

## **APPENDICES**

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# APPENDIX A

## RESEARCH DESIGN AND PROCESS

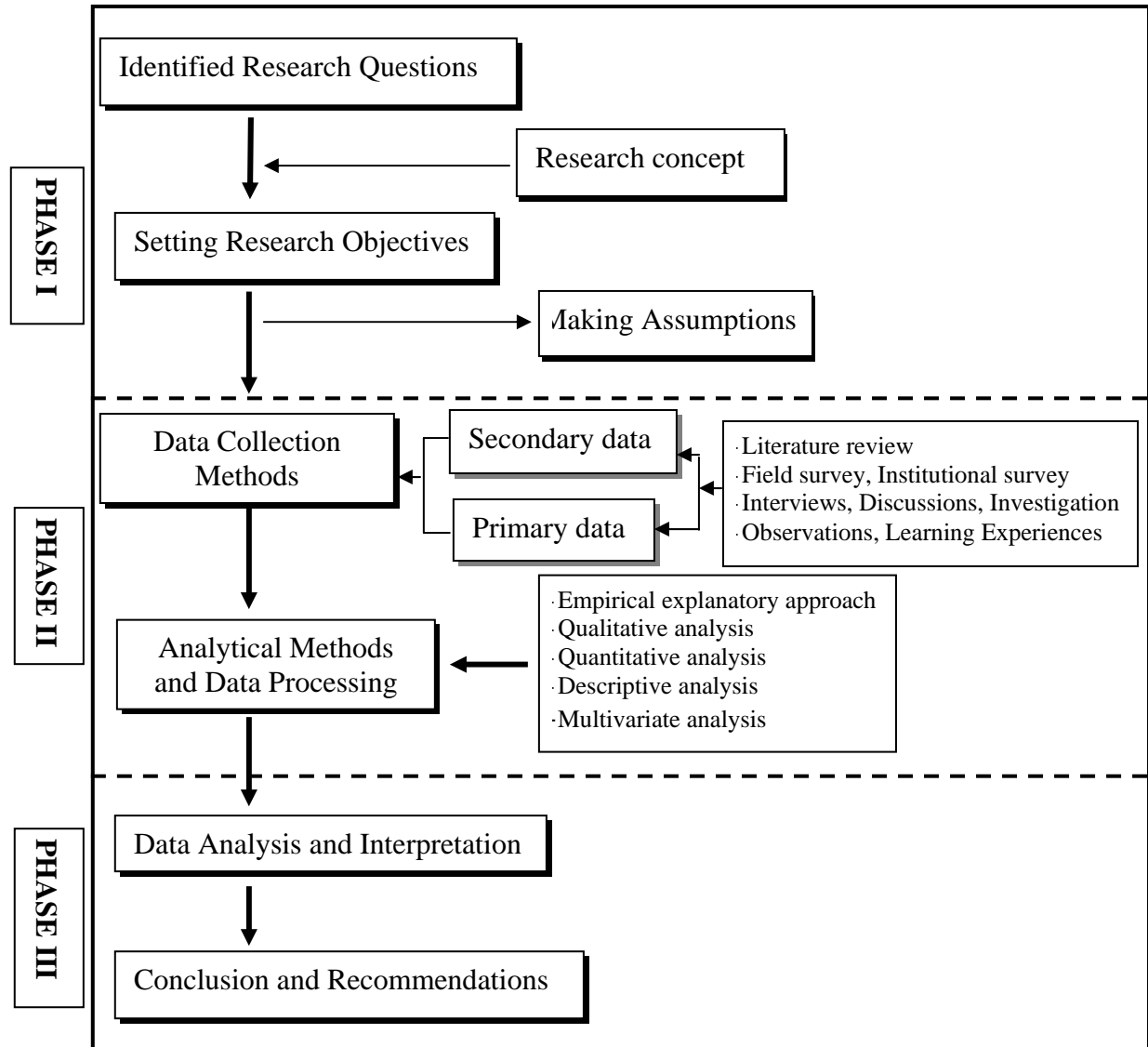


Figure 1: Research Design and Process

## APPENDIX - B

### ORGANIZATION CHARTS AND AVAILABLE DATA INFORMATION

**Table 1: Effective Water Tariff in PUB, Singapore**

Tariff Category	Consumption Block (m <sup>3</sup> /month)	Before 1 July 1997			Effective 1 July 1997		
		Tariff (¢/m <sup>3</sup> )	WCT (%)	WBF (¢/m <sup>3</sup> )	Tariff (¢/m <sup>3</sup> )	WCT (%)	WBF (¢/m <sup>3</sup> )
Domestic	1 to 20	56	0	10	73	10	15
	20 to 40	80	15	10	90	20	15
	Above 40	117	15	10	121	25	15
Non-domestic	All units	117	20	22	117	25	32
Shipping	All units	207	20	-	199	25	-

Tariff Category	Consumption Block (m <sup>3</sup> /month)	Effective 1 July 1998			Effective 1 July 1999			Effective 1 July 2000		
		Tariff (¢/m <sup>3</sup> )	WCT (%)	WBF (¢/m <sup>3</sup> )	Tariff (¢/m <sup>3</sup> )	WCT (%)	WBF (¢/m <sup>3</sup> )	Tariff (¢/m <sup>3</sup> )	WCT (%)	WBF (¢/m <sup>3</sup> )
Domestic	1 to 20	87	20	20	103	25	25	117	30	30
	20 to 40	98	25	20	106	30	25	117	30	30
	Above 40	124	35	20	133	40	25	140	45	30
Non-Domestic	All units	117	25	42	117	30	51	117	30	60
Shipping	All units	199	25	-	192	30	-	192	30	-

Source: PUB, 2005

Note: WCT= Water Conservation Tax: Levied by the Government to reinforce the water conservation message

WBF= Water Borne Fee and Sanitary Appliance Fee (SAF): Statutory charges prescribed under the statutory Appliances and water charges regulation to offset the cost of treating used water and for the maintenance and extension of the public sewerage system. SAF is S\$3per sanitary fitting per month.

WBF and SAF charges are inclusive of goods and services tax.

**Table 2: Population Density in each Townships and Districts of Yangon City**

<b>District Name</b>	<b>Township Name</b>	<b>Total Area (ha)</b>	<b>Population (persons)</b>	<b>Number of HHs</b>	<b>Avg. Family Size</b>	<b>Density</b>
<b>District (East)</b>	Dagon Myothit East	9,103.30	99,241	13,630	7.28	10.90
	Dagon Myothit North	2,627.60	82,721	18,646	4.44	31.15
	Dagon Myothit Seikkan	8,530.50	22,922	6980	3.28	2.69
	Dagon Myothit South	7,911.20	200,026	39,551	5.06	25.28
	North Okkalapa	2,825.69	242,522	48,773	4.97	85.83
	South Okkalapa	770.01	192,977	44,704	4.32	250.62
	Thingangyun	1,149.96	178,673	37,720	4.74	155.37
<b>District (North)</b>	Hlaing	1,370.11	125,473	27,899	4.49	91.58
	Hlaingthaya	6,736.60	192,430	37,551	5.12	28.57
	Insein	3,501.70	218,402	48,856	4.47	62.37
	Kamayut	621.60	72,705	14,348	5.07	116.96
	Mayangone	2,533.50	139,090	28,974	4.80	54.90
	Mingalardon	10,728.00	170,950	27,590	6.20	15.93
	Shwepyitha	3,936.80	148,620	29,508	5.04	38.17
<b>District (South)</b>	Botataung	238.28	41,561	8,064	5.15	153.23
	Dala	2,830.90	80,721	16,275	4.96	25.96
	Dawbon	367.78	67,228	13,841	4.86	188.97
	Mingalartaungnyunt	506.35	97,465	18,431	5.29	192.49
	Pazundaung	101.27	31,166	6,806	4.58	307.75
	Seikan Port		0	0	0	
	Seikkyi Kanaungto	585.34	21,106	4,616	4.57	43.00
	Tarmwe	4,408.18	98,797	19,925	4.96	22.19
	Thaketa	1,301.22	213,944	44,084	4.85	153.39
	Yankin	502.98	77,685	12,946	6.00	172.83
<b>District (West)</b>	Ahlone	362.60	41,718	7,643	5.46	114.75
	Bahan	1,165.50	81,868	16,337	5.01	273.82
	Dagon	1,165.50	38,144	7,087	5.38	3.14
	Kyauktada	64.75	36,708	6,733	5.45	557.56
	Kyeemyindaing	559.44	74,343	15,618	4.76	130.73
	Lanmadaw	140.64	41,482	7,394	5.61	294.95
	Latha	81.00	27,000	6,600	4.09	338.84
	Pabedan	39.00	39,360	6,505	6.05	518.60
	Sanchaung	246.05	63,161	13,813	4.57	273.82

Population and the number of households are unofficial data of YCDC Headquarters (2002)

**Table 3: Population in each Townships and Districts of Yangon City Year 1973-1998**

District Name	Township Name	Population (persons)		
		1973	1983	1998
<b>District (East)</b>	Dagon Myothit East	-	-	55,192
	Dagon Myothit North	-	-	101,673
	Dagon Myothit Seikkan	-	-	18,279
	Dagon Myothit South	-	-	140,387
	North Okkalapa	155,259	190,905	289,068
	South Okkalapa	149,409	183,264	220,214
	Thingangyun	141,209	194,100	240,417
<b>District (North)</b>	Hlaing	131,587	167,687	167,881
	Hlaingthaya	-	-	199,190
	Insein	143,625	196,809	240,704
	Kamayut	67,309	75,177	82,943
	Mayangone	108,749	152,616	183,024
	Mingalardon	80,867	108,303	170,950
	Shwepyitha	-	-	172,377
<b>District (South)</b>	Botataung	44,057	49,168	52,653
	Dala	43,503	54,167	77,236
	Dawbon	37,439	49,967	79,582
	Mingalartaungnyunt	96,287	110,435	109,796
	Pazundaung	34,763	38,306	38,363
	Seikan Port	7,732	5,285	1,379
	Seikkyi Kanaungto	12,458	15,393	25,586
	Tamwe	106,682	119,914	128,455
	Thaketa	145,888	193,028	279,799
	Yankin	68,818	82,646	107,195
<b>District (West)</b>	Ahlone	46,547	51,849	43,569
	Bahan	85,757	102,112	95,114
	Dagon	35,746	35,541	39,967
	Kyauktada	37,772	37,634	44,076
	Kyeemyindaing	64,145	69,866	87,491
	Lanmadaw	42,691	41,663	40,597
	Latha	31,646	31,061	32,535
	Pabedan	40,718	41,913	47,461
	Sanchaung	66,593	68,867	78,788
<b>Total</b>		2,027,256	2,467,676	3,691,941

Source: YCDC 2002

**Table for Statisticians (Herbert Arkin and Raymond R. Colton, 1950)**

**Table 4: Table of Sample Size Required for Finite Population for Confidence Limits  
and Specified Reliability Limits in Sampling Attributes in Percent.  
95% Confidence Interval (0.05)**

<b>Number of Sampling Size for Reliability of Population</b>						
<b>Occupied DU's in Area</b>	<b>+ - 1%</b>	<b>+ - 2%</b>	<b>+ - 3%</b>	<b>+ - 4%</b>	<b>+ - 5%</b>	<b>+ - 10%</b>
500					222	83
1,000				385	286	91
1,500			638	441	316	94
2,000			714	476	333	95
2,500		1,250	769	500	345	96
3,000		1,364	811	517	353	97
3,500		1,458	843	530	359	97
4,000		1,538	870	541	364	98
4,500		1,607	891	549	367	98
5,000		1,667	909	556	370	98
6,000		1,765	938	566	375	98
7,000		1,842	959	574	378	99
8,000		1,905	976	580	381	99
9,000		1,957	989	584	383	99
10,000	5,000	2,000	1,000	588	385	99
15,000	6,000	2,143	1,034	600	390	99
20,000	6,667	2,222	1,053	606	392	100
25,000	7,147	2,237	1,064	610	394	100
50,000	8,333	2,331	1,082	617	397	100
100,000	9,031	2,439	1,099	621	398	100
&	10,000	25,000	11,111	625	400	100

95 % Confidence Interval means that we have a 95% probability of being “correct” and only 5% of being “wrong” if we make 100guesses.

**Table 5: Specification of Transmission Pipes**

Name	Pipe Material	Diameter	Length (km)	Operation Starting Year
Gyobyu Pipe	Mild Steel Pipe	1,400 mm (56 inch)	68.6	1940
Phugyi Pipe	Pre-stressed RC Pipe	1,500 mm (60 inch)	25.9	1988
Hlawga Pipe (No.1)	Cast Iron Pipe	1,050 mm (42 inch)	22.9	1904
Hlawga Pipe (No.2)	Pre-stressed RC Pipe	1,650 mm (66 inch)	21.9	1988
Total length of Transmission Main			139.3	

Source: YCDC 2002

**Table 6: Specification of Service Reservoirs**

Name	Dimension	Capacity	H.W.L./L.W.L.*
Kokine Service Reservoir	RC made Semi-underground reservoir <sup>L</sup> 90.2 m x <sup>W</sup> 85.2 m (widest) x 6.1 m x 2 units	90,900 m <sup>3</sup> (20 MG)	+42.7 m/+36.6 m (above MSL)
Shwedagon Sevice Reservoir	RC made underground reservoir <sup>L</sup> 19.2 m x <sup>W</sup> 38.8 m x <sup>D</sup> 6.1 m	4,545 m <sup>3</sup> (1 MG)	+40.2 m/+34.1 m (above MSL)
Central Service Reservoir	RC made underground reservoir Dimension is unknown	45,450 m <sup>3</sup> (10 MG)	+40.2 m/+34.1 m (above MSL)

\* H.W.L. = High Water Level, L.W.L. = Low Water Level

Source: YCDC 2002

**Table 7: Distribution of Water Supply Duration and Coverage by Township**

<b>Township</b>	<b>Supply Duration (Hours per Day)</b>	<b>Number of Wards with Water Supply to Total Wards Number</b>
Ahlonge	10	10:11
Bahan	15	21:22
Botataung	24-10	10:10
Dagon	8	5:5
Dagon Myothit (East)	No pipe water supply system	0:54
Dagon Myothit (North)	No pipe water supply system	0:25
Dagon Myothit (Seikan)	No pipe water supply system	0:39
Dagon Myothit (South)	6	5:33
Dala	6	3:23
Dawbon	24-16	3:14
Hlaing	<b>24</b>	12:16
Hlaingthayar	4	7:29
Insein	24-2	4:21
Kamayut	12	10:10
Kyauktada	<b>24</b>	9:9
Kyeemyindaing	6	18:21
Lanmadaw	<b>24</b>	11:12
Latha	<b>24</b>	10:10
Mayangone	24-14	8:10
Mingalardon	<b>24</b>	18:31
Mingalartaungnyunt	<b>24</b>	20:20
North Okklapa	24-8	18:19
Pabedan	24-15	11:11
Pazundaung	<b>24</b>	10:10
Sanchaung	5-1	18:18
Seikkan (Port)	No pipe water supply system	0:3
Seikkyi Kanaungto	No pipe water supply system	0:8
Shwepyitha	4	13:21
South Okklapa	24-10	13:13
Tamwe	<b>24</b>	17:20
Thaketa	24-8	17:19
Thinganchaung	24-8	24:38
Yankin	24-18	15:16

Source: JICA Study Team 2002



**Table 8: Water Pressure Condition by Township**

NO.	Address		Source of water	Water supply hours	Water pressure (kg/cm <sup>2</sup> )
	Township	Street			
1	Insein	Thazin st	P	24	1.5
2	Insein	Thukhita st	P	24	0.7
3	Mayangone	Kyauk Wai Pagoda st	P	12	1.0
4	Mayangone	Pyee Rd	P	24	1.0
5	Mayangone	Myaing Hai Win st	P	12	1.5
6	Hlaing	Insein Rd	P	24	1.1
7	Hlaing	Yedaner Mon3 Rd	P	24	1.0
9	North Okkalapa		W	24	0.5
10	North Okkalapa	Thudama st	W	24	1.0
11	Mayangone	Ta Yoke Kyaung st	P	24	1.0
12	North Okkalapa	Parami st	P	24	0.8
13	South Okkalapa				very low
14	Thingangyun	Yadanar Theik Pan st.	P	24	0.5
17	Yankin		P	24	3.0
18	Yankin		P	24	0.9
19	Yankin		P	24	0.7
20	Yankin		P	24	2.0
21	Tamwe		P	24	0.6
22	Tamwe		P	24	0.5
23	Tamwe		P	24	0.6
24	Thingangyun				low
26	Kamayut		P	24	1.0
28	Bahan		P	24	1.5
29	Bahan				0.2
30	Bahan				0.5
33	Dawbon				low
36	Dagon		P,W		low
37	Dagon		P	24	3.0
38	Mingalartaungnyunt		P	24	0.4
39	Botataung		P	24	0.1
40	Pazundaung			24	0.0
41	Botataung				0.0
42	Kyauktada				0.0
43	Kyauktada				0.0
44	Latha				0.0
45	Latha				0.0
46	Lanmadaw		P,W	12	0.1
47	Lanmadaw		P,W,		low
48	Bahan		P	24	1.0
49	Hlaing		P	24	1.0

Note: pipeline (P) or well (W)

Source: JICA Study Team 2002

**Table 9: Water Pressure Condition by Township**

<b>Township</b>	<b>Water Pressure Measurement</b>	<b>Water Pressure Condition</b>
Ahlone	O	x
Bahan	O	o
Botataung	O	x
Dagon	O	x
Dagon Myothit (East)		-
Dagon Myothit (North)		-
Dagon Myothit (Seikan)		-
Dagon Myothit (South)		-
Dala		-
Dawbon	O	X
Hlaing	O	O
Hlaingthayar		-
Insein	O	O
Kamayut	O	X
Kyauktada	O	X
Kyeemyindaing	O	X
Lanmadaw	O	X
Latha	O	X
Mayangone	O	O
Mingalardon		-
Mingalartaungnyunt	O	X
North Okklapa	O	X
Pabedan		-
Pazundaung	O	X
Sanchaung	O	X
Seikkan (Port)		-
Seikkyi Kanaungto		-
Shwepyitha		-
South Okklapa	O	X
Tamwe	O	O
Thaketa		-
Thinganchaung	O	X
Yankin	O	O

o' Appropriate water supply pressure area

x' Low or negative water supply pressure area

- ' No measurement or no water supply system

Source: JICA Study Team 2002

**Table 10: Drinking Water Standard**

Parameters	Unit	Myanmar Standard	WHO Standard
Faecal Coliform	No./100ml	0	0
Coliform Organisms	No./100ml	0	0
Arsenic	mg/l	0.05	0.01
Cadmium	mg/l	0.005	0.003
Chromium	mg/l	0.05	0.05
Cyanide	mg/l	0.05	0.07
Fluoride	mg/l	1.5	1.5
Lead	mg/l	0.05	0.01
Mercury	mg/l	0.001	0.001
Nitrate (as N)	mg/l	10.0	50.0
Nitrite (as N)	mg/l	0.5	3.0
Selenium	mg/l	0.01	0.01
Aluminium	mg/l	0.2	0.2
Chloride	mg/l	200-600	250
Colour	TCU	5-50	15
Copper	mg/l	1.0	2.0
Hardness (as CaCO <sub>3</sub> )	mg/l	500	-
Iron	mg/l	0.5-1.5	0.3
Manganese	mg/l	0.3	0.5
pH	mg/l	6.5-9.2	Preferably<8.0
Sodium	mg/l	200	200
Sulphates	mg/l	400	250
Taste & Odor	mg/l	Inoffensive	No objection
Solid	mg/l	1,000	1,000
Turbidity	NTU	20	5
Zinc	mg/l	5-15	3
Calcium	mg/l	75-200	-
Magnesium	mg/l	30-150	-
Electrical Conductivity	μS/cm	1,500	-

Source: NHC, Ministry of Health 1990

**Table 11: Connection Number**

Township	Number of metered connection					Number of unmetered connection					Total connection					% of metered
	Dmstic	Dptmnt	Com&Ind	Foreign	Total	Dmstic	Dptmnt.	Com&Ind.	Foreign	Total	Dmstic	Dptmnt.	Com&Ind	Foreign	Total	Domestic
1 Ahlone	109		2		111	2,112	38	50	-	2,200	2,221	38	52		2,311	4.9
2 Bahan	1,226		105	17	1,348	4,154	85	80	-	4,319	5,380	85	185	17	5,667	22.8
3 Botataung	755	5	118		878	3,927	100	132	-	4,159	4,682	105	250		5,037	16.1
4 Dagon	207		9	2	218	1,667	40	53	-	1,760	1,874	40	62	2	1,978	11.0
5 Dagon Myothit (East)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6 Dagon Myothit (North)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7 Dagon Myothit (Seikka)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8 Dagon Myothit (South)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9 Dala	408	8	56	-	472				-		408	8	56	-	472	100.0
10 Dawbon	40	1	9	-	50	78	2	17	-	97	118	3	26	-	147	33.9
11 Hlaing	1,075	5	27	-	1,107	1,202	1	2	-	1,205	2,277	6	29	-	2,312	47.2
12 Hlaingthaya	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13 Insein	2,123	18	1,165	-	3,306	204	7	10	-	221	2,327	25	1,175	-	3,527	91.2
14 Kamayut	445	1	21	3	470	1,048	19	40	-	1,107	1,493	20	61	3	1,577	29.8
15 Kyauktada	373	11	172	1	557	5,679	96	212	-	5,987	6,052	107	364	1	6,544	6.2
16 Kyeemyindaing	59				59	1,865	30	24	-	1,919	1,924	30	271	-	1,978	3.1
17 Lanmadaw	1,055	7	115		1,177	4,835	46	249	-	5,130	5,890	53	145	-	6,307	17.9
18 Latha	795	1	36		832	3,924	38	235	-	4,197	4,719	39	136	-	5,029	16.8
19 Mayangone	1,496	1	144	3	1,644	1,966	40	1	-	2,007	3,462	41	412	3	3,651	43.2
20 Mingalardon	795	4	125		926	164	9	11	-	134	961	13	318	-	1,110	82.9
21 Mingalartaungnyunt	2,908	5	214	1	3,128	8,434	74	198	-	8,706	11,342	79	1,269	1	11,834	25.6
22 North Okkalapa	1,556		148		1,704	5,474	72	1,717	-	5,716	7,030	72	139	-	7,420	22.1
23 Pabedan	637	6	95	1	739	5,521	60	1,174	-	6,755	6,158	66	167	1	7,494	10.3
24 Pazundaung	1,452	15	52	-	1,519	4,411	48	87	-	4,546	5,863	63	-	-	6,065	24.8
25 Sanchaung	138		11	-	149	3,175	40	156	-	3,371	3,313	40	-	-	3,520	4.2
26 Seikan (port)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27 Seikkyi Kanaungto	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28 Shwepyitha	1	2	-	-	3	-	-	-	-	-	1	2	-	-	3	100.0

29 South Okkalapa	440	4	76	-	520	4,113	97	121	-	4,331	4,553	101	197	-	4,851	9.7
30 Tamwe	3,062	1	58	1	3,122	11,377	78	107	-	11,562	14,439	79	165	1	14,683	21.2
31 Thaketa	227	1	20	-	248	2,025	61	202	-	2,288	2,252	62	222	-	2,536	10.1
32 Thingangyun	78		8	-	86	85	24	107	-	1,018	963	24	117	-	1,104	8.1
33 Yankin	1,150	5	153	11	1,319	3,780	66	32	-	3,878	4,930	71	185	11	5,186	23.3
Total	22,612	101	2,939	40	25,692	82,020	1,171	3,472	-	86,663	104,632	1,272	6,411	40	112,315	21.6

Note: 26 townships have water connection.,

Dmstic = Domestic customers

Dptmnt = Department customers

Com & Ind. = Commercial and Industrial Customers

Foreign = Foreign customers

Source: YCDC Head Quarter

**Table 12: Government Ministries involved in Water Supply within the Study Area**

<b>Institutions &amp; Organizations</b>	<b>Water related activities</b>	<b>Coverage</b>	<b>Operational Area</b>
Yangon City Development Committee	Planning, construction, O&M and management of reservoirs, ponds, lakes, tube-wells, pipe networks, tanks, pumping stations and other facilities, related machinery and buildings. Actual supply of water for city dweller and industries	100 % to 20% customers in the townships where YCDC has water supply	28 Townships
Ministry of Home Affairs	General Administration Department is responsible for the administration of Peace & Development Councils. PDCs have the responsibility for coordination of all development and social sector activities including water in townships.		
Ministry of Co-operatives (Co-operative Department )	Co-operative societies undertake planning, drilling tube-wells, install and manage water supply systems, provide water to society members, and overall management of water facilities	29 co-operative societies operate 33 tube-wells and distribute water to customers	12 Townships
Ministry of Agriculture & Irrigation (water resources Utilization Department)	Drilling tube-wells at the request of YCDC, other ministries and organizations	Has not drilled in YCDC area	
Ministry of Construction (Dept of Human Settlement & Housing Development)	Issues licence for drilling tube-wells, own and operate 18 tube-wells, provide water to ---- housing estates	Provide water to 20 housing estates and manage their water facilities	14 Townships
Ministry of Hotels & tourisms	Overall planning and coordination relating to hotel water supply, provide assistance and advice in providing water to hotels, coordinate with Ministry of Health for water quality monitoring	Each main hotel has a minimum of one tube-well	Throughout study area
Ministry of Health	Monitoring water quality in private and industry tube-wells, issue certificate of fitness in respect of new tube-wells	All private and industry tube wells at the time of construction. Subsequent quality monitoring is done of wells used by the industry on an annual basis	Throughout study area

Ministry of Industry I	Overall planning and coordination of water supply for heavy industries		
Ministry of Industry II	Overall planning and coordination of water supply for small and cottage industries		
Ministry of Livestock Feed Stuff and Fishery	Operation and maintenance of tube-wells owned by the ministry to provide water to livestock farms under the ministry, fisheries ponds, laboratories, and offices of the ministry.	All farms, laboratories and offices except for offices in Mingalardon and Insein town ships are supplied with own tube-wells.	Insein, Thaketa, Mingalardon, Dagon East, Dagon North

Source: JICA Study Team 2002

**Table 13: Private sector involvement in Water Supply in Yangon City**

Type of Organization	Water-related Activity	Coverage	Operational Area
Individuals	Digging and construction of tubewells and open wells; operate and manage wells to supply water bear the cost of construction and operational cost; sharing and selling water		
Entrepreneurs	Digging and construction of deep tubewells; installation of water supply network to obtain water for domestic use and industries; sharing and selling water; management of private distribution networks; drilling, construction, operate and maintain tubewells; install, operate and manage private water supply systems for individual/groups of houses and industries; water selling to public and restaurants	Provide water needs of 100% of customers in different townships; provide 90% of the plumbing service in the study area	
Private Organization	Digging deep tubewells and install mechanisms to obtain water mainly for industries; manufacture and/or import materials needed for the water service organization including YCDC: stock and sell materials to the public and organizations		Whole area

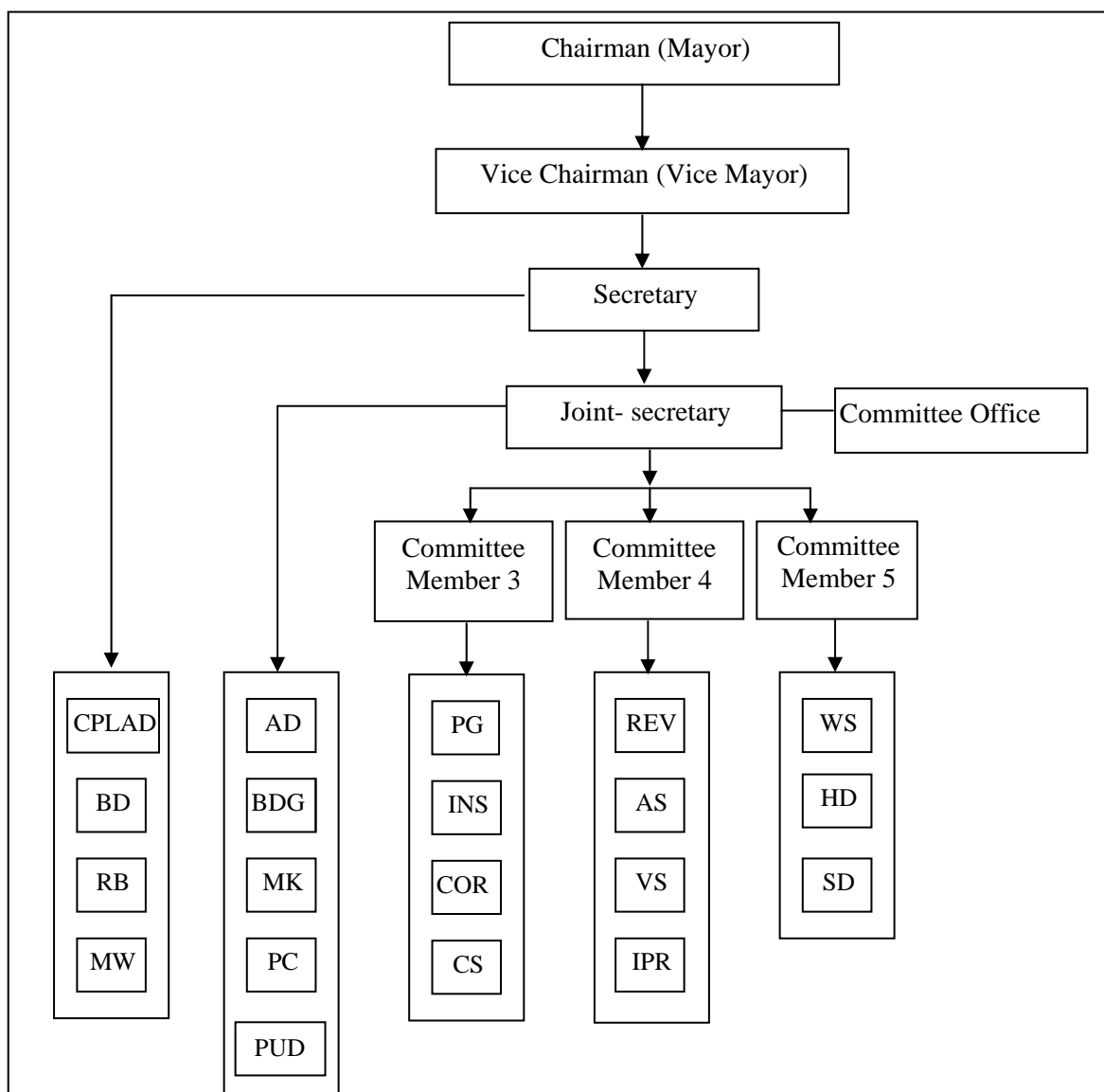
Source: JICA Study Team 2002

**Table 14: Water Supply Activities of other Organization in Yangon City**

Type of Organization	Water-related Activity	Coverage	Operational Area
Township Peace and Development Council (Other)	Coordinate all development and social service activities including water supply in townships/wards; Resolve conflicts relating to water supply/demand; Provide leadership in and organize cleaning of drinking water lakes and adding alum to lakes; Distribute water (bottled) delivered by YCDC to customers	Coordination of activities with YCDC in 28 townships; lake cleaning work in 7 townships; distribute water (bottled) in Seikky Kanantung township	
Ward Peace and Development Council (CBO)	Coordination of development and social sector activities at the ward level; collect data on water sector activities including the numbers of wells and other water services.	Provide water needs of 100% of customers in different townships; provide 90% of the plumbing service in the study area	
Union Solidarity and Development Organization (CBO)	Although the responsibility of this organization is to facilitate development at the grassroots level including water-related activities; provide logistic and organizational support to other organizations; provide information on broken pipes and leaks to supply staff; improve public awareness on water use	Through activities are insignificant scale at present cover the entire study area	Whole area
MSF – Holland (NGO)	Water sector service provision including improvement of hand pumps and water supply work	Hlainghtayar township	

Source: JICA Study Team 2002





CPLAD City Planning & Land Admin. Dept.	PG Playgrounds, Parks & Gardens Dept.
BD Engineering Dept. (Building)	INS Inspection Dept.
RB Engineering Dept. (Road and Bridge)	COR Coordination Dept.
MW Motor Transport & Workshop Dept.	CS Central Store Dept.
AD Administration Dept.	REV Revenue Dept.
BDG Budget Dept.	AS Assessor's Dept.
MK Market Dept.	VS Veterinary & Slaughter House Dept.
PC Pollution Control & Cleansing Dept.	IPR Information & Public Relation Dept.
PUD Production Unit Department	HD Health Dept.
WS Engineering Dept. (Water and Sanitation)	SD Security & Discipline Dept.

Source: YCDC (2004)

**Figure 1: Organization Chart of Yangon City Development Committee**

**Table 15: Group of Township in each District**

<b>District Name</b>	<b>Township Name</b>
<b>District (East)</b>	Dagon Myothit East
	Dagon Myothit North
	Dagon Myothit Seikkan
	Dagon Myothit South
	North Okkalapa
	South Okkalapa
	Thingangyun
<b>District (North)</b>	Hlaing
	Hlaingthaya
	Insein
	Kamayut
	Mayangone
	Mingalardon
	Shwepyitha
<b>District (South)</b>	Botataung
	Dala
	Dawbon
	Mingalartaungnyunt
	Pazundaung
	Seikan Port
	Seikkyi Kanaungto
	Tarmwe
	Thaketa
	Yankin
<b>District (West)</b>	Ahlone
	Bahan
	Dagon
	Kyauktada
	Kyeemyindaing
	Lanmadaw
	Latha
	Pabedan
	Sanchaung

Source: YCDC Head Office, 2006

**Table 16: Domestic Water Consumption by YCDC Water Customers**

Township	lit/cap/day
Dagon Myothit East	0
Dagon Myothit North	0
Dagon Myothit Seikkan	0
Dagon Myothit South	0
North Okkalapa	119
South Okkalapa	148
Thingangyun	127
Hlaing	146
Hlaingthaya	0
Insein	176
Kamayut	194
Mayangone	148
Mingalardon	179
Shwepyitha	0
Botataung	83
Dala	86
Dawbon	111
Mingalartaungnyunt	123
Pazundaung	99
Seikan Port	0
Seikkyi Kanaungto	0
Tarmwe	149
Thaketa	101
Yankin	271
Ahlone	75
Bahan	179
Dagon	173
Kyauktada	109
Kyeemyindaing	97
Lanmadaw	115
Latha	98
Pabedan	110
Sanchaung	109
Sub TOTAL	

Source: JICA, 2001

## APPENDIX C

### QUESTIONNAIRES AND CHECKLIST

#### **Questionnaires for Domestic Household Survey** **(YCDC Water Supply Users)**

*The information collected from this questionnaires survey will be used for research purpose only. Please be frank and open-minded in your evaluations and opinions. All information obtained will be kept strictly confidential. Your kind cooperation is highly appreciated.*

Questionnaire No.: .....  
 Name of Interviewer: .....  
 Date of interview: .....

#### **I. Personal Information of Respondents**

1. Name of respondent: .....
2. Name of Township .....
3. Address: .....
4. Sex  
☐ Male ☐ Female
5. Age  
☐ 18- 20 years ☐ 41-60 years ☐ 21-40 years ☐ above 60 years
6. Educational attainment  
☐ None ☐ Elementary school ☐ Secondary school ☐ High school  
☐ College school ☐ Graduated ☐ Higher education ☐ Others
7. Occupation  
☐ Government Sector ☐ Retired ☐ Student  
☐ Private Sector ☐ Housekeeper ☐ Dependent
8. How many persons live in your household?  
 Infants (less than 1 year old) ( ) persons  
 Children (1-15 years old) ( ) persons  
 Adults (more than 15 year old) ( ) persons  
 Total ( ) persons

9. Please indicate type of dwelling (if your dwelling is apartment, please indicate the floor)

Type of dwelling	Owned	Rent	Other (specify)
Independent house			
Apartment			
Others (specify)			

10. Type of dwelling structure

☐ Concrete                      ☐ Bamboo                      ☐ Wooden                      ☐ Others (specify)

11. Number of rooms in your dwelling

Kitchen and dining room (    )

Bath room (    )

Living and bed room (    )

Toilet (    )

Total (    )

12. How long have you been living in this area? .....Years

## II. Socio-Economic Characteristic of Respondents

13. Monthly income (Kyats/month)

☐ <100,000                      ☐ >200,000                      ☐ 100,001-200,000

14. Does your household own the following items? If Yes, please describe quantity of each item.

No.	Item	Qty.	No.	Item	Qty.
1	Telephone		9	Washing machine	
2	Radio/cassette/recorder		10	Electric fan	
3	Sewing machine		11	Air conditioner (water)	
4	Refrigerator		12	Air conditioner (non-water)	
5	Television		13	Microwave or oven	
6	Computer		14	Bicycle	
7	Generator		15	Motor cycle	
8	Motor/pump		16	Car	

15. Please indicate the monthly average household expenditure for the following utilities.

No.	Utility items	Kyats/month	Remarks
1	Waste water disposal		For septic tank cleaning, wastewater disposal or treatment
2	Solid waste disposal		For garbage collection and disposal
3	Gas		For cooking and lighting
4	Electricity		For cooking, lighting and electric appliance
5	Fuel		For cooking, lighting
6	Telephone		
7.	Water		For drinking, bathing, watering, etc
Total			

16. Please indicate monthly average household expenditure in following items.

No.	Utility items	Kyats/month	Remarks
1	Food & beverages		Estimate average
2	Clothing		Estimate average
3	House rent & repairs		Apartment, house and land rental fee, etc
4	Charity & ceremonials		Donation, marriage, funeral , etc.
5	Educational		Including public and private school fee, books and so on.
6	Transportation		
7	Medical care		
8	Tax		
Total			

### III. Water Sources, Usage and Consumer Interests on Water Supply System

17. Which water supply sources do your household use?

#### **YCDC water supply sources**

- ☐ Household taps connected to YCDC water supply system
- ☐ YCDC supply public water tap (stand pipe)
- ☐ YCDC supply communal tank
- ☐ YCDC supply water tanker
- ☐ YCDC own lakes and ponds

#### **None YCDC water supply sources**

- ☐ Household taps connected to None YCDC piped water supply system
- ☐ Private tube well installed with electric/fuel pump
- ☐ Private tube well installed with hand pump
- ☐ Unprotected dug well (open type)
- ☐ Protected dug well (covered type)
- ☐ Private water tanker
- ☐ Rain water
- ☐ Other (specify)

18. What is the main water supply source for your household? Please select from above question No.17. -----

19. How does your household obtain the water from water supply sources?

- ☐ From taps (inside and outside of my house)
- ☐ By order from water vender
- ☐ By walk to fetch water
- ☐ Other (specify) -----

20. If you answer “from taps”, how many taps do you have inside and outside of your house? Inside taps ----- Outside taps ----- Total -----

21. If you answer “by order”, how many time order for a day and how many drum have to order for a day? -----time/day, -----drum /day

22. If you answer “by walk”, how long does it take you to get the water from the source per time?

- ☐ Less than 5 min      ☐ More than 10 min      ☐ More than 30 min  
☐ Within 10 min      ☐ More than 20 min      ☐ More than 1 hour

23. Who mainly fetch the water in your household?    ☐ Man    ☐ Woman    ☐ Children

24. Does your household need to store water or directly use from water supply distribution?

- ☐ Yes                              ☐ No

25. If yes, please indicate storage facility, capacity and quantity.

Facilities	Quantities	Capacity (gallon or litre)
Underground tank		
Tank on ground		
Overhead tank		
Drum		
Other (specify)		

26. What purpose does your household use water from which source? (please see Q17)

- ☐ Drinking -----  
☐ Cooking and dish washing -----  
☐ Cloth washing and bathing -----  
☐ Drinking, cooking, washing and bathing -----  
☐ Cooking, washing and bathing -----  
☐ Watering for garden and general use -----

27. How does your household use water for drinking purpose?

- ☐ Directly used water from supply source  
☐ Buying bottle water  
☐ Boil water from supply source  
☐ Filtered water from supply source  
☐ Filtered and boil water from supply source  
☐ Other (specify) -----

28. How do you feel about water quality from main water source in your household?

	Desirable (Nil)	Slightly taste (some)	Offensive (or) undesirable (specify)
Taste			
Color			
Odor			
Appearance			

29. Are you satisfied with the quality of main water source available in your household?

- ☐ Yes                              ☐ No

30. How do you feel about water quantity from main water source in your household?

Rating	Dry season	Wet season
Sufficient		
Sometime insufficient		
Insufficient		
Insufficient mostly		

31. How is water pressure from city water supply system without electric/fuel pump?

- ☐ High                      ☐ Generally high                      ☐ sometime high/sometime low  
☐ Low                      ☐ Every time low                      ☐ Very low  
☐ Every time no water

32. Does your household get steady supply of water from YCDC water supply system without using an electric/fuel pump?                      ☐ Yes                      ☐ No

33. If no, does your household need an electric/fuel pump to take water from YCDC water distribution pipeline?                      ☐ Yes                      ☐ No                      ☐ others-----

If yes, please describe the power of motor. -----Watt or -----hp

If others, how -----

34. If “Yes” for Q-32, how many hour per day do you get the water from YCDC water distribution system without using electric/fuel pump? (please describe on average)

- ☐ 24 hours                      ☐ 18 hours                      ☐ 12hour  
☐ 6hours                      ☐ 4 hours                      ☐ other (specify) -----hours

35. If “No” for Q-32, how many hours per day do you get the water from YCDC water distribution system by using an electric/fuel pump? (please describe on average)

- ☐ 24 hours                      ☐ 18 hours                      ☐ 12hour  
☐ 6hours                      ☐ 4 hours                      ☐ other (specify)-----hours

36. What time does your household usually obtain the water from YCDC water distribution pipe? (on average)

- ☐ 4 – 8 AM                      ☐ 8-12 AM                      ☐ 12 – 16 PM  
☐ 16-20 PM                      ☐ 20 -24 PM                      ☐ other (specify) -----

37. Do you satisfy with current supply water both quantity and quality?

- ☐ Yes                      ☐ No

If No, why? -----

38. How do you think YCDC water supply system need to improve?

- ☐ Yes                      ☐ No

39. Are you willing to participate in upgrading process of water supply in or near your community?

- ☐ Yes                      ☐ No

40. Do you know how water is important for our human being life?

- ☐ Yes                      ☐ No



41. Do you think an importance for taking care of running water away unused through leaks or wastage? ☐ Yes ☐ No

If yes, why? (please select one or more)

☐ Water is an important resources and should not be waste unnecessarily

☐ Water is expensive for me and I cannot afford to pay for wastage

☐ It takes a lot of effort to get (fetching, carrying, etc)

☐ Others (specify) -----

If no, why? (please select one or more)

☐ Water can easily get and sufficient available in my house

☐ Water does not cost much money

☐ Other reason (specify) -----

42. Do you want (willing) to participate for preventing water running away through leaks or wastage near your house?

☐ Yes

☐ No

43. If water leakage problem is in or near your household, how do you act for this problem? (please select one or more)

☐ Immediately repair the fault by ourselves

☐ Immediately inform to YCDC staff for repair the fault

☐ Immediately call the private plumber for repair the fault

☐ Leave the leak because water is not cost too much

☐ Leave the leak because the cost of repairs is too much

☐ Leave the leak because difficult to call YCDC staff for repair the fault and too much cost

☐ Other (specify)

#### IV. Water Connection, Billing and Willingness to Pay for Water Supply

44. Who install for piped water connection?

☐ WSS staff

☐ Private contractor

☐ Self support

☐ other (specify) -----

45. Do you pay for water connection fee? ☐ Yes

☐ No

If yes, how much -----Kyats/connection

46. Does your household have a water meter? ☐ Yes

☐ No

If yes, is the water meter functioning? ☐ Yes

☐ No

☐ Don't know

How much water do you consume per month? (Please check in your water bill) ----m<sup>3</sup>

47. If your household has no water meter, do you willing to install water meter and willing to pay for water according to water meter.

☐ Yes (no cost for installing water meter)

☐ Yes (any cases)

☐ No (any cases)

If No, why? -----

48. What tariff structure (or type of payment) does your household employ?

☐ Flat rate -----Kyats/month

☐ Metered rate -----Kyats/m<sup>3</sup>

49. How frequently do you pay for water tariff?  
☐ Every month                      ☐ Quarterly a year  
☐ Twice a year                      ☐ Other (specify) -----

50. How do you pay for water tariff?  
☐ YCDC staff comes and collects at home  
☐ We have to go and pay at township WSS office  
☐ Other (specify) -----

51. How much your household pay for water in all purpose?

No.	Water Usage	Kyats/month
1	Drinking water purpose (bottle water)	
2	Main water connection for all purpose (YCDC water bill)	
3	Private water vender, tanker, for other supply water	
4	Other (specify)	
Total		

52. How do you feel on current total water cost paid by your household?

- ☐ Expensive                      ☐ Cheap  
☐ Right amount                      ☐ Other (specify) -----

53. Do you satisfy current water tariff structure?                      ☐ Yes                      ☐ No  
If no, please give a reason -----

54. Do you satisfy current water tariff collection system?                      ☐ Yes                      ☐ No  
If no, please give a reason -----

55. If YCDC will make some improvement for current water supply, are you willing to pay more money for water supply service?                      ☐ Yes                      ☐ No

56. Are you willing to participate for the improvement of YCDC water supply service?  
☐ Yes                      ☐ No

57. Do you know current laws, regulations and penalties for water users that obligated by YCDC?  
☐ Yes                      ☐ No

58. Which way do you want to participate on water supply improvement and water resources sustainability? (Please select one or more)  
☐ Paying water tariff regularly  
☐ Reducing water usage or water wastage  
☐ Taking care of running water away unused through leaks or wastage  
☐ Obey laws and regulations related with water and environmental concerns  
☐ Participate in movement of water conservation activities  
☐ Sharing information and knowledge about water to young generation and neighbors  
☐ Others (Please specify -----)

---

**Thank you so much for your cooperation!**

---

**Questionnaires for Domestic Household Survey**  
**(None YCDC Water Supply Users)**

*The information collected from this questionnaires survey will be used for research purpose only. Please be frank and open-minded in your evaluations and opinions. All information obtained will be kept strictly confidential. Your kind cooperation is highly appreciated.*

Questionnaire No.: .....

Name of Interviewer: .....

Date of interview: .....

**I. Socio-Economic Characteristic of Respondent Households**

1. Name of respondent: .....
2. Name of Township .....
3. Address: .....

4. Sex            ☐ Male                                  ☐ Female

5. Age  
☐ 18- 20 years                      ☐ 41-60 years                      ☐ 21-40 years                      ☐ above 60 years

6. Educational attainment  
☐ None                      ☐ Elementary school                      ☐ Secondary school                      ☐ High school  
☐ College school    ☐ Graduated                      ☐ Higher education                      ☐ Others

7. Occupation  
☐ Government Sector                      ☐ Retired                                  ☐ Student  
☐ Private Sector                      ☐ Housekeeper                      ☐ Dependent

8. How many persons live in your household?  
Infants (less than 1 year old)    (     ) persons  
Children (1-15 years old)            (     ) persons  
Adults (more than 15 years old) (     ) persons  
Total                                      (     ) persons

9. Please indicate type of dwelling (if your dwelling is apartment, please indicate the floor)

Type of dwelling	Owned	Rent	Other (specify)
Independent house			
Apartment			
Others (specify)			

10. Type of dwelling structure  
☐ Concrete                      ☐ Bamboo                                  ☐ Wooden                      ☐ Others (specify)

11. Monthly income (Kyats/month)  
☐ <100,000                      ☐ 100,001-200,000                      ☐ >200,000

12. Number of rooms in your dwelling?

Kitchen and dining room (    )

Bath room (    )

Living and bed room (    )

Toilet (    )

Total (    )

13. How long have you been living in this area? .....Years

14. Does your household own the following items?

No.	Item	Qty.	No.	Item	Qty.
1	Telephone		9	Washing machine	
2	Radio/cassette/recorder		10	Electric fan	
3	Sewing machine		11	Air conditioner (water)	
4	Refrigerator		12	Air conditioner (non-water)	
5	Television		13	Microwave or oven	
6	Computer		14	Bicycle	
7	Generator		15	Motor cycle	
8	Motor/pump		16	Car	

15. Please indicate the monthly average household expenditure for the following utilities.

No.	Utility items	Kyats/month	Remarks
1	Waste water disposal		For septic tank cleaning, wastewater disposal or treatment
2	Solid waste disposal		For garbage collection and disposal
3	Gas		For cooking and lighting
4	Electricity		For cooking, lighting and electric appliance
5	Fuel		For cooking, lighting
6	Telephone		
7.	Water		For drinking, bathing, watering, etc
Total			

16. Please indicate monthly average household expenditure in following items?

No.	Utility items	Kyats/month	Remarks
1	Food & beverages		Estimate average
2	Clothing		Estimate average
3	House rent & repairs		Apartment, house and land rental fee, etc
4	Charity & ceremonials		Donation, marriage, funeral , etc.
5	Educational		Including public and private school fee, books and so on.
6	Transportation		
7	Medical care		
8	Tax		
Total			

## II. Water Sources, Water Usage and Water Supply System

17. Which water supply sources do your household use?

### **YCDC water supply sources**

- ☐ Household taps connected to YCDC water supply system
- ☐ YCDC supply public water tap (stand pipe)
- ☐ YCDC supply communal tank
- ☐ YCDC supply water tanker
- ☐ YCDC own lakes and ponds

### **None YCDC water supply sources**

- ☐ Household taps connected to None YCDC piped water supply system
- ☐ Private tube well installed with electric/fuel pump
- ☐ Private tube well installed with hand pump
- ☐ Unprotected dug well (open type)
- ☐ Protected dug well (covered type)
- ☐ Private water tanker
- ☐ Rain water
- ☐ Other (specify)

18. What is the main water supply source for your household? Please select from above question no. 17. -----

19. How does your household get the water from water supply sources?

- ☐ Owned tubewell
- ☐ From taps (inside and outside of my house)
- ☐ By order
- ☐ By walk
- ☐ Other (specify) -----

If you answered “from taps”, how many taps do you have inside and outside of your house?    Inside taps -----    Outside taps -----    Total -----

If you answered “by order”, how many time order for a day and how many drum have to order for a day? -----time/day, -----drum /day

If you answered “by walk”, how long does it take you to get the water from the source per time?

- |  |  |   |
|--|--|---|
| <input type="checkbox"/> Less than 5 min | <input type="checkbox"/> Within 20 min | <input type="checkbox"/> Within 1hour     |
| <input type="checkbox"/> Within 10 min   | <input type="checkbox"/> Within 30 min | <input type="checkbox"/> More than 1 hour |

20. Who mainly fetch the water for your household?    ☐ Man    ☐ Woman    ☐ Children

21. Does your household need to store water or directly use from water supply distribution pipe?    ☐ Yes    ☐ No

22. If yes, please indicate storage facility, capacity and quantity.

Facilities	Quantities	Capacity (gal or litre)
Underground tank		
Tank on ground		
Overhead tank		
Drum		
Other (specify)		

23. What purpose does your household use the water from which source? (please see Q17)

- ☐ Drinking -----  
☐ Cooking and dish washing -----  
☐ Cloth washing and bathing -----  
☐ Drinking, cooking, washing and bathing -----  
☐ Cooking, washing and bathing -----  
☐ Watering for garden and general use -----

24. How does your household use water for drinking purpose?

- ☐ Directly used water from supply source  
☐ Buying bottle water  
☐ Boil water from supply source  
☐ Filtered water from supply source  
☐ Filtered and boil water from supply source  
☐ Other (specify) -----

25. How do you feel about water quality from main water source in your household?

	Desirable (Nil)	Slightly taste (some)	Offensive (or) undesirable (specify)
Taste			
Color			
Odor			
Appearance			

26. Are you satisfied with the quality of main water source for your household?

- ☐ Yes                      ☐ No

27. How do you feel about water quantity from main water source in your household?

Rating	Dry season	Wet season
Sufficient		
Sometime insufficient		
Insufficient		
Insufficient mostly		

28. Does your household need an electric/fuel pump to take water from tube well?

- ☐ Yes                      ☐ No

If yes, please tell us the power of motor. -----Watt or -----hp

29. Does your household get steady supply of water from your source of water supply?

- ☐ Yes                      ☐ No

30. Do you know how water is important for our human being life? ☐ Yes ☐ No

31. Do you think an importance for taking care of running water away unused through leaks or wastage? ☐ Yes ☐ No

If yes, why? -----

- ☐ Water is an important resources and should not be waste unnecessarily
- ☐ Water is expensive for me and I cannot afford to pay for wastage
- ☐ It takes a lot of effort to get (fetching, carrying, etc)
- ☐ Others (specify) -----

If no, why? -----

- ☐ Water is easily get and sufficient available in my household
- ☐ Water does not cost much money
- ☐ Other reason (specify) -----

32. If water leakage problem is in or near your household, how do you act for this problem?

- ☐ Immediately repair the fault by ourselves
- ☐ Immediately inform to YCDC staff for repair the fault
- ☐ Immediately call the private plumber for repair the fault
- ☐ Leave the leak because water is not cost too much
- ☐ Leave the leak because the cost of repairs is too much
- ☐ Leave the leak because difficult to call YCDC staff for repair the fault and too much cost
- ☐ Other (specify)

### III. Water Connection, Billing and Willingness to Pay for Water Supply System

33. Do you know who does the installation of piped water connection?

- ☐ WSS staff ☐ Private contractor ☐ Self support ☐ Other (specify) ---

34. Do you pay for water supply connection? ☐ Yes ☐ No

If yes, how much -----Kyats/connection

35. If your household uses your own tube well, do you know tube well license?

- ☐ Yes ☐ No

36. If yes, do your household tube well have license? ☐ Yes ☐ No

37. How much do you pay for it? -----Kyats/tube well

38. How much your household pay for water in all purposes?

No.	Water Usage	Kyats/month
1	Drinking water purpose (bottle water)	
2	Main water connection for all purpose	
3	Private water vender, tanker	
4	Other (specify)	
Total		

39. How do you feel on the current total water cost paid by your household?
- ☐ Expensive                      ☐ Cheap  
☐ Right amount                ☐ Other (specify) -----
40. If you use private water connection, how do you pay for water using in your household?
- ☐ per monthly basis              ☐ per m<sup>3</sup>  
☐ per drum                        ☐ Other (specify) -----
41. Do you satisfy with current water supply system available in your household?
- ☐ Yes                                ☐ No  
If No, why? -----
42. If YCDC water supply connection will be made available for your household and you can get necessary amount of water but you have to pay for water with metering rate, would you willing to connect?
- ☐ Yes                                ☐ No
43. Are you willing to participate in YCDC water supply upgrading process in near your area?
- ☐ Yes                                ☐ No
44. If yes, how much will be the maximum amount of money paying for getting water per month? -----Kyats/month
45. Do you know current laws, regulations and penalties related to water supply users that imposed by YCDC?
- ☐ Yes                                ☐ No
46. Which way do you want to participate on water supply improvement and water resources sustainability? (Please select one or more)
- ☐ Paying water tariff regularly  
☐ Reducing water usage or water wastage  
☐ Taking care of running water away unused through leaks or wastage  
☐ Obey laws and regulations related with water and environmental concerns  
☐ Participate in movement of water conservation activities  
☐ Sharing information and knowledge about water to young generation and neighbors  
☐ Others (Please specify -----)

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**Thank you so much for your cooperation!**

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### **Checklists For Informants Interview With Government Officials**

1. Water authorities concerned in YCDC, WSS Department, Districts, and Township
2. Total number of residents who are living in study area
3. Income and expenditure for water supply system in last 10 years
4. Average daily water production
5. Annual rainfall, land use, population of Yangon City
6. Water tariff structure, penalties
7. Current situation of financial, administrative, legislative, political
8. Existing enforcement policy of the government in term of laws and regulation compliance, relating with water
9. Informant opinion about existing water supply system management situation
10. Operation and maintenance practices
11. Education and training program of the authorities for raising NRW awareness, working skills and people participation.
12. Organization structure of responsible parties
13. Opinion about willingness to pay and willingness to participate in water supply system management of professional persons, retire experts, responsible person who are very well understand about NRW control in water supply
14. Opinion of staff, professional persons, officer who related organization of water supply management
15. Their solution and recommendation to reduce NRW in water supply system management for Yangon City

## APPENDIX - D

### RESPONDENT'S SURVEY RESULT

**Table 1: Main Source of Water of YCDC Supply Water Users**

No.	Source of Water	f	Percent (%)
1	Household taps connected to YCDC pipe water supply	110	54
2	YCDC supply public water tap (stand pipe)	36	18
3	Household taps connection + stand pipe users	56	27
4	YCDC supply communal tank	3	1
5	YCDC supply water tanker	-	-
6	YCDC own lakes and ponds	-	-
Total		205	100

Source: Field survey 2006

Note: f = frequency

**Table 2: Main Water Source for Non-YCDC Water Supply Customers**

No.	Source of water	f	Percent (%)
1	Household tap connected to neighbor tube well	14	16
2	Private tube well installed with electric/fuel pump	42	47
3	Private tube well installed with hand pump	12	13
4	Unprotected dug well (open type)	3	3
5	Protected dug well (covered type)	-	-
6	Private water tanker	15	17
7	Rain water	4	4
Total		90	100

Source: Field survey 2006

Note: f = frequency

**Table 3: Way of Taking Water Treatment for Drinking Purpose by YCDC Customers**

Way of Water Treatment	f	Percentage (%)
Buying Bottle Water	38	18.5
Boiled Water	24	11.7
Filtered Water	86	42.0
Filtered and Boiled Water	41	20.0
Others	16	7.8
Total	205	100

Source: Field survey 2006

Note: f = frequency

**Table 4: Way of Taking Water Treatment for Drinking Purpose by Non-YCDC Customers**

Way of Water Treatment	f	Percentage (%)
Buying Bottle Water	22	24.2
Boiled Water	5	5.6
Filtered Water	37	41.2
Filtered and Boiled Water	17	18.9
Others	9	10.0
Total	90	100.0

Source: Field survey 2006

Note: f = frequency

**Table 5: Duration of Water Getting from YCDC Supply Line by Using Pump**

Time (Avg. Duration)	f	Percentage (%)
<4 hr	8	4.4
4 hr	2	1.1
6hr	57	28.0
12hr	37	18.0
18hr	2	1.2
24hr	97	47.3
Total	188	100

Source: Field survey 2006

**Table 6: Duration of Water Getting from YCDC Supply Line without Using Pump**

Time (Avg. Duration)	f	Percentage (%)
<4 hr	16	8.7
4 hr	3	1.5
6hr	57	30.3
12hr	51	27.3
18hr	1	0.5
24hr	60	31.7
Total	188	100

Source: Field survey 2006

**Table 7: Respondents' Perception on Sufficiency of Supply Water (YCDC Customers)**

Township	Sufficient for whole year		Insufficient in dry season		Insufficient in whole year		No Answer		Total	
	f	%	f	%	f	%	f	%	f	%
S.Okkalapa	16	29.6	17	31.5	16	29.6	5	6.5	54	100.0
Sanchaung	9	29.0	9	29.0	12	38.7	-	-	31	100.0
Kamayut	20	33.3	27	45.0	13	21.7	-	-	60	100.0
Puzundaung	19	31.7	25	41.7	14	23.3	2	3.3	60	100.0
Total	64	31.2	79	38.1	55	27.3	7	3.4	205	100.0

Source: Field survey 2006

**Table 8: Respondents' Perception on Sufficiency of Supply Water (Non-YCDC Customers)**

Township	Sufficient for whole year		Insufficient in dry season		Insufficient in whole year		No Answer		Total	
	f	%	f	%	f	%	f	%	f	%
S.Okkalapa	17	73.8	3	13.0	2	8.9	1	4.3	23	100.0
Sanchaung	42	89.4	4	8.5	1	2.1	-	-	47	100.0
Kamayut	18	90.0	1	5.0	1	5.0	-	-	20	100.0
Puzundaung	-		-		-		-	-	-	100.0
Total	77	86.2	8	8.5	4	4.2	1	1.1	90	100.0

Source: Field survey 2006

**Table 9: Respondent's Satisfaction of Current Supplied Water Quality (YCDC customers)**

Parameter	Satisfied		Do not satisfied		No Answer	
	f	%	f	%	f	%
<b>Odor</b>	177	86.3	28	13.7	-	-
<b>Color</b>	170	82.8	35	17.2	-	-
<b>Taste</b>	195	95.0	10	5.0	-	-

Source: Field survey 2006

Note: f = frequency

**Table 10: Respondent's Opinion on Water Price**

Respondents	Expensive		Right Amount		Above right Amount		Cheap	
	f	%	f	%	f	%	f	%
YCDC Customers	15	7.0	176	86.0	10	5.0	4	2.0
Non-YCDC Customers	51	56.5	27	30.0	9	10	3	3.5

Source: Field survey 2006

Note: f = frequency

**Table 11: Water Consumption of Industrial Zones in Yangon**

Zone Name	Area (ha)	No. of plot			Start (year)	No. of worker	No. of Operating Plot					Water Consumption (m <sup>3</sup> /day)				
		Total	Opera-ting	%			2000	2005	2010	2015	2020	2000	2005	2010	2015	2020
Shwepyitha	254	584	101	17.3	1992	14,432	101									
Hlaingthayar	580	1048	271	25.9	1995	36,543	271	543	814	1,048	1,048	5,402	10,834	16,226	20,890	20,890
Dagon South	157	2019	737	36.5	1992	11,822	737	1,198	1658	2,019	2,019	14,691	23,880	33,049	40,245	40,245
Dagon Seikan	334	432	22	5.1	1996	3,606	22	50	77	105	132	439	997	1535	2093	2631
Mingaladon	90	39	2	5.1	1995	NA	2	4	6	8	10	40	80	120	159	199
Shwepaukkan	31	348	70	20.1	1998	4,205	70	245	348	348	348	1,395	4,884	6,937	6,937	6,937
Yangon	22	194	0	0.0	2000		0	29	58	87	116	0	578	1156	1734	2312
Sub total	1,468	4,664	1,203	25.8		70,608										
Planned																
Dagon East	200				2003		0	9	30	51	73	0	179	598	1,017	1,455
Shwehitha	161				2004		0	12	72	131	191	0	239	1435	2,611	3,807

Source: DHSHD (Department of Human Settlement and Housing Development), JICA Study Team Consumer Survey, 2001

**Table 12: Respondent's Income Distribution in Each Township of Study Area**

Monthly Income	S Okkalapa		Sanchaung		Kamayut		Puzundaung		Total	
	f	%	f	%	f	%	f	%	f	%
<100,000	21	27.3	4	5.1	2	2.5	14	23.3	41	13.9
100,001- 200,000	53	68.8	59	75.6	69	86.3	44	73.4	225	76.3
>200,001	3	3.9	15	19.2	9	11.2	2	3.3	29	9.8
<b>Total</b>	<b>77</b>	<b>100.0</b>	<b>78</b>	<b>100.0</b>	<b>80</b>	<b>100.0</b>	<b>60</b>	<b>100.0</b>	<b>295</b>	<b>100.0</b>

Source: Field survey 2006

**Table 13: Respondent's Household Expenditure Distribution in Each Township of Study Area**

Monthly HH Expenditure	S Okkalapa		Sanchaung		Kamayut		Puzundaung		Total	
	f	%	f	%	f	%	f	%	f	%
40,001-60,000	2	2.6	-	-	-	-	-	-	2	0.7
60,001-80,000	16	20.8	4	5.1	2	2.5	11	18.3	33	11.2
80,001-100,000	33	42.9	25	32.1	17	21.3	11	18.3	86	29.1
100,001-120,000	4	5.2	6	7.7	19	23.7	7	11.7	36	12.2
120,001-140,000	9	11.6	17	21.8	16	20.0	14	23.3	56	19.0
140,001-160,000	11	14.3	21	26.9	18	22.5	15	25.0	65	22.0
160,001-180,000	2	2.6	2	2.6	2	2.5	-	-	6	2.0
180,001-200,000	-	-	3	3.8	4	5.0	2	3.4	9	3.1
Above 200,001	-	-	-	-	2	2.5	-	-	2	0.7
Total	77	100.0	78	100.0	80	100.0	60	100.0	295	100.0

Source: Field survey 2006

**Table 14: Comparison of Average Monthly Expenditure of Respondents**

No.	Expenditure Items	% of Total Income	
		YCDC water customers	Non-YCDC water customers
1	Foods and beverages	52.1	50.6
2	Clothing	2.1	2.0
3	House rent and repairs	1.2	1.2
4	Charity and ceremonials	2.2	2.0
5	Education	8.2	8.0
6	Transportation	5.4	7.2
7	Medical care	3.0	2.5
8	Utilities (telephone, electricity, fuel, water, etc.)	21.7	23.9
9	Tax	1.4	1.1
10	Saving amount	2.7	1.5
Total		100.0	100.0

Source: Field survey 2006

**Table 15: Comparison of Average Monthly Utilities Expenditure of Respondents**

Expenditure for utility	YCDC water customers	Non-YCDC water customers
	% of total utility expenses	% of total utility expenses
Water	5.3	20.2
Waste water disposal	3.3	3.3
Electricity	44.0	41.0
Solid waste disposal	2.4	1.8
Gas	9.7	9.7
Fuel	13.9	11.9
Telephone	21.4	12.1
Total	100.0	100.0

Source: Field survey 2006

**APPENDIX E**  
**PHOTO SECTION**



**YCDC Official explain about Yangon City Water Supply System**



**Schematic Flow Diagram of New Water Supply Project  
(Ngamoeyike Water Supply Project)**



**Hlawga Reservoir**



**Gyophyu Reservoir**



**Transmission Main Pipe in City Water Supply System**



**Pumping Station in New Water Supply Project**



**Water Pumping for Water Treatment Plant from Ngamoeyike Reservoir**





**Cleaning Floating Material from Water Treatment Plant by Manual Practice in City Water Supply Project**



**Water Authority's Demonstration in New Water Treatment Plant Project**



**Sludge Disposing Practice from New Water Treatment Plant  
(This Water Drainage to Agricultural Paddy Field)**



**Water Flow Measurement**



**Communal Tank Practices in City Water Supply System**



**Water Meter Installation and Maintenance Practices in City Water Supply Management**





**Water Distribution Pipe Rehabilitation Project**



**New Water Treatment Project for City Water Supply is Ongoing Project**