	QCVN 07: 2010
		Water Demand	m3/d	99	107	116	125	135	144	153	165	175	183	189	197	203	212	218	225	232	241	248	
3	Public	Ratio per Domestic	%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	QCVN 07: 2010
		Water Demand	m3/d	50	53	58	62	67	72	77	82	88	91	95	99	102	106	109	113	116	121	124	
4	Commercial	Ratio per Domestic	%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	QCVN 07: 2010
		Water Demand	m3/d	199	214	232	249	269	288	307	330	351	366	378	394	407	423	437	451	464	482	497	
5	Industrial Zone	Area	ha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Unit Water Demand	m3/ha/d	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	QCVN 07: 2010
		Coverage	%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
		Water Demand	m3/d	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6	**Total Water Demand**		m3/d	**1,341**	**1,444**	**1,567**	**1,682**	**1,817**	**1,943**	**2,072**	**2,226**	**2,367**	**2,469**	**2,553**	**2,660**	**2,746**	**2,858**	**2,948**	**3,042**	**3,134**	**3,256**	**3,354**	
7	NRW	Ratio	%	34%	32%	31%	29%	27%	25%	24%	22%	20%	20%	20%	19%	19%	19%	19%	19%	18%	18%	18%	
		Volume	m3/d	691	687	688	679	672	656	636	619	592	610	622	640	653	670	683	695	707	724	736	
8	**Daily Average Water Supply Volume (Water Demand)**		m3/d	**2,032**	**2,131**	**2,255**	**2,361**	**2,489**	**2,599**	**2,708**	**2,845**	**2,959**	**3,079**	**3,175**	**3,300**	**3,399**	**3,528**	**3,631**	**3,737**	**3,841**	**3,980**	**4,090**	
	Daily Peak Factor		-	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	TCXD VN 33: 2006
9	**Daily Maximum Water Supply Volume**		m3/d	**2,336**	**2,450**	**2,593**	**2,715**	**2,862**	**2,988**	**3,114**	**3,272**	**3,403**	**3,541**	**3,651**	**3,795**	**3,909**	**4,058**	**4,176**	**4,297**	**4,418**	**4,577**	**4,703**	
B. Water Treatment Plant Capacity																							
10	**Long Hoa WTP**		m3/d	**2,000**	**2,000**	**2,000**	**2,000**	**2,000**	**2,000**	**2,000**	**2,000**	**2,000**	**2,000**	**2,000**	**2,000**	**2,000**	**2,000**	**2,000**	**2,000**	**2,000**	**2,000**	**2,000**	

		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Deficit (Daili Max - Capacity)	m3/d	336	450	593	715	862	988	1,114	1,272	1,403	1,541	1,651	1,795	1,909	2,058	2,176	2,297	2,418	2,577	2,703

Tra Noc (Water Demand and Capacity)

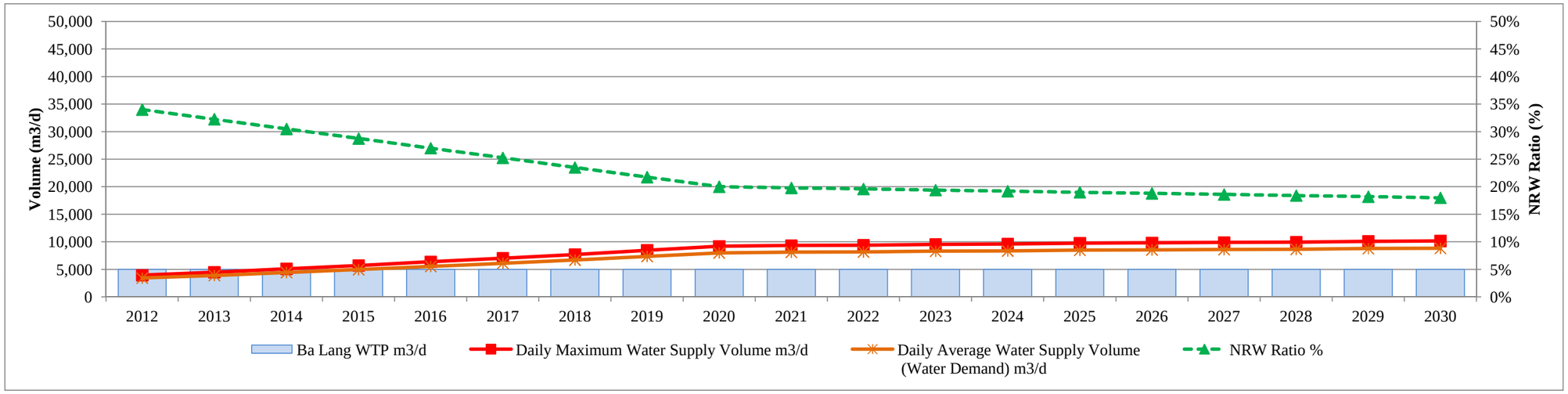


*Target Year

Tra Noc				2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Note
A. Demand Projection																							
1	Domestic	Population	thousand	29	29	29	30	30	31	31	31	32	32	32	33	33	34	34	34	35	35	35	
		Service Ratio	%	48%	55%	62%	67%	73%	77%	84%	90%	94%	97%	100%	97%	100%	97%	100%	100%	97%	100%	100%	
		Served Population	thousand	14	16	18	20	22	24	26	28	30	31	32	32	33	33	34	34	34	35	35	
		Unit Water Demand	L/c/d	134	137	142	146	151	156	160	166	171	171	169	175	173	179	177	181	185	186	190	Class I (Ubn, S-Ubn)
		Water Demand	m3/d	1,878	2,195	2,556	2,917	3,329	3,735	4,163	4,655	5,132	5,298	5,422	5,594	5,723	5,901	6,034	6,169	6,306	6,496	6,638	
2	Institutional	Ratio per Domestic	%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	QCVN 07: 2010
		Water Demand	m3/d	188	220	256	292	333	374	416	465	513	530	542	559	572	590	603	617	631	650	664	
3	Public	Ratio per Domestic	%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	QCVN 07: 2010
		Water Demand	m3/d	94	110	128	146	166	187	208	233	257	265	271	280	286	295	302	308	315	325	332	
4	Commercial	Ratio per Domestic	%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	QCVN 07: 2010
		Water Demand	m3/d	376	439	511	583	666	747	833	931	1,026	1,060	1,084	1,119	1,145	1,180	1,207	1,234	1,261	1,299	1,328	
5	Industrial Zone	Area	ha	292	292	292	292	292	292	292	292	292	692	692	692	692	692	692	692	692	692	692	
	(Tra Noc-1,2)	Unit Water Demand	m3/ha/d	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	QCVN 07: 2010
	(O Mon)	Coverage	%	50%	55%	60%	65%	70%	75%	80%	85%	90%	41%	45%	48%	52%	55%	59%	62%	66%	69%	73%	
		Water Demand	m3/d	5,840	6,424	7,008	7,592	8,176	8,760	9,344	9,928	10,512	11,472	12,432	13,392	14,352	15,312	16,272	17,232	18,192	19,152	20,112	
5-1	Tra Noc 1&2	Area	ha	292	292	292	292	292	292	292	292	292	292	292	292	292	292	292	292	292	292	292	
		Unit Water Demand	m3/ha/d	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	QCVN 07: 2010
		Coverage	%	50%	55%	60%	65%	70%	75%	80%	85%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	
		Water Demand	m3/d	5,840	6,424	7,008	7,592	8,176	8,760	9,344	9,928	10,512	10,512	10,512	10,512	10,512	10,512	10,512	10,512	10,512	10,512	10,512	
5-1	O Mon	Area	ha										400	400	400	400	400	400	400	400	400	400	
		Unit Water Demand	m3/ha/d										40	40	40	40	40	40	40	40	40	40	QCVN 07: 2010
		Coverage	%										6%	12%	18%	24%	30%	36%	42%	48%	54%	60%	
		Water Demand	m3/d	0	0	0	0	0	0	0	0	0	960	1,920	2,880	3,840	4,800	5,760	6,720	7,680	8,640	9,600	
6	**Total Water Demand**		m3/d	**8,376**	**9,388**	**10,459**	**11,530**	**12,670**	**13,803**	**14,964**	**16,212**	**17,440**	**18,625**	**19,751**	**20,944**	**22,078**	**23,278**	**24,418**	**25,560**	**26,705**	**27,922**	**29,074**	
7	NRW	Ratio	%	34%	32%	31%	29%	27%	25%	24%	22%	20%	20%	20%	19%	19%	19%	19%	19%	18%	18%	18%	
		Volume	m3/d	4,315	4,469	4,590	4,652	4,686	4,663	4,597	4,506	4,360	4,598	4,815	5,041	5,246	5,460	5,653	5,841	6,022	6,213	6,382	
8	**Daily Average Water Supply Volume (Water Demand)**		m3/d	**12,691**	**13,857**	**15,049**	**16,182**	**17,356**	**18,466**	**19,561**	**20,718**	**21,800**	**23,223**	**24,566**	**25,985**	**27,324**	**28,738**	**30,071**	**31,401**	**32,727**	**34,135**	**35,456**	
	Daily Peak Factor		-	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	TCXD VN 33: 2006
9	**Daily Maximum Water Supply Volume**		m3/d	**14,595**	**15,936**	**17,307**	**18,609**	**19,959**	**21,236**	**22,496**	**23,826**	**25,070**	**26,707**	**28,251**	**29,883**	**31,422**	**33,049**	**34,582**	**36,111**	**37,637**	**39,256**	**40,775**	
B. Water Treatment Plant Capacity																							
10	**Tra Noc WTP**		m3/d	**20,000**	**20,000**	**20,000**	**20,000**	**20,000**	**20,000**	**20,000**	**20,000**	**20,000**	**20,000**	**20,000**	**20,000**	**20,000**	**20,000**	**20,000**	**20,000**	**20,000**	**20,000**	**20,000**	

		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Deficit (Daili Max - Capacity)	m3/d	-5,405	-4,064	-2,693	-1,391	-41	1,236	2,496	3,826	5,070	6,707	8,251	9,883	11,422	13,049	14,582	16,111	17,637	19,256	20,775

Ba Lang (Water Demand and Capacity)

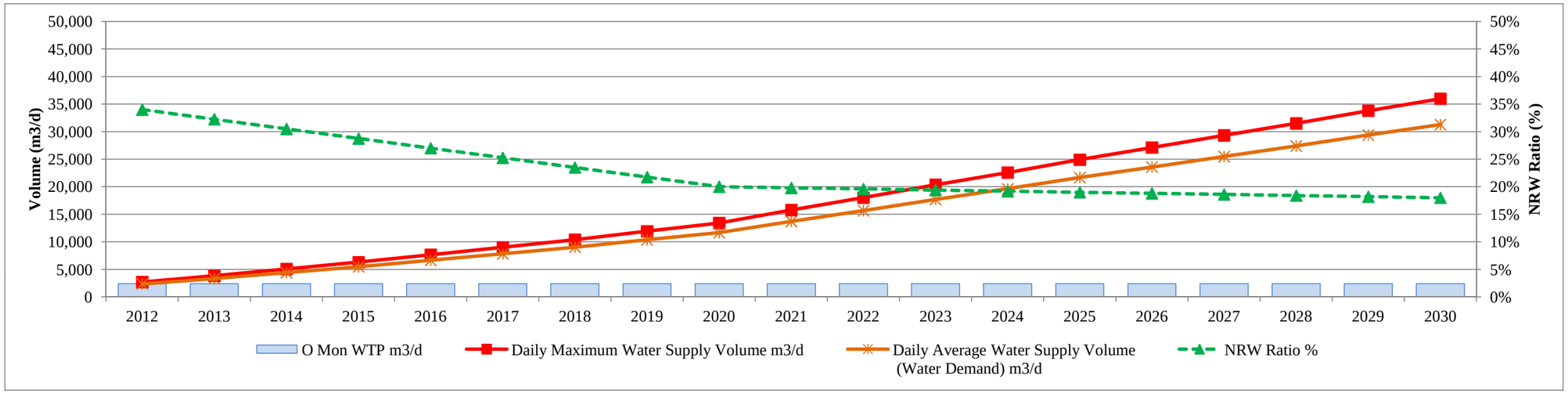


*Target Year

Ba Lang				2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Note
A. Demand Projection																							
1	Domestic	Population	thousand	22	22	22	22	23	23	23	24	24	24	25	25	25	26	26	26	26	27	27	
		Service Ratio	%	55%	59%	68%	73%	78%	83%	91%	92%	100%	100%	96%	100%	100%	96%	100%	100%	100%	100%	100%	
		Served Population	thousand	12	13	15	16	18	19	21	22	24	24	24	25	25	25	26	26	26	27	27	
		Unit Water Demand	L/c/d	140	151	152	164	167	178	181	194	197	201	203	198	200	204	198	199	201	197	199	Class I
		Water Demand	m3/d	1,677	1,960	2,287	2,619	3,002	3,387	3,797	4,270	4,736	4,823	4,870	4,957	5,003	5,091	5,138	5,184	5,231	5,319	5,366	
2	Institutional	Ratio per Domestic	%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	QCVN 07: 2010
		Water Demand	m3/d	168	196	229	262	300	339	380	427	474	482	487	496	500	509	514	518	523	532	537	
3	Public	Ratio per Domestic	%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	QCVN 07: 2010
		Water Demand	m3/d	84	98	114	131	150	169	190	214	237	241	243	248	250	255	257	259	262	266	268	
4	Commercial	Ratio per Domestic	%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	QCVN 07: 2010
		Water Demand	m3/d	335	392	457	524	600	677	759	854	947	965	974	991	1,001	1,018	1,028	1,037	1,046	1,064	1,073	
5	Industrial Zone	Area	ha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Unit Water Demand	m3/ha/d	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	QCVN 07: 2010
		Coverage	%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
		Water Demand	m3/d	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6	**Total Water Demand**		m3/d	**2,264**	**2,646**	**3,087**	**3,536**	**4,052**	**4,572**	**5,126**	**5,765**	**6,394**	**6,511**	**6,574**	**6,692**	**6,754**	**6,873**	**6,937**	**6,998**	**7,062**	**7,181**	**7,244**	
7	NRW	Ratio	%	34%	32%	31%	29%	27%	25%	24%	22%	20%	20%	20%	19%	19%	19%	19%	19%	18%	18%	18%	
		Volume	m3/d	1,166	1,259	1,355	1,427	1,499	1,544	1,575	1,602	1,599	1,608	1,603	1,611	1,605	1,612	1,606	1,599	1,592	1,598	1,590	
8	**Daily Average Water Supply Volume (Water Demand)**		m3/d	**3,430**	**3,905**	**4,442**	**4,963**	**5,551**	**6,116**	**6,701**	**7,367**	**7,993**	**8,119**	**8,177**	**8,303**	**8,359**	**8,485**	**8,543**	**8,597**	**8,654**	**8,779**	**8,834**	
	Daily Peak Factor		-	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	TCXD VN 33: 2006
9	**Daily Maximum Water Supply Volume**		m3/d	**3,945**	**4,491**	**5,108**	**5,707**	**6,384**	**7,033**	**7,706**	**8,472**	**9,192**	**9,337**	**9,403**	**9,549**	**9,613**	**9,758**	**9,824**	**9,887**	**9,952**	**10,096**	**10,160**	
B. Water Treatment Plant Capacity																							
10	**Ba Lang WTP**		m3/d	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**	

		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Deficit (Daili Max - Capacity)	m3/d	-1,055	-509	108	707	1,384	2,033	2,706	3,472	4,192	4,337	4,403	4,549	4,613	4,758	4,824	4,887	4,952	5,096	5,160

O Mon (Water Demand and Capacity)

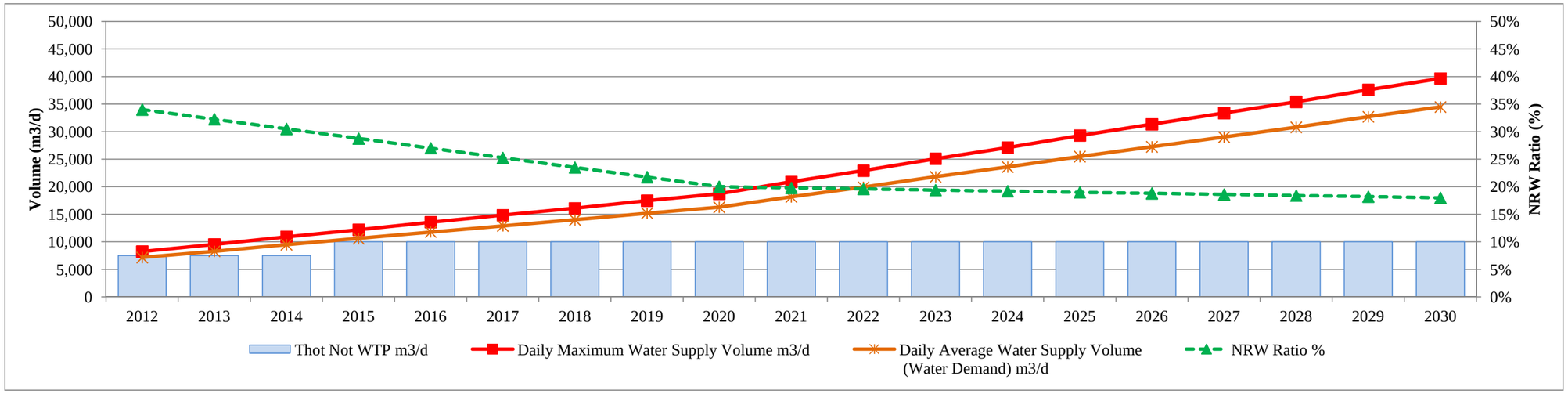


*Target Year

O Mon				2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Note
A. Demand Projection																							
1	Domestic	Population	thousand	35	36	36	37	37	38	38	39	39	40	40	41	41	42	42	42	43	43	44	
		Service Ratio	%	23%	33%	42%	51%	62%	68%	79%	87%	97%	98%	98%	98%	98%	98%	100%	100%	98%	100%	100%	
		Served Population	thousand	8	12	15	19	23	26	30	34	38	39	39	40	40	41	42	42	42	43	44	
		Unit Water Demand	L/c/d	144	140	151	152	157	167	171	177	182	182	184	184	187	187	185	188	191	191	189	Class I (Suburban), V
		Water Demand	m3/d	1,152	1,676	2,269	2,895	3,602	4,335	5,119	6,009	6,909	7,080	7,193	7,368	7,484	7,663	7,781	7,901	8,023	8,210	8,334	
2	Institutional	Ratio per Domestic	%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	QCVN 07: 2010
		Water Demand	m3/d	115	168	227	289	360	433	512	601	691	708	719	737	748	766	778	790	802	821	833	
3	Public	Ratio per Domestic	%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	QCVN 07: 2010
		Water Demand	m3/d	58	84	113	145	180	217	256	300	345	354	360	368	374	383	389	395	401	410	417	
4	Commercial	Ratio per Domestic	%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	QCVN 07: 2010
		Water Demand	m3/d	230	335	454	579	720	867	1,024	1,202	1,382	1,416	1,439	1,474	1,497	1,533	1,556	1,580	1,605	1,642	1,667	
5	Industrial Zone	Area	ha	0	0	0	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	
	(North O Mon)	Unit Water Demand	m3/ha/d	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	QCVN 07: 2010
		Coverage	%	0%	0%	0%	0%	0%	0%	0%	0%	0%	6%	12%	18%	24%	30%	36%	42%	48%	54%	60%	
		Water Demand	m3/d	0	0	0	0	0	0	0	0	0	1,440	2,880	4,320	5,760	7,200	8,640	10,080	11,520	12,960	14,400	
6	**Total Water Demand**		m3/d	**1,555**	**2,263**	**3,063**	**3,908**	**4,862**	**5,852**	**6,911**	**8,112**	**9,327**	**10,998**	**12,591**	**14,267**	**15,863**	**17,545**	**19,144**	**20,746**	**22,351**	**24,043**	**25,651**	
7	NRW	Ratio	%	34%	32%	31%	29%	27%	25%	24%	22%	20%	20%	20%	19%	19%	19%	19%	19%	18%	18%	18%	
		Volume	m3/d	801	1,077	1,344	1,577	1,798	1,977	2,123	2,255	2,332	2,715	3,069	3,434	3,769	4,115	4,432	4,741	5,040	5,349	5,631	
8	**Daily Average Water Supply Volume (Water Demand)**		m3/d	**2,356**	**3,340**	**4,407**	**5,485**	**6,660**	**7,829**	**9,034**	**10,367**	**11,659**	**13,713**	**15,660**	**17,701**	**19,632**	**21,660**	**23,576**	**25,487**	**27,391**	**29,392**	**31,282**	
	Daily Peak Factor		-	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	TCXD VN 33: 2006
9	**Daily Maximum Water Supply Volume**		m3/d	**2,709**	**3,841**	**5,068**	**6,307**	**7,660**	**9,003**	**10,389**	**11,923**	**13,407**	**15,770**	**18,009**	**20,356**	**22,576**	**24,909**	**27,113**	**29,311**	**31,499**	**33,800**	**35,974**	
B. Water Treatment Plant Capacity																							
10	**O Mon WTP**		m3/d	**2,400**	**2,400**	**2,400**	**2,400**	**2,400**	**2,400**	**2,400**	**2,400**	**2,400**	**2,400**	**2,400**	**2,400**	**2,400**	**2,400**	**2,400**	**2,400**	**2,400**	**2,400**	**2,400**	

		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Deficit (Daili Max - Capacity)	m3/d	309	1,441	2,668	3,907	5,260	6,603	7,989	9,523	11,007	13,370	15,609	17,956	20,176	22,509	24,713	26,911	29,099	31,400	33,574

Thot Not (Water Demand and Capacity)

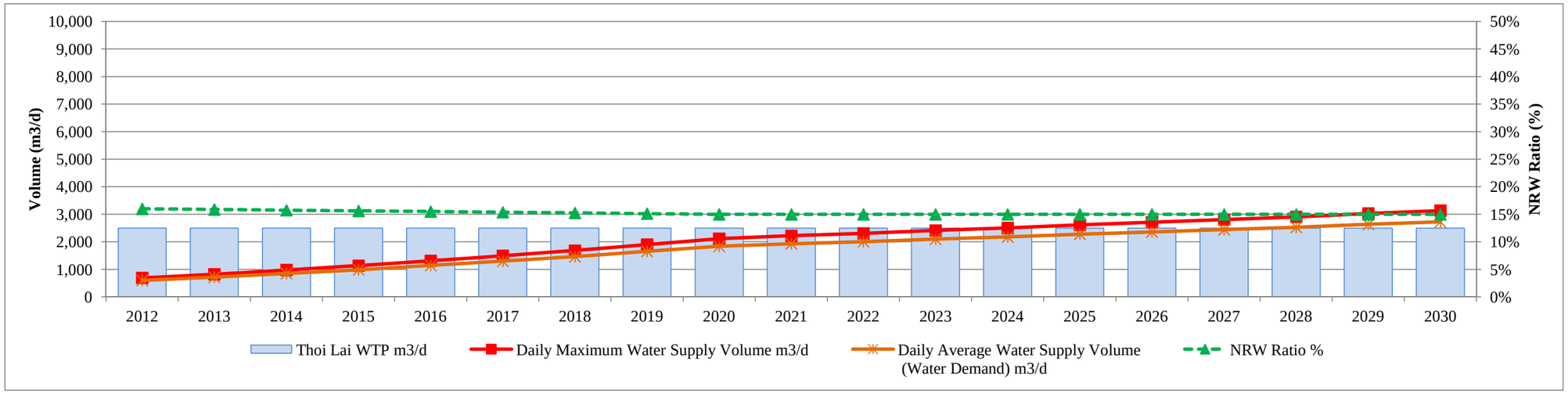


*Target Year

Thot Not				2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Note
A. Demand Projection																							
1	Domestic	Population	thousand	50	50	51	51	52	53	53	54	55	56	56	57	58	59	59	60	60	61	61	
		Service Ratio	%	56%	62%	67%	73%	77%	81%	87%	91%	95%	95%	96%	96%	97%	97%	98%	98%	98%	100%	100%	
		Served Population	thousand	28	31	34	37	40	43	46	49	52	53	54	55	56	57	58	59	59	61	61	
		Unit Water Demand	L/c/d	125	127	130	133	136	139	142	147	150	154	156	159	162	165	168	170	175	176	181	Class I (Suburban)
		Water Demand	m3/d	3,503	3,933	4,426	4,905	5,458	5,989	6,545	7,189	7,800	8,137	8,412	8,764	9,051	9,419	9,718	10,022	10,331	10,730	11,053	
2	Institutional	Ratio per Domestic	%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	QCVN 07: 2010
		Water Demand	m3/d	350	393	443	491	546	599	654	719	780	814	841	876	905	942	972	1,002	1,033	1,073	1,105	
3	Public	Ratio per Domestic	%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	QCVN 07: 2010
		Water Demand	m3/d	175	197	221	245	273	299	327	359	390	407	421	438	453	471	486	501	517	537	553	
4	Commercial	Ratio per Domestic	%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	QCVN 07: 2010
		Water Demand	m3/d	701	787	885	981	1,092	1,198	1,309	1,438	1,560	1,627	1,682	1,753	1,810	1,884	1,944	2,004	2,066	2,146	2,211	
5	Industrial Zone	Area	ha	104	104	104	104	104	104	104	104	504	504	504	504	504	504	504	504	504	504	504	
		Unit Water Demand	m3/ha/d	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	QCVN 07: 2010
		Coverage	%	0%	8%	15%	23%	30%	38%	45%	53%	12%	18%	23%	29%	34%	39%	45%	50%	55%	61%	66%	
		Water Demand	m3/d	0	312	624	936	1,248	1,560	1,872	2,184	2,496	3,581	4,666	5,750	6,835	7,920	9,005	10,090	11,174	12,259	13,344	
5-1	Phase I	Area	ha	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	
		Unit Water Demand	m3/ha/d	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	QCVN 07: 2010
		Coverage	%	0%	8%	15%	23%	30%	38%	45%	53%	60%	63%	66%	69%	72%	75%	78%	81%	84%	87%	90%	
		Water Demand	m3/d	0	312	624	936	1,248	1,560	1,872	2,184	2,496	2,621	2,746	2,870	2,995	3,120	3,245	3,370	3,494	3,619	3,744	
5-2	Phase II	Area	ha									400	400	400	400	400	400	400	400	400	400	400	
		Unit Water Demand	m3/ha/d									40	40	40	40	40	40	40	40	40	40	40	QCVN 07: 2010
		Coverage	%									0%	6%	12%	18%	24%	30%	36%	42%	48%	54%	60%	
		Water Demand	m3/d	0	0	0	0	0	0	0	0	0	960	1,920	2,880	3,840	4,800	5,760	6,720	7,680	8,640	9,600	
6	**Total Water Demand**		m3/d	**4,729**	**5,622**	**6,599**	**7,558**	**8,617**	**9,645**	**10,707**	**11,889**	**13,026**	**14,566**	**16,022**	**17,581**	**19,054**	**20,636**	**22,125**	**23,619**	**25,121**	**26,745**	**28,266**	
7	NRW	Ratio	%	34%	32%	31%	29%	27%	25%	24%	22%	20%	20%	20%	19%	19%	19%	19%	19%	18%	18%	18%	
		Volume	m3/d	2,436	2,676	2,896	3,050	3,187	3,258	3,289	3,305	3,257	3,596	3,906	4,232	4,528	4,841	5,122	5,397	5,665	5,951	6,205	
8	**Daily Average Water Supply Volume (Water Demand)**		m3/d	**7,165**	**8,298**	**9,495**	**10,608**	**11,804**	**12,903**	**13,996**	**15,194**	**16,283**	**18,162**	**19,928**	**21,813**	**23,582**	**25,477**	**27,247**	**29,016**	**30,786**	**32,696**	**34,471**	
	Daily Peak Factor		-	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	TCXD VN 33: 2006
9	**Daily Maximum Water Supply Volume**		m3/d	**8,240**	**9,542**	**10,919**	**12,199**	**13,574**	**14,838**	**16,095**	**17,473**	**18,726**	**20,887**	**22,917**	**25,085**	**27,119**	**29,298**	**31,334**	**33,368**	**35,404**	**37,601**	**39,641**	
B. Water Treatment Plant Capacity																							
10	**Thot Not WTP**		m3/d	**7,500**	**7,500**	**7,500**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	**10,000**	

		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Deficit (Daili Max - Capacity)	m3/d	740	2,042	3,419	2,199	3,574	4,838	6,095	7,473	8,726	10,887	12,917	15,085	17,119	19,298	21,334	23,368	25,404	27,601	29,641

Toi Lai (Water Demand and Capacity)

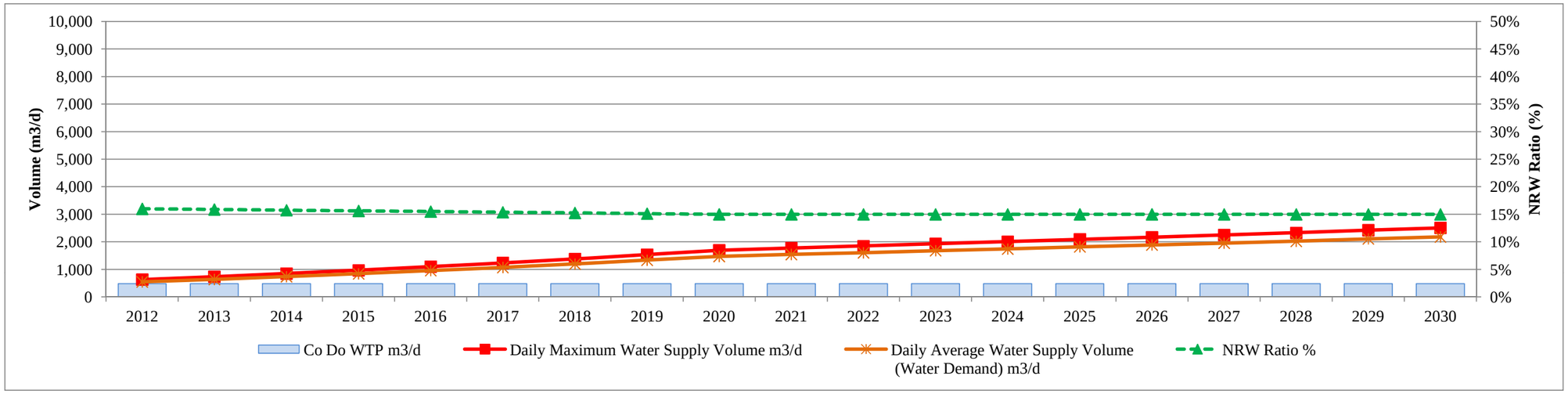


*Target Year

Thoi Lai				2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Note
A. Demand Projection																							
1	Domestic	Population	thousand	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	18	18	18	18	
		Service Ratio	%	40%	47%	53%	60%	67%	69%	75%	81%	88%	94%	88%	88%	94%	94%	94%	89%	94%	94%	94%	
		Served Population	thousand	6	7	8	9	10	11	12	13	14	15	15	15	16	16	16	16	17	17	17	
		Unit Water Demand	L/c/d	62	64	66	69	72	74	77	80	83	81	84	88	86	90	93	96	94	98	101	CiassV
		Water Demand	m3/d	373	447	531	617	716	814	919	1,040	1,159	1,216	1,263	1,322	1,371	1,434	1,485	1,538	1,592	1,660	1,716	
2	Service	Ratio per Domestic	%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	QCVN 07: 2010
		Water Demand	m3/d	37	45	53	62	72	81	92	104	116	122	126	132	137	143	149	154	159	166	172	
3	Public	Ratio per Domestic	%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	QCVN 07: 2010
		Water Demand	m3/d	19	22	27	31	36	41	46	52	58	61	63	66	69	72	74	77	80	83	86	
4	Commercial	Ratio per Domestic	%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	QCVN 07: 2010
		Water Demand	m3/d	75	89	106	123	143	163	184	208	232	243	253	264	274	287	297	308	318	332	343	
5	Industrial Zone	Area	ha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Unit Water Demand	m3/ha/d	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	QCVN 07: 2010
		Coverage	%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
		Water Demand	m3/d	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6	**Total Water Demand**		m3/d	**504**	**603**	**717**	**833**	**967**	**1,099**	**1,241**	**1,404**	**1,565**	**1,642**	**1,705**	**1,784**	**1,851**	**1,936**	**2,005**	**2,077**	**2,149**	**2,241**	**2,317**	
7	NRW	Ratio	%	16%	16%	16%	16%	16%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	
		Volume	m3/d	96	114	134	154	177	200	223	250	276	290	301	315	327	342	354	367	379	395	409	
8	**Daily Average Water Supply Volume (Water Demand)**		m3/d	**600**	**717**	**851**	**987**	**1,144**	**1,299**	**1,464**	**1,654**	**1,841**	**1,932**	**2,006**	**2,099**	**2,178**	**2,278**	**2,359**	**2,444**	**2,528**	**2,636**	**2,726**	
	Daily Peak Factor		-	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	TCXD VN 33: 2006
9	**Daily Maximum Water Supply Volume**		m3/d	**691**	**825**	**979**	**1,135**	**1,315**	**1,494**	**1,684**	**1,902**	**2,117**	**2,221**	**2,307**	**2,414**	**2,505**	**2,619**	**2,713**	**2,811**	**2,907**	**3,031**	**3,135**	
B. Water Treatment Plant Capacity																							
10	**Thoi Lai WTP**		m3/d	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	**2,500**	

		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Deficit (Daili Max - Capacity)	m3/d	-1,809	-1,675	-1,521	-1,365	-1,185	-1,006	-816	-598	-383	-279	-193	-86	5	119	213	311	407	531	635

Co Do (Water Demand and Capacity)

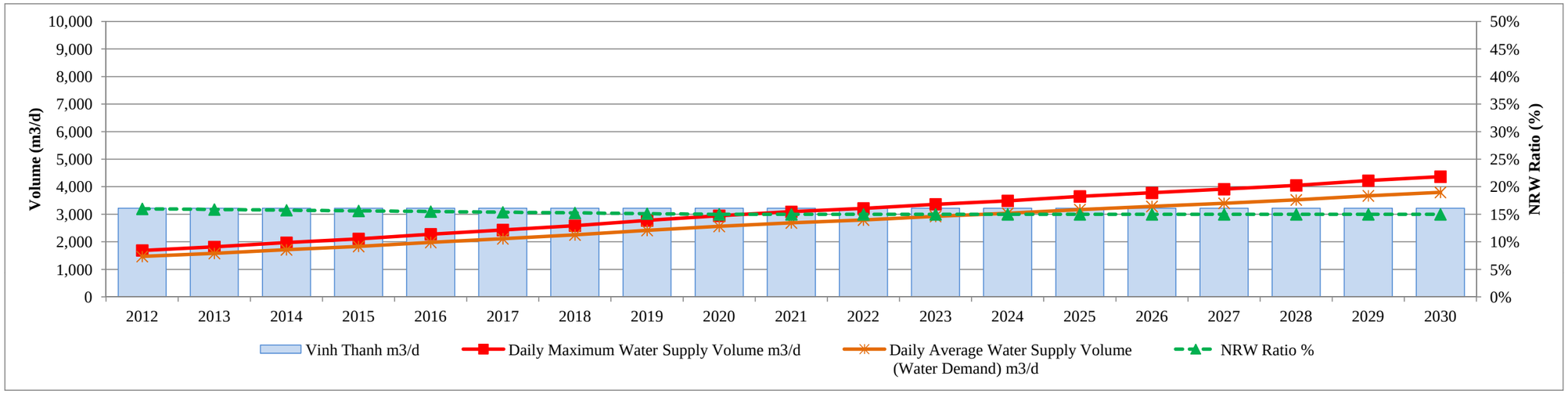


*Target Year

Co Do				2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Note
A. Demand Projection																							
1	Domestic	Population	thousand	12	12	12	12	12	12	13	13	13	13	13	13	14	14	14	14	14	14	14	
		Service Ratio	%	50%	50%	58%	67%	75%	75%	77%	85%	92%	92%	92%	92%	86%	93%	93%	93%	93%	100%	100%	
		Served Population	thousand	6	6	7	8	9	9	10	11	12	12	12	12	12	13	13	13	13	14	14	
		Unit Water Demand	L/c/d	57	66	66	66	67	75	75	76	77	81	84	88	91	88	91	95	98	95	98	CiassV
		Water Demand	m3/d	342	398	462	526	599	673	750	840	927	972	1,010	1,058	1,097	1,147	1,188	1,230	1,273	1,328	1,373	
2	Service	Ratio per Domestic	%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	QCVN 07: 2010
		Water Demand	m3/d	34	40	46	53	60	67	75	84	93	97	101	106	110	115	119	123	127	133	137	
3	Public	Ratio per Domestic	%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	QCVN 07: 2010
		Water Demand	m3/d	17	20	23	26	30	34	38	42	46	49	51	53	55	57	59	62	64	66	69	
4	Commercial	Ratio per Domestic	%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	QCVN 07: 2010
		Water Demand	m3/d	68	80	92	105	120	135	150	168	185	194	202	212	219	229	238	246	255	266	275	
5	Industrial Zone	Area	ha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Unit Water Demand	m3/ha/d	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	QCVN 07: 2010
		Coverage	%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
		Water Demand	m3/d	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6	**Total Water Demand**		m3/d	**461**	**538**	**623**	**710**	**809**	**909**	**1,013**	**1,134**	**1,251**	**1,312**	**1,364**	**1,429**	**1,481**	**1,548**	**1,604**	**1,661**	**1,719**	**1,793**	**1,854**	
7	NRW	Ratio	%	16%	16%	16%	16%	16%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	
		Volume	m3/d	88	101	116	131	148	165	182	202	221	232	241	252	261	273	283	293	303	316	327	
8	**Daily Average Water Supply Volume (Water Demand)**		m3/d	**549**	**639**	**739**	**841**	**957**	**1,074**	**1,195**	**1,336**	**1,472**	**1,544**	**1,605**	**1,681**	**1,742**	**1,821**	**1,887**	**1,954**	**2,022**	**2,109**	**2,181**	
	Daily Peak Factor		-	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	TCXD VN 33: 2006
9	**Daily Maximum Water Supply Volume**		m3/d	**632**	**735**	**849**	**967**	**1,101**	**1,235**	**1,375**	**1,536**	**1,693**	**1,776**	**1,846**	**1,933**	**2,003**	**2,094**	**2,170**	**2,248**	**2,326**	**2,425**	**2,508**	
B. Water Treatment Plant Capacity																							
10	**Co Do WTP**		m3/d	**480**	**480**	**480**	**480**	**480**	**480**	**480**	**480**	**480**	**480**	**480**	**480**	**480**	**480**	**480**	**480**	**480**	**480**	**480**	

		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Deficit (Daili Max - Capacity)	m3/d	152	255	369	487	621	755	895	1,056	1,213	1,296	1,366	1,453	1,523	1,614	1,690	1,768	1,846	1,945	2,028

Vinh Thanh (Water Demand and Capacity)

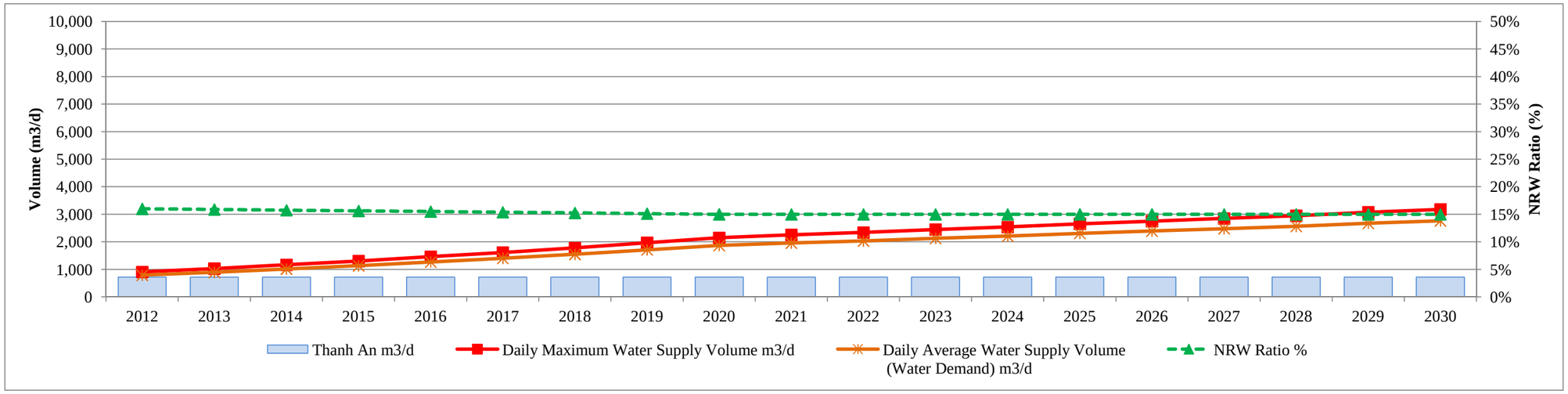


*Target Year

Vinh Thanh				2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Note
A. Demand Projection																							
1	Domestic	Population	thousand	20	20	21	21	21	22	22	22	22	23	23	23	24	24	24	24	25	25	25	
		Service Ratio	%	75%	80%	76%	81%	86%	82%	86%	91%	91%	91%	91%	91%	92%	92%	92%	96%	92%	96%	96%	
		Served Population	thousand	15	16	16	17	18	18	19	20	20	21	21	21	22	22	22	23	23	24	24	
		Unit Water Demand	L/c/d	61	62	67	67	69	74	74	76	81	81	84	88	87	91	94	93	96	96	100	CiassV
		Water Demand	m3/d	914	985	1,069	1,147	1,239	1,325	1,413	1,518	1,615	1,693	1,759	1,841	1,910	1,997	2,069	2,142	2,217	2,312	2,390	
2	Service	Ratio per Domestic	%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	QCVN 07: 2010
		Water Demand	m3/d	91	98	107	115	124	132	141	152	161	169	176	184	191	200	207	214	222	231	239	
3	Public	Ratio per Domestic	%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	QCVN 07: 2010
		Water Demand	m3/d	46	49	53	57	62	66	71	76	81	85	88	92	96	100	103	107	111	116	119	
4	Commercial	Ratio per Domestic	%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	QCVN 07: 2010
		Water Demand	m3/d	183	197	214	229	248	265	283	304	323	339	352	368	382	399	414	428	443	462	478	
5	Industrial Zone	Area	ha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Unit Water Demand	m3/ha/d	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	QCVN 07: 2010
		Coverage	%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
		Water Demand	m3/d	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6	**Total Water Demand**		m3/d	**1,234**	**1,329**	**1,443**	**1,548**	**1,673**	**1,788**	**1,908**	**2,050**	**2,180**	**2,286**	**2,375**	**2,485**	**2,579**	**2,696**	**2,793**	**2,891**	**2,993**	**3,121**	**3,226**	
7	NRW	Ratio	%	16%	16%	16%	16%	16%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	
		Volume	m3/d	235	251	270	287	307	325	343	365	385	403	419	439	455	476	493	510	528	551	569	
8	**Daily Average Water Supply Volume (Water Demand)**		m3/d	**1,469**	**1,580**	**1,713**	**1,835**	**1,980**	**2,113**	**2,251**	**2,415**	**2,565**	**2,689**	**2,794**	**2,924**	**3,034**	**3,172**	**3,286**	**3,401**	**3,521**	**3,672**	**3,795**	
	Daily Peak Factor		-	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	TCXD VN 33: 2006
9	**Daily Maximum Water Supply Volume**		m3/d	**1,689**	**1,817**	**1,970**	**2,110**	**2,278**	**2,430**	**2,589**	**2,778**	**2,949**	**3,092**	**3,213**	**3,363**	**3,489**	**3,648**	**3,779**	**3,912**	**4,049**	**4,222**	**4,364**	
B. Water Treatment Plant Capacity																							
10	**Vinh Thanh**		m3/d	**3,220**	**3,220**	**3,220**	**3,220**	**3,220**	**3,220**	**3,220**	**3,220**	**3,220**	**3,220**	**3,220**	**3,220**	**3,220**	**3,220**	**3,220**	**3,220**	**3,220**	**3,220**	**3,220**	

		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Deficit (Daili Max - Capacity)	m3/d	-1,531	-1,403	-1,250	-1,110	-942	-790	-631	-442	-271	-128	-7	143	269	428	559	692	829	1,002	1,144

Thanh An (Water Demand and Capacity)

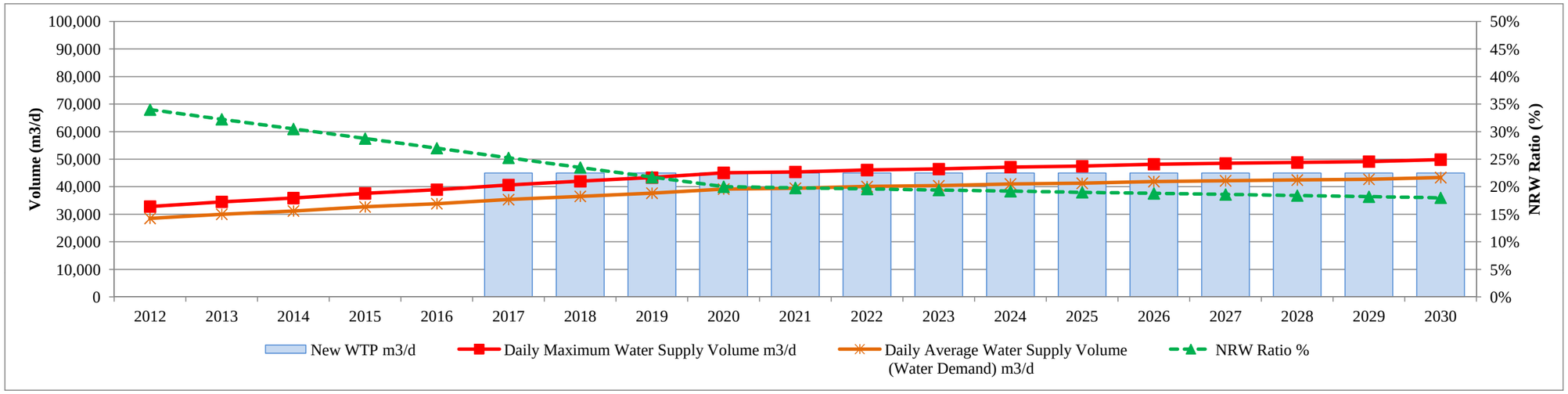


*Target Year

Thanh An				2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Note
A. Demand Projection																							
1	Domestic	Population	thousand	15	15	15	15	16	16	16	16	16	17	17	17	17	17	18	18	18	18	18	
		Service Ratio	%	53%	60%	67%	67%	69%	75%	81%	88%	94%	88%	88%	94%	94%	94%	89%	94%	94%	94%	94%	
		Served Population	thousand	8	9	10	10	11	12	13	14	15	15	15	16	16	16	16	17	17	17	17	
		Unit Water Demand	L/c/d	61	62	63	71	72	73	75	77	78	82	85	84	87	91	94	92	95	99	102	CiassV
		Water Demand	m3/d	491	557	633	708	795	880	971	1,075	1,176	1,233	1,281	1,341	1,391	1,454	1,507	1,560	1,615	1,683	1,740	
2	Service	Ratio per Domestic	%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	QCVN 07: 2010
		Water Demand	m3/d	49	56	63	71	80	88	97	107	118	123	128	134	139	145	151	156	161	168	174	
3	Public	Ratio per Domestic	%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	QCVN 07: 2010
		Water Demand	m3/d	25	28	32	35	40	44	49	54	59	62	64	67	70	73	75	78	81	84	87	
4	Commercial	Ratio per Domestic	%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	QCVN 07: 2010
		Water Demand	m3/d	98	111	127	142	159	176	194	215	235	247	256	268	278	291	301	312	323	337	348	
5	Industrial Zone	Area	ha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Unit Water Demand	m3/ha/d	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	QCVN 07: 2010
		Coverage	%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
		Water Demand	m3/d	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6	**Total Water Demand**		m3/d	**663**	**752**	**855**	**956**	**1,074**	**1,188**	**1,311**	**1,451**	**1,588**	**1,665**	**1,729**	**1,810**	**1,878**	**1,963**	**2,034**	**2,106**	**2,180**	**2,272**	**2,349**	
7	NRW	Ratio	%	16%	16%	16%	16%	16%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	
		Volume	m3/d	126	142	160	177	197	216	236	259	280	294	305	319	331	346	359	372	385	401	415	
8	**Daily Average Water Supply Volume (Water Demand)**		m3/d	**789**	**894**	**1,015**	**1,133**	**1,271**	**1,404**	**1,547**	**1,710**	**1,868**	**1,959**	**2,034**	**2,129**	**2,209**	**2,309**	**2,393**	**2,478**	**2,565**	**2,673**	**2,764**	
	Daily Peak Factor		-	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	TCXD VN 33: 2006
9	**Daily Maximum Water Supply Volume**		m3/d	**908**	**1,028**	**1,167**	**1,303**	**1,462**	**1,615**	**1,779**	**1,966**	**2,148**	**2,253**	**2,339**	**2,448**	**2,540**	**2,655**	**2,751**	**2,850**	**2,949**	**3,074**	**3,179**	
B. Water Treatment Plant Capacity																							
10	**Thanh An**		m3/d	**720**	**720**	**720**	**720**	**720**	**720**	**720**	**720**	**720**	**720**	**720**	**720**	**720**	**720**	**720**	**720**	**720**	**720**	**720**	

		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Deficit (Daili Max - Capacity)	m3/d	188	308	447	583	742	895	1,059	1,246	1,428	1,533	1,619	1,728	1,820	1,935	2,031	2,130	2,229	2,354	2,459

New WTP (Water Demand and Capacity)



*Target Year

Can Tho No.1				2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Note
A. Demand Projection																							
1	Domestic	Population	thousand	91	93	94	96	97	99	99	100	102	103	105	106	107	108	110	111	112	113	115	
		Service Ratio	%	95%	96%	96%	97%	97%	98%	98%	99%	99%	99%	99%	99%	99%	100%	100%	100%	100%	100%	100%	
		Served Population	thousand	87	89	90	92	94	96	97	99	101	102	104	105	107	108	110	111	112	113	115	
		Unit Water Demand	L/c/d	140	148	155	163	170	178	185	193	200	200	200	200	200	200	200	200	200	200	200	Class I (Ubn, S-Ubn)
		Water Demand	m3/d	12,151	13,122	13,994	15,029	15,952	17,051	18,025	19,021	20,218	20,415	20,791	20,990	21,368	21,567	21,946	22,146	22,347	22,549	22,930	
2	Institutional	Ratio per Domestic	%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	QCVN 07: 2010
		Water Demand	m3/d	1,458	1,575	1,679	1,803	1,914	2,046	2,163	2,283	2,426	2,450	2,495	2,519	2,564	2,588	2,634	2,658	2,682	2,706	2,752	
3	Public	Ratio per Domestic	%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	QCVN 07: 2010
		Water Demand	m3/d	972	1,050	1,120	1,202	1,276	1,364	1,442	1,522	1,617	1,633	1,663	1,679	1,709	1,725	1,756	1,772	1,788	1,804	1,834	
4	Commercial	Ratio per Domestic	%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	QCVN 07: 2010
		Water Demand	m3/d	4,253	4,593	4,898	5,260	5,583	5,968	6,309	6,657	7,076	7,145	7,277	7,347	7,479	7,549	7,681	7,751	7,822	7,892	8,025	
5	Industrial Zone	Area	ha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Unit Water Demand	m3/ha/d	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	QCVN 07: 2010
		Coverage	%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
		Water Demand	m3/d	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6	**Total Water Demand**		m3/d	**18,834**	**20,340**	**21,691**	**23,294**	**24,725**	**26,429**	**27,939**	**29,483**	**31,337**	**31,643**	**32,226**	**32,535**	**33,120**	**33,429**	**34,017**	**34,327**	**34,639**	**34,951**	**35,541**	
7	NRW	Ratio	%	34%	32%	31%	29%	27%	25%	24%	22%	20%	20%	20%	19%	19%	19%	19%	19%	18%	18%	18%	
		Volume	m3/d	9,702	9,682	9,519	9,399	9,145	8,928	8,583	8,195	7,834	7,812	7,856	7,831	7,870	7,841	7,876	7,844	7,811	7,776	7,802	
8	**Daily Average Water Supply Volume (Water Demand)**		m3/d	**28,536**	**30,022**	**31,210**	**32,693**	**33,870**	**35,357**	**36,522**	**37,678**	**39,171**	**39,455**	**40,082**	**40,366**	**40,990**	**41,270**	**41,893**	**42,171**	**42,450**	**42,727**	**43,343**	
	CT-1		m3/d	12,282	12,921	13,433	14,072	14,578	15,218	15,719	16,217	16,860	16,982	17,252	17,374	17,642	17,763	18,030	18,151	18,270	18,390	18,655	
	CT-2		m3/d	16,254	17,099	17,777	18,622	19,292	20,139	20,802	21,461	22,312	22,474	22,831	22,992	23,348	23,508	23,861	24,020	24,179	24,337	24,688	
	Daily Peak Factor		-	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	TCXD VN 33: 2006
9	**Daily Maximum Water Supply Volume**		m3/d	**32,816**	**34,525**	**35,892**	**37,597**	**38,950**	**40,661**	**42,000**	**43,330**	**45,046**	**45,374**	**46,095**	**46,421**	**47,138**	**47,461**	**48,177**	**48,497**	**48,818**	**49,136**	**49,844**	
	CT-1		m3/d	14,124	14,859	15,448	16,182	16,764	17,500	18,077	18,649	19,389	19,530	19,840	19,980	20,289	20,428	20,735	20,873	21,011	21,148	21,453	
	CT-2		m3/d	18,692	19,664	20,444	21,416	22,186	23,160	23,923	24,680	25,659	25,845	26,256	26,441	26,850	27,034	27,440	27,623	27,806	27,988	28,391	
B. Water Treatment Plant Capacity																							
10	**New WTP**		m3/d						**45,000**	**45,000**	**45,000**	**45,000**	**45,000**	**45,000**	**45,000**	**45,000**	**45,000**	**45,000**	**45,000**	**45,000**	**45,000**	**45,000**	

APPENDIX B2 LAWS AND REGULATIONS

B2.1 List of Laws and Regulations Related to Water Supply BOT Business

Table B2.1 Laws and Regulations on Water Supply Business

No.	Title
Law No.08/1998/QH10	The Law on Water Resources
Decree No.179/1999	Decree Stipulating The Implementation of The Law on Water Resources
Decree No.117	Decree on Clean Water Production, Supply and Consumption
Circular No.01/2008	Implementation Guide Some Content of Decree No. 117/2007/ND-CP of the Day July 11, 2007 Government of Production, Supply and Clean Water Consumption
Decree No.149/2004	Decree on the Issuance of Permits for Water Resource Exploration, Exploitation and Use, or for Discharge of Wastewater into Water sources
Circular No.2/2005	Guiding the Implementation of the Government's Decree No. 149/2004/ND-CP of July 27, 2004, on the Issuance of Permits for Water Resource Exploration, Exploitation and use, or for Discharge of Wastewater into Water Sources
Law No.45/2009/QH12	The Law on Royalties
Decree No.50/2010	Degree Detailing and Guiding a Number of Articles of the Law on Royalties
Law No.16/2003/QH11	The Law on Construction
Decree No.12/2009/ND-CP	Decree on Management of Investment Projects on the Construction of Works
National Resolution No. 66/2006/QH11)	Resolution on Projects and Works of National Importance to be Submitted to the National Assembly for Decision on their Investment

Source: JICA Study Team

Table B2.2 Laws and Regulations on Water Tariff Setting

No.	Title
Inter Circular No.95/2009	Inter-Ministerial Circular Guidelines on the Principles, Methods, and Jurisdiction for Determination of Clean Water Tariff Rate at Urban Areas, Industrial Zones and Rural Areas
Circular No.100/2009	Circular on the Promulgation of Domestic Clean Water Tariff Framework

Source: JICA Study Team

Table B2.3 Laws and Regulations on Investment

No.	Title
Law No.59/2005/QH11	Common Investment Law
Decree No.108/2006	Detailing and Guiding in the Investment Law
Decision No.1088/2006	Issuing Standard Forms For Conducting Investment Procedures in Vietnam
Law No.60/2005/QH11	Law on Enterprises
Decree No 102/2010	Decree Detailing a Number of Articles of the Law on Enterprises

Source: JICA Study Team

Table B2.4 Laws and Regulations on Land Use

No.	Title
Law No.13/2003	Law on Land
Decree No.181/2004/ND-CP	The Implementation of the Land Law
Decree No.69/2009/ND-CP	Decree Additionally Providing for Land Use Planning, Land Prices, Land Recovery, Compensation, Support and Resettlement

Source: JICA Study Team

Table B2.5 Laws and Regulations on PPP/BOT

No.	Title
Decree 108/2009/ND-CP	Decree On Investment In The Form Of Build-Operate-Transfer, Build-Transfer-Operate or Build-Transfer Contract
Decree No. 24/2011/ND-CPg	Amending A Number of Articles of the November 27, 2009 Decree NO.108/2009/ND-CP on Investment in the Form of Build-Operate-Transfer Contract, Build-Transfer-Operate Contract, Build-Transfer Contract

Circular No.03/2011	Circular Guiding the Implementation of a Number of Articles of Decree NO. 108/2009/ND-CP of the Government Dated 27 November 2009 on Investment on the Basis of Bot Contracts, Bto Contracts and Bt Contracts

Source: JICA Study Team

Table B2.6 Laws and Regulations on Tax

No.	Title
Law No. 14/2008/QH12	Law on Enterprise Income Tax
Decree No.124/2008/ND-CP	Detailing and Guiding the Implementation of a Number of Articles of the Law on the Enterprise Income Tax
Circular No.130/2008/TT-BTC	Circular Providing Guidelines for Implementation of the Law on Corporate Income Tax and Decree 124-2008-ND-CP
Circular No.18/2011/TT-BTC	Amending and Supplementing the Finance Ministry's Circular No.130/2008/TT-BTC
Circular No.134/2008	Guiding the Performance of Tax Obligations Applicable to Foreign Organizations and Individuals Doing Business or Earning Incomes in Vietnam
Circular No.197/2009	Supplement of Circular No.134/2008/TT-BTC

Source: JICA Study Team

B2.2 Summary of Development Procedures of BOT Project (Decree 108/2009/ND-CP)

B2.2.1 Formulation of the Project List (Article 9, 10)

1. Based on the master plan and planning for socio-economic development, ministries, branches, and provincial people's committees shall organize formulation of Lists of BOT Projects in their respective localities.
2. Ministries, branches, and provincial people's committees send the project list to the relevant ministries, branches, or provincial people's committees to obtain opinions.
3. Relevant ministries, branches, and provincial people's committees provide written opinions within 30days from the receipt of the list.
4. In January of each year, ministries, branches and provincial people's committees shall announce a List of Projects on their websites and also publish it in three consecutive editions of the Tendering Newsletter.
5. The maximum period within which an investor may select and register with the authorized State body to implement a project is 30 business days from the last publication date of a List of Projects.

B2.2.2 Proposal of a Project (Article 11)

An investor may propose implementation of a project outside the List of Projects already announced, and must formulate a proposal for the project and send it to the ministry, branch or provincial people's committee for approval. (According to DPI, an investor who proposes a BOT project in Can Tho City must first submit to DPI, then DPI forward the proposal to Can Tho PC for approval. The approved project will be added to the city's Project List.)

B2.2.3 Selection of Investors for Project Contract Negotiation (Article 13, 14, 15)

(1) Tendering for Selection of an Investor

The authorized State body must hold open domestic or international tendering to select the investor for any project on an announced List of Projects for which two or more investors have registered to implement.

(2) Appointment of an Investor

The appointment of an investor shall only be conducted when one of the following conditions is satisfied:

1. Only one investor has registered to implement the project within the 30 business days from the last publication date of the Project List.
2. After the projects proposed by investors are approved and added to the Project List and the amended List was published, no other investor has registered within 30 business days.

3. The project is required to be implemented in order to satisfy an urgent need to use infrastructure facilities as decided by the Prime Minister on the basis of a proposal from a ministry, branch or provincial people's committee and an evaluation report from the Ministry of Planning and Investment.

The authorized State body shall hold project contract negotiations on the results of (1) or (2).

B2.2.4 Formulation and Approval of Feasibility Reports (Article 12)

The authorized State body shall arrange formulation of a feasibility study report to provide the basis for formulation of tender invitation documents and project contract negotiations with the investor.

Authority to approve feasibility study reports:

1. The Prime Minister approves feasibility reports for national important projects (See Appendix B2.4 for definition)
2. Ministers, heads of ministerial equivalent bodies and chairmen of provincial people's committees shall approve feasibility reports for projects other than (a)

B2.2.5 Negotiation and Signing of Project Contract (Article 15)

At the conclusion of negotiations, the project contract and contracts related to implementation of the project (if any) shall be created by the parties involved.

After the project has been issued with an investment certificate, the investor and the authorized State body shall officially sign the project contract.

B2.3 Contents of F/S Report (Decree No.12/2009/ND-CP, Decree 108/2009/ND-CP)

F/S report must contain 1) detailed explanations of investment project, 2) basic designs, as well as 3) the items specified in Decree 108/2009/ND-CP (BOT Law).

B2.3.1 Details of explanations of an investment project on the construction of works

1. The investment necessity and objective; assessment of the market demand, sale of products, for production and business projects; product competitiveness; social impacts (if any) on the locality or region; the form of construction investment; the construction location and land use demand: conditions of the supply of raw materials, fuel and other input elements.
2. Description of the work's size and construction area, work items; analysis and selection of technical plans, technologies and capacity.
3. Implementation solutions, including:

   - The general plan on ground clearance and resettlement and the plan to support technical infrastructure construction, if any;

   - Architectural design plans, for works in urban centers and works subject to architectural requirements;

   - The plan on the project operation and labor use;

   - Implementation phases and schedules and the form of project management.
4. Assessment of environmental impacts, fire and explosion prevention and fighting measures, and security and defense requirements.
5. The project's total investment; the capital arrangement capacity, capital sources and the capacity to allocate capital according to implementation schedule; the capital repayment plan, for projects with capital recovery requirements, and analysis and assessment of the project's economic-financial and social benefits.

B2.3.2 Details of the basic design of an investment project on the construction of works

1. Basic design means a design made during the formulation of an investment project on the construction of works on the basis of the selected design plan, which must indicate major technical specifications conformable with applicable regulations and standards, as a basis for carrying out subsequent designing steps. A basic design consists of explanations and drawings.
2. A basic design's explanations cover:

   - A brief description of the construction location, the design plan: the work's general plan or the plan on work lines, for works to be constructed in lines; locations and sizes

of work items; connection among work items and to the region's technical infrastructure;

- The technological plan and chain, for works subject to technological requirements;

- The architectural plan, for works subject to architectural requirements;

- The work's major structure plan, technical and technical infrastructure systems;

- Environmental protection and fire prevention and fighting plans as prescribed by law;

- A list of applicable major regulations and standards.

3. A basic design's drawings cover:

- The drawing of the work's general plan or the drawing of the plan on work lines, for works to be constructed in lines;

- The technological plan and the technological chain drawing, for works subject to technological requirements:

- The architectural plan drawing, for works subject to architectural requirements;

- Drawings of the work's major structure plan, technical and technical infrastructure systems, connection to the region's technical infrastructure.

B2.3.3 Items required in BOT Law

1. Analysis of the necessity and advantages of implementing the project in the form of a BOT contract as compared with other investment forms
2. A determination of the goods and services and fees and charges for goods and services which it is proposed to collect from operation of the facility
3. A determination of the duration for constructing and operating the facility, and the method of management and commercial operation of the facility
4. A determination of the conditions and method of handing over and accepting the facility
5. Proposals on applying forms of investment incentives and support and Government guarantee (if any)

B2.4 National Important Projects (National Resolution No. 66/2006/QH11)

Projects or works which satisfy one of the following 5 criteria shall be considered projects or works of national importance:

1. Having an investment capital of VND 20,000 billion or more each, for projects or works with state capital representing 30% or more of their capital.
2. Projects or works which greatly affect the environment or have latent potential to seriously affect the environment, including:
   a/ Nuclear power plants;
   b/ Land-using investment projects requiring change of the use purpose of headwater protective forest land of two hundred hectares or more; of wave breaking or sea-encroaching protective forest land of five hundred hectares or more; of special-use forest land of two hundred hectares or more, except forest land areas belonging to national parks or nature conservation zones; or of production forest land of one thousand hectares or more.
3. Projects or works requiring relocation and resettlement of 20,000 people or more in mountain areas or 50,000 people or more in other areas.
4. Investment projects or works in geographical areas of special national defense or security significance or areas where exist national relics of special historical-cultural significance.
5. Projects or works subject to particular mechanisms or policies which should be decided by the National Assembly.

Appendix B3 Result of Jar Test at Can Tho No.2 Water Treatment Plant

B3.1 Objective

This test aims that it is to confirm adequately of water treatment process of the existing WTP at Can Tho city and to suggest better sedimentation process for new build WTP. Furthermore, it is to confirm reproducibility of flocculation by using different season raw water.

B3.2 Materials and Methods

B3.2.1 Materials

1) Water Samples : raw water in CanTho No.2 WTP

2) Turbidity of Samples : 118NTU (6/25 raw water)

115NTU (8/28 raw water)

108NTU (8/29 raw water)

3) Coagulant : Polyaluminium chloride（PAC）

B3.2.2 Experimental Methods

1) Conditions of jar test

- Sample volume : 1,000mL
- Process and mixing conditions :

	Process	Conditions
1	PAC dosage	dose to samples before mixing
2	rapid mixing	130rpm 3minutes
3	slow mixing	30rpm 10minutes
4	floc settling	5minutes
5	settled water quality analysis	

2) PAC dosage(mg/L as PAC) : 6.7, 13.3, 20.0, 26.7, 33.3

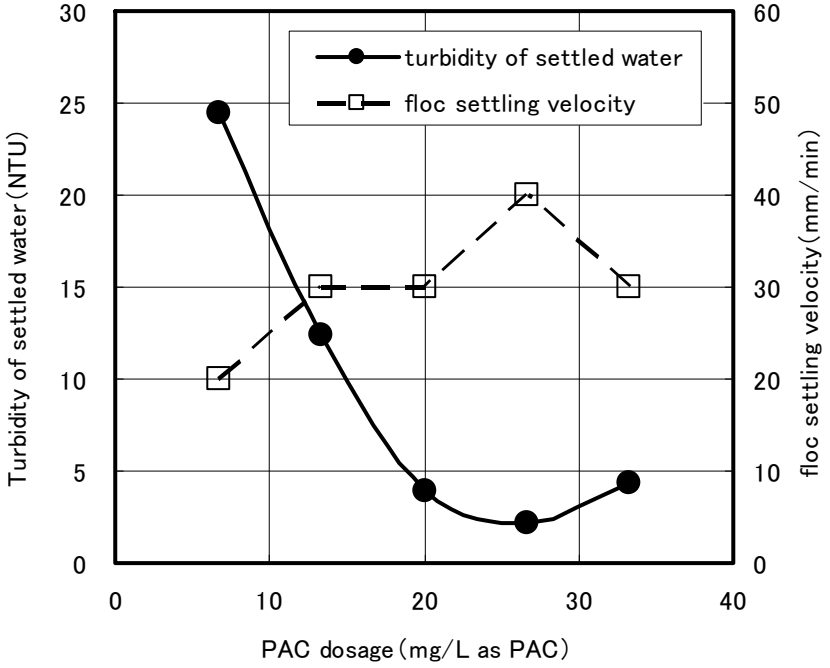
3) Water quality analysis items : turbidity, pH

B3.3 Results

B3.3.1 Result of Jar test

Figure B3.1 shows that the relation of PAC dosage, turbidity of settled water and floc settling velocity for 6/25 raw water. In case PAC dosage is 20～33.3mg/L, floc settling velocity is high and turbidity of settled water is low. This PAC dosage is two to four times of actual

dosage (9mg/L as PAC carried out) in CanTho No.2 WTP. Furthermore, Table B3.1 shows that even if the PAC dosage was increased, the pH of settled water remained as it was.



Source: JICA Study Team

Figure B3.1 Relation of PAC dosage, turbidity of settled water and floc settling velocity

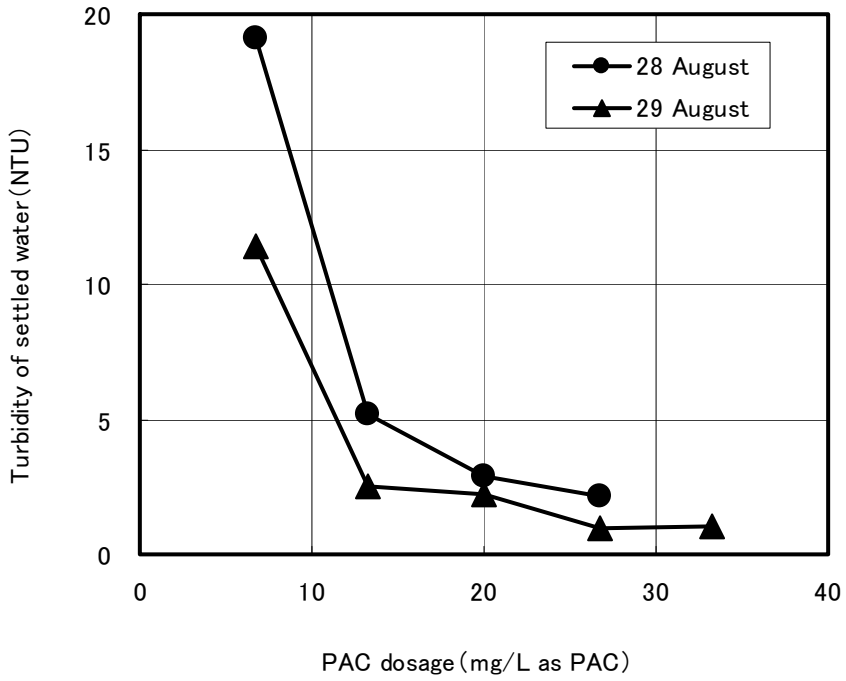
Table B3.1 Result of Jar Test（test date : 25 June,2012)

PAC dosage		floc conditions		water quality of settled water	
(mg/L as PAC)	(mg/L as Al_2O_3)	size (mm)	settling velocity (mm/min)	pH (－)	turbidity (NTU)
6.7	2	<1	20	7.24	25
13.3	4	<1	30	7.21	12
20.0	6	<1	30	7.17	3.9
26.7	8	<1	40	7.12	2.2
33.3	10	<1	30	NA*	4.3

*Not Analysis

Source: JICA Study Team

Figure B3.2 shows that the relation of PAC dosage and turbidity of settled water about the different two days (8/28 and 8/29 raw water). In case PAC dosage is 20 to 26.7mg/L, turbidity of settled water is low on both batches. This PAC dosage is two to four times of actual dosage (5~9mg/L as PAC carried out) in CanTho No.2 WTP. Furthermore, Table B3.2 shows that the PAC dosage was increased, the floc settling velocity is also increased. Therefore, it was to confirm that the reproducibility of flocculation by PAC optimum dosage of the last time found out for raw water of CanTho No.2 WTP.



Source: JICA Study Team

Figure B3.2 Relation of PAC dosage and turbidity of settled water for two batches

Table B3.2 Result of Jar Test (test date : 29 August,2012)

PAC dosage		floc conditions		Settled water turbidity (NTU)
(mg/L as PAC)	(mg/L as Al_2O_3)	size (mm)	settling velocity (mm/min)	
6.7	2	<1	0	11
13.3	4	<1	5	2.5
20.0	6	<1	10	2.2
26.7	8	<1	15	1.0
33.3	10	<1	15	1.1

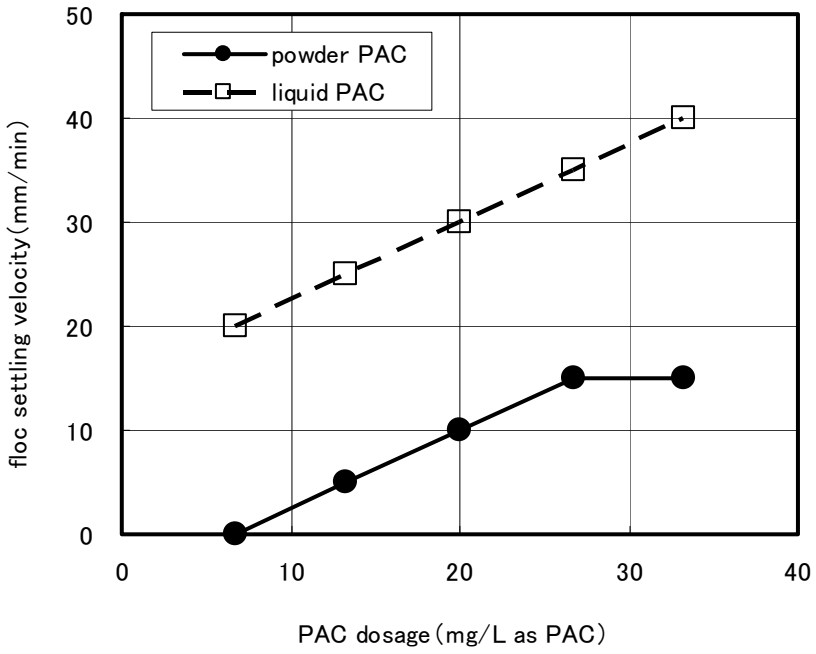
Source: JICA Study Team

These results suggest that (1) coagulation aid like alkali agent is not required for sedimentation process, (2) PAC optimum dosage is two to four times higher than actual dosage at Can Tho No.2 WTP.

B3.3.2 Comparison of PAC

It compared with efficiency of coagulation about two types of PAC. One is the current use PAC in CanTho No.2 WTP(it says “powder PAC” as the follows), the other one is made in Vietnam PAC(it says “liquid PAC” as the follows).

Figure B3.3 shows that the formed floc by liquid PAC treated has higher floc settling velocity than the formed floc by powder PAC treated. Furthermore, Table B3.3 shows that the optimum dosage of liquid PAC is lower than powder PAC. It might be necessary more research about liquid PAC efficiency of coagulation for raw water of CanTho No.2 WTP.



Source: JICA Study Team

Figure B3.3 Comparison of floc settling velocity between powder PAC treated water and liquid PAC treated water

Table B3.3 Comparison of settled water turbidity between powder PAC treated water and liquid PAC treated water

PAC dosage		settled water turbidity (NTU)	
(mg/L as PAC)	(mg/L as Al_2O_3)	powder PAC	liquid PAC
6.7	2	11	4.3
13.3	4	2.5	2.5
20.0	6	2.2	1.3
26.7	8	1.0	2.1
33.3	10	1.1	3.1

Source: JICA Study Team

B3.3.3 Alkalinity of Raw Water

The alkalinity of raw water in CanTho No.2 WTP was 58.0mg/L (8/28 raw water). It is known that the alkalinity decrease 0.45mg/L by 1mg/L PAC (in case of Al_2O_3 concentration is 30wt%) dosage, and the alkalinity of treated water need more than 20mg/L for good coagulation Therefore, it is enough for the alkalinity of this raw water to get good coagulation even if the PAC dosage increase two times of optimum dosage.

APPENDIX B4 DISTRIBUTION PIPE

Table B 1.1 Detailed Information of Existing Distribution Pipe

Name of Road	Location	Diameter (mm)	Material	Length (m)	Year
LE LOI	TRAN PHU - TRAN VAN KHEO (BEN PHAI)	250	PVC	419	-
NGUYEN VAN CU	MAU THAN - CMT8 (BEN TRAI)	250	DCI	1297	-
QUANG TRUNG	30 THANG 4 - CAU QUANG TRUNG (BEN TRAI)	250	DCI	413	-
TRAN PHU	HUNG VUONG - LE LOI (BEN PHAI)	250	DCI	1065	-
CACH MANG THANG 8	NGUYEN VAN CU - HEM 286 (BEN PHAI)	250	DCI	1211	-
CMT8	NMNCT2 - CAU BINH THUY (BEN PHAI)	250	DCI	1198	-
CACH MANG THANG TAM	NGUYEN VAN CU - CAU BINH THUY (BEN TRAI)	250	DCI	3068	-
MAU THAN NOI DAI	NGUYEN VAN CU - SO 114A(BEN PHIA)	250	DCI	470	-
NGUYEN VAN CU NOI DAI	LO 91 B - CAU RACH NGONG 2 (BEN PHAI)	250	DCI	1800	-
QUOC LO 91 B	3 THANG 2 - NVC NOI DAI	250	DCI	1695	-
LO 91 B	3 THANG 2 - CAI SON HANG BAN	250	DCI	2445	-
TRAN VAN KHEO	NGUYEN TRAI - LE LOI (BEN PHAI)	250	PVC	815	-
LE LOI	TRAN VAN KHEO - CONG VIEN NUOC	250	PVC	461	-
BUI HUU NGHIA	D300 - D150 (NGANG CN BINH THUY)	250	DCI	250	-
BUI HUU NGHIA	LE HONG PHONG	250	PVC	620	-
HOANG VAN THU	-	250	DCI	729	-
QUAN TRUNG CAI CUI	CONG SO 2 - KDC DIEU HIEN	250	DCI	198	-
NGUYEN VAN CU NOI DAI	MAU THAN - 91 B (BEN PHAI)	250	PVC	2200	-
CMT8	TRAN PHU - NGUYEN VAN CU (BEN PHAI)	250	DCI	986	-
QUANG TRUNG - CAI CUOI	-	250	DCI	172	-
QUANG TRUNG - CAI CUOI	-	250	DCI	750	-
QUANG TRUNG - CAI CUOI	-	250	DCI	1600	-
CACH MANG THANG TAM	HUYEN THANH QUAN - NGUYEN VAN CU (BEN TRAI)	300	DCI	800	1998
PHAN DANG LUU	HUNG VUONG - HUYEN THANH QUAN - CMT8	300	DCI	135	1998
BUI HUU NGHIA	LE HONG PHONG - NOI D250	300	DCI	250	2004
LE HONG PHONG	CAU TRA NOC - KHU CN (BEN TRAI)	300	DCI	737	2004
TRUC CHINH	KHU CN TRA NOC	300	DCI	1210	2004
TRUC CHINH	NGA BA CUA KCN - NMN TRA NOC (BEN PHAI)	300	DCI	2352	2004
3 THANG 2	TRAN VAN HOAI - CONG DOI (GAN TRAM BOM)	300	DCI	2926	1999
-	KHU DAN CU NGAN THUAN	300	DCI	444	2009
-	KDC NGAN THUAN	300	DCI	15	2009
-	KDC NGAN THUAN	300	DCI	15	2009
-	KDC NGAN THUAN	300	DCI	15	2009
-	KDC NGAN THUAN	300	DCI	15	2009
-	KDC NGAN THUAN	300	DCI	15	2009
-	KDC NGAN THUAN	300	DCI	21	2009
-	KDC NGAN THUAN	300	DCI	76	2009
-	KDC NGAN THUAN	300	DCI	21	2009
-	KDC NGAN THUAN	300	DCI	21	2009
-	KDC NGAN THUAN	300	DCI	21	2009
-	KDC NGAN THUAN	300	DCI	20	2009
-	KDC NGAN THUAN	300	DCI	20	2009
-	KDC NGAN THUAN	300	DCI	20	2009
-	KDC NGAN THUAN	300	DCI	30	2009
-	KDC NGAN THUAN	300	DCI	30	2009
TRAN HUNG DAO	MAU THAN - QUA CAU NHI KIEU (BEN TRAI)	375	DCI	1282	1973
NGO QUYEN	HOA BINH - HAI BA TRUNG (BEN PHAI)	375	DCI	253	1973
PHAN DINH PHUNG	THU KHOA QUAN - N.T.M.KHAI (BEN TRAI)	375	DCI	878	1973
NGUYEN TRAI - BANG LO	HEM 20	375	DCI	30	1973
HUNG VUONG	CAU NHI KIEU - CMT8 (BEN TRAI)	375	DCI	723	1973
NGUYEN THI MINH KHAI	PHAN DINH PHUNG - MAU THAN (O GIUA)	375	DCI	980	1973
NGUYEN TRAI	CAU CAI KHE - TRAN PHU (BEN TRAI)	375	DCI	475	1973
BANG LO 3 THANG 2	DAU DUONG TRAN VAN HOAI	400	DCI	40	2003
BANG LO NVC NOI DAI	CAU RACH NGONG 2	400	DCI	40	2004
CACH MANG THANG 8	TRAN PHU - NGUYEN VAN CU (BEN PHAI)	400	DCI	1031	1998
NGUYEN VAN CU	MAU THAN - CMT8 (BEN PHAI)	400	DCI	1315	1998
MAU THAN	CAU RACH NGONG - NGUYEN VAN CU (BEN PHAI)	400	DCI	660	2009
30 T 4	-	400	DCI	1750	2011
TRAN NGOC QUE	DUONG 30 THANG 4 - DUONG 3 THANG 2 (BEN PHAI)	400	DCI	470	2004
NGUYEN VAN CU NOI DAI	BANG LO MAU THAN	400	DCI	60	2009
BANG LO QUANG TRUNG CAI CUI	CONG SO 2 - KHU DIEU HIEN	400	DCI	80	2005
-	-	400	DCI	85	2008
CAU RACH NGONG II	-	400	DCI	250	2004
NGUYEN TRAI	H20 NGUYEN TRAI - TRAN PHU	400	DCI	260	1998
	KDC NGAN THUAN	400	DCI	300	2009
3 THANG 2	MAU THAN - TRAN VAN HOAI	600	DCI	820	1973
HOA BINH - 30 THANG 4	NMNCT1 - NGUYEN TRAI (O GIUA)	600	DCI	2129	1973
TRAN VAN HOAI	NMNCT1 - 3 THANG 2	600	DCI	540	1973
CACH MANG THANG TAM	NGUYEN VAN CU - CAU BINH THUY (BEN TRAI)	600	DCI	3100	1998
DUONG ONG NUOC THO	NMN CT2	600	DCI	650	1998
NGUYEN TRAI	HOA BINH - CAU CAI KHE (O GIUA)	600	DCI	762	1973
CAU CAI KHE		600	DCI	100	1973
LE HONG PHONG (QL91)	CAU BINH THUY - CAU TRA NOC (BEN PHAI)	600	DCI	4900	1998
MAU THAN	TRAN HUNG DAO - CAU RACH NGONG (BEN TRAI CACH BO VIA 3M)	600	DCI	885	2004
HEM VAO NMN CT2	CMT8	700	DCI	500	1998

Source: WSSC

Note: Information of distribution pipe line in under 250 mm is not shown in the table due to enormous number of data.

Appendix C

APPENDIX C1 INTAKE PUMP COMPARISON

C1.1 Objective

This paper aims to select a suitable flow control system of the raw water pumps. Water source of this WTP is tidal river, and the water level always changes. The maximum range of the water level variation is about 3.5m, and is about 23% of the total head of the pumps. Under such condition, the pumping system must have a flow control system to adjust the rate to meet the required rate by the water treatment operation.

Traditionally, a system with a butterfly valve has been used. This system can be provided with less investment at the beginning; however, it causes large energy losses. A new flow control system with a variable speed pumps became widely be used to save electricity for pumping; however, this system requires larger initial investment in comparison with the conventional method.

This paper calculates the electricity consumptions for both based on the tidal conditions of the river and other hydraulic conditions. An economical comparison is also carried out to evaluate both cases.

C1.2 Conditions of the Comparison

C1.2.1 Alternatives

This study selects two types of the flow control system as follows:

i) Variable speed type: by VVVF(Variable Voltage, Variable Frequency)

ii) Fix speed type: by a combination of butterfly valve adjustment and operating number of the pumps.

C1.2.2 Water levels and other conditions

Conditions for the calculation are summarized as follows:

i) Receiving well Water Level (RWL) =10.0m (Only for study purpose)

ii) Highest High Water Level (HHWL) =+2.05m (Data source Hhung Phu WTP's drawing)

iii) Lowest Low Water level (LLWL) = -1.5m. (Data source Hhung Phu WTP's drawing).

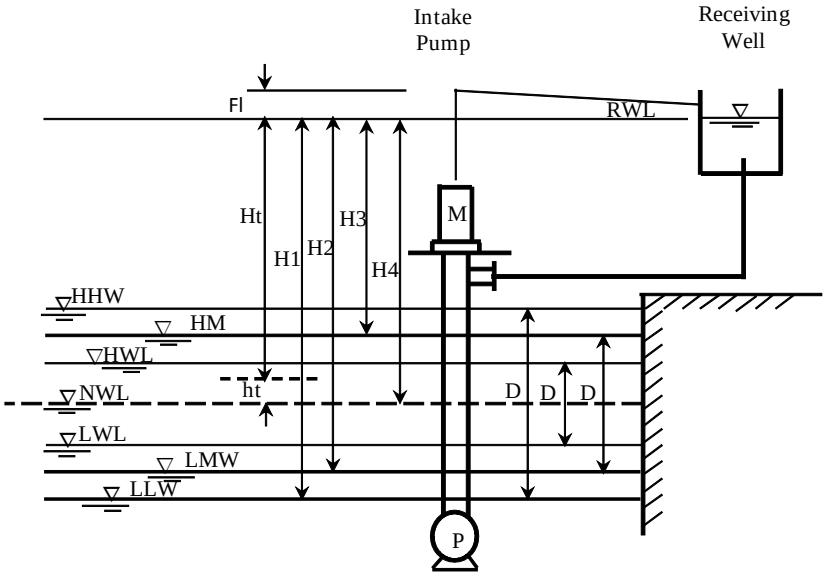
iv) The maximum water variation in the river=3.55m

v) Water variation for the calculation =2.85m (80% of 3.55m) (assumed by the JICA team).

vi) Cycle of tide=2 times/day.

vii) Water level of the river is assumed to change with a sine curve:

viii) Raw water pipe: 600mm (Only for study purpose)



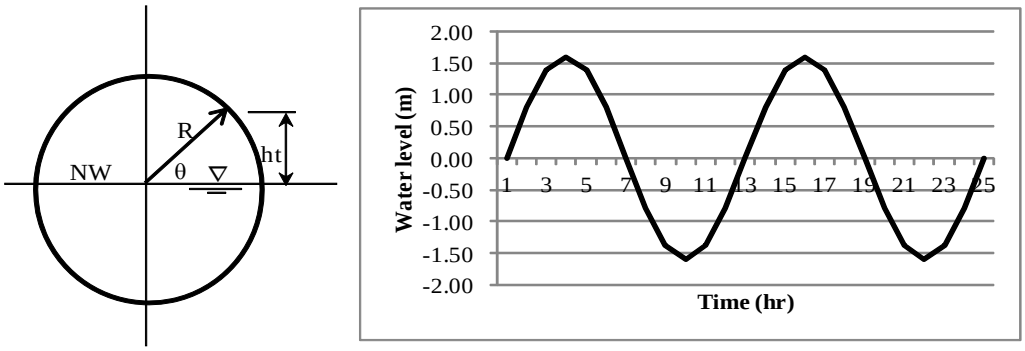
Source: JICA Study Team

Figure C1.1 Schematic Profile of Pumping System

Table C1.1 Water Levels for the Calculations

Symbols	Equation	Ratio	Water level (m)	Water Depth (m)	Actual Pump Head (m)
α	Low tide/High tide	0.8			
RWL			10.00		
LLWL			-1.50		
HHWL			2.05		
NWL	=(HHWL+LLWL)/2		0.28		
D1	=HHWL-LLWL			3.55	
LWL	=LLWL+D1*(1-α)/2		-1.15		
HWL	=HHWL-D1*(1-α)/2		1.70		
D2	=D1*α			2.84	
LMWL	=(LLWL+LWL)/2		-1.32		
HMWL	=(HHWL+HWL)/2		1.87		
D3	=MHMWL-LMWL			3.20	
H1	=RWL-LLWL				11.50
H2	=RWL-LMWL				11.32
H3	=RWL-HMWL				8.13
H4	=RWL-NWL				9.73
R	=D3/2			1.60	
θ	=30 deg =1hr				
ht	=R sin θ				
Ht	=H4-ht				

Source: JICA Study Team



Source: JICA Study Team

Figure C1.2 River Water Level Variation

C1.3 Hydraulic Calculations

Hydraulic calculations such as friction loss of the pipe and pump head are carried out in the following table:

Table C1.2 Head Loss and Pump Head Calculations

Water production		Qd=	45,000	m3/day				
Rate of water loss			5	%				
Design flow		Qd=			=	47,250	m3/day	
					=	0.547	m3/sec	
Number of pumps		Pn=	2	Nos				
Pump capacity/set		Qp=	Qd/Pn		=	0.273	m3/sec	
					=	16.5	m3/min	
Pump head		Ph=	H1+Fl		=	14.98	m	
					=	15.0	m (rounded)	
	Pipe dia.	D=	0.6	m				
	Pipe length	L=	100	m				
	Manning's	n=	0.012					
		λ=	12. 7g･n^2/$D^{1/3}$		=	0.021		
		V=	Qd/(π/4*D^2)		=	1.935	m/sec	
	90°bends	b90=	2	Nos	fb 90=	0.6		
	45°bends	b45=	2	Nos	fb 45=	0.4		
		In=	1	Nos	f in=	0.2		
		Out=	1	Nos	f out=	1.0		
	Pipe loss	Pl=	(λ*L/D+fb90*b90+fb40*b45+In*fin+Out*fout)V^2/2g					
					=	1.29	m	
	Pomp loss	Pal=			=	2.0	m	
	Velocity h.	Vh=	V^2/2g		=	0.19	m	
		Fl=	Pl+Pal+Vh		=	3.48	m	
	Total Head	T. Head=	Ht+Fl					
	Actual Head	Ht=	RWL-NWL-ht					
	Pump efficiency				η1=	0.8		
	Motor efficiently				η2=	0.9		
	E. Power	WP=	ρ*g*Qd*(T.Head +Fl)/η1/η2					
		ρ=	1.0	t/m3				

Source: JICA Study Team

C1.4 Calculation of Electricity to be consumed

The calculation of electricity consumptions of each type is based on the total pump heads. The equation is shown in Table C1.2 as WP= ρ *g*Qd*(T.Head +Fl)/η1/η2. Table 5.3 calculates electricity of variable speed type on hourly, daily and yearly basis.

Table C1.3 Calculation of Electricity for Variable Speed Type

Time	θ(deg)	ht=R sinθ	Ht=H4-h	T. Head	Wp (kw)
0	0	0	9.73	13.20	98.4
1	30	0.799	8.93	12.40	92.4
2	60	1.383	8.34	11.82	88.1
3	90	1.598	8.13	11.61	86.5
4	120	1.383	8.34	11.82	88.1
5	150	0.799	8.93	12.40	92.4
6	180	0.000	9.73	13.20	98.4
7	210	-0.799	10.52	14.00	104.3
8	240	-1.383	11.11	14.59	108.7
9	270	-1.598	11.32	14.80	110.3
10	300	-1.383	11.11	14.59	108.7
11	330	-0.799	10.52	14.00	104.3
12	360	0.000	9.73	13.20	98.4
13	390	0.799	8.93	12.40	92.4
14	420	1.383	8.34	11.82	88.1
15	450	1.598	8.13	11.61	86.5
16	480	1.383	8.34	11.82	88.1
17	510	0.799	8.93	12.40	92.4
18	540	0.000	9.73	13.20	98.4
19	570	-0.799	10.52	14.00	104.3
20	600	-1.383	11.11	14.59	108.7
21	630	-1.598	11.32	14.80	110.3
22	660	-1.383	11.11	14.59	108.7
23	690	-0.799	10.52	14.00	104.3
24	720	0.000	9.73	13.20	98.4
				Total	2,459.5

897,718 kW/year
2,600 VND/kW
2,334.1 Mil VND/year

Source: JICA Study Team

Electricity consumption of the fix speed type is also calculated by the same equation above; however, only one total head which is the maximum estimated from the LLWL is used. The detail is shown in the next page.

Total Heac	Ht=	H1+Fl	=	15	m
Nu. of pur	Pn=	2 + 1 standby			
Flow rate	Qd=		=	17	m^3/min
Power	P=	ρ*g*Qd*Pn*(T.Head +Fl)/60sec/η1/η2			
			=	112	kWh
			=	2,698	kW/day
			=	984,679	kW/year
				2,600	VND/kW
				2,560.2	Mil VND/year

C1.5 Cost Comparison

C1.5.1 Initial Cost

This comparison only takes items which have different prices or operation costs among two alternatives. Items to be considered as the initial costs are only electric panels. Other items such as pumps and motors are disregarded as common items among them. Table 5.4 shows the costs of the electric panels.

Table C1.4 Cost of Electric Panels

Alternatives	Price ($)	Exchange rate	Price (VND x 10^6)
(1) Variable speed type	105,000	21,258	2232.1
(2) Fixed speed type	40,000	21,258	850.3

Source: JICA Study Team

Exchange rates used for costs comparison are: 1US$=79.92Yen, =21258 VND, 1Yen=266VND.

C1.5.2 Operation Costs

Operation costs of both alternatives are estimated on annual electricity consumptions and unit price of the electricity. Unit price of electricity is set at 2600VND/kW. The annual operational cost of the variable speed type is 2,334.1 millions VND, and the fixed speed type is 2,560.2 millions VND. The annual cost difference is 226.1millions VND, and he variable speed type is about 10% cheaper than that of the fixed speed type.

C1.5.3 Cost Evaluation and Conclusion

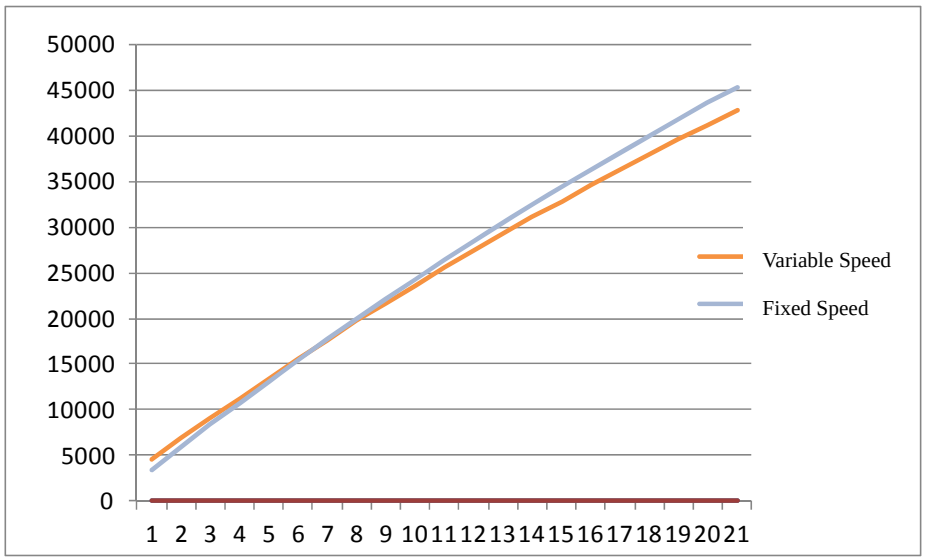
The initial costs and operational costs are evaluated with net present value method. The calculation detail is shown in Table 5.5. The discount factor shown in the table is calculated by df=1/(1+r)^n. Where “r” is a discount rate and “n” is year. This evaluation r=2% and n=20years were employed in consideration of the real interest of the Vietnam

Table C1.5 Cost of Electric Panels

Year	Dscount Factor	Variable speed type				Fixed speet type			
		Cost		Total	Discounted C.	Cost		Total	Discounted C.
(n)	1)	2) Initial	3) Running	4)=2)+3)	5)=1)*4)	7) Initial	8) Running	9)=7)+8)	10)=1)*9)
0	1.0000	2,232.1	2,334.1	4,566.2	4566.2	850.3	2560.2	3410.5	3410.5
1	0.9804		2,334.1	2,334.1	2288.4		2560.2	2560.2	2510.0
2	0.9612		2,334.1	2,334.1	2243.5		2560.2	2560.2	2460.9
3	0.9423		2,334.1	2,334.1	2199.4		2560.2	2560.2	2412.5
4	0.9238		2,334.1	2,334.1	2156.2		2560.2	2560.2	2365.1
5	0.9057		2,334.1	2,334.1	2114.0		2560.2	2560.2	2318.8
6	0.8880		2,334.1	2,334.1	2072.7		2560.2	2560.2	2273.5
7	0.8706		2,334.1	2,334.1	2032.1		2560.2	2560.2	2228.9
8	0.8535		2,334.1	2,334.1	1992.2		2560.2	2560.2	2185.1
9	0.8368		2,334.1	2,334.1	1953.2		2560.2	2560.2	2142.4
10	0.8203		2,334.1	2,334.1	1914.7		2560.2	2560.2	2100.1
11	0.8043		2,334.1	2,334.1	1877.3		2560.2	2560.2	2059.2
12	0.7885		2,334.1	2,334.1	1840.4		2560.2	2560.2	2018.7
13	0.7730		2,334.1	2,334.1	1804.3		2560.2	2560.2	1979.0
14	0.7579		2,334.1	2,334.1	1769.0		2560.2	2560.2	1940.4
15	0.7430		2,334.1	2,334.1	1734.2		2560.2	2560.2	1902.2
16	0.7284		2,334.1	2,334.1	1700.2		2560.2	2560.2	1864.8
17	0.7142		2,334.1	2,334.1	1667.0		2560.2	2560.2	1828.5
18	0.7002		2,334.1	2,334.1	1634.3		2560.2	2560.2	1792.7
19	0.6864		2,334.1	2,334.1	1602.1		2560.2	2560.2	1757.3
20	0.6730		2,334.1	2,334.1	1570.8		2560.2	2560.2	1723.0
					42,732.2				45,273.6

Source: JICA Study Team

Figure 5.3 plots the accumulated discounted costs of both alternatives; two lines closed 6 years after commissioning. It means that the variable speed type recovers the cost difference with the fix speed pump with 6 years operation.



Source: JICA Study Team

Figure C1.3 Cumulative Discounted Cost

APPENDIX C2 CLEAR WATER RESERVOIR RETENTION TIME

C2.1 Objective

This paper aims to determine a suitable retention time for the clear water reservoir of the proposed WTP. The plant site has a very limited space and the space for the reservoir is also very limited. This situation does not allow the determination /and design of the reservoir based on conservative criteria. Study team collected data of water distribution among the water treatment plants of WSSC. The Thot Not WTP kept reliable data which were logged automatically at 30 minute-intervals and stored in a computers disk. No other plants have reliable data that can be applied to this study.

C2.2 Data Analysis

C2.2.1 Source Data

A set of data was selected at random among the data. It is shown in Table C2.1.

Table C2.1 Water Distribution Date from Thot Not Plant

Time / Date	Flow Rate Recorded (m^3/h)	Distributed Volume (m^3)	Time / Date	Flow Rate Recorded (m^3/h)	Distributed Volume (m^3)
12:30:01 AM 19/06/2012	143	71.5	12:30:00 PM 19/06/2012	363	181.5
01:00:01 AM 19/06/2012	168	84.0	01:00:01 PM 19/06/2012	305	152.5
01:30:01 AM 19/06/2012	149	74.5	01:30:01 PM 19/06/2012	303	151.5
02:00:01 AM 19/06/2012	147	73.5	02:00:01 PM 19/06/2012	297	148.5
02:30:01 AM 19/06/2012	151	75.5	02:30:01 PM 19/06/2012	291	145.5
03:00:01 AM 19/06/2012	139	69.5	03:00:01 PM 19/06/2012	297	148.5
03:30:01 AM 19/06/2012	141	70.5	03:30:01 PM 19/06/2012	340	170.0
04:00:01 AM 19/06/2012	144	72.0	04:00:01 PM 19/06/2012	366	183.0
04:30:00 AM 19/06/2012	158	79.0	04:30:00 PM 19/06/2012	383	191.5
05:00:00 AM 19/06/2012	278	139.0	05:00:00 PM 19/06/2012	449	224.5
05:30:00 AM 19/06/2012	316	158.0	05:30:00 PM 19/06/2012	470	235.0
06:00:00 AM 19/06/2012	402	201.0	06:00:00 PM 19/06/2012	422	211.0
06:30:00 AM 19/06/2012	435	217.5	06:30:00 PM 19/06/2012	449	224.5
07:00:00 AM 19/06/2012	423	211.5	07:00:00 PM 19/06/2012	434	217.0
07:30:01 AM 19/06/2012	422	211.0	07:30:00 PM 19/06/2012	335	167.5
08:00:01 AM 19/06/2012	361	180.5	08:00:01 PM 19/06/2012	307	153.5
08:30:01 AM 19/06/2012	352	176.0	08:30:01 PM 19/06/2012	297	148.5
09:00:01 AM 19/06/2012	363	181.5	09:00:01 PM 19/06/2012	288	144.0
09:30:01 AM 19/06/2012	380	190.0	09:30:01 PM 19/06/2012	269	134.5
10:00:01 AM 19/06/2012	427	213.5	10:00:01 PM 19/06/2012	246	123.0
10:30:01 AM 19/06/2012	409	204.5	10:30:00 PM 19/06/2012	235	117.5
11:00:00 AM 19/06/2012	441	220.5	11:00:00 PM 19/06/2012	151	75.5
11:30:00 AM 19/06/2012	398	199.0	11:30:00 PM 19/06/2012	144	72.0
12:00:01 PM 19/06/2012	377	188.5	12:00:00 AM 20/06/2012	147	73.5

Source: JICA Study Team

C2.2.2 Retention Time Calculation

The procedure to calculate the retention tame of the reservoir is shown in Table C2.2. The calculation procedure of retention time is shown in the third row of the table.

Table C2.2 Retention Time Calculation

Time / Date	Flow Rate Recorded (m^3/h)	Distributed Volume (m^3/0.5h)	Average F. (m^3/min)		Stored Volune(m^3)	Discharged Volune(m^3)
	a	b=a*0.5	c	d=b-c	e	f
12:30:01 AM 19/06/2012	143	71.5	153.3	-81.8	-81.8	
01:00:01 AM 19/06/2012	168	84.0	153.3	-69.3	-69.3	
01:30:01 AM 19/06/2012	149	74.5	153.3	-78.8	-78.8	
02:00:01 AM 19/06/2012	147	73.5	153.3	-79.8	-79.8	
02:30:01 AM 19/06/2012	151	75.5	153.3	-77.8	-77.8	
03:00:01 AM 19/06/2012	139	69.5	153.3	-83.8	-83.8	
03:30:01 AM 19/06/2012	141	70.5	153.3	-82.8	-82.8	
04:00:01 AM 19/06/2012	144	72.0	153.3	-81.3	-81.3	
04:30:00 AM 19/06/2012	158	79.0	153.3	-74.3	-74.3	
05:00:00 AM 19/06/2012	278	139.0	153.3	-14.3	-14.3	
05:30:00 AM 19/06/2012	316	158.0	153.3	4.8		4.8
06:00:00 AM 19/06/2012	402	201.0	153.3	47.8		47.8
06:30:00 AM 19/06/2012	435	217.5	153.3	64.3		64.3
07:00:00 AM 19/06/2012	423	211.5	153.3	58.3		58.3
07:30:01 AM 19/06/2012	422	211.0	153.3	57.8		57.8
08:00:01 AM 19/06/2012	361	180.5	153.3	27.3		27.3
08:30:01 AM 19/06/2012	352	176.0	153.3	22.8		22.8
09:00:01 AM 19/06/2012	363	181.5	153.3	28.3		28.3
09:30:01 AM 19/06/2012	380	190.0	153.3	36.8		36.8
10:00:01 AM 19/06/2012	427	213.5	153.3	60.3		60.3
10:30:01 AM 19/06/2012	409	204.5	153.3	51.3		51.3
11:00:00 AM 19/06/2012	441	220.5	153.3	67.3		67.3
11:30:00 AM 19/06/2012	398	199.0	153.3	45.8		45.8
12:00:01 PM 19/06/2012	377	188.5	153.3	35.3		35.3
12:30:00 PM 19/06/2012	363	181.5	153.3	28.3		28.3
01:00:01 PM 19/06/2012	305	152.5	153.3	-0.8	-0.8	
01:30:01 PM 19/06/2012	303	151.5	153.3	-1.8	-1.8	
02:00:01 PM 19/06/2012	297	148.5	153.3	-4.8	-4.8	
02:30:01 PM 19/06/2012	291	145.5	153.3	-7.8	-7.8	
03:00:01 PM 19/06/2012	297	148.5	153.3	-4.8	-4.8	
03:30:01 PM 19/06/2012	340	170.0	153.3	16.8		16.8
04:00:01 PM 19/06/2012	366	183.0	153.3	29.8		29.8
04:30:00 PM 19/06/2012	383	191.5	153.3	38.3		38.3
05:00:00 PM 19/06/2012	449	224.5	153.3	71.3		71.3
05:30:00 PM 19/06/2012	470	235.0	153.3	81.8		81.8
06:00:00 PM 19/06/2012	422	211.0	153.3	57.8		57.8
06:30:00 PM 19/06/2012	449	224.5	153.3	71.3		71.3
07:00:00 PM 19/06/2012	434	217.0	153.3	63.8		63.8
07:30:00 PM 19/06/2012	335	167.5	153.3	14.3		14.3
08:00:01 PM 19/06/2012	307	153.5	153.3	0.3		0.3
08:30:01 PM 19/06/2012	297	148.5	153.3	-4.8	-4.8	
09:00:01 PM 19/06/2012	288	144.0	153.3	-9.3	-9.3	
09:30:01 PM 19/06/2012	269	134.5	153.3	-18.8	-18.8	
10:00:01 PM 19/06/2012	246	123.0	153.3	-30.3	-30.3	
10:30:00 PM 19/06/2012	235	117.5	153.3	-35.8	-35.8	
11:00:00 PM 19/06/2012	151	75.5	153.3	-77.8	-77.8	
11:30:00 PM 19/06/2012	144	72.0	153.3	-81.3	-81.3	
12:00:00 AM 20/06/2012	147	73.5	153.3	-79.8	-79.8	
	Total	7356		Total	-1081	1081
	Average	153.3		Retention	-3.5hr	3.5hr

Source: JICA Study Team

The total distribution volume is 7356m^3/day. An average flow for 30miniutes is calculated to 153.3m^3/30minites (7,356 m^3/day /48 time zones). The column "e" is the volume stored in the reservoir at related time zones, and the total is 1,081m^3/day. Therefore, the retention time is calculated to 3.5hrs (1,081m^3 /153.3m^3x 2)

C2.3 Conclusion

This analysis obtained 3.5hr retention time for the reservoir as the minimum. However, if the site condition allows, the reservoir should have larger volume than the calculated as much as possible.

APPENDIX C3 DISTRIBUTION PUMP COMPARISON

C3.1 Objective

The comparison aims to select a suitable pumping system of distribution pumps for the proposed water supply area. Water distribution amount from the WTP varies time to time in a day. According to the water distribution data of the Thot Not, the peak flows occur at am 6:30 and 11:00 and pm 5:30. The maximum rate occurs at pm 5:30 and the flow is about 1.5 times of the average flow rate. Minimum flows occur from pm11:00 to am 4:30 and the flow rate is about 30% cent of the average. Under such condition, the pumping flow must controlled by some ways to meet the water demand to be distributed

There are two methods to control the flows The conventional method uses several number of fixed speed pumps and a butterfly valve. Currently variable speed pumps become to be used. The conventional system can be provided with smaller initial investment, and the disadvantage is lower energy efficiency. The variable speed pumps; on the other hand is high energy efficiency although the initial cost is slightly higher than the conventional one. .

This paper, therefore, confirms economy of the both systems and selects the best pumping and flow control system

C3.2 Conditions of the Comparison

Conditions for this study are summarized as follow:

i) Peak factor ageist the average flow is 1.5,

ii) Minimum flow against the average is 0.3,

iii) Minimum residual pressure in the pipe net work is 0.1MPa,

iv) Distribution pipe between the WTP and connection pipe is 700mm in diameter,

v) Pump head of the variable speed pumps is 22m. This head is calculated based on the daily average flow, and the electricity consumption is calculated by this head.

vi) Pump head of the fixed speed system is 38m. This head is calculated based on the hourly peak flow rate, and the electricity consumption of fixed speed pumps is calculated by this head

vii) Water head loss in the distribution pipe is calculated by William Hazen's equation, and C value of 120 is taken for the calculations.

C3.3 Calculation of Electricity Consumption

Electricity consumption of each type is calculated by the following equation:

$W_P = (\rho \times g \times Q \times H) / \eta 1 / \eta 2$.

Where: W_P: Total Pump Power (kWh),

ρ: Density of Water (kg/m3), (1000)

g: Gravity Acceleration (m/s2), (9.8)

Q: Flow Rate (m3/s),

H: Pump Head (m),

η1: Pump Efficiency, (0.9)

η2: Motor Efficiency (0.8)

Electricity consumptions are as follow:

Case 1: VVVF speed pump

Daily Average Head	Ht=		=	22 m
No. of pump	Pn=	2 + 1 standby		
Flow rate	Qd=		=	18 m^3/min
Power	P=	ρ*g*Qd*H/60sec/η1/η2		
			=	130 kWh
				3,120 kW/day

Case 2: Fix speed pump

Hourly Maximum Head	Ht=		=	38	m	
No. of pump	Pn=	2 + 1 standby				
Flow rate	Qd=		=	16	m^3/min	
Power	P=	ρ*g*Qd*H/60sec/η1/η2				
	2 Pumps 18 hours operation		=	270	kWh	
			=	4,860	kW/18 hr	(a)
	1 Pump 6 hours operation		=	135	kWh	
				810	kW/6hr	(b)
				5,670	kW/day	(a)+(b)

C3.4 Cost Comparison

C3.4.1 Initial Cost

This comparison only takes items which have different prices or operation costs among two alternatives. Items to be considered as the initial costs are only electric panels. Other items are disregarded as common items among them. Table C3.4 shows the costs of the electric panels.

Table C3.4 Cost of Electric Panels

Alternatives	Price ($)	Exchange rate	Price (VND x 10^6)
(1) Variable speed type	200,000	21,258	4251.6
(2) Fix speed type	60,000	21,258	1275.5

Source: JICA Study Team

Exchange rates used for costs comparison are: 1US$=79.92Yen, =21258 VND, 1Yen=266VND.

C3.4.2 Operation Costs

Operation costs of both systems are estimated on the basis of annual electricity consumptions and unit price of the electricity which is set at 2600VND/kW. The annual operational costs of the variable speed type and the fixed speed pump are estimated to 2,968 million 5,380 million VND respectively.

of the Vietnam.

Table C3.5 Cost of Electric Panels

Year	Dscount Factor	Variable speed type				Fix speet type			
		Cost		Total	Discounted C	Cost		Total	Discounted C.
(n)	1)	2) Initial	3) Running	4)=2)+3)	5)=1)*4)	7) Initial	8) Running	9)=7)+8)	10)=1)*9)
0	1.0000	4,251.6	2,968.3	7,219.9	7219.9	1275.5	5,380.8	6,656.3	6656.3
1	0.9709		2,968.3	2,968.3	2881.9		5,380.8	5380.8	5224.2
2	0.9426		2,968.3	2,968.3	2797.9		5,380.8	5380.8	5071.9
3	0.9151		2,968.3	2,968.3	2716.3		5,380.8	5380.8	4924.0
4	0.8885		2,968.3	2,968.3	2637.3		5,380.8	5380.8	4780.8
5	0.8626		2,968.3	2,968.3	2560.5		5,380.8	5380.8	4641.5
6	0.8375		2,968.3	2,968.3	2486.0		5,380.8	5380.8	4506.4
7	0.8131		2,968.3	2,968.3	2413.5		5,380.8	5380.8	4375.1
8	0.7894		2,968.3	2,968.3	2343.2		5,380.8	5380.8	4247.6
9	0.7664		2,968.3	2,968.3	2274.9		5,380.8	5380.8	4123.8
10	0.7441		2,968.3	2,968.3	2208.7		5,380.8	5380.8	4003.9
11	0.7224		2,968.3	2,968.3	2144.3		5,380.8	5380.8	3887.1
12	0.7014		2,968.3	2,968.3	2082.0		5,380.8	5380.8	3774.1
13	0.6810		2,968.3	2,968.3	2021.4		5,380.8	5380.8	3664.3
14	0.6611		2,968.3	2,968.3	1962.3		5,380.8	5380.8	3557.2
15	0.6419		2,968.3	2,968.3	1905.4		5,380.8	5380.8	3453.9
16	0.6232		2,968.3	2,968.3	1849.8		5,380.8	5380.8	3353.3
17	0.6050		2,968.3	2,968.3	1795.8		5,380.8	5380.8	3255.4
18	0.5874		2,968.3	2,968.3	1743.6		5,380.8	5380.8	3160.7
19	0.5703		2,968.3	2,968.3	1692.8		5,380.8	5380.8	3068.7
20	0.5537		2,968.3	2,968.3	1643.5		5,380.8	5380.8	2979.3
					51,381.1				86,709.5

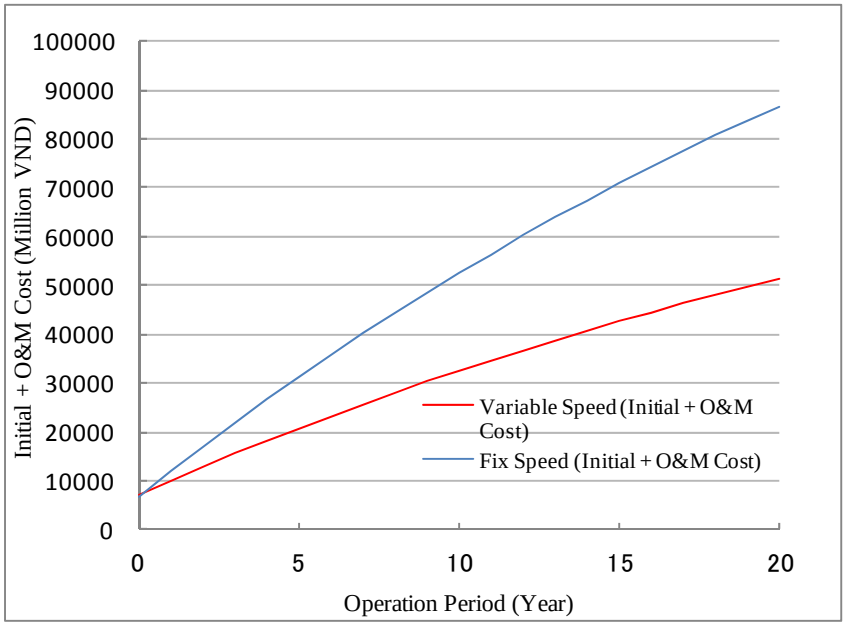
Source: JICA Study Team

C3.4.3 Cost Evaluation and Conclusion

The initial costs and operational costs are evaluated with net present value method. The calculation detail is shown in Table C3.5. The discount factor shown in the table is calculated by df=1/(1+r)^n. Where “r” is a discount rate and “n” is year. This evaluation

r=2% and n=20years were employed in consideration of the real interest

Figure C3.6 plots the accumulated discounted costs of both systems; two lines closed 1 year after commissioning. It means that the variable speed pumps recover the cost difference of the system with the fix speed pump with 1 years operation.



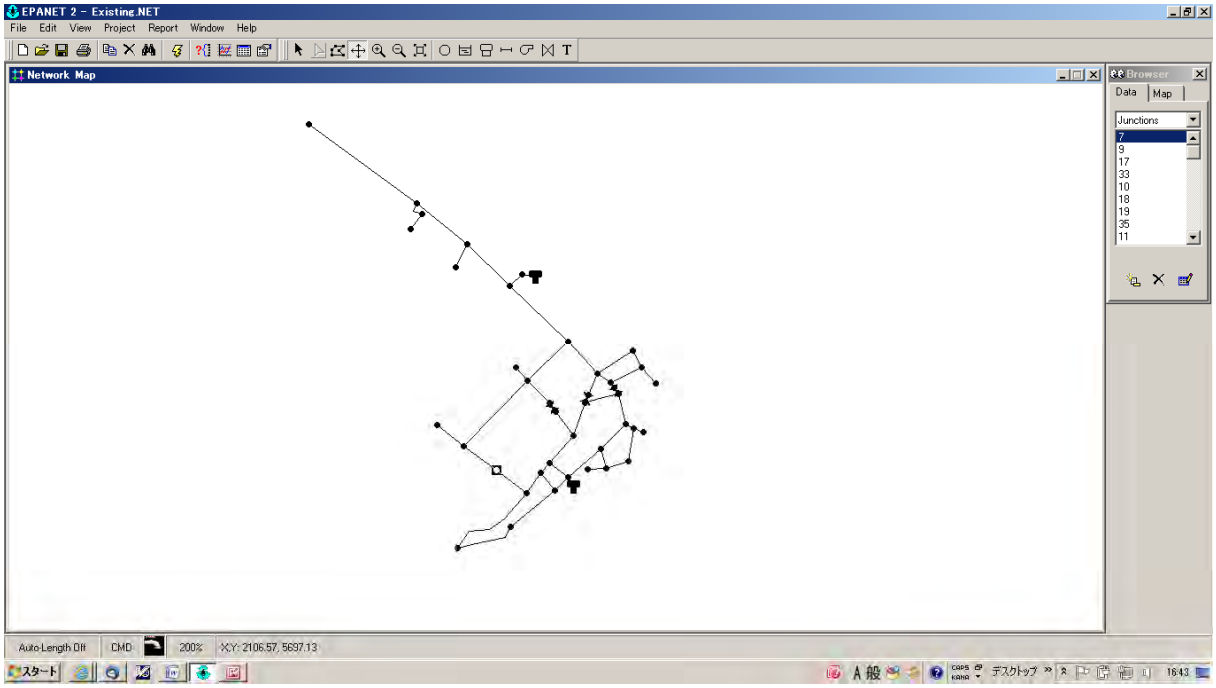
Source: JICA Study Team

Figure C3.6 Cumulative Discounted Cost

APPENDIX C4 MODELING FOR FLOW ANALYSIS OF THE DISTRIBUTION PIPE NETWORK

(1) Modeling of Current Distribution System

The pipeline network model was developed based on the GIS data from WSSC such as pipe length and diameter. To simplify the hydraulic calculation, only pipeline in diameter of over 250 mm is considered for the calculation. The network model is shown in Figure C4.1.



Source: JICA Study Team

Figure C4.1 Hydraulic Model of Current Distribution Network

(2) Outflow at each Node of Current Distribution Network

Outflow at each Node has been set by the following procedure:

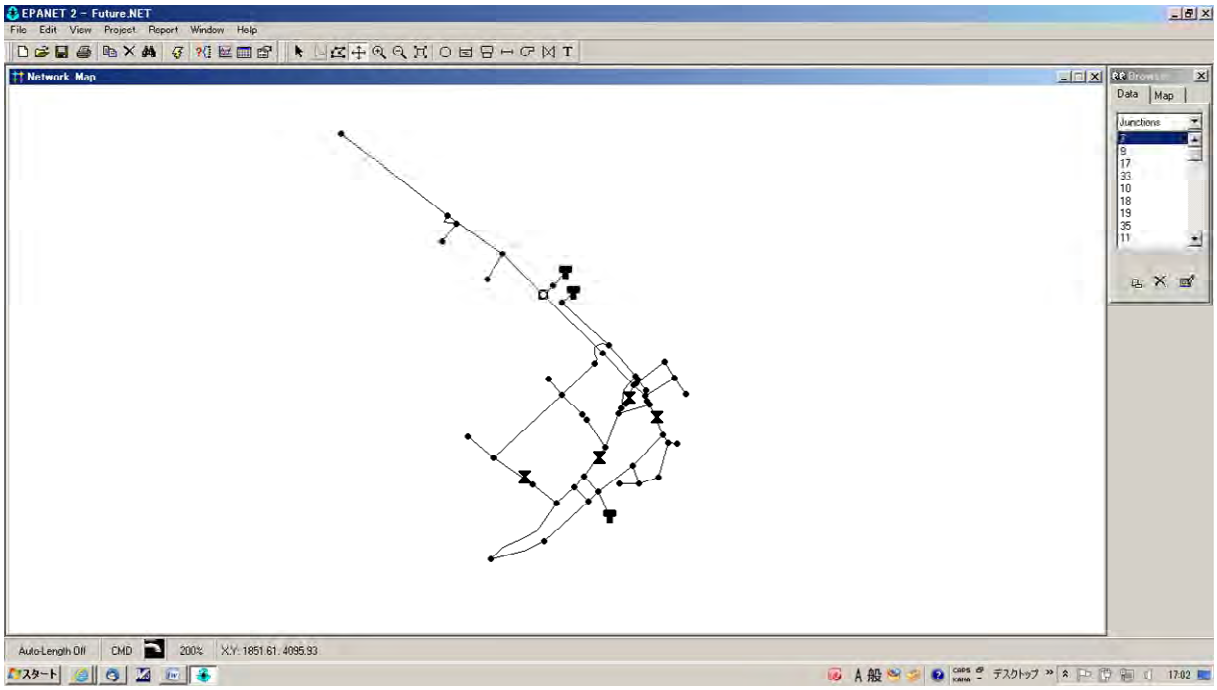
1) Entire supply area has been divided into small supply area each having one Node.
2) The population of each small supply area has been calculated by multiplying the population density by the size of small supply area.
3) Outflow at each Node
   = Entire water supply amount x (Population of each small supply area/Entire population of the supply area)

The hourly maximum flow (Peak factor: 1.5) has been taken as the outflow at each Node.

(3) Modeling of Proposed Distribution System

It is proposed that each water supply area of Can Tho No.1 WTP, Can Tho No.2 WTP and the new WTP is clearly divided by the sluice valve to be installed in the distribution pipeline network, in order to maintain stable operation of each WTP. The treated water of the new

WTP is to be transmitted to the connection points on the existing distribution pipeline. Figure C4.2 shows the model of the proposed network.



Source: JICA Study Team

Figure C4.2 Hydraulic Model of Proposed Distribution Network

(4) Outflow at each Node of Proposed Distribution Network

Outflow at each Node has been set by the following procedure:

1) Entire supply area has been divided into small supply area each having one Node.
2) The population of each small supply area has been calculated by multiplying the projected population density by the size of small supply area.
3) Outflow at each Node
   = Projected entire water demand x (Population of each small supply area/Entire population of the supply area)

The hourly maximum flow (Peak factor: 1.5) has been taken as the outflow at each Node.

Appendix D

Appendix D1 COST ESTIMATE AND CONSTRUCTION SCHEDULE

Table D1.1 Basic Unit Prices

Labor Cost

Labor	VND/day
Foreman	255,000
Common Labor	154,000
Re-bar worker	181,000
Form worker	168,000
Scaffold worker	181,000
Welder	194,000
Heavy machine operator	165,000
Mason	194,000
Electrician	226,000
Plumber	168,000

Machine Rent Cost

Machine	VND/day
Swamp Bulldozer 21ton	10,472,000
Swamp Bulldozer 16ton	8,698,000
Back Hoe 0.6m^3	7,006,000
Back Hoe 0.35m^3	4,392,000
Dump Truck 10ton	4,785,000
Dump Truck 4ton	2,173,000
4ton truck w/2.9t crane	2,580,000
Crawler crane 50ton	10,385,000
Trailer Truck 25ton	7,956,000
Truck crane 50ton	13,023,000
Truck crane 25ton	6,703,000
Truck crane 5ton	2,934,000
Crawler Hydraulic hammer 6.5-8ton	33,537,000
Pile braker D300-600	1,077,000
Hydraulic piler 221kW	33,657,000
Vibrating roller 0.5ton hand guided	543,000
Vibrating plate 40-60kg	396,000
Rammer 60-80kg	420,000
Concrete pump car 55-60m^3/h	7,105,000
Concrete cutter brade=30cm	497,000
Generator 45kVA	1,947,000
Concrete mixer 1.0m^3, 11kW	1,535,000
Barge 600ton	7,698,000
Barge 150ton	2,897,000

Material Cost

Name	Unit	Unit price (VND)
Steel		
Re-bar	kg	19,000
Steel pipe	kg	29,000
Structural Steel	kg	19,000
Sheet pile	kg	19,000
Cement, aggregate		
Cement	kg	3,000
Fine aggregate	m^3	356,000
Coarse aggregate	m^3	205,000
Stone		
Stone	m^3	527,000
Road Work		
Asphalt mixture	ton	1,891,000
Bitumen	kg	21,000
Fuel		
Diesel fuel	lit.	24,000
Gasoline		24,000
Concrete Product		
RC pile Dia. 300	m	1,101,000
RC pile Dia. 350	m	1,269,000
RC pile Dia. 400	m	1,354,000
RC pile Dia. 500	m	1,639,000
Pipe Material		
DCI Dia 300 L=6m	no.	12,183,000
DCI Dia 400 L=6m	no.	19,498,000
DCI Dia 500 L=6m	no.	26,760,000
DCI Dia 600 L=6m	no.	39,208,000
DCI Dia 700 L=6m	no.	51,125,000
Gate valve D300	no.	12,688,000
Gate valve D400	no.	27,052,000
Gate valve D500	no.	45,885,000
Butterfly valve D600	no.	103,740,000
Butterfly valve D700	no.	133,266,000
Air valve D75	no.	3,559,000
Air valve D100	no.	4,429,000
Ultrasomic Flowmeter	no.	478,800,000
Manhole cover	no.	5,299,000

Source: Study Team

Table D1.2 Process Unit Cost

Item		Spec	Unit	Unit cost (VND)
1.	**Earth Work**			
	Stripping	Swamp Bulldozer 21 ton	m^3	40,000
	Loading of Earth Material	0.6BH	m^3	28,000
	Excavation	Back Hoe 0.35m^3	m^3	64,000
	Soil Transportation 10tDT	10t DT, L=6.0km	m^3	19,000
	Soil Transportation 4tDT	4t DT, L=4km	m^3	170,000
	Spreading and compaction	Swamp Bulldozer 16t	m^3	66,000
	Manual excavation	Manual	m^3	115,000
	Backfill (Manual)	Compaction by rammer	m^3	94,000
	Pavement demolish and restoration	Base course 35cm, Asphalt 7cm	m^2	244,000
	Sheet pile driving (Permanent)	SP-III, B= 0.4m, L=12m	no.	15,569,000
	Sheet pile driving (Temporary)	SP-III, B= 0.4m, L=12m	no.	8,756,000
	H-beam driving	H-300 L=40m	no.	74,312,000
	Temporary steel walling and strut	H-300, H-250	ton	7,401,000
2.	**Structure Work**			
	Pile foundation Dia 300 L=40m(Structure)	Structure foundation	no	61,184,000
	Pile foundation Dia 350 L=40m(Structure)	Structure foundation	no	67,887,000
	Pile foundation Dia 400 L=40m (Structure)	Structure foundation	no	71,292,000
	Pile foundation Dia 400 L=48m (Pier)	Pier foundation	no	85,691,000
	Foundation gravel	t=10cm	m^2	77,000
	Production of Concrete (C-16)	Design Strength 16N/mm^2	m^3	1,296,000
	Production of Concrete (C-21)	Design Strength 21N/mm^2	m^3	1,396,000
	Mannual Placing and Curing	Small structure	m^3	239,000
	Placing by Concrete Pump and Curing	60m^3/h	m^3	149,000
	Form work	Fabric, Install, Remove	m^2	370,000
	Form work (small structure)	Fabric, Install, Remove	m^2	271,000
	Rebar	Fabric, Install	ton	23,117,000
	Scaffolding	Install, Remove	m^2	242,000
	Temporary Support of Form work	Install, Remove	m^3	140,000
3.	**Pipeline Work**			
	Installation of Dia 300 DCI pipe	Installation and connection	m	168,000
	Installation of Dia 400 DCI pipe	Installation and connection	m	249,000
	Installation of Dia 500 DCI pipe	Installation and connection	m	282,000
	Installation of Dia 600 DCI pipe	Installation and connection	m	307,000
	Installation of Dia 700 DCI pipe	Installation and connection	m	332,000

Source: Study Team

Table D1.3 Work Unit Cost

Item	Spec	Unit	Unit Cost (VND)
Earth Work			
Temporary Facility for Intake Pier	Barge rental	Ls	827,590,000
Embankment	Spreading and compaction	m^3	113,000
Gravel Layer	For sludge dry bed	m^3	311,000
Sand Layer	For sludge dry bed	m^3	493,000
Structure Work			
Foundation gravel and lean concrete	Gravel and lean concrete	m^2	170,000
Structure Concrete	Placing by concrete pump	m^3	1,629,000
Structure Concrete (small structure)	Manual placing	m^3	1,719,000
Pipeline Work			
D700 pipeline	Road area	m	10,693,000
D600 pipeline	Road area	m	8,341,000
D500 pipeline	Road area	m	5,949,000
D400 pipeline	Road area	m	4,455,000
D300 pipeline	Road area	m	2,906,000
Connection point No.1	D600 BV, D400 GV	no.	388,580,000
Connection point No.2	D500 GV, D400 GV	no.	278,464,000
Connection point No.3	D500 GV	no.	200,157,000
Connection point No.4	D400 GV	no.	151,120,000
Branch Point	D500 GV, D400 GV	no.	169,705,000
Drain facility	D400 GV, D400 GV	no.	174,380,000

Source: Study Team

Table D1.4 Breakdown of Direct Construction Cost (1/2)

Item		Description/Specification /Applied Process Cost	Unit	Q'ty	Unit Cost (VND)	Total (VND)
A	**Intake**	**Capacity: 47,500 m3/day**				
A1	**Intake Pier Foundation**					
(1)	Pile foundation Dia 400 L=48m (Pier)	Pier foundation	no.	35	85,691,000	2,999,202,000
(2)	Structure Concrete	Production and placing	m3	63	1,629,000	103,048,000
(3)	Form work	Fabric, Install, Remove	m2	305	370,000	113,139,000
(4)	Rebar	Fabric, Install	ton	6.3	23,117,000	146,236,000
(5)	Scaffolding	Install, Remove	m2	450	242,000	109,066,000
(6)	Temporary Support of Form work	Install, Remove	m3	720	140,000	100,708,000
(7)	Temporary Facility for Intake Pier	Barge rental	Ls	1		827,590,000
(8)	Miscellaneous work	handrail, etc.	Ls	1		17,166,000
					Sub-total of A1	**4,416,156,000**
A2	**Intake Pump house**	120m2 (6m x 20m)	Ls		**Sub-total of A2**	**1,502,155,000**
A3	**Intake pipeline**					
(1)	Supply and laying of pipes	DCI D700	m	80	9,738,000	779,054,000
(2)	Pipeline trench work	D700, Field area	m	70	359,000	25,162,000
					Sub-total of A3	**804,217,000**
					Sub-total of A	**6,722,528,000**
B	**WTP**	**Capacity: 45,000 m3/day**				
B1	**Receiving Well**					
(1)	Pile foundation Dia 400 L=40m (Structure)	Structure foundation	no.	10	71,292,000	712,922,000
(2)	Excavation	Back Hoe 0.35m3	m3	321	64,000	20,390,000
(3)	Soil Transportation 10tDT	10t DT, L=6.0km	m3	86	19,000	1,620,000
(4)	Backfill (Manual)	Compaction by rammer	m3	235	94,000	22,007,000
(5)	Foundation gravel and lean concrete	Gravel and lean concrete	m2	52	170,000	8,730,000
(6)	Structure Concrete	Placing by concrete pump	m3	104	1,629,000	169,412,000
(7)	Form work	Fabric, Install, Remove	m2	457	370,000	169,264,000
(8)	Rebar	Fabric, Install	ton	10	23,117,000	240,413,000
(9)	Scaffolding	Install, Remove	m2	240	242,000	58,266,000
(10)	Temporary Support of Form work	Install, Remove	m3	185	140,000	25,876,000
(11)	Miscellaneous work	handrail, etc.	Ls	1		19,897,000
					Sub-total of B1	**1,448,796,000**
B2	**Sedimentation Facility**					
(1)	Pile foundation Dia 400 L=40m (Structure)	Structure foundation	no.	144	71,292,000	10,266,075,000
(2)	Excavation	Back Hoe 0.35m3	m3	1,612	64,000	102,396,000
(3)	Soil Transportation 10tDT	10t DT, L=6.0km	m3	879	19,000	16,493,000
(4)	Backfill (Manual)	Compaction by rammer	m3	733	94,000	68,739,000
(5)	Foundation gravel and lean concrete	Gravel and lean concrete	m2	569	170,000	96,518,000
(6)	Structure Concrete	Placing by concrete pump	m3	3,141	1,629,000	5,117,050,000
(7)	Form work	Fabric, Install, Remove	m2	6,981	370,000	2,586,049,000
(8)	Rebar	Fabric, Install	ton	314	23,117,000	7,261,642,000
(9)	Scaffolding	Install, Remove	m2	1,468	242,000	355,750,000
(10)	Temporary Support of Form work	Install, Remove	m3	1,206	140,000	168,659,000
(11)	Miscellaneous work	handrail, etc.	Ls	1		464,675,000
					Sub-total of B2	**26,504,046,000**
B3	**Sand Filter Facility**					
(1)	Pile foundation Dia 400 L=40m (Structure)	Structure foundation	no.	158	71,292,000	11,264,166,000
(2)	Excavation	Back Hoe 0.35m3	m3	1,563	64,000	99,258,000
(3)	Soil Transportation 10tDT	10t DT, L=6.0km	m3	1,237	19,000	23,210,000
(4)	Backfill (Manual)	Compaction by rammer	m3	326	94,000	30,549,000
(5)	Foundation gravel and lean concrete	Gravel and lean concrete	m2	829	170,000	140,523,000
(6)	Structure Concrete	Placing by concrete pump	m3	1,453	1,629,000	2,366,715,000
(7)	Form work	Fabric, Install, Remove	m2	6,457	370,000	2,392,112,000
(8)	Rebar	Fabric, Install	ton	145	23,117,000	3,358,622,000
(9)	Scaffolding	Install, Remove	m2	1,958	242,000	474,463,000
(10)	Temporary Support of Form work	Install, Remove	m3	2,629	140,000	367,726,000
(11)	Miscellaneous work	handrail, etc.	Ls	1		268,789,000
					Sub-total of B3	**20,786,132,000**
B4	**Distribution Facility**					
B4.1	**Clear Water Reservoir**					
(1)	Pile foundation Dia 350 L=40m(Structure)	Structure foundation	no.	323	67,887,000	21,927,627,000
(2)	Excavation	Back Hoe 0.35m3	m3	6,894	64,000	437,912,000
(3)	Soil Transportation 10tDT	10t DT, L=6.0km	m3	5,813	19,000	109,085,000
(4)	Backfill (Manual)	Compaction by rammer	m3	1,081	94,000	101,360,000
(5)	Foundation gravel and lean concrete	Gravel and lean concrete	m2	1,939	170,000	328,677,000
(6)	Structure Concrete	Placing by concrete pump	m3	2,051	1,629,000	3,340,670,000
(7)	Form work	Fabric, Install, Remove	m2	8,069	370,000	2,989,186,000
(8)	Rebar	Fabric, Install	ton	205	23,117,000	4,741,230,000
(9)	Scaffolding	Install, Remove	m2	1,890	242,000	457,982,000
(10)	Temporary Support of Form work	Install, Remove	m3	9,660	140,000	1,351,171,000
(11)	Sheet pile driving (Temporary)	SP-III, B= 0.4m, L=12m	no.	473	8,756,000	4,141,699,000
(12)	H-beam driving	H-300 L=40m	no.	16	74,312,000	1,188,987,000
(13)	Temporary steel walling and strut	H-300, H-250	ton	86	7,401,000	638,738,000
(14)	Miscellaneous work	handrail, etc.	Ls	1		386,407,000
					Sub-total of B4.1	**42,140,732,000**
B4.2	**Distribution Pump House**		Ls		**Sub-total of B4.2**	**1,502,155,000**

Source: Study Team

Table D1.4 Breakdown of Direct Construction Cost (2/2)

B5	**Sludge Treatment Facility**					
B5.1	**Backwash Wastewater Tank**					
(1)	Pile foundation Dia 400 L=40m (Structure)	Structure foundation	no.	33	71,292,000	2,352,642,000
(2)	Excavation	Back Hoe 0.35m3	m3	2,294	64,000	145,710,000
(3)	Soil Transportation 10tDT	10t DT, L=6.0km	m3	1,555	19,000	29,174,000
(4)	Backfill (Manual)	Compaction by rammer	m3	739	94,000	69,320,000
(5)	Foundation gravel and lean concrete	Gravel and lean concrete	m2	475	170,000	80,500,000
(6)	Structure Concrete	Placing by concrete pump	m3	334	1,629,000	543,747,000
(7)	Form work	Fabric, Install, Remove	m2	792	370,000	293,517,000
(8)	Rebar	Fabric, Install	ton	33	23,117,000	771,635,000
(9)	Scaffolding	Install, Remove	m2	880	242,000	213,334,000
(10)	Temporary Support of Form work	Install, Remove	m3	202	140,000	28,254,000
(11)	Sheet pile driving (Temporary)	SP-III, B= 0.4m, L=12m	no.	263	8,756,000	2,298,512,000
(12)	H-beam driving	H-300 L=40m	no.	3	74,312,000	222,935,000
(13)	Temporary steel walling and strut	H-300, H-250	ton	31	7,401,000	231,597,000
(14)	Miscellaneous work	handrail, etc.	Ls	1		55,515,000
					Sub-total of B5.1	**7,336,391,000**
B5.2	**Sludge Tank**	**Combined with B1 Receiving Well**				
					Sub-total of AB5.2	**0**
B5.3	**Sludge Discharge Pipeline**					
(1)	Supply and laying of pipes	DCI D300	m	100	2,419,000	241,900,000
(2)	Pipeline trench work	D300, Field area	m	100	106,000	10,602,000
					Sub-total of B5.3	**252,502,000**
B6	**Chemical Facility**					
(1)	Pile foundation Dia 300 L=40m(Structure)	Structure foundation	no.	10	61,184,000	611,842,000
(2)	Chemical Building	PAC and Chlorinator 270m2	Ls	1		3,755,380,000
					Sub-total of B6	**4,367,222,000**
B7	**Electrical Facility**					
(1)	Pile foundation Dia 300 L=40m(Structure)	Structure foundation	no.	10	61,184,000	611,842,000
(2)	Electrical Building	Electric facility, Monitor, Generator 270m2	Ls	1		3,849,262,000
					Sub-total of B7	**4,461,104,000**
B8	**Site Preparation and Ancillary Work**					
(1)	Stripping	Swamp Bulldozer 21 ton	m3	3,000	40,000	118,614,000
(2)	Retaining wall	Sheet pile-III, H=12m (Permanent)	no.	125	15,569,000	1,946,084,000
(3)	Landscapomg		Ls	1		10,928,275,000
					Sub-total of B8	**12,992,974,000**
B9	**Sludge Dry Bed**					
(1)	Stripping	Swamp Bulldozer 21 ton	m3	1,500	40,000	59,307,000
(2)	Embankment	Spreading and compaction	m3	5,240	113,000	590,332,000
(3)	Gravel Layer	For dry bed	m3	2,340	311,000	728,548,000
(4)	Sand Layer	For dry bed	m3	1,500	493,000	739,934,000
(5)	Foundation gravel and lean concrete	Gravel and lean concrete	m2	780	170,000	132,217,000
(6)	Structure Concrete	Placing by concrete pump	m3	345	1,629,000	561,991,000
(7)	Form work	Fabric, Install, Remove	m2	1,800	370,000	666,832,000
(8)	Rebar	Fabric, Install	ton	34.5	23,117,000	797,525,000
(8)	Miscellaneous work		Ls	1		60,790,000
					Sub-total of B9	**4,337,477,000**
					Sub-Total of B	**126,129,531,000**
C	**Water Transmission Pipeline**					
C1	**Pipeline**					
(1)	D700 pipeline	Road area	m	2,223	10,693,000	23,771,395,000
(2)	D600 pipeline	Road area	m	1,078	8,341,000	8,991,125,000
(3)	D500 pipeline	Road area	m	419	5,949,000	2,492,652,000
(4)	D400 pipeline	Road area	m	562	4,455,000	2,503,452,000
(5)	Temporally retaining equipment		Ls			2,502,528,000
(6)	Protection of obstacles		Ls			5,097,414,000
(7)	Underpass of existing pipe		no.	8	250,217,000	2,001,735,000
					Sub-total of C1	**45,358,566,000**
C2	**Valve Facility**					
(1)	Connection point No.1	D600 BV, D400 GV	Ls	1		388,580,000
(2)	Connection point No.2	D500 GV, D400 GV	Ls	1		278,464,000
(3)	Connection point No.3	D500 GV	Ls	1		200,157,000
(4)	Connection point No.4	D400 GV	Ls	1		151,120,000
(5)	Branch point	D500 GV, D400 GV	Ls	1		169,705,000
					Sub-total of C2	**1,188,026,000**
					Sub-Total of C	**46,546,592,000**
					Total of A+B+C	**179,398,651,000**

Source: Study Team

Table D1.5 Breakdown of Equipment Cost

(Yen)

Item			Description	Unit	Q'ty	Unit Price	Amount
Equipment Cost							
I.	**Costs for equipment procurement**						**627,378,000**
	1.	Intake Facility					**14,001,000**
		Intake Pump		set	3	4,182,000	12,546,000
		Chain Hoist	Electric chain hoist with motorized torolly	set	1	1,455,000	1,455,000
	2.	Sedimentation Facility					**92,364,000**
		Hi-Arator	Tube settler,Accesorries	set	2	16,000,000	32,000,000
		Tube settler		set	1	60,364,000	60,364,000
	3.	Sand Filter Facility					**132,635,000**
		Green Leaf Filter	8 sand filter /unit	set	1	124,545,000	124,545,000
		Vacuum pump		set	2	2,409,000	4,818,000
		Backwash Blower		set	2	1,636,000	3,272,000
	4.	Distribution Facility					**31,091,000**
		Distribution Pump	Centrifugal Type	set	3	9,091,000	27,273,000
		Service Water Unit	Centrifugal Type	set	2	1,091,000	2,182,000
		Chain Hoist	Electric chain hoist with motorized torolly	set	1	1,636,000	1,636,000
	5.	Sludge Treatment Facility					**5,728,000**
		Waster water discharge pump	Submargible Centrifugal Type	set	2	2,455,000	4,910,000
		Sludge discharge pump	Progressive cavity Pump	set	2	409,000	818,000
	6.	Chemical Facility					**16,181,000**
		PACL Dosing Pump	Diaphragm Type	set	2	2,045,000	4,090,000
		PACL Agitator	Propeller type	set	2	1,091,000	2,182,000
		Chain Hoist	Electric chain hoist with motorized torolly	set	1	909,000	909,000
		Chlorinator	Pre/Post chlorine dosing	set	3	3,000,000	9,000,000
	7.	Air Facility					**726,000**
		Air Compressor	Oil Type, Accesorry	set	2	227,000	454,000
		Air Tank		set	2	136,000	272,000
	8.	Piping Work					**58,182,000**
		Pipe		set	1	42,727,000	42,727,000
		Valve		set	1	15,455,000	15,455,000
	9.	Electrical Work					**222,454,000**
		Panel		Ls	1	131,545,000	131,545,000
		Field Instrument		set	1	44,545,000	44,545,000
		Cable /Ruck /Tray		set	1	46,364,000	46,364,000
	10.	Generator					**48,455,000**
		Generator		set	1	48,182,000	48,182,000
		Oil Tank		set	1	273,000	273,000
	11.	Electrical Work (EVN cost)					**5,561,000**
		Switchgear	22kV	Ls	1	237,000	237,000
		Transformer	2000kVA, 22kV/380V	Ls	1	4,588,000	4,588,000
		Elecetric Cable		Ls	1	736,000	736,000
II.	**Cost for training and technology transfer**		**(included in Item III.)**	**Ls**	**1**		**0**
III.	**Cost for installing equipment and testing, calibration**			**Ls**	**1**		**210,909,000**
			Total Amount of Equipment Cost(Before Tax)				**838,287,000**
				VAT(10%)			**83,828,700**
			Total Amount of Equipment Cost(After Tax)				**922,115,700**

Source: Study Team

Appendix E

APPENDIX E1
SOCIAL BASELINE SURVEY

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1. Introduction

Officially established as a centrally governed city in 2004, currently, Can Tho City has become one of the most important hubs on economy, culture, and science in the Mekong Delta area. However, due to a rapid increase in population and economic growth, water deficit has become a bottleneck for future growth. Groundwater depletion in the surrounding area of Can Tho City and salt water intrusion from the downstream of Hau River has also become critical issues. To cope with these problems, groundwater exploitation has been strictly restricted in recent years and new intake facilities for water supply need to be constructed in the upstream area to avoid salt water intrusion.

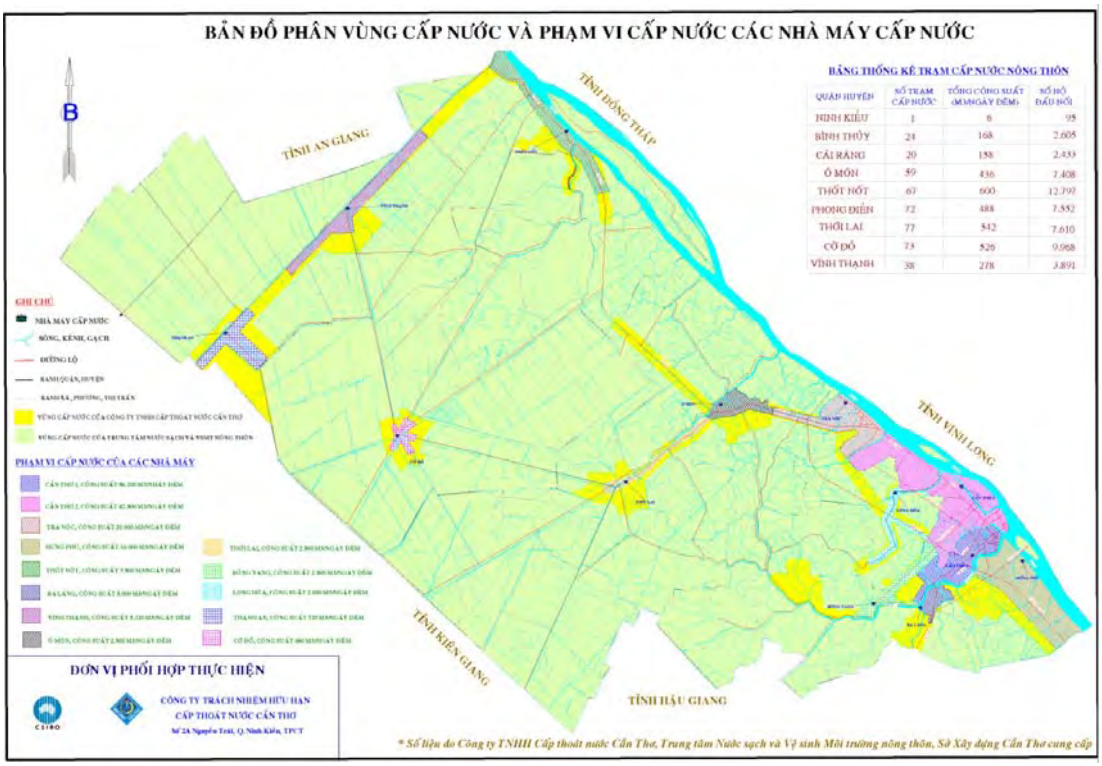
In this context, Can Tho People's Committee (hereinafter referred to as Can Tho PC) has decided to establish new intake and water treatment facilities at O Mon District in the upstream area of Hau River as well as transmission and distribution mains to meet the water demand in Can Tho City for the target year of 2020. In addition, Can Tho PC planned to execute the water supply system improvement jointly with the private sector.

To meet the above-mentioned requirement of Can Tho PC, the Japan International Cooperation Agency (JICA) has decided to execute a technical assistance in carrying out the preparatory study, namely, the feasibility study for private sector participation in the water supply project, by clarifying the necessity and sustainability of the project in view of its technical, financial, environmental and social aspects as well as proposing optimum implementation plan and operation and management (O&M) schemes utilizing private funds as well as foreign funds.

This report presents results of a social baseline survey, conducted as a part of the feasibility study, on demographic and socio-economic characteristics, and the current condition of water use in Can Tho city. The satisfaction to the existing system and willingness to pay for improved water service of both residents who are currently connected to the water supply system of Can Tho Water Company and those who are not connected today was also evaluated.

2. Objectives of the Survey

The survey aims to assess the current water use patterns of households living in the service areas of Can Tho Water Supply and Sewerage Company (WSSC). For households who are currently connected to WSSC piped water, the survey assesses their satisfaction and the elasticity of demand. For households who are not currently connected to WSSC piped water, the survey assesses factors that influence their decision of (not) choosing to connect to WSSC water and their willingness to pay for an improved water supply. The result will contribute to the feasibility study of Can Tho City Water Supply Improvement Project. In particular, by assessing the elasticity of demand of current users and willingness to pay for unconnected households (which, according to the master plan, to be connected by 2020), the survey informs the economic and financial analysis of the proposed project.



Source: JICA Study Team

Figure 2-1 Water supply zoning, and proposed and exiting locations of water treatment plants

3. Description of the Survey Area

3.1. Location

The study area of the Social Baseline survey is located in Ninh Kieu, O Mon, Cai Rang and Binh Thuy Districts of Can Tho City (Figure).

Source: Statistical Yearbook of Can Tho City 2012

Figure 2-2: Map of Can Tho City

(1) Can Tho City

Can Tho City on the right bank of Hau River, the largest tributary of Mekong River, is located at about 120 km southwest of Ho Chi Minh City. In 2004, Can Tho Province was divided into Can Tho City and Hau Giang Province under a government decision. Can Tho City was designated as a centrally governed city. Can Tho City has an area of approximately 1,401 km^2 and a current population of 1.209 million and the population density of 863 persons/km2 as of 2011. The natural population growth rate is 1.08 % per annum from 2005 to 20111. The population is projected to increase up to 1.5 million by 2020.

The City has nine dependent administrative units, including five urban districts namely Binh Thuy, Cai Rang, Ninh Kieu, O Mon and Thot Not, and four rural districts namely Vinh

1 *Source: Statistical Yearbook of Can Tho City 2012*

Thanh, Co Do, Phong Dien and Thoi Lai.

According to the 2011 Statistical Yearbook of Can Tho City, total Gross Domestic Product at current prices of Can Tho City in 2011 was 59,158 billion VND. The economic structure of the province mainly contributed by manufacturing (35.46%) followed by wholesale and retail trade (13.47%) and agriculture and aquaculture (11.5 %).

(2) Binh Thuy District

Binh Thuy District is located to the East of Can Tho City, stretching along Hau River. The district is bordered with O Mon District to the West and Northwest, Phong Dien District to the Southwest, Ninh Kieu District to the South and Hau River to the North and Northeast.

Binh Thuy district has 8 administrative divisions. Total area of the district is about 70.68 km^2 with a total population of 116,349 persons in 2011; accordingly, the population density was 1,639 persons per km^2.

Binh Thuy is an economic center of the Can Tho city where the Can Tho Airport and Can Tho Port is located. In Binh Thuy District there are several industrial zones, Import-Export Area and the Tra Noc Thermo-power Plant. About 39.9km2 (~56.4%) is agriculture land while 30.9km2 is non agriculture land.

(3) Cai Rang District

Cai Rang District is located to the East of Can Tho City, which is bordered by Ninh Kieu District to the North, Phong Dien District to the West, Hau Giang province to the South and Hau River to the East.

Cai Rang district has 7 administrative divisions namely Le Binh, Thuong Thanh, Phu Thu, Tan Phu, Ba Lang, Hung Phu and Hung Thanh wards. Total area of the district is about 69 km^2 and total population in 2011 was 88,432 persons, accordingly, the population density is 1,282 persons per km^2. Cai Rang district was established on the second of January 2004 based on one ward and one commune of the old Can Tho City, the town of Cai Rang and several communes of Chau Thanh and Chau Thanh A Districts.

Even though Cai Rang district is classified as an urban district of Can Tho City, most people living in a rural area with poor infrastructure and service including water service (~38% covered by Can Tho WSSC). About 35.8km2 (~52%) is agriculture land and 32.5km2 is non agriculture land.

(4) Ninh Kieu District

Ninh Kieu District is located to the East of Can Tho City, which is bordered by Binh Thuy District to the north and northwest, Phong Dien District to the Southwest, Cai Rang District to the South and Hau River to the East and Northeast.

Ninh Kieu district has 13 administrative divisions. Total area of the district is about 29 km^2 and is smallest district of the Can Tho City. Total population of Ninh Kieu district is 249,451 persons, accordingly, the population density is 8,602 persons per km^2.

Ninh Kieu is a political - economic - social center of the Can Tho city where most govermental offices, university, banks... are located. About 20.7km2 (~70.8%) is non

agriculture land while only 8.5km2 is agriculture land.

(5) O Mon District

O Mon District, one of five urban districts of Can Tho City, is located to the Northwest of the City. The district is bordered with Binh Thuy District to the Southeast, Thoi Lai and Phong Dien Districts to the South, Thot Not District to the North and Hau River to the North and Northeast.

O Mon district has 7 wards namely Chau Van Liem, Thoi Hoa, Thoi An, Phuoc Thoi, Truong Lac, Thoi Long and Long hung. Total area of the district is about 127 km^2. Total population of O Mon district is 131,972 persons, accordingly, the population density is 1,039 persons per km^2. O Mon district was established on the second of January 2004 based on the town of O Mon and several communes of the old O Mon and Thoi Lai Districts and Co Do District.

Even though O Mon district is classified as an urban district of Can Tho City, most people living in a rural area with poor infrastructure and service including water service (~10% covered by Can Tho WSSC). About 101.4km2 (~76%) is agriculture land and 30.8km2 is non agriculture land. There are few large industrial zones including O Mon Thermo-power and the expansion of Tra Noc Industrial Zone.

3.2 Surveyed areas and Demographic characteristics

The survey was undertaken in Ninh Kieu District (An Cu, An Khanh, An Binh, Hung Loi Wards), O MonDistrict (Chau Van Liem and Long Hung), Binh Thuy District (An Thoi, Long Hoa and Tra An Wards) and Cai Rang District (Hung Phu and Hung Thanh Wards) of Can Tho City Source: JICA Study Team

Figure 2-3 shows location of the surveyed wards and water treatment plants.

Source: JICA Study Team

Figure 2-3: Map of survey area in Can Tho City

4. Methodology of the Survey

The fieldwork of study was conducted using a household survey instrument and established economic methodologies to estimate a demand function for water supply.

A total of 516 households in Ninh Kieu, O Mon, Binh Thuy and Cai Rang districts of Can Tho City were surveyed to estimate demand by two methods:

- Indirect method was used to determine consumer's coping costs. Under this approach, we observe how much people spend on water and the types of economic and behavioral changes they have made to cope with an unreliable water supply.
- Direct method was used to determine consumer's willingness to pay more for improved water service. Under this approach, one asks individual households how much they would pay in addition to current fees for a full-service water system. Since this method *directly reveals consumer demand through a structured series of questions*, it constitutes a direct method called the contingent valuation (CVM), or willingness to pay (WTP), method.

A questionnaire was used to acquire the following information from respondents (See Annex 1):

- demographic characteristics;
- socio-economic characteristics;
- existing water sources and problems of quantity and quality;
- details of household water usage;
- common hygiene practices and cultural beliefs;
- capacity and willingness of the community to pay towards recurrent costs of operating water and
- sanitation provisions;
- latrine coverage and usage;
- highest flood level in the recent years

4.1 Sample Size

Since the target of the project was urban households residing in the service area of WSSC (including "to be serviced" area), the sample was selected from four urban districts. The sample population was selected proportionally to the overall urban population and based on the service coverage ratio.

At the beginning, we planned to survey 300 households who are current connected to piped water and 170 households who are not connected today (Table 4-1). Some of the households in WSSC service area are actually using water from Center of Rural Water Supply and Environmental Sanitation (CERWAS) under management of Department of Agriculture and Rural Development (DARD) instead of WSSC.

Table 2-1. Proposed sample size of the survey

Districts	Urban population	WSSC coverage ratio	Sample size (WSSC)	Sample size (non-WSSC)	Sample size (Total)
Binh Thuy	116,349	90%	*80*	*20*	**100**
Cai Rang	88,432	38%	*30*	*40*	**70**
Ninh Kieu	249,451	90%	*180*	*20*	**200**
O Mon	131,972	10%	*10*	*90*	**100**
Total	**586,204**		**300**	**170**	**470**

Source: JICA Study Team

In addition to the above, additional 30 households residing in rural area was planned to be surveyed to complement the analysis. This complementary survey was set to review current water use patterns in rural area and contribute to the long-term analysis of water consumption pattern in Can Tho City in general.

After consulting with the consultants and conducting pilot survey, there are some small changes in the number of households to be interviewed and selected wards in each district. Detail number of households in each administration area is illustrated in Table 2-2.

Table 2-2. Actual sample size of the survey

District	Ward	Sampled size (WSSC)	Sampled size (Non-WSSC)	Sampled size Total
Binh Thuy (n=115)	An Thoi	49	6	55
	Long Hoa	43 (3)	12	55
	Tra An*	15		15
Cai Rang (n=80)	Hung Phu	20	20	40
	Hung Thanh	16 (16)	24	40
Ninh Kieu (n=201)	Hung Loi	80		80
	An Cu	80		80
	An Khanh*	20	-	20
	An Binh	-	21	21
O Mon (n=110)	Chau Van Liem	30 (2)	30	60
	Long Hung	6 (6)	44	50
Total		**359(27)**	157	**516**

Note: figures in parentheses are households connecting to CERWAS piped water.
Source: JICA Study Team

Two new wards, namely Tra An ward in Binh Thuy district and An Khanh ward in Ninh Kieu district (with asterisk mark) was selected for the survey since these wards are located at the edge of the service area of Can Tho 2 and Can Tho 1 Water Treatment Plants. The expansion of the survey in these two wards provided information on the quality of the service, particularly the level of water pressure and the frequency of service disruption in these service areas

4.2 Sample Selection

To select the households to be interviewed, a set of random numbers was used to select households from the residential registers of the different administrative units (*Quarter* and *hamlet)*. The number of households selected from each unit was proportionate to that unit's population. Since the residential registers were used as the basis for sampling, only permanent residents were included in the household selection. The in charged person from Town/Commune People's Committee and the *Quarter* and *hamlet* leaders, helped to locate the houses randomly selected from the registration books. Interviewers were instructed to interview the head of the household and his/her spouse if both were present. If only one was available at the time, then that was the person to be interviewed.

4.3 Implementation Process and Issues

The Survey was carried out on the basic of face-to-face interview, with step-by-step workout schedule as three main steps described below:

(1) Testing the questionnaires

A questionnaire was designed based on the requirement/objectives of the social baseline survey and the expected current condition of livelihood of local people. After getting comment from the consultant, the questionnaire was tested via a pilot survey with some households to confirm it fits to living condition of local people. Any unsuitable option was taken away and new options were added to express local people's responses.

(2) Organizing interviewers and training

Based on the number of HHs to be interviewed, three interview groups consisting of 2 interviews per each group were established. A training seminar was held to improve interviewers' survey techniques, knowledge on the Project, etc. During this training, questionnaires and explanatory documents such as dwelling classification, which would have been prepared in the framework of monitoring works, were introduced to the interview groups.

(3) Getting permission for the survey

The consultants, together with responsible staffs of Can Tho WSSC, arranged meeting with people's committees of Binh Thuy, Cai Rang, Ninh Kieu and O Mon districts of Can Tho City in order to explain and discuss with people's committees of districts on the Survey. The purpose of this activity is also to get permission as well as introduction letters to People's committee of wards in the study area to conduct the interviews.

(4) Conducting interviews to key persons of selected households:

Interviewers were accompanied by local leaders where this was felt to be necessary to locate houses or assure households of the legitimacy of the survey.

The *Quarter* or *hamlet* leader helped to supervise interviewers in the field. At the end of each day, a meeting was held by the interviewers with participation of the supervisor to check whether the questionnaires were filled successfully. The d*ay*'s work was also reviewed and the next day's activities planned. The national social specialist reviewed all

completed interviews before leaving the area and other social analyzer reviewed and evaluated again the collected data before inputting them into computer for analyzing.

(5) Data input:

Input data using Microsoft Excel and SPSS software to prepare a database to which show and aggregate questionnaire results. Any mistakes/errors of the filled questionnaires also are identified while inputting data. These findings were forwards to request the interviewers to do the supplementary interview.

(6) Analyses of the Questionnaire Result and Reporting Works

After field editing, questionnaires were returned to the office for data processing. The processing operation consisted of office editing, coding of others category open-ended questions, data entry, and editing inconsistencies found by the computer programs.

Once the data was stored in computer in readable form, the next task was to eliminate the more obvious errors that had occurred during the data collection, coding and input stages. In case of pre-coded response choices there was a need to list and develop a coding frame for the various 'other" response choices that were offered to respondents whose replies did not fit the codes given. Responses in others category were listed by the investigator after the data have been collected, and then grouped by theme for the development of an appropriate coding frame. The data was edited before being presented as information. This action ensured that the information provided is accurate, complete and consistent and to ensure these three types of checks were applied namely validity check, range check and consistency check.

After data processing, data analysis was conducted. Analysis of the data was carried out using the most advanced data analysis package namely SPSS. As the study intends to develop a baseline of water and sanitation indicators, the analysis of the survey is guided by the research objective. The preparation of final report involved following tasks:

a. Developing Data Entry Program
b. Scrutiny and coding of interview schedules
c. Data entry of the raw data
d. Data interpretation and analysis
e. Report writing.

5. Survey Results and Anlalysis

5.1 General Information and Basis to Evaluate Affordability to Pay

(1) Sex of key respondents

The overall gender distribution of the surveyed population is presented in Table 2-3. It shows that over 65% of the key respondents in all areas is found women whereas only 35% of the informants is man in the surveyed areas.

Table 2-3. Gender distribution of key respondents

District	Male	Female	Couple
Binh Thuy (n=125)	41	84	-
Cai Rang (n=80)	27	53	-
Ninh Kieu (n= 201)	63	138	-
O Mon (n=110)	47	63	-
Total (n=516)	178	338	

Source: JICA Study Team

(2) Family composition

The overall average household size in all surveyed districts is 4.57 persons (sd=1.9) and is the same in the four districts. However, this figure is fluctuated from 1 person to 17 persons per household. The analysis indicated that approximately a quarter of households in each district has 4 adult members (152 HHs). The majority of surveyed households has 2 adult women and 2 adult men (aged 15 to 60 years). A relatively high percentage of households had only 1 member under 15 years old and 1 member over 60 years old (Table 2-4). Number of disable or chronically ill person was quite high ranging from 4 persons (5%) in Cai Rang to 21 person (16.6%) in Binh Thuy district.

Table 2-4. Structure of surveyed households

	Binh Thuy (n=125)	Cai Rang (n= 80)	Ninh Kieu (n=201)	O Mon (n= 110)
Mean of total number of family member	4.73	4.53	4.56	4.45
No. of adult women (15-60 years old)	205	131	343	172
No. of adult men (15-60 years old)	202	110	298	171
Adult over 60 years old	59	42	95	39
Number of children younger than 15 years old	125	80	180	106
Number of disabled or chronically ill persons	21	4	19	17
Minimum of total number of family member	1	1	1	2
Maximum of total number of family member	17	11	13	11
Percentage of household headed by woman	32	34	43	31

Source: JICA Study Team

It was calculated that about 27.1% of households in surveyed area are headed by woman. It was lowest in Ninh Kieu distict (21.4%) and highiest in Cai Rang district (42.5%).

(3) Type of dwelling

In the surveyed area, the dwellings of over two third of the households interviewed are semi permanent (Table 2-5). The proportion of those interviewed lived in permanent houses and and temporal house is similar for the whole survey but is quite different between districts. In Ninh Kieu District, only 6% of 201 interviewed households living in temporalry house but 22% living in permenant house. In contrast, 34% of 110 interviewed hoseholds in O Mon district living in temporary house and only 11% of them living in permenant house. As shown in the descritption of survey area, O Mon district is classified as an urban district but the urbanization is lower and slower than other urban districts like Ninh Kieu or Binh Thuy.

Table 2-5. Type of dwelling

Type of dwelling	% Binh Thuy	% Cai Rang	% Ninh Kieu	% O Mon	Total
	(n=125)	(n=80)	(n=201)	(n=110)	(n=516)
Permanent house	15%	3%	22%	11%	15%
Semi-permanent house	75%	83%	72%	55%	71%
Temporary	10%	15%	6%	34%	14%

Source: JICA Study Team

(4) Type of business and monthly income

Activities generating household income: The data showed that majority of the population (54%) have income generating from the activities conducted outside their house such as works in factories, governmental sectors, running business activities etc... In total of 222 households having activities at home to generate income, only 24 households have more than one activities. Small-scale trade is a popular activity generating household income with 17% of total responses from interviewed persons. Followed by this about 7% was engaged in backyard cultivation of fruit, vegetable or preparing foodstuffs for sale. Only 4% set their home for coffee shops and 4% for animal raising. Setting their home for eating places was source of income of only 2% of the surveyed households whereas 10% of them selected other activities to diversify their family income (Table 2-6).

Table 2-6. Activities at home to generate income for surveyed households

Activities	Number of HHs	Percentage (%)
No	291	54%
Eating place	11	2%
Coffee shop	22	4%
Backyard cultivation of fruit, vegetable	37	7%
Small-scale trade (selling groceries, cigarettes, fruits… from house);	91	17%
Preparation of foodstuffs for sale	10	2%
Animal raising	19	4%
Others	54	10%
Total	535	100%

Note: Multiple responses possible, two missing value
Source: JICA Study Team

In detail, the data showed a significant difference in terms of income generating activities through districts (Table 2-7) From the table, except activities conducted outside their house such as works in factories, governmental sectors, running business activities, small-scale

trade (selling groceries, cigarettes, fruits…) in four surveyed district occupies 12%, 15%, 19% and 21% in Binh Thuy, Cai Rang, Ninh Kieu and O Mon districrs respectively. Backyard cultivation was main income source of nearly 18% of households in Binh Thuy and 13% of those who select this activity for generating income in Cai Rang districts. Surveyed households in Cai Rang tended to raise animals as their main income source (10 out of 19 surveyed households who based on this activity for income generating).

Table 2-7. Income generating activities by districts

	Binh Thuy		Cai Rang		Ninh Kieu		O Mon	
	N	%	N	%	N	%	N	%
No	74	56%	46	53%	108	52%	63	56%
Eating place	2	2%	2	2%	6	2.9%	2	2%
Coffee shop	5	4%	3	3%	12	5.7%	2	2%
Backyard cultivation	24	18%	10	12%	0	-	3	3%
Small-scale trade (selling groceries, cigarettes, fruits…)	16	12%	13	15%	40	19%	23	21%
Preparation of foodstuffs for sale	0	0%	3	3%	5	2.4%	2	2%
Animal raising	6	5%	3	3%	1	0.5%	10	9%
Others	4	3%	6	7%	37	17%	7	6%
Total	131	100%	86	100%	209	100%	112	100%

Source: JICA Study Team

Monthly income: Table 5-6 shows the average monthly income of households in all surveyed area and each district. From the table, total average monthly income of the four surveyed districts was around 7.5 million dong/month. The highiest average monthly income of sampled households was around 8 millions dong/month found in Ninh Kieu district whereas 6.2 millions dong per month was average monthly income of those in O Mon district. There was a big fluctuation in terms of income over surveyed households. While some households earned only 400,000 dong/months, many others got tenfold for monthly income, especially households in Ninh Kieu.

Table 2-8. Total monthly income (in VND)

District	N	Mean	Lowest income	Highest income
Ninh Kieu	201	8,772,800	1,200,000	81,000,000
O Mon	110	6,221,600	1,700,000	18,000,000
Cai rang	80	6,587,800	1,800,000	20,500,000
Binh Thuy	125	7,122,800	400,000	30,000,000
Total	516	7,490,400	400,000	81,000,000

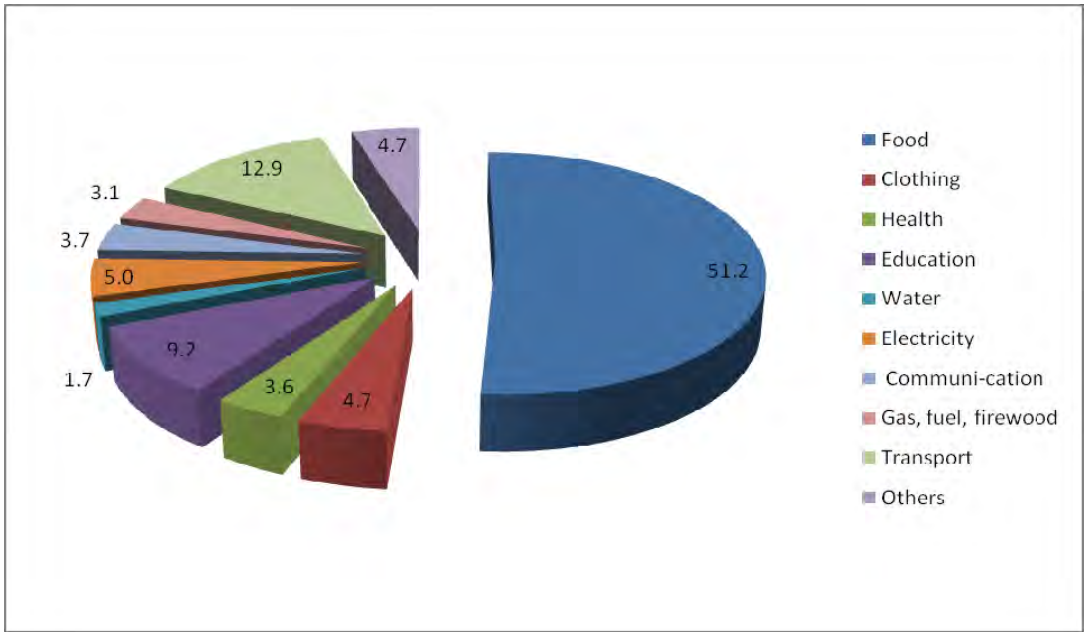
Source: JICA Study Team

(5) Monthly expenditure

Average total monthly expenditure of households in all surveyed areas was about 5.0 millions dong/month. Among 177 persons who gave the detail expenditure, the analysis indicates that more than a half of monthly income was spent for food (51.%) whereas merely 3.6% was expensed for health care services. Monthly expenditure for education is quite high, making up 9.2% of total expenses. Gas for cooking made up 3.1% of total monthly expenditure while electricity appropriated 5% and 12.9% of the expenditure was for transportation (Source: JICA Study Team

Figure 2-4). Cost for water makes up a quite small proportion of total expenditure (only

1.7%) compared to other costs.



Source: JICA Study Team

Figure 2-4. Monthly expenditure of interviewed households in the four districts

5.2 Present Conditions of Water Use

5.2.1 Type of water source

Table 2-9 shows the percentage of household connected to piped water. At the time of the survey, there were 64.3% of interviewed households connected to Can Tho WSSC while only 5.2% connected to CERWAS. Over 30% of interviewed household have no connection to piped water.

Table 2-9. Percentage of household connected to piped water

	No (n=157)	Connected to CERWAS piped water (n=27)	Connected to WSSC piped water (n=332)
Binh Thuy (n=125)	14.4%	2.4%	83.2%
Cai Rang (n=80)	55%	20%	25%
Ninh Kieu (n=201)	10.4%	0%	89.6%
O Mon (n=110)	67.3%	7.3%	25.5%
Total	30.4%	5.2%	64.3%

Source: JICA Study Team

In Ninh Kieu and Binh Thuy Districts, percentage of interviewed household connected to piped water is 88% and 85.6% respectively while household who have not connected to piped water is 12% and 14.4%. In constrast, only 25% of interviewed households in O Mon and Cai Rang districts were connected to Can Tho WSSC. Twenty percent of interviewed households in Cai Rang (or 16 HHs) and 7.3% (8 HHs) in O Mon districts were connected to CERWAS piped water.

(1) Households without WSSC connection

As mentioned in the methodology section, 90% of surveyed households in Ninh Kieu and

Binh Thuy districts were serviced by the Can Tho WSSC whereas 90% of surveyed households in O Mon and 62% in Cai Rang were not connected to WSSC network. Table 2-10 shows the reasons given by the 156 households in the four districts who were not connected to the WSSC pipe system, of which 33 households have 2 reasons.

Table 2-10. Reasons for not having connected to WSSC system

Reasons	% Binh Thuy (n=22)	% Cai Rang (n=56)	% Ninh Kieu (n=26)	% O Mon (n=85)	Total (n=189)
The WSCC doesn't have any distribution pipes in the area;	27.3	76.8	80.8	82.4	74.1
My house is a long way away from the pipes in the street;	18.2	5.4	0.0	3.5	5.3
Cost of connection is too high;	27.3	1.8	0.0	0.0	3.7
Quality or quantity of available water is not satisfactory	4.5	-	0.0	0.0	0.5
Already applied, still waiting to be connected;	0.0	1.8	3.8	0.0	1.1
I have another satisfactory source of water	18.2	14.3	15.4	14.1	14.8
Other	4.5	-	0.0	0.0	0.5
Total	100%	100%	100%	100%	100%

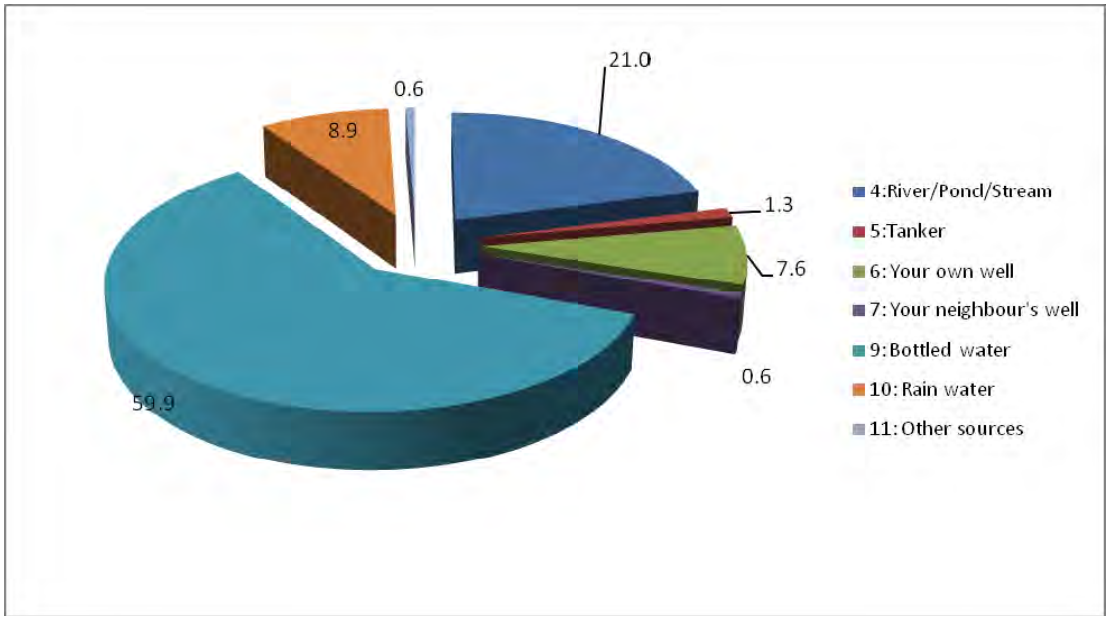
Note: Multiple responses possible
Source: JICA Study Team

The most frequently (74% in general) and approximately 81% for Ninh Kieu and O Mon, 76.8% and 27.3% for Cai Rang and Binh Thuy given reasons are that Can Tho City WSSC does not have distribution pipes in their region. People in Binh Thuy district also claimed that cost of connectiion is too high (27.3%) and their houses are a long way away from the pipes in the street. However, 15% (n=28) of sampled households in the four districts said that they already have another satisfactory source of water for all household needs. Of which, 17 households used bottled water for drinking and 6 households used for cooking. Number of household using river/pond water for drinking, cooking and washing are 3, 7 and 13 respectively. Moreover, number of household using their own well for drinking, cooking and washing is 4, 9 and 12 respectively. Some household used rain water for daily uses.

1) Drinking water

With regards to type of sources of water for drinking of household without WSSC connection, the survey showed that majority of respondents (59.9%) bought bottled water for drinking (Source: JICA Study Team

Figure 2-5). 21% of surveyed households are using river/stream/pond water while 7.6% using their own well for this purpose. Almost 9% of surveyed households use rain water for drinking while 1.3% using water from tanker. Even though these household do not have connection to WSSC, few of them (1.4%) buy piped water from their neighbors.



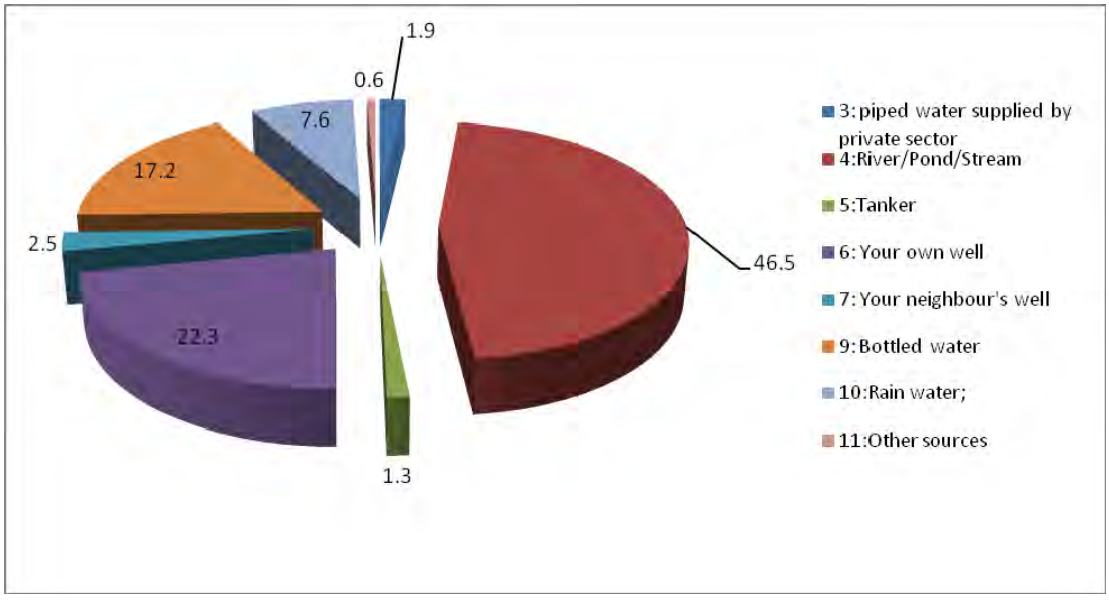
Source: JICA Study Team

Figure 2-5. Water sources for drinking

2) Cooking water

Unlike to water sources for drinking, more than 46.5% of the population in the surveyed areas used water from river/stream/pond for cooking purpose. Following this, 22.3% using water from their own well and 17.2% using bottled water for cooking purpose. About 7.6% of them use rain water while 1.9% of those using piped water from private sectors (Source: JICA Study Team

Figure 2-6).



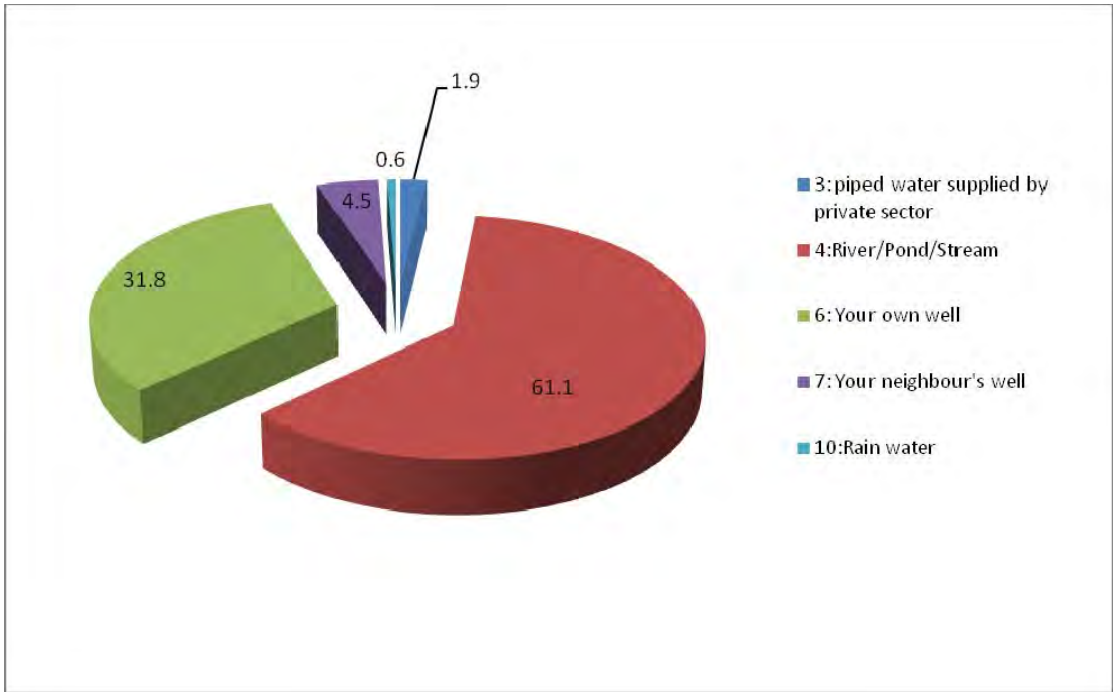
Source: JICA Study Team

Figure 2-6. Water sources for cooking purposes

3) Water for body and cloth washes

Similar to water sources for cooking, about 60% of the population in the surveyed areas used water from river/pond/stream for washing body and clothes. Following this, 31.8% using water from their own wells and 4.5% using water from ctheir neighbor's wells for this purpose. Only 1.9% of those bought piped water from private sectors (Source: JICA Study Team

Figure 2-7). Only 0.6% of interviewed household uses rain water for washing purpose.



Source: JICA Study Team

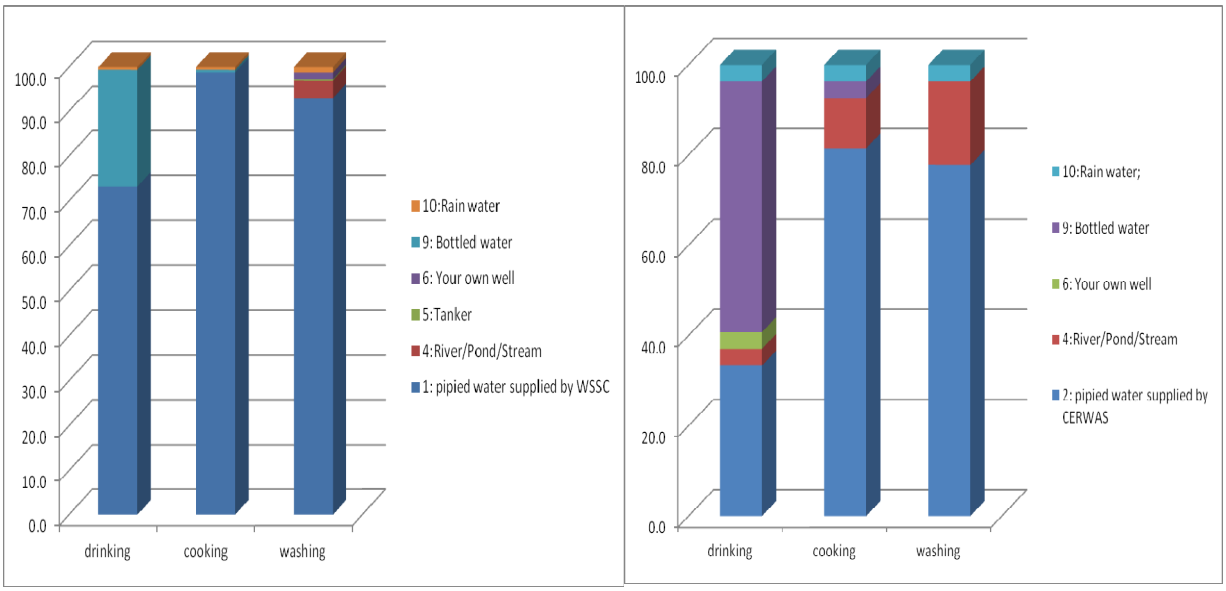
Figure 2-7. Water sources for body and clothes washing purpose

(2) Households with Can Tho WSSC and CERWAS connections

1) Water source for daily uses:

Source: JICA Study Team

Figure 2-8. Main sources of water used for drinking, cooking and washing shows the use of WSSC water (left) and CERWAS water (right) by connected households. Approximately 73.2% of connected households use WSCC water for drinking, 98.8% uses for cooking and 92.7 use for washing. For those who were connected to piped water, tap water is usually first choice for all household purposes. Dissatisfaction with the water quality, a high proportion of interviewed households used bottled water (26.2%) as main source of drinking. Even connected to WSCC network, 7.3% of connected households keep using well/tanker water, river/pond water or rain water for washing body and clothes. This may related to the available of these type of water where they live and/or their habit. Rain water was also used as main source of water for drinking and cooking in some household (0.6% for each purposes) and for washing (1.2%).



Source: JICA Study Team

Figure 2-8. Main sources of water used for drinking, cooking and washing

For households who connected to CERWAS (Source: JICA Study Team

Figure 2-8: right) only 33.3% used CERWAS water for drinking, 81.5% used for cooking and 77.8% used for washing. People in Cai Rang and O Mon tended to use bottle water for drinking for health safety. Even though having piped water, some household still used river/pond water for drinking (3.7%), cooking (11.1%) and washing (18.5%) purposes.

2) Satisfaction level to water services of Can Tho WSSC and CERWAS

There are 332 of households connected to Can Tho WSSC network were interviewed in the surveyed areas of which 160 households served by Can Tho 1 Water Treatment Plant (WTP), 124 household served by Can Tho 2 WTP, 28 households served by O Mon WTP and 20 households served by Hung Phu WTP. In addtion, 27 households who connected to

CERWAS were also interviewed to assess the sastifaction level to water services of these both companies. The results of their sastisfation was showed in Table 2-11.

Table 2-11. Sastisfaction level of interviewed households to servies of water treatment plants

	Can Tho 1		Can Tho 2		Hung Phu		O Mon		CERWAS	
	n	%	n	%	n	%	n	%	n	%
Yes	145	90.6	86	69.4	14	70	24	85.7	12	44.4
No	15	9.4	38	30.6	6	30	4	14.3	15	55.6
Total	160	100	124	100	20	100	28	100	27	100

Source: JICA Study Team

The answers given by the respondents showed about 81% (269 out of 332 connected HHs giving answer for this question) of them are satisfactory with the Can Tho WSSC services. In detail, only 70% interviewed people (n=14) who served by Hung Phu WTP and 69.4% (n=86) people who served by Can Tho 2 WTP are satisfied with the services of these WTPs. Only 44.4% of interviewed households who connecting to CERWAS are satisfied to the service of this center.

Among 63 persons who are not satisfactory, low pressure of water is the main reason (50% of responses), especially in the service area of Hung Phu WTP (n=8, 86%), Can Tho 1 WTP (n=10, 67%) and Can Tho 2 WTP (n=24, 59%) (Table 2-12). Water outage several time was recorded in O Mon WTP (38%) and Can Tho 2 WTP (5%). Low water quality is also a concerned issue of interviewed households from service areas of Can Tho 1 WTP (20%), of Can Tho 2 WTP (32%), of O Mon WTP (38%).

Table 2-12. Satisfaction level to the service

WTP / Complaint	Can Tho 1		Can Tho 2		Hung Phu		O Mon		CERWAS	
	N	%	N	%	N	%	N	%	N	%
Water outages several times		0%	2	5%		0%	3	38%	7	22%
Low water pressure	10	67%	24	59%	6	86%	2	25%	4	13%
low water quality	3	20%	13	32%	1	14%	3	38%	12	38%
More leakage			1	2%						
Problems with meter readings, billing…	1	7%	1	2%						
Slow in carrying out repairs									8	25%
Lack of warning about disruptions									1	3%
Other reason	1	7%								
Total	15	100%	41	100%	7	100%	8	100%	32	100%

Source: JICA Study Team

Other responses to satisfaction level of unsatisfied households to the Can Tho WSSC are “more leakage”, “problems with meter readings, billing or cash collection” and “slow in carrying out repairs”.

For CERWAS service, low quality is the most concerning issues of interviewed households (38%) following by was “slow in carrying out repairs” (25%), “water outages several

times" (22%) and "low water pressure" (13%).

3) Availability of water from the tap:

Regarding to water availability, about 97.5% of sampled households have piped water available for 24 hours per day in area served by Can Tho 1 WTP. This figure in Can Tho 2 WTP and Hung Phu WTP is 95% and 84.7% respectively. In O Mon district, only 50% said the water is available for 24 hours a day whereas other 35.7% of population can access to WSSC piped water for 18-23 hours per day (Table 2-13). About 14.3% of water supply connected households in O Mon reporded the availability of water for only 12-17 hours a day. In the area served by Can Tho 2 WTP, it still has 1.6% reported the availability of water for only 6-11 hours a day.

In the area served by CERWAS, 59.3% of interviewed households reported that water is available in 24hrs. About 22.2% interviewed households experienced available water from 18-23hrs, 7.4% can access to tap water from 12-17hrs and 11.1% can access to water only 6-11hrs.

Table 2-13. Availability of WSSC piped water

	Can Tho 1 WTP	Can Tho 2 WTP	Hung Phu WTP	O Mon WTP	CERWAS
24hours	97.5%	84.7%	95.0%	50.0%	59.3%
18-23 hours	2.5%	9.7%	0.0%	35.7%	22.2%
12-17 hours	0.0%	4.0%	5.0%	14.3%	7.4%
6-11 hours	0.0%	1.6%	0.0%	0.0%	11.1%
Total	100%	100%	100%	100%	100%

Source: JICA Study Team

4) WSSC water pressure:

Virtually, almost interviewed households were satisfied with the pressure of piped water source provided by the WSSC. Majority of the sampling population (65%) evaluated that WSSC water pressure is strong and about 10% evaluated that is vary but usually strong. In the areas served by Can Tho 1 WTP and Can Tho 1 WTP, proportion of interviewed households evaluated the WSSC water pressure is weak is 5% and 13.7%, and vary but usually weak is 5.6% and 12.1% respectively. Nearly 25% of the households in the area served by Hung Phu WTP reported that WSSC piped water is weak, and 5% of them said that water pressure is vary but usually weak (Table 5-12). Most people in the area served by O Mon WTP reported that water pressure is strong (75%) or vary but usually strong (21.4%). Only 3.6% of them complained that water pressure is weak. This result may related to theshort distance between the survey area and the O Mon WTP.

For households who live in An Khanh ward (n=20) of Ninh Kieu district and Tra Cu ward (n=15) of Binh Thuy district, two wards that are located at the edge of the service area of Can Tho 2 water treatment plant, 16 households (80%) from An Khanh and 3 households (20%) from Tra Cu reported that they are not sastified with the service because of low water pressure.

Table 2-14. Pressure of WSSC piped water

	Can Tho 1 WTP	Can Tho 2 WTP	Hung Phu WTP	O Mon WTP	CERWAS
Strong	69.4%	59.7%	50.0%	75.0%	59.3%
Weak	5.0%	13.7%	25.0%	3.6%	22.2%
Varies but usually strong	20.0%	13.7%	20.0%	21.4%	7.4%
Varies but usually weak	5.6%	12.1%	5.0%	0.0%	11.1%
Others	0.0%	0.8%	0.0%	0.0%	0.0%
Total	100%	100%	100%	100%	100%

Source: JICA Study Team

For households who uses piped water of CERWAS, people reported that water pressureis weak (22.2%) or vary but usually weak (11.1%). Only 59.3% of them reported that water pressure is strong.

5) WSSC water quality:

The survey also tried to take the perception of the households on quality of the WSSC piped water.

Table 5-13 shows the visual indicators of Can Tho WSSC and CERWAS piped water by water treatment plants. Interviewed households from Can Tho 1 WTP, O Mon WTP and Hung Phu WTP reported that they never found bad taste of WSSC water while 98.4% of them in Can Tho 2 WTP reported the same. People in the area served by O Mon WTP reported high frequency of bad color and smell sometime happened to WSSC water. 33.3% People in the service area of Hung Phu and Can Tho 2 WTP sometime experienced with strong smell (clorine) while this issues was reported by 20% people who live in the service area of Can Tho 1 WTP.

It seems that the quality of water supplied by CERWAS was not highly assessed. About 46.4% interviewed households reported that water has bad taste while proportion of household complaint that water usually has strong smell is 33.3% (mostly sludge smell) and usually has bad color is 17.9%.

Table 2-15. Visual indicators of WSSC piped water quality by districts

Indicator	Frequency	Can Tho 1 WTP N= 160	Can Tho 2 WTP N=124	Hung Phu WTP N=20	O Mon WTP N=28	CERWAS N= 27
WSC water has bad taste	Never	100	98.4	100.0	100.0	46.4
	Rarely	0.0	0.8	0.0	0.0	3.6
	Sometimes	0.0	0.8	0.0	0.0	46.4
	Usually	0.0	0.0	0.0	0.0	0.0
	Total	**100**	**100**	**100**	**100**	**100**
WSC water has strong smell	Never	63.1	40.7	44.4	61.1	88.9
	Rarely	13.8	22.0	22.2	22.2	5.6
	Sometimes	20.0	33.3	33.3	16.7	22.2
	Usually	3.1	4.1	0.0	0.0	33.3
	Total	**100**	**100**	**100**	**100**	**100**
WSC water has bad color	Never	78.8	76.6	95.0	46.4	17.9
	Rarely	15.0	7.3	5.0	14.3	25.0
	Sometimes	5.6	13.7	0.0	35.7	35.7
	Usually	0.6	2.4	0.0	3.6	17.9
	Total	**100**	**100**	**100**	**100**	**100**
Drink WSC tap water directly	Never	75.6	76.6	73.9	71.4	92.9
	Rarely	3.8	4.0	-	3.6	3.6
	Sometimes	8.1	12.9	8.7	14.3	
	Usually	12.5	6.5	17.4	10.7	
	Total	**100**	**100**	**100**	**100**	**100**

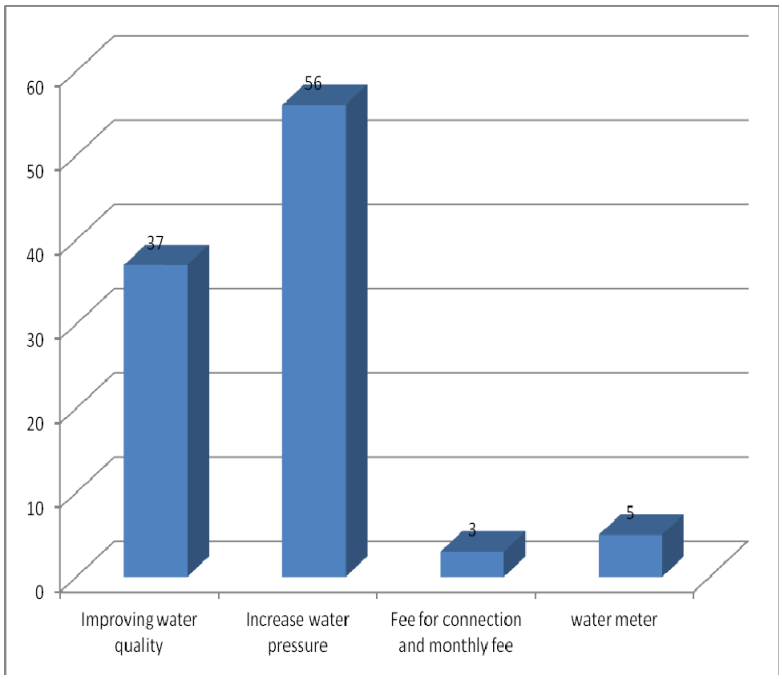
Source: JICA Study Team

Percentage of interviewed household who drink tap water directly is quite low in the whole survey areas. Only 17.4% of interviewed households in area served by Hung Phu WTP usually drink tap water directly while this proportion in the service areas of Can Tho 1, Can Tho 2 and O Mon WTPs are 12.5%, 6.5% and 10.7%. No body in the area served by CERWAS usually or sometime drink water directly.

6) How to improve WSSC services

In total, 101 opinions of interviewed households suggested to Can Tho WSSC to improve their services. Their opinion can be grouped to 4 main suggestions. 56 opinions want to improve water pressure including increase of water piped size. 37 opinions want to have better water quality especialy reduction of odor, mainly chlorine, sediment and color. Three opinion are related to water fee, of which one would like to have lower connection fee and two want to keep the price stable (Source: JICA Study Team

Figure 2-9).



Source: JICA Study Team

Figure 2-9 Opinion of interviewed households to improve Can Tho WSSC services

7) Water consumption of households response to improvement of WSSC services

In total of 331 households response to the question that you will use more/less water from WSSC pipe if their services improved or household income increased, only 8 households said that they will use more water if the service is available 24h/day without disruption while 323 of them keep the same amount of consumption (Table 2-16).

Table 2-16: Responses of interviewed households to changes of WSSC service

	Consumption amount		
Changes of service and income	**More**	**Less**	**Same/don't know**
1. the service is available 24h/day without disruption	8	-	323
2. water pressure improves	19	-	312
3. the quality of water (taste, smell) improves	10	-	321
4. the price of WSSC water goes up by 10%	-	60	269
5. the price of WSSC water goes up by 30%	-	150	181
6. your income goes up by 20%	30	2	296

Source: JICA Study Team

Response to water pressure improves, only 19 households will increase their water consumption while 312 households still keep the same amount since it already meet their demands. It is noted that many household complaint about the quality of current supplied water but their response to the improvement of water quality is weak. Only 10 households will increase water consumption whereas 321 households will keep the current amount if the water quality is improved.

In contrast, response of interviewed household to the increase of water price is very strong. No one will increase their water consumption but at least 60 household will use less water from WSSC if the price of water going up 10% compared to current price and 150 households will do the same if the price of WSSC water going up 30%.

Only 30 households reported that they will use more water if their income increasing 20%.

5.2.2 Water consumption and cost

With respect to water consumption, households who connected to WSSC piped water use average 17.3 m^3 (18,344 liters) per month for their household's needs while those using CERWAS reported using less water at average 14m^3 (14,362liters) each month and household who have not connected to piped water use only 13m^3 (Table 2-17). For the average amount per capitat, households who connecting to Can Tho City WSSC also use highest amount of water (4,152 liters per capita) while water consumption per capita of households who use piped water of CERWAS and who do not use piped water is 3,145 and 3,042 liters respectively. For those who use water supplied by WSSC, the proportion of water from this company occupied 97% () of total demands while households who use water from CERWAS the proportion from this source just occupied 88%. This mean than people who use piped water served by Can Tho WSSC are sastisfied to the water's quality.

Table 2-17. Monthly amount of water used from different sources

Water consumption	Non WSSC	Can Tho WSSC	CERWAS
Number of household	157	332	27
Total household consumption (liter)	13,058	18,344	14,362
Water consumption per capita (liter)	3,042	4,152	3,145
Water consumption per capita provided by WSSC	-	4029	-
Water consumption per capita provided by CERWAS	-	-	2796

Source: JICA Study Team

However, some households who connected to piped water of Can Tho WSSC still use other sources of water for their daily uses. There were 79 households used bottle water at an average of 94liters per household for drinking purpose. 18 households used river/stream water at an average of 7.4m^3 and 16 households used rain water at an average of 3m^3 for other purposes.

In general, households who connecting to Can Tho WSSC consumed more water and then paid for monthly fee more than those who connecting to CERWAS or non-WSSC households. Accordingly, monthly fee per capita was also highest for WSSC households then to CERWAS households and lowest for non-WSSC households. However, if average tariff/m3 was taken into account, households who used water of Can Tho WSSC paid only 4,598VND/m3 compared to 5,392VND/m3 for those who used CERWAS' water and 11,006VND/m3 for those who have not connected to piped water. For non-WSSC households payment for bottle water for drinking was very high and it led to the highest average tariff/m3. They also have to pay for operation and maintenance their well. For CERWAS' households, payment for piped water occupied only 59% of total payment. The remain was charged for bottle water, cost for operation and maintenance of well. Househld who used Can Tho WSSC spent about 88% total water payment for this company. Some households still used bottle water for drinking and well water for washing (Table 2-18). It is obvious that if people use water from Can Tho WSSC they have oppoturnity to use more water and pay for a lower unit cost.

Table 2-18. Monthly payment for water uses

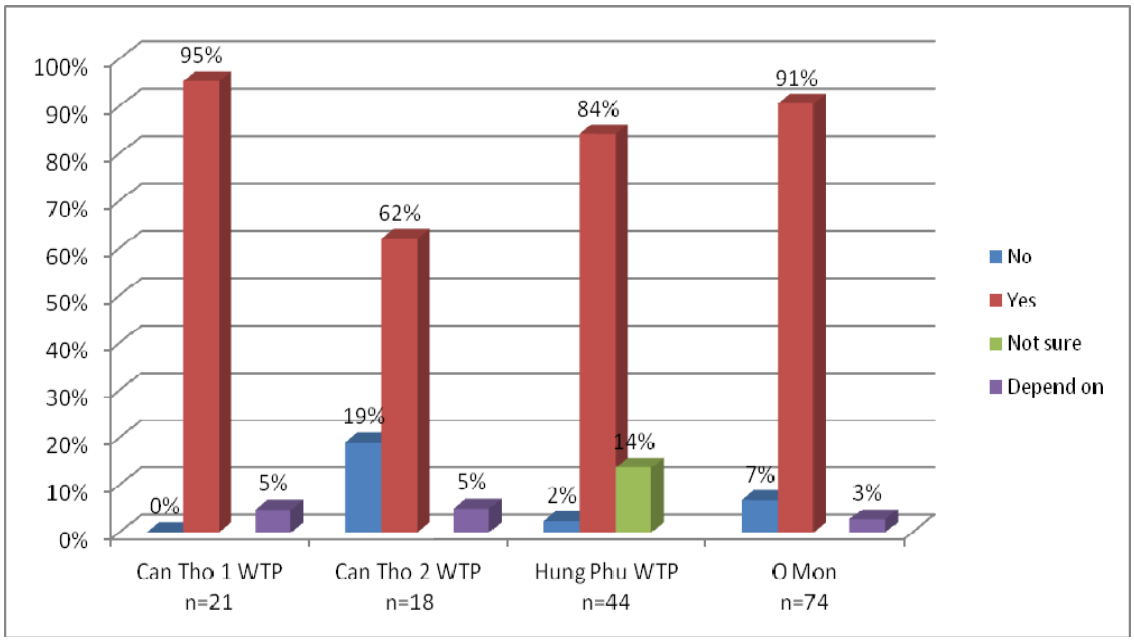
Group	Monthly payment	n	Amount (VND)
Non-WSSC	Total pay of water/ month	**139**	**60,837**
	Operation and maintenance of your own well	103	17,672
	Bottled water	93	63,602
	Monthly fee per capita	139	15,193
	Average tariff/m3	142	11,006
CERWAS	Total pay of water	**27**	**70,056**
	Monthly fee pay for CERWAS	26	41,250
	Operation and maintenance of your own well	4	10,250
	Bottled water	16	45,813
	Monthly fee per capita	27	16,052
	Average tariff/m3	27	5,392
Can Tho WSSC	Total pay of water	**332**	**98,130**
	Monthly fee pay for WSSC	332	85,494
	Operation and maintenance of your own well	8	17,125
	Bottled water	94	41,894
	Monthly fee per capita	332	22,651
	Average tariff/m3	332	4,598

Source: JICA Study Team

5.3 Awareness and Willingness to Pay to the Water Supply Service

5.3.1 Willingness to connect and pay to WSSC water system

Figure 2-10 shows the willingness of households to connect to a new WSSC system. In general, more than 70% of interviewed household are happy to be provided piped water by the WSCC. In the area served by Can Tho 1 WTP, 95% of unconnected households are willing to connect whereas 91% (n=67) of those in O Mon are ready to use WSCC water. In addition to this, about 5% of those in the areas served by Can Tho 1 WTP, Can Tho 2 WTP and 3% in O Mon WTP reported that their decision is depended on either quality of the service or connection fee. On the other hand, 19% of sample households in Can Tho 2 WTP, 2% in Hung Phu WTP and 7% in O Mon WYP thought the connection to WSCC network is not necessary since they have another source that provides sufficient and quality water for their demand (well water) or just because of high cost of first connection (n=10 HHs in total).



Source: JICA Study Team

Figure 2-10. Willingness to connect to WSSC network of households

Regarding to the amount that local people willing pay for connecting to WSSC network, about 65% of 147 surveyed households accepted the rank from 900,000 to 1,200,000 VND for connection cost meanwhile 6% (n=9) agreed the amount that was around more than 1,500,000 VND for the first connection. About 12% (n=) want to conntect WSSC with the first connection fee less than 900,000VND. Among 13 households who currently do not pay for any cost of water uses (mainly use river/pond water directly) 61.5% (n=8) are willing to pay for the first connection at the rate between 900,000-1,200,000 VND (Table 2-19).

Table 2-19. Amount those willing to connect are able to pay for the first connection

Amount (VND)	Total HHs willing to connect	HHs already paid for water use	HHs who does not paid for water use
	N=147	*N=134*	*N=13*
Less than 900,000	12.2%	13.4%	0.0%
900,000 - 1,200,000	64.6%	64.9%	61.5%
1,200,000 - 1,500,000	17.0%	16.4%	23.1%
1,500,000 - 1,800,000	2.0%	2.2%	0.0%
1,800,000 - 2,000,000	2.7%	2.2%	7.7%
2,000,000 - 2,300,000	0%	0%	0%
More than 2,300,000	1.4%	0.7%	7.7%

Source: JICA Study Team

Table 2-20 shows the amount that households willing to connect felt that they afford to pay for water on a monthly basis. In general, more than 70% of households through districts accept the cost of water use less than 54,000 dong per month. This is rather less than the average monthly amount paid for WSSC water (85,494 VND) by already connected households and current payment for water use of non-WSSC households (60,837 VND) (Table 2-17). For households who have to pay for water uses either purchasing bottle water or operation and maintenance of their own wells only 27% (n=36) agreed to pay equal or more than their current payment. However, 12% of those who doing business or being

higher family member could pay more than 94,500 VND/month. This figure is higher than the average monthly cost of household who already connected to Can Tho WSSC. Among 13 households who used river/pond water and do not pay for any cost, 84.6% afford to pay for the amount less than the average amount of non-WSSC have to pay every month.

Table 2-20. Amount those willing to connect are able to pay for monthly use of water

Amount (VND)	Total HHs willing to connect	HHs already paid for water use	HHs who does not paid for water use
	N=147	*N=134*	*N=13*
18,000 - 31,500 (4-7m3)	29.3%	26.9%	53.8%
36,000 - 54,000 (8-12m3)	44.9%	46.3%	30.8%
58,500 - 67,500 (13-15m3)	9.5%	9.0%	15.4%
72,000 - 90,000 (16-20m3)	5.4%	6.0%	-
94,500 - 112,500 (21-25m3)	7.5%	8.2%	-
more than 117,000 (more than 25m3)	3.4%	3.7%	-
Total	100%	100%	100%

Source: JICA Study Team

It is noted that 145 households out of 147 households who willing to connect to Can Tho WSSC usually use less than 12m^3/month with an average of 2.88m^3/month . This amount water consumption is equal to the cost of less than 54,000VND/month.

5.3.2 Awareness on water-related health problems

Table 2-21 shows interviewees' responses to an open question asking what health problems they believed could be the effects of using water. The proportion of households who reported that there are no member in their households suffered any water-born diseases were 95.8% for people how use water served by Can Tho WSSC Overall, about 92.6% of household who use CERWAS's eater and 82.8% of households who does not use piped water. Proportion of people who suffered water-born disease from the area who does not use piped water was quite high, accounting for 19.1%. The most popular water-born diseases that local people recorded are mild diarrhea, severe diarrhea and skin disease.

Table 2-21. Awareness of effect of water quality on health

Water supplier / Water-born disease	Non-WSSC	CERWAS	WSSC
	n=157	n=27	n=332
Mild diarrhoea	7.0%	-	0.6%
Severe diarrhoea/dysentery	2.5%	-	-
Eye diseases	-	-	0.3%
Skin diseases	9.6%	3.7%	0.9%
Don't know	1.9%	3.7%	2.1%
Don't have	82.8%	92.6%	95.8%

Note: Multiple responses possible
Source: JICA Study Team

It can be seen from the Table 2-22 that people who use water served by Can Tho WSSC have lower proportion of illness related to bad water causes. People who do not use piped water have suffered high risk of water-born diseases, 25 cases or 15.9% while only 10 cases or 3% of those who used WSSC experienced with these diseases.

Table 2-22. Number of cases of illness caused by bad water over last 12 months

Water supplier / Opinion	Non-WSSC N=157	CERWAS N= 27	WSSC N=332
No	129	23	316
Yes	25	3	10
Don't know	3	1	6

Source: JICA Study Team

dingly, people should use water served by Can Tho WSSC to reduce the cost for treatment of water-born diseases. It is not only cost saving but also time saving for local people.

It is noted that number of cases of water-born diseases reported for 2011 and the first six months of 2012 in the surveyed areas is quite high2. Even though dengue was not reported by any interviewed households, at least 164 cases of dengue fever were reported in An Binh (28), An Thoi (22), Hung Thanh (11), Hung Phu (16), Hung Loi (30), Chau Van Liem (15), Long Hoa (14) and Long Hung (28).

Over last 12 months, 33 cases of infected illness were reported, of which 30 cases have sought treatment. Among 24 households reported that they suffered from some water-born disease such as mild diarrhoea and skin diseases and spent money for treatment, households who do not use piped water accounting for 83.3% total households with the average mount paid for treatment about 346,750 VND and ranged from 20,000 to 1,000,000 VND/year. This is the highest average amount paid by households to treat infected illness for the last 12 months. For households who used water served by WSSC, only three cases were reported with an average amount of 173,333 VND/year and ranged between 70,000 and 360,000 VND/year (Table 2-23).

Table 2-23. Amount paid by households to treat infected illness for last 12 months

Water supplier	Number of HHs	Lowest amount	Average	Highest amount
Non-WSSC	20	20,000	346,750	1,000,000
CERWAS	1	62,000	62,000	62,000
WSSC	3	70,000	173,333	360,000

Source: JICA Study Team

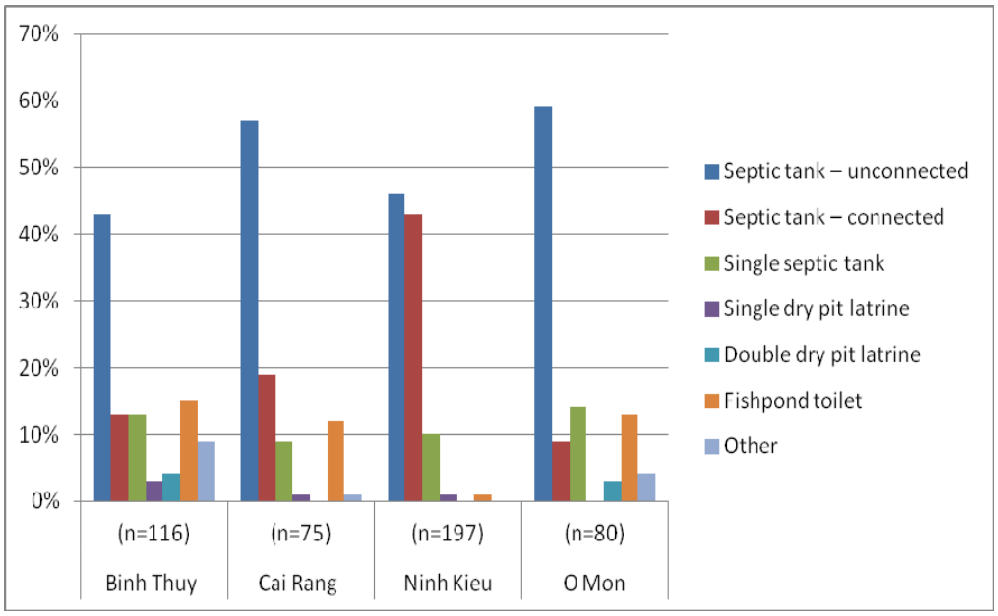
5.4 Sanitary Conditions and Awareness

5.4.1 Sanitary conditions

Among 468 households responded to sanitary conditions, it was found that most of surveyed households (89%) have own toilet of which 49% of them were using septic tank - unconnected to public discharge system and 26% use the connected type. Except in Ninh Kieu percentage of interviewed household still using fishpond-toilet is still high, occupying while other 5% use15%, 12% and 13% in Binh Thuy, Cai Rang and O Mon respectively (Source: JICA Study Team

Figure 2-11).

2 2011 Annual reports and the first six months reports on socio-economy of An Binh, An Thoi, Hung Thanh, Hung Phu, Hung Loi, Chau Van Liem, Long Hoa and Long Hung Wards.



Source: JICA Study Team

Figure 2-11. Percentage of households using different types of toilet

5.4.2 Disposal of household waste

(1) Discharge of waste water

It was estimated that only one third of interviewed households discharged waste water to the public sewer pipes system in which 68% of them was in Ninh Kieu, 13% was in Binh Thuy and only 6% of respondents in O Mon and Cai Rang discharge the waste water to public sewer network (Table 2-24). In the new urban district such as O Mon, Cai Rang and Binh Thuy, over two third of interviewed households discharge waste water directly to river/stream. This issue may relate to habit of local people or no sewer piped system in those regions.

Table 2-24. How people discharge waste water

% of HHs discharge waste water	**Ninh Kieu** (n=201)	**O Mon** (n=109)	**Cai rang** (n=80)	**Binh Thuy** (n=125)	**Total** (n=515)
To the public sewer pipes	68%	6%	6%	13%	32%
To the garden	6%	19%	19%	14%	13%
To ponds	1%	3%	11%	8%	5%
To river/stream	25%	69%	64%	65%	50%
Others (direct to the ground through a slump)	0%	3%	0%	1%	1%
Total	100%	100%	100%	100%	100%

Source: JICA Study Team

(2) Discharge of garbage/household waste

The survey showed that just over half of interviewed households (about 60%) disposed the household waste to the provincial collection system. Follow by this, approximately 20% of respondents in the four districts chose to burnt their waste whereas 12% of respondents thrown the waste either to the street or to their garden (Table 2-25).

Table 2-25. The ways households dispose garbage/household waste

	Collected from house	Collected from public bin	Burnt	Burried	Thrown away	other
Ninh Kieu (n=201)	89.6	1.5	6.5	0.0	2.0	0.5
O Mon (n=110)	36.4	17.3	17.3	3.6	20.0	5.5
Cai Rang (n=80)	42.5	1.25	36.25	5	15	0
Binh Thuy (n=124)	35.5	8.1	26.6	4.8	19.4	5.6
Total (n=515)	57.9	6.4	18.3	2.7	12.0	2.7

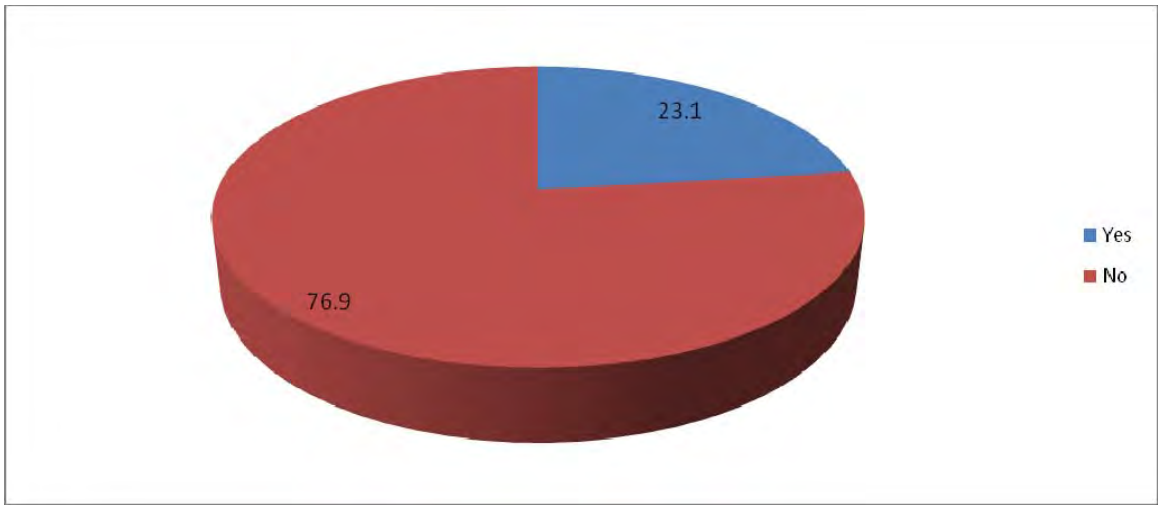
Source: JICA Study Team

In general, the households in Ninh Kieu district seemed to dispose the garbage/waste better than those in other three districts. People in O Mon and Binh Thuy tended to throw away their garbage/waste than other districts (about 20%). It might originate from people awareness as well as the development of public disposal system. People who live in Cai Rang, Binh Thuy and O Mon seem to live in open land so that they chosen to burnt house waste.

5.4.3. Water-related hazards

(1) water-related hazards in the past 5 years

Regarding to water related hazards in the surveyed area for the past 5 years, 76.9% interviewed household reported that they have no experience about these issues while 23.1% of them do have experience about water related hazards (Source: JICA Study Team Figure 2-12).



Source: JICA Study Team

Figure 2-12. Response of interviewed HHs about water related hazards in the past five years

In total of 119 persons who reported that they have experience with water-related hazards, only three people said that the hazard cause of water outage, two of them live in An Khanh Ward, Ninh Kieu district and one live in Chau Van Liem Ward of O Mon district, but did not inform for how long. The later one are not connected to WSSC and their opinion about

water outage seems to be misunderstood . Except 4 households did not provide detail information, 112 persons reported the inundation above floor level. Depended on area, the highest flood level varied from 40cm in O Mon to 150cm in Binh Thuy district (Table 2-26). The household reporting highest level of 150cm in An Thoi Ward of Binh Thuy district lives near the river. The second highest level in the same district is only 50cm.

Table 2-26. The highest flood level (cm) in the surveyed areas in the past five year

Districts	highest flood level (cm)
Ninh Kieu (n=44)	**50**
O Mon (n=27)	**40**
Cai Rang (n=19)	**50**
Binh Thuy (n=21)	**150**

Source: JICA Study Team

6. Conclusion

Can Tho City is one of the most important hubs on economy, culture, and science in the Mekong Delta area. The development of the city with construction of industrial zones, residential areas… is closely connected to the clean water and environmental sanitation issues. As consequences, any improvement in water supply system and sanitation is not only responded by local residents but also supported by local government.

Majority of currently unconnected households across Ninh Kieu, Binh Thuy, Cai Rang and O Mon of Can Tho City said that they would connect to the Can Tho WSSC system. The major factor that has influenced the decision of householders living in these areas not connect has been the long distance from their house to the current piped line and therefore, it is costly for connection. Households who already have another satisfactory source of water for all household needs are also do not want to contact to Can Tho WSSC piped water.

One of the main motivating factors underlying the desire for access to piped water is convenience. The majority of households surveyed who were not connected to the WSC system used wells with electric pumps as their main source of water for domestic use, supplemented by bottled water for drinking and river/pond water for washing. Generally, users found the quality and quantity of their well water mostly satisfactory, only few issues like water-born diseases were reported. While households who connecting to WSSC paid monthly fee higher than other households, the average tariff/m^3 was just half of those paid by non-WSSC households.

On the other hand, people using other sources of water (drilled wells) have paid not only for drilling and pump investment but also for electricity cost for pumping water from well. Over a half of the households using well had to buy bottled water for drinking and even cooking purposes pushing the cost for monthly water use somewhat double.

People seem to select the lowest cost to be connected to WSSC network at about 900,000 – 1,200,000 dong (65% of the respondents). Poor people tended to pay less for connecting WSSC network. However, monthly water charge was not a real issue as mentioned by interviewees and they could afford to pay for the volume they used.

For connected households, a high percentage of the respondents (81%) was satisfied with the service of the Can Tho WSSC. Nevertheless, among 63 persons (19% of total respondents) who are not satisfactory, low pressure of water is the main reason (50% of unsatisfied respondents), especially An Khanh ward of Ninh Kieu district. Low water quality and water outage several time occupy 32% and 10% respectively. Low water quality is the most concerned issue of interviewed households from area served by Hung Phu WTP and Can Tho 2 WTP. People had complained on color, taste as well as smell of WSSC piped water recently. Not many suggestions were drawn from connected households except some requests on repairing damaged water meter and removing water smell or color or improving water pressure.

Furthermore, response to improvement of WSSC services is weak. For water pressure

improves, only 19 households will increase their water consumption and only 10 households will increase water consumption if the water quality is improved even though this is their main complaint. In contrast, response of interviewed household to the increase of water price is very strong. No one will crease their water consumption but at least 60 household will use less water from WSSC if the price of water going up 10% compared to current price and 148 households will do the same if the price of WSSC water going up 30%.

People in the surveyed areas seem to lack of knowledge on water-born diseases therefore, only few of water-born diseases were reported.

APPENDIX E2 QEUESTIONNAIRE SHEET FOR SOCIAL BASELINE SURVEY

HOUSEHOLD INTERVIEW

CAN THO CITY

QUESTIONNAIRE NO……

This page to be completed by interviewer

Interviewer	
Supervisor	
Date	

ADDRESS OF HOUSEHOLD (Confidential)

Ward/Commune	
Street	
Residence Number	
Owner Name	

1. Please circle the sex of the respondent:

Male…….1
Female…..2

2. Which of the following best describes this type of dwelling?

permanent house……..1
semi permanent house of mixed construction……..2
temporary……..3

Introduction (interviewer should always request the permission to conduct interview prior to conducting the survey).

Hello. My name is_____. This survey is being carried out on behalf of the Can Tho Water Supply and Sewerage Company (WSSC). Thank you for taking the time to answer our questions. The information you give us will be confidential and is for the exclusive use of this project. The aim of this interview is to understand existing living conditions, the demand for water and capacity to pay, so that the appropriate water supply system and sanitation facilities can be provided in the future.

A GENERAL INFORMATION

	How many people live in this house:	Male	Female
Q1.	Number of adult in this house (from 15 years to 60)		
Q2.	Number of senior citizens in this house (over 60)		
Q3.	Number of children in this house (younger than 15 years)		
Q4.	Is anyone in this house disabled or chronically ill (if so, please insert number)		

Q5. Is the head of household:
1. *Male*
2. *Female*

Q6. Does any member of the household carry out any income generating activities here in your home?

Multiple responses possible (Probe after each response: Any other?)

1. *No*
2. *Eating place*
3. *Coffee shop*
4. *Backyard cultivation of fruit, vegetable,…..*
5. *Small-scale trade (selling groceries, cigarettes, fruit etc from house)*
6. *Preparation of foodstuffs for sale*
7. *Animal raising and/or fish farming (circle one that apply)*
8. *Other (Please specify) ……..*

Q7.	What is the **TOTAL** monthly income of your household:	
Q8.	How much is your total average monthly expenditure for food, water, electricity, fuel, medicine, education, clothes, footwear, transport, loan payment, house rental)? VND	1. Food 2. Clothing 3. Health 4. Education 5. Water 6. Electricity 7. Communication 8. Gas, fuel, firewood (for cooking) 9. Transport 10. Other (Specify.....) **Total:**

Instruction to interviewers: If interviewees have difficulties in separating different components of expenditures, please ask the total amount first and then try to identify the breakdown. For some expenditure, it may be difficult to identify "monthly" amount. In this case, you can ask a "yearly" expenditure and then divide it by 12 to get the monthly figure.

B PRESENT CONDITIONS OF WATER USE

Q9. Are you connected to the Can Tho Water Supply and Sewerage Company (WSSC)'s piped water? (If yes, check that their piped water comes from WSSC not a private vendor)
1. *No connection to piped water* -----***Go to Q11***
2. *Connected to CERWAS* -----***Go to Q10***
3. *Yes (connected to WSSC)* ----- ***Go to Q10***

Q10. **If connected**: Do you:
1. *have a meter that is not shared with any other house*
2. *do you share a meter with one or more other houses*

Q10a. How long do you use the piped water (how many years)? .....

Q11. **If not connected**, what are your reasons for not connecting to the **WSSC** piped water supply?

Multiple responses possible. ***(Probe after each response: Any other reason?)***

1. *I am using piped water supply by DARD/CERWAS*
2. *The WSSC doesn't have any distribution pipes in this area*
3. *My house is a long way away from the pipes in the street,*
4. *Cost of connection is too high,*
5. *Monthly cost of piped water is too high,*
6. *Quality or quantity of available piped water is not satisfactory,*
7. *Already applied, still waiting to be connected,*
8. *The process of applying for a connection is too complicated*
9. *I have another satisfactory source of water for all my needs (please specify……..)*
10. *Other (Please specify……)*

Q12. What is the **MAIN** source of water used by your household:

1. **For drinking :**

One response only

1. *WSSC piped water (own or shared meter)*
2. *DARD/CERWAS water (own or shared meter)*
3. *Water piped to your house by a private business*
4. *River/canal/pond/stream*
5. *Tanker*
6. *Your own well*
7. *Your neighbour's well*
8. *A communal well/tap stand*
9. *Bottled water*
10. *Rainwater*
11. *Other (Please specify.....)*

2. **For cooking:**

One response only

1. *WSSC piped water (own or shared meter)*
2. *DARD/CERWAS water (own or shared meter)*
3. *Water piped to your house by a private business*
4. *River/canal/pond/stream*
5. *Tanker*
6. *Your own well*
7. *Your neighbour's well*
8. *A communal well/tap stand*
9. *Bottled water*
10. *Rainwater*
11. *Other (Please specify.....)*

3. **For washing (body and clothes):**

One response only

1. *WSSC piped water (own or shared meter)*
2. *DARD/CERWAS water (own or shared meter)*
3. *Water piped to your house by a private business*
4. *River/canal/pond/stream*
5. *Tanker*
6. *Your own well*
7. *Your neighbour's well*
8. *A communal well/tap stand*
9. *Bottled water*
10. *Rainwater*
11. *Other (Please specify.....)*

WATER CONSUMPTION AND COST		
Q13.	One average, how much water does your household use from different sources each month? (Note: $1m^3$ = 1,000 litres; $1m^3$ is about the size of a household water tank).	**LITRES**
	1. WSSC piped water (own or shared meter)	
	2. DARD/CERWAS water (own or shared meter)	
	3. Water piped to your house by a private business	
	4. Tanker	
	5. Your own or neighbour's well	
	6. A communal well/tap stand	
	7. Bottled water	
	8. River/canal/pond/stream	
	9. Rain water	
	10. Other (Please specify……)	
	Instruction to interviewers: After this question, please calculate the per capita consumption of water based on the family size and water use. The average per capita consumption in Can Tho is about 130-160. If the number is significantly different, please check the answer in Q13 again.	
Q14.	Do you pay for any of the water you use (**not** including cost of constructing, operating wells etc)? *1. No (I don't pay for water I use) –**Go to C.2.*** *2. Yes (I pay for water I use) – **Go to Q15.***	
Q15.	How much do you pay for water **per month** for:	
	1. WSSC piped water (own or shared meter)	VND
	2. DARD/CERWAS water (own or shared meter)	VND
	3. Water piped to your house by a private business	VND
	4. Tanker	VND
	5. Operation and maintenance of your own well	VND
	6. Water from your neighbour's well	VND
	7. Use of a communal well/tap	VND
	8. Bottled water	VND
	9. Other (Please specify……)	VND

C. QUALITY OF WATER AND SERVICE: WSSC PIPED WATER ONLY
IF HOUSEHOLD DOES NOT HAVE OWN WC CONNECTION, GO TO C.2

***** If households are using DARD/CERWAS connection, please ask question in both C.1 and C.2. *****

C.1. Satisfaction level to the service

Q16. From **your** household's experience, are you satisfied with the Can Tho Water Supply and Sewerage Company's service?

1. No
2. Yes

Q16a.If no (unsatisfied), please explain the reasons (select all that apply):

1. too many disruptions to supply
2. Water pressure is too weak
3. Water quality is poor
4. too much leakage
5. the time they take to make connections after applications have been made
6. problems with meter readings, billing or cash collection
7. slow in carrying out repairs
8. lack of warning about disruptions to supply for repairs
9. slow staff respond to queries and customer complaints
10. other (please specify...)

Q17. How many hours per day is WSSC water usually available from your tap?

1. *24 hours*
2. *18-23 hours*
3. *12-17 hours*
4. *6-11 hours*
5. *< 6 hours*

If your answer is 3, 4 or 5, please answer 17a.

17a. What do you do when the tap water is not available? (choose one that applies

1. I have water storage tank at home in case tap water is not available
2. I will wait until tap water becomes available (do not use water during supply disruption)
3. Other (please explain)

Q18. Is your WSSC water pressure:

1. *Strong*
2. *Weak* ---------- ***please go to Q18a***
3. *Varies but usually strong*
4. *Varies but usually weak* ---------- ***please go to Q18a***
5. *Other (Please specify...)*

Q18a. What do you do when you face this problem? (please choose one that applies)

1. I have installed a pump to improve water pressure (and I pay .... VND for monthly operating cost of the pump)
2. I use alternative sources of water (river/canal water etc.)
3. Other

Q19. Does your WSSC piped water ever have a bad taste?

1. *Never*
2. *Rarely*
3. *Sometimes*
4. *Usually*

Q20. Does your WSSC piped water ever have a strong smell?

1. Never
2. Rarely
3. Sometimes
4. Usually

Q20a. What kind of smell? If you can specify, please explan .....

Q21. Does your WSC piped water ever have a bad colour?

1. Never
2. Rarely
3. Sometimes
4. Usually

Q22. Do you drink tap water directly (without boilng)?

1. Never
2. Rarely
3. Sometimes
4. Usually

Q23. Do you have suggestions to the Can Tho Water Supply and Sewerage Company to improve their service? .....
.....
.....

Q24. You will use more/less water from WSSC pipe if:

	More	Less	Same/ don't know
1. the service is available 24h/day without disruption			
2. water pressure improves			
3. the quality of water (taste, smell) improves			
4. the price of WSSC water goes up by **10%**			
5. the price of WSSC water goes up by **30%**			
6. your income goes up by 20%			
If interviewees answer "less" in any of the question above, please go to **Q25**. Otherwise, go to **C2**			

Q25. If you are going to use less water from WSSC pipe, what you will do (please choose one)?
1. My household simply reduces consumption of water (no substitution)
2. My household will use water from different sources (please specify: well, bottled water etc....)

C.2 **WILLINGNESS TO PAY TO THE WATER SUPPLY SERVICE**
PLEASE ASK THESE QUESTIONS ONLY IF RESPONDENT IS **NOT** CONNECTED TO WSSC

Q26. If the WSSC provides good quality and reliable piped water to your residential area 24 hours a day, will you connect?
1. No – **Why not** .....
2. Yes - **Go to next**
3. Not sure – **Go to next**
4. Depends on .....

Q27. Which of the following amounts would your household be willing and able to pay in order to connect? **(Interviewer, please read out the amounts in turn, and tick those the respondent would be willing and able to pay.)**

1. 900,000 – 1,200,000VND
2. 1,200,000 – 1,500,000VND
3. 1,500,000 - 1,800,000VND
4. 1,800,000- 2,000,000VND
5. 2,000,000- 2,300,000VND
6. >2,300,000VND

Q28. Which of the following amounts is the maximum your household could afford to pay per month for good quality and reliable piped water 24hrs a day. **(Note to interviewer: Please do not read out the m^3 at this stage, just the amount in dong.)**

1. *18,000 – 31,500VND (approx. 4 - 7 m3)*
2. *36,000 – 54,000VND (approx.8 - 12 m3)*
3. *58,500 – 67,500VND (approx. 13 - 15 m3)*
4. *72,000 – 90,000VND (approx. 16 - 20 m3)*
5. *94,500-,112,500VND (approx. 21 - 25m3)*
6. *More than 117,000VND (more than 25 m3)*

Q29. When you consider connecting to WSSC piped water, what are the most important issues for you? Please rank the following in order of importance.
1. Price; 2. Water quality; 3. Reliability of service

If the interviewee has no preference, leave this question blank.

D. SANITARY CONDITIONS AND AWARENESS

Q30. What health problems do you believe can be influenced by the water used? **Note to interviewer: Please do not read the list or make any suggestion. Just circle whichever of the following health problems the respondent mentions. However, please use the 'Any other' probe.**
(Note in instruction – this question is asking about knowledge of links between water and health in general, not about respondent's own water) **Multiple responses possible**

1. *Mild diarrhoea*
2. *Severe diarrhoea / dysentery*
3. *Eye diseases*
4. *Skin diseases*
5. *Internal parasites*
6. *Malaria or dengue fever*
7. *Typhoid or cholera*
8. *Gynaecological problems/reproductive tract infection*
9. *Hepatitis A*
10. *Other (Please specify:……..)*
11. *Don't know*

Q31. Do you think bad water quality has caused any illness in your family in the past twelve months?

1. *No*
2. *Yes*
3. *Don't know*

Q32. Which of the following illnesses has affected member of your household in the last twelve months?

Please tick box

		Adult (inc. Senior citizen)	Child	Total no. in household who sought treatment from a health care provider for this illness
1	Mild diarrhoea			
2	Severe diarrhoea (cannot go to work or school)/dysentery			
3	Eye diseases			
4	Skin diseases			
5	Internal parasites			
6	Malaria or dengue fever			
7	Typhoid or cholera			
8	Gynaecological problems/ reproductive tract infection			
9	Hepatitis A			

Q33. If any person in the household sought treatment from a health care provider, what was the total amount of money the household paid for medical care for all members with the above illnesses during the last 12 months?
(check: was all this amount only spent on treatment for household members with one or more of above illnesses)

…….VND

Q34. Does this household have its own TOILET?

1.No
2.Yes – Go to next

Q35. **If household has its own toilet**: Which of the following best describes the toilet?

1. Septic tank - unconnected
2. Septic tank – connected
3. Single septic tank
4. Single dry pit latrine
5. Double dry pit latrine
6. Fishpond toilet
7. Other (specify) ……

Q36. **How do you discharge wastewater from your house?**

1. *To the public sewer pipes*
2. *To the garden*
3. *Ponds*
4. *River, streams*
5. *Other (specify) ……..*

Q37. How do you dispose of your household garbage?
Multiple responses possible

1. *Collected from house*
2. *Collected from public bin*
3. *Burnt*
4. *Buried*
5. *Thrown away*
6. *Other (specify)* ……..

E WATER RELATED HAZARDS

Q38. Have you experienced any water-related hazards in the past 5 years (flood, etc)?

1. No.
2. Yes

If yes, please ***go to Q39***

Q39. In each of the water-related hazard you experienced, please answer the following.

1. Did the hazard cause disruption of water supply? If yes, for how long?
2. In case of inundation above floor level, what is the highest water level?

THANK YOU VERY MUCH FOR PARTICIPATING IN THIS SURVEY.

APPENDIX E3 OUTLINE OF THE PRELIMINARY ENVIRONMENTAL IMPACT ASSESSMENT

APPENDIX E4 OUTLINE OF THE ABBREVIATED RESETTLEMENNT PLAN