Chapter 5

Water Supply Plan

CHAPTER 5 WATER SUPPLY PLAN

5.1 GENERAL

The Water Supply Plan was prepared for 278 target villages identified by Village Inventory Survey (Refer to Chapter 1 of Supporting Report) and was finalized based on the results of the supplementary field survey carried out by the Study Team in June and July 2005. The Villages were evaluated considering the population in 2015 and availability of water sources in or around the village. Alternatives of the water supply plan are (1) Piped water supply scheme (Level-2), (2) Hand pump (Level-1) and (3) Extension of existing water supply schemes. Project cost, implementation plan, financial plan and evaluation for the Water Supply Plan are discussed in this Chapter.

5.2 CRITERIA FOR WATER SUPPLY PLAN

5.2.1 TARGET VILLAGES AND SERVICE AREA

Numbers of target villages are 217 in Coast Region and 61 in Dar es Salaam Peri-Urban, totalling 278 villages in the Study area. District wise breakdown is presented in *Table 1.1* in Chapter 1.

A total of 248 villages out of 278 target Villages have no reliable water supply schemes. Community people mainly depend on unprotected sources or water vendors. Entire areas of these villages are considered as the service areas for water supply in this Study.

Remaining 30 Villages are partially receiving water supply through DAWASA, Chalinze Water Supply Scheme or their own water supply schemes. Service areas by the existing water supply schemes in these Villages are basically excluded from the Study area. Location map of target Villages are presented in Databook.

5.2.2 PROJECT TARGET YEAR

The target year for the Water Supply Plan is determined as 2015, while the implementation of priority projects (Chapter 6) will be completed by the year 2010. The year 2015 was set as the target year for the project in the Study, giving additional five year period for meeting the water demand.

5.2.3 POPULATION TO BE SERVED

Population to be covered by the Study is confirmed as approximately 864.5 x 10^3 in the year 2002 and is projected at 1,386 x 10^3 in the target year 2015 using the result of 2002 Census data. The study on operation and maintenance cost revealed that piped water supply scheme (Level-2) is applicable and feasible in Villages when population is more than 2,500 (refer to Chapter 8). Therefore, in case of Level-2, the population of 2,500 is necessary as the basic requirement for the provision of piped water supply schemes in 2015. From this point of view, the population in 2015 was projected. *Table 5.1* shows the District and Municipal wise population to be served in the target year 2015.

Table 5.1 Population to be Covered (2015)

District	Population	Municipality	Population
Bagamoyo	134,876	Ilala	390,020
Kibaha	62,291	Kinondoni	191,110
Kisarawe	102,782	Temeke	255,045
Mkuranga	252,204		
Sub-Total (Coast)	552,153	Sub-Total (DSM)	836,175
Total (Study Area)			1,386,328

In the estimation of population growth, District/Municipality wise growth rates presented in *Table 5.2* were used. Detailed discussion of the population projection is presented in Chapter 5 of Supporting Report.

Table 5.2 Population Growth Rate

District	Growth Rate (%)	Municipality	Growth Rate (%)
Bagamoyo	2.0	Ilala	4.6
Kibaha	3.4	Kinondoni	4.1
Kisarawe	1.4	Temeke	4.6
Mkuranga	3.5		

5.2.4 Water Demand

In this Study, following factors were considered in the projection of water demand in the target year of 2015. Design Manual (MoWLD, 1997) was applied in the decision of the unit water demand. Based on the projection of future population in the target villages, water demands were estimated.

Unit water demand applied in the Study is shown in *Table 5.3.*

Table 5.3 Unit Water Demand

Category		Unit	Rural	Urban	Remarks
Domestic		lit/capita/day	25	25	served from public taps
Public Institution (School)*1	Day School	lit/pupil/day	10	10	without flush toilet (pit latrine, VIP*2, pour flush toilet only)
	Boarding School	lit/pupil/day	70	70	
Public Institution (Health)*1	Dispensary	lit/visitor/day	10	10	out patient only
	Health Centre 1	lit/bed/day	50	50	without flush toilet (pit latrine, VIP, pour flush toilet only)
	Health Centre 2	lit/bed/day	100	100	with flush toilet
	Hospital	lit/bed/day		200	District hospital

*1 Domestic water consumption for staff of school and health facilities is assumed to be included in the unit rate for the domestic use.

*2 VIP: Ventilated Improved Pit (Latrine)

Accordingly, water demand is estimated as 13.9 x 10^3 m^3/day in Coast Region and 20.9 x 10^3 m^3/day in Dar es Salaam Region, totalling 34.8 x 10^3 m^3/day in the whole Study area.

5.2.5 Water Source

Both surface water and groundwater have been used as water sources of existing water supply schemes in the Study area. Potential of each water source were evaluated in Chapter 4 whether or not they are suitable as water sources for the water supply schemes to be planned in the Study. The result of evaluation revealed that groundwater should be the main water source, because only the Wami River has development potential while the Ruvu River has no surplus development potential as surface water. Therefore, river water is planned only exceptionally as the water source for a village when groundwater is not available. Spring water is also planned as the water source in a village.

In the evaluation of groundwater, two criteria were used, yield and water quality (EC). As for the yield, groundwater potential is classified into three categories, less than 10 litre/min, between 10 and 100 litre/min, and more than 100 litre/min. The yield of more than 100 litre/min meets the water demand for 2,500 population under 10 hours of operation per day in average (maximum 12 hours operation). The yield of less than 10 litre/min is not suitable even for hand pump.

Water quality was evaluated using EC value. An EC value less than 1000 micro-S/cm is suitable for drinking. An EC value more than 3,000 micro-S/cm is not suitable for drinking. The value

of 3,000 micro-S/cm is derived from the TDS value of 2,000 mg/litre (Tanzanian standards) by calculation.

Although the groundwater is planned as the main water source for the water supply scheme in this Study as discussed above, Wami river water in Matipwili Village, Bagamoyo District and spring water in Njopeka, Mkuranga District were planned as the water source, because groundwater is not suitable as the source in these villages. In Matipwili Village, groundwater is saline (EC is more than 3,000 micro-S/cm) and the yield is low, therefore, groundwater is not available. As for Wami river water, it is deteriorated by Microbial aspects and its turbidity is high, however, it is suitable as water source because the water can be properly treated. Therefore, the water of the Wami River is considered as the water source.

In case of Saadani Village in Bagamoyo District, groundwater is not available due to high salinity. There is no alternative water sources other than a shallow groundwater (protected well) used for the existing water supply scheme. Therefore, the shallow well was planned as the source.

The spring water in Njopeka Village, Mkuranga District is planned as the water source because the water quality is suitable for drinking use and the yield of the spring is considered much higher than that of the groundwater.

Based on the discussion above, criteria shown in *Table 5.4* was applied in the selection of type of water supply scheme from the view point of water source.

Table 5.4 Criteria of Water Source for Selection of Water Supply Scheme

<table>
<tr><td colspan="2" rowspan="2">Groundwater
Water Quality</td><td colspan="3">Yield (litre/min)</td></tr>
<tr><td>>100</td><td>10 – 100</td><td>10></td></tr>
<tr><td rowspan="3">EC (micro-S/cm)</td><td>less than 1000</td><td>Level-2</td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>1000 – 3000</td><td colspan="2">Level-1</td></tr>
<tr><td>more than 3000</td><td colspan="3">not suitable as water source</td></tr>
</table>

Applying this criteria, 45 Level-2 schemes were planned in 51 Villages. Those schemes were clarified from the technical point of view based on the results of the field survey in the target Villages conducted in June and July 2005.

5.2.6 TOPOGRAPHIC SITUATION AND COST EFFECTIVENESS

Level-2 scheme was initially planned in 51 villages. As the second step, the criteria, suitability of topography and cost effectiveness were applied in the evaluation of Level-2 in 51 villages based on the results of field survey of the villages carried out in June and July 2005. The concept of Level-2 scheme is to supply water to the service area by gravity. Therefore, village, sub-village or a part of the village in following conditions were excluded from the service area.

(1) Elevation is much higher than other major part of the village and requires a booster pump to supply the area.

(2) An area, which is isolated from the major part of the village and its population is too low.

(3) A village, population of which becomes less than 2,500 after exclusion mentioned above (1) and (2).

Excluded village, sub-village or a part of village is considered to be supplied by Level-1 (Hand Pump).

Evaluation was made on the target villages of Level-2 using the criteria mentioned above. *Table 5.5* presents the name of villages where Level-2 was initially planned and the reasons why a part of

village or Sub Village(s) was excluded from the service area of Level-2. In the table, the village marked by "N" in the column of "Result" was excluded from the service area. The reasons for exclusion are shown in the column on the extreme right. The "Water Supply Plan" was revised and finalized based on the results.

Table 5.5 Result of Technical Evaluation on Proposed Level-2 Schemes (1/3)

	Name of Village	Name of Sub Village	Result	Population (2002)	Population (2015)	Population served (2015)	Rate of Population served	Reason for exclusion from service area
BAGAMOYO								
KIBINDU	**KIBINDU**	**Total Area**		**5,605**	**7,251**			
		Service Area only		**4,904**	**6,344**	6,344	87.5	
		Chapuku	Y	1,397	1,807			
		Kikomba	Y	1,805	2,335			
		Msete	Y	1,702	2,202			
		~~Kwaikonje~~	N	343				D, E
		~~Pera~~	N	358				D, E
KWAMDUMA	**KWAMDUMA**	**Total Area**		**3,677**	**4,757**			
		Service Area only		**2,545**	**3,292**	3,292	69.2	
		Kwakilumbi	Y	988	1,278			
		Kwedi Yule	Y	1,557	2,014			
		~~Gole~~	N	87				D, E
		~~Kwavuli~~	N	627				D, S
		~~Mjembe~~	N	418				D
MKANGE	**MATIPWILI**	**Total Area**		**2,698**	**3,490**			
		Service Area only		**1,948**	**2,518**	2,518	72	
		Mkunguni	Y	615	795			
		Msikitini	Y	827	1,069			
		Mzambarauni	Y	506	654			
		~~Biga~~	N	N.A				(temporary dwelling)
		~~Gongo~~	N	641				E, D
		~~Kisauke~~	N	N.A				(migrated to other)
		~~Tumbilini~~	N	109				E, D
KIBAHA								
RUVU	**MINAZI MIKINDA (1/2)**	**Total Area**		**1,624**	**2,508**			
		Service Area only		**1,624**	**2,508**	2,508	100	
		Miniji Mikinda	Y	1,624	2,508			
RUVU	**MINAZI MIKINDA (2/2) /KITOMONDO**	**Total Area**		1,657	2,559			
		Service Area only		**1,627**	**2,513**	2,513	100	
	MINAZI MIKINDA	Mnaji	Y	1,000	1,544			
	KITOMONDO	Gumba	Y	230	355			
		Kitomondo	Y	397	613			

Table 5.5 Result of Technical Evaluation on Proposed Level-2 Schemes (2/3)

	Name of Village	Name of Sub Village	Result	Population (2002)	Population (2015)	Population served (2015)	Rate of Population served	Reason excluded from survice area
KISARAWE								
MSIMBU	**MSIMBU**	**Total Area**		2,967	3,555			
		Service Area only		**2,199**	**2,635**	2,635	100	
		Kifukumko	Y	252	302			
		Mgoge	Y	753	902			
		Msimbu Mjini	Y	588	705			
		Ngwazi	Y	363	435			
		Chambasi	Y	243	291			
		~~Mwanzo Mgumu~~	N	396				D
		~~Vinyawanjwa~~	N	372				D
CHOLE	~~KWALA-CHOLE~~	~~**Total Area**~~		~~2,245~~	~~2,690~~			Water Source
		~~Kwala~~	N	~~937~~				
		~~Sanvula~~	N	~~762~~				
		~~Viyombo~~	N	~~546~~				
CHOLE	**CHOLE**	**Total Area**		2,685	**3,217**			
		Service Area only		**2,685**	**3,217**	3,217	100.0	
		Egea	Y	940	1,126			
		Mdogoyo	Y	537	643			
		Ponza	Y	402	482			
		Shuleni	Y	806	966			
MKURANGA								
VIKINDU	~~MKOKOZI~~	~~**Total Area**~~		~~1,769~~	~~**2,767**~~			S, T
VIKINDU	**MWANDEGE/KIPALA**	**Total Area**		2,100	**3,285**			
	MWANDEGE	**Service Area only**		**2,100**	**2,815**	2,687	85.7	
		Chatembo	Y	300	469			
		Kirungule	Y	400	626			
		Mwandege	Y	600	938			
	KIPALA	a part of Kipala	Y	500	782			
	MWANDEGE	~~Vicheji~~	N	~~300~~				D, E
VIKINDU	**KISEMVULE**	**Total Area**		2,260	**3,535**			
		Service Area only		**2,260**	**3,244**	3,244	91.8	
		Kisemvule	Y	850	1,330			
		Kitangwi	Y	162	253			
		Mpela	Y	660	1,032			
		Vibura	Y	402	629			
		~~Utunge~~	N	~~186~~				D
VIKINDU	~~MALELA~~	~~**Total Area**~~	N	~~**1,250**~~	~~**1,955**~~			No access
	~~YAVAYAVA~~	~~**Total Area**~~	N	~~**1,830**~~	~~**2,862**~~			S
VIKINDU	**MOROGORO**	**Total Area**		**2,935**	**4,590**			
	MFURU MWAMBAO	**Service Area only**		**1,945**	**2,635**	2,635	100	
	MAROGORO	Marogoro	Y	640	**1,001**			
		Sangatini	Y	600	**938**			
	MFURU MWAMBAO	Mfuru Mwambao	Y	445	**696**			
	MAROGORO	~~Zingezinge~~	N	~~260~~				D
	MFURU MWAMBAO	~~Kibane~~	N	~~336~~				D
		~~Kigobedi~~	N	~~228~~				D
		~~Kikonga~~	N	~~181~~				D
		~~Songola~~	N	~~245~~				D
VIKINDU	**VIANZI**	**Total Area**		2,625	**4,106**			
		Service Area only		**1,871**	**2,926**	2,926	71.3	
		Kwajokoo	Y	591	924			
		Mwajasi	Y	257	402			
		Nyamisiki	Y	268	419			
		Vianzi Town	Y	755	1,181			
		~~Changombe~~	N	~~452~~				D
		~~Honda~~	N	~~302~~				D
VIKINDU	**VIKINDU**	~~**Total Area**~~	N	5,125	8,015			(Private schemes)
LUKANGA	**NJOPEKA**	**Total Area**		**6,611**	**10,339**			
		Service Area only		**3,371**	**5,272**	5,272	51.0	
		Mikwasu	Y	1,595	**2,494**			
		Njopeka Mjini	Y	1,489	**2,329**			
		Nyamalonda	Y	287	**449**			
		~~Kingoma Mashariki~~	N	~~1,103~~				D
		~~Kingoma Magh.~~	N	~~1,025~~				D
		~~Malenda~~	N	~~1,112~~				D

Table 5.5 Result of Technical Evaluation on Proposed Level-2 Schemes (3/3)

	Name of Village	Name of Sub Village	Result	Population (2002)	Population (2015)	Population served (2015)	Rate of Population served	Reason for exclusion from service area
ILALA								
KITUNDA	**KITUNDA**	**Total Area**		**23,424**	**42,031**			
		Service Area only		**8,472**	**15,202**			
		Kivule (1/2)	Y	2,614	4,690	4,690	11.2	
		Kivule (2/2)	Y	1,744	3,129	3,129	7.4	
		Mzinga	Y	4,114	7,382	7,382	17.6	
		~~Kipunguni Machimbo~~	N	~~6,039~~				W
		~~Kitunda Kati~~	N	~~8,913~~				W
UKONGA	~~GONGO LA MBOTO~~	(N.A)		20,470	**36,731**			DAWASA
MSONGOLA	**MSONGOLA**	**Total Area**		**3,668**	**6,582**			
		Service Area only		**1,410**	**2,530**	2,530	38.4	
		Yange Yange	Y	1,410	2,530			
		~~Mbondole~~	N	~~990~~				D
		~~Kitonga~~	N	~~593~~				D
		~~Mvuleni~~	N	~~675~~				D
PUGU	**PUGU STATION**	**Total Area**		7,139	12,810			
		Service Area only		6,481	11,629	2,882	22.5	
		Kichangani	Y	1,340	2,404			
		Pugu Station	Y	5,141	9,225			
		~~Bangulo~~	N	~~658~~				E, D
KINONDONI								
KIBAMBA	~~KWEMBE~~	~~(N.A)~~	N	~~7,600~~	~~12,814~~			S, T
GOBA	**MATOSA**		Y	2,580	4,350	2,747	21.4	
TEMEKE								
PEMBA MNAZI	**YALEYALE PUNA**	**Total Area**		**3,321**	**5,959**			
		Service Area only		**3,113**	**5,586**	5,586	93.7	
		Kibungo	Y	419	752			
		Kwamorisi	Y	624	1,120			
		Puna Centre	Y	2,070	3,714			
		~~Potea~~	N	~~208~~				S, D
~~CHARAMBE~~	~~KIMBANGULILE~~	~~(N.A)~~		~~12,500~~	~~22,430~~			CWSSP
PEMBAMNAZI	**TUNDWI SONGANI**	**Total Area**		**2,204**	**3,955**			
		Service Area only		**1,475**	**2,647**	2,647	66.9	
		Nyange	Y	320	574			
		Songani	Y	545	978			
		Tundwi	Y	610	1,095			
		~~Kichangani~~	N	~~448~~				D, S
		~~Muhimbili~~	N	~~281~~				D, S
MBAGALA	~~KINGUGI~~	~~(N.A)~~		~~4,663~~	~~8,367~~			DAWASA
MJIMWEMA	**MJIMWEMA**	**Total Area**		**5,670**	**10,174**			
		Service Area only		**2,000**	**3,589**	3,589	35.3	
		Salanga	Y	2,000	3,589			
		~~Jiwe La Adabu~~	N					
		~~Mjimwema~~	N	~~3,670~~				W
		~~Tangwani~~	N					
MJIMWEMA	**KIBUGUMO**	**Total Area**		1,883	3,379			
		Service Area only		1,883	3,379	3,379	100	

(Note)
E: Elevation is to high compared with other Sub Villages.
D: Distance is too long from other Sub Villages.
S: Distribution of houses are too scattered.
T: Topography is not suitable for piped scheme.
W: Existing piped scheme is available.
DAWASA: Included in DAWASA extension plan.
CWSSP: Target village of CWSSP.

5.3 WATER RESOURCES DEVELOPMENT PLAN

Type of water supply scheme highly depends on the availability of water sources in the Study area. Available water source is groundwater, spring water and river water. If development potential of those water sources is adequate, the scheme will cover the total population of the village as required. However, provided that potential of the water source is not adequate, the service population is decided according the available amount of water source potential. At the same time, development of groundwater sources shall avoid negative impact on the environment of the target village and its surrounding area, *i.e.* lowering of groundwater level and sea water intrusion due to overexploitation of groundwater. Therefore, actual exploitable yield and number of wells were technically analyzed in Chapter 4. The groundwater is exploited using deep tube wells. Standard design is shown in Section 5.5 of this Chapter.

The water of the Wami river, it is not deteriorated by factors neither related to protection of human health (WHO, 2004) or factors related to the obstruction of water utilization for drinking water and domestic water other than Turbidity and Coliform group. The river water is suited to supply required amount to Matipwili. Therefore, necessary amount of water is developed through the intake facility, and used after reducing the Turbidity and treatment of Microbial aspects.

No water quality deterioration was confirmed on the spring water in Njopeka. However, yield of the spring is capable to cover only around 66 % of the population. The spring water is exploited through the intake facility and used without any treatment.

The results are reflected in the "Water Supply Plan". Design and layout of those facilities are presented in detail in Section 5.5 of this Chapter.

5.4 WATER SUPPLY PLAN

The "Water Supply Plan" was formulated considering the population of target villages, availability of water sources and technical issues as mentioned in Section 5.2 of this Chapter.

5.4.1 ALTERNATIVE OF TYPIFIED WATER SUPPLY SCHEME

Following four types of water supply schemes were selected as the alternatives of Water Supply Plan.
(1) Piped Water Supply Scheme (Level-2)
(2) Rehabilitation of existing scheme (Level-2)
(3) Hand Pump (Level-1: Deep Tube Well)
(4) Extension of existing water supply scheme (Chalinze Water Supply Scheme, DAWASA)

The "Water Supply Plan" is summarized in *Table 5.6*. Location Maps of these village are given in Appendix of Supporting Report.

Table 5.6 Summary of Water Supply Plan (1/4)

No.	District/Municipality Ward	Villages/Mitaa		Population to be served		Water Demand (m3/day)(2015)	Neessary Number of Well (Level-2)	Exploitable Number of Well (Level-2)	Neessary Number of Well (Level-1)	Exploitable Number of Well (Level-1)	Serial No. (Level-2)	Served Population (2015) by Level-2	Served Population (2015) by Level-1	Served Population (2015) by Others(*)	Total Served Population (2015)	Coverage of Water Supply (%)	Alternative Water Supply
		Name of Village	Target Area	2002	2015												
Bagamoyo																	
1	Chalinze	Chamakweza	All	2,152	2,784	70	Chalinze-2							2,784	2,784	100.0	
2	Chalinze	Mdaula	Part	2,982	3,858	96	Chalinze-2							3,858	3,858	100.0	
3	Chalinze	Msolwa	All	2,672	3,457	86	Chalinze-2							3,457	3,457	100.0	
4	Dunda	Kaole	Part	292	378	9	DAWASA							378	378	100.0	
5	Kibindu	Kibindu	All	5,605	7,251	126	3	2	4	4	BGM-1	6,344	907		7,251	100.0	
6	Kibindu	Kwamduma	All	3,677	4,757	119	2	2	6	6	BGM-2	3,292	1,465		4,757	100.0	
7	Kibindu	Kwamsanja	All	1,001	1,295	32			6	6			1,295		1,295	100.0	
8	Kiwangwa	Fukayosi	All	3,700	4,786	120	Chalinze-2							4,786	4,786	100.0	
9	Kiwangwa	Kidomole	All	586	758	19	Chalinze-2							758	758	100.0	
10	Kiwangwa	Kiwangwa	All	12,762	16,509	413	Chalinze-2							16,509	16,509	100.0	
11	Kiwangwa	Masuguru	All	1,768	2,287	57	Chalinze-2							2,287	2,287	100.0	
12	Kiwangwa	Mkenge	All	2,050	2,652	66	Chalinze-2							2,652	2,652	100.0	
13	Kiwangwa	Msinune	All	1,927	2,493	62	Chalinze-2							2,493	2,493	100.0	
14	Lugoba	Diozile	All	1,631	2,110	53	Chalinze-2							2,110	2,110	100.0	
15	Magomeni	Magomeni	Part	645	834	21			4	2			500		500	59.9	
16	Magomeni	Makurunge	All	1,636	2,116	53	Chalinze-2							2,116	2,116	100.0	
17	Mbwewe	Kifuleta	All	3,523	4,557	114	Chalinze-2							4,557	4,557	100.0	
18	Mbwewe	Kwang'Andu	All	2,016	2,608	65	Chalinze-2							2,608	2,608	100.0	
19	Mbwewe	Kwaruhombo	All	2,068	2,675	67	Chalinze-2							2,675	2,675	100.0	
20	Mbwewe	Pongwekiona	All	3,135	4,055	101	Chalinze-2							4,055	4,055	100.0	
21	Miono	Kweikonje	All	1,124	1,454	36	Chalinze-2							1,454	1,454	100.0	
22	Miono	Masimbani	All	1,181	1,528	38	Chalinze-2							1,528	1,528	100.0	
23	Miono	Mihuga	All	1,417	1,833	46	Chalinze-2							1,833	1,833	100.0	
24	Mkange	Manda Mazingara	All	3,122	4,039	101	Chalinze-2							4,039	4,039	100.0	
25	Mkange	Matipwili*	All	2,698	3,490	87	Wami River		4	4	BGM-3	2,518	972		3,490	100.0	
26	Mkange	Mkange	All	2,396	3,099	77	Chalinze-2							3,099	3,099	100.0	
27	Mkange	Saadani	All	1,344	1,739	43	Protected Well				BGM-4	1,739			1,739	100.0	
28	Msata	Pongwe Msungura	All	1,005	1,300	33	Chalinze-2							1,300	1,300	100.0	
29	Talawanda	Kisanga	All	855	1,106	28	Chalinze-2							1,106	1,106	100.0	
30	Talawanda	Malivundo	All	1,166	1,508	38	Chalinze-2							1,508	1,508	100.0	
31	Talawanda	Mindukeni	All	1,438	1,860	47	Chalinze-2							1,860	1,860	100.0	
32	Talawanda	Msigi	All	1,124	1,454	36	Chalinze-2							1,454	1,454	100.0	
33	Talawanda	Talawanda	All	4,124	5,335	133	Chalinze-2							5,335	5,335	100.0	
34	Ubenazomozi	Kaloleni	All	3,210	4,152	104	Chalinze-2							4,152	4,152	100.0	
35	Ubenazomozi	Matuli	All	1,349	1,745	64	Chalinze-2							1,745	1,745	100.0	
36	Ubenazomozi	Mwidu	All	1,977	2,557	64	Chalinze-2							2,557	2,557	100.0	
37	Ubenazomozi	Tukamisasa	All	3,051	3,947	99	Chalinze-2							3,947	3,947	100.0	
38	Ubenazomozi	Ubenazomozi	All	2,490	3,221	81	Chalinze-2							3,221	3,221	100.0	
39	Ubenazomozi	Visakazi	All	4,893	6,330	158	Chalinze-2							6,330	6,330	100.0	
40	Vigwaza	Buyuni	All	1,759	2,275	57	Chalinze-2							2,275	2,275	100.0	
41	Vigwaza	Kidogozero	Part	1,077	1,393	35			6	2			500		500	35.9	
42	Vigwaza	Vigwaza	All	4,039	5,225	131	Chalinze-2							5,225	5,225	100.0	
43	Vigwaza	Visezi	All	1,281	1,657	41	Chalinze-2							1,657	1,657	100.0	
44	Yombo	Yombo	Part	121	157	4	DAWASA							157	157	100.0	
45	Zinga	Mapinga	Part	195	252	6	DAWASA							252	252	100.0	
Total (with Chalinze-2 & DAWASA)				104,264	134,876	3,336	5	4	30	24		13,893	5,639	114,117	133,649	99.1	
Total (without Chalinze-2 & DAWASA)				16,047	20,759	463									19,532	94.1	
Kibaha																	
1	Kibaha	Kongowe	Part	362	559	14			3	3			559		559	100.0	
2	Kibaha	Msangani		3,025	4,671	*117*	DAWASA							500	500	10.7	
3	Kibaha	Mwendapole	Part	854	1,319	33	DAWASA							4,671	4,671	354.1	
4	Kibaha	Tangani	All	2,800	4,325	*108*	DAWASA							500	500	11.6	
5	Kibaha	Viziwaziwa	All	2,124	3,280	82			14	2			500		500	15.2	DAWASA
6	Kwala	Dutumi	All	1,300	2,008	50			9	9			2,008		2,008	100.0	
7	Kwala	Mpelamumbi	All	346	534	13			3	3			534		534	100.0	
8	Magindu	Gumba	All	5,000	7,722	193	Chalinze-2							7,722	7,722	100.0	
9	Magindu	Gwata	All	2,136	3,299	82	Chalinze-2							3,299	3,299	100.0	
10	Magindu	Lukenge	All	1,050	1,622	41	Chalinze-2							1,622	1,622	100.0	
11	Magindu	Magindu	All	2,041	3,152	79	Chalinze-2							3,152	3,152	100.0	
12	Mlandizi	Mlandizi 'B'	Part	4,040	6,239	156	DAWASA							6,239	6,239	100.0	
13	Ruvu	Kikongo	All	710	1,097	27			5	2			500		500	45.6	
14	Ruvu	Kitomondo	All	627	968	24	1	1			KBH-2	968			968	100.0	
15	Ruvu	Lupunga	All	1,128	1,742	44			7	2			500		500	28.7	
16	Ruvu	Minazi Mikinda	All	2,624	4,053	101	1	1			KBH-1	4,053			4,053	100.0	
17	Ruvu	Mwanabwito	All	1,540	2,378	59			10	4			1,000		1,000	42.1	DAWASA
18	Ruvu	Ngeta	All	1,616	2,496	62			10	2			500		500	20.0	DAWASA
19	Soga	Bokomnemela	All	2,831	4,372	109			18	4			1,000		1,000	22.9	DAWASA
20	Soga	Kipangege	All	347	536	13			3	3			536		536	100.0	
21	Soga	Misufini	All	337	520	13			3	3			520		520	100.0	
22	Soga	Mpiji	All	1,774	2,740	69			11	4			1,000		1,000	36.5	DAWASA
23	Tumbi	Bokotimiza	All	623	962	24			4	2			500		500	52.0	
24	Visiga	Zogowale	All	1,099	1,697	42			7	2			500		500	29.5	DAWASA
Total (Kibaha) (with Chalinze-2 & DAWASA)				40,334	62,291	1,555	2	2	107	45		5,021	10,157	27,705	42,883	68.8	
Total (Kibaha) (without Chalinze-2 & DAWASA)				23,428	36,181	902									15,178	42.0	

Table 5.6 Summary of Water Supply Plan (2/4)

No.	District/Municipality Ward	Villages/Mitaa		Population to be served		Water Demand (m3/day)(2015)	Neessary Number of Well (Level-2)	Exploitable Number of Well (Level-2)	Neessary Number of Well (Level-1)	Exploitable Number of Well (Level-1)	Serial No. (Level-2)	Served Population (2015) by Level-2	Served Population (2015) by Level-1	Served Population (2015) by Others(*)
		Name of Village	Target Area	2002	2015									
Kisarawe														
1	Chole	Chole	All	2,685	3,217	80	2	2			KSW-1	3,217		
2	Chole	Kurui-Chole	All	1,032	1,236	31			5	4			1,000	
3	Chole	Kwala-Chole	All	2,245	2,690	67			11	4			1,000	
4	Chole	Mafumbi	All	664	796	20			4	4			796	
5	Chole	Sofu	All	142	170	4			1	1			170	
6	Chole	Yombo Lukinga	All	862	1,033	26			5	4			1,000	
7	Kibuta	Bwama	All	1,332	1,596	40			7	6			1,500	
8	Kibuta	Chang'ombe 'B'	All	989	1,185	30			5	2			500	
9	Kibuta	Kauzeni	All	1,685	2,019	50			9	4			1,000	
10	Kibuta	Kibuta	All	2,050	2,456	61			10	2			500	
11	Kibuta	Masanganya	All	2,289	2,742	69			11	2			500	
12	Kibuta	Mtamba	All	840	1,006	25			5	4			1,000	
13	Kibuta	Muhaga	All	911	1,091	27			5	4			1,000	
14	Kiluvya	Kiluvya 'A'	Part	1,287	1,542	39			7	2			500	
15	Kiluvya	Mloganzila	All	1,250	1,498	37			6	2			500	
16	Kiluvya	Tondoroni	All	4,233	5,072	127			21	4			1,000	
17	Kisarawe	Kazimzumbwi	All	1,678	2,010	50			9	6			1,500	
18	Kisarawe	Kifuru	All	544	652	16			3	2			500	
19	Kisarawe	Kisarawe	Part	900	1,078	27			5	4			1,000	
20	Kisarawe	Visegese	All	1,182	1,416	35			6	4			1,000	
21	Kurui	Kidugalo	All	532	637	16			3	3			637	
22	Kurui	Kurui	All	584	700	18			3	3			700	
23	Kurui	Mtakayo	All	998	1,196	30			5	5			1,196	
24	Kurui	Zegero	All	738	884	22			4	5			1,250	
25	Mafizi	Gwata	Part	1,956	2,343	59			10	10			2,343	
26	Mafizi	Kimala Misale	All	720	863	22			4	4			863	
27	Mafizi	Mafizi	All	1,436	1,720	43			7	6			1,500	
28	Mafizi	Nyani	All	861	1,032	26			5	5			1,032	
29	Mafizi	Ving'Andi	All	780	935	23			4	4			935	
30	Maneromango	Boga	All	2,038	2,442	61			10	2			500	
31	Maneromango	Chale	All	516	618	15			3	3			618	
32	Maneromango	Kidugalo-Kanga	All	857	1,027	26			5	2			500	
33	Maneromango	Mengwa	All	996	1,193	30			5	2			500	
34	Maneromango	Msegamo	All	777	931	23			4	2			500	
35	Maneromango	Ngongele	All	710	851	21			4	2			500	
36	Marui	Kihare	All	720	863	22			4	4			863	
37	Marui	Kisangire	All	300	359	9			2	2			359	
38	Marui	Marui-Mipera	All	1,034	1,239	31			5	2			500	
39	Marui	Marui-Ngwata	All	1,443	1,729	43			7	2			500	
40	Marui	Titu	All	427	512	13			3	3			512	
41	Marumbo	Chang'ombe 'A'	All	548	657	16			3	2			500	
42	Marumbo	Kitonga	All	734	879	22			4	2			500	
43	Marumbo	Kivukoni	All	1,770	2,121	53			9	2			500	
44	Marumbo	Marumbo	All	1,115	1,336	33			6	6			1,336	
45	Marumbo	Mfuru Kikwete*	All	3,686	4,416	110			18	2			500	
46	Marumbo	Palaka	All	963	1,154	29			5	2			500	
47	Masaki	Kisanga	All	2,125	2,546	64			11	8			2,000	
48	Masaki	Masaki	All	2,786	3,338	83			14	4			1,000	
49	Masaki	Sungwi	All	1,573	1,885	47			8	2			500	
50	Msanga	Bembeza*	All	1,259	1,508	38			7	6			1,500	
51	Msanga	Mianzi	All	747	895	22			4	2			500	
52	Msanga	Msanga	All	1,998	2,394	60			10	4			1,000	
53	Msanga	Visiga	All	1,188	1,423	36			6	4			1,000	
54	Msimbu	Gumba	All	1,385	1,659	41			7	2			500	
55	Msimbu	Homboza	All	1,458	1,747	44			7	2			500	
56	Msimbu	Kitanga	All	486	582	15			3	2			500	
57	Msimbu	Luhangai	All	769	921	23			4	2			500	
58	Msimbu	Maguruwe	All	497	595	15			3	2			500	
59	Msimbu	Msimbu	All	2,967	3,555	89	2	2	4	4	KSW-2	2,635	920	
60	Mzenga	Chakenge	All	1,356	1,625	41			7	6			1,500	
61	Mzenga	Mitengwe	All	408	489	12			2	2			489	
62	Mzenga	Mzenga 'A'	All	1,163	1,393	35			6	2			500	
63	Mzenga	Vilabwa	All	197	236	6			1	1			236	
64	Vihingo	Chamalale	All	149	179	4			1	1			179	
65	Vihingo	Kibwemwenda	All	740	887	22			4	4			887	
66	Vihingo	Mihugwe	All	310	371	9			2	2			371	
67	Vihingo	Mzenga 'B'	All	1,231	1,475	37			6	2			500	
68	Vihingo	Sangwe	All	741	888	22			4	2			500	
69	Vihingo	Vihingo	All	340	407	10			2	2			407	
70	Vikumburu	Kitonga	All	420	503	13			3	3			503	
71	Vikumburu	Koresa	All	689	825	21			4	2			500	
72	Vikumburu	Mtunani	All	504	604	15			3	3			604	
73	Vikumburu	Pangala Mwingereza	All	778	932	23			4	2			500	
74	Vikumburu	Vikumburu	All	1,484	1,778	44			8	6			1,500	
	Total (Kisarawe)			85,787	102,782	2,568	4	4	422	236		5,852	56,206	0

Table 5.6 Summary of Water Supply Plan (3/4)

No.	District /Municipality Ward	Villages/Mitaa		Population to be served		Water Demand (m3/day)(2015)	Neessary Number of Well (Level-2)	Exploitable Number of Well (Level-2)	Neessary Number of Well (Level-1)	Exploitable Number of Well (Level-1)	Serial No. (Level-2)	Served Population (2015) by Level-2	Served Population (2015) by Level-1	Served Population (2015) by Others(*)	Total Served Population (2015)	Coverage of Water Supply (%)	Alternative Water Supply
		Name of Village	Target Area	2002	2015												
Mkuranga																	
1	Bupu	Bupu	All	1,435	2,244	56			9	4			1,000		1,000	44.6	
2	Bupu	Mamndikongo	All	1,421	2,222	56			9	4			1,000		1,000	45.0	
3	Bupu	Mandimpela	All	1,820	2,846	71			12	2			500		500	17.6	
4	Bupu	Tundu	All	1,416	2,215	55			9	8			2,000		2,000	90.3	
5	Kimanzichana	Kilimahewa Kaskazini	All	3,256	5,092	127			21	2			500		500	9.8	
6	Kimanzichana	Kimanzichana Kaskazini	All	1,006	1,573	39			7	2			500		500	31.8	
7	Kimanzichana	Kimanzichana Kusini	All	13,700	21,426	536			86	2			500		500	2.3	
8	Kimanzichana	Kimbwinindi	All	3,250	5,083	127			21	4			1,000		1,000	19.7	
9	Kimanzichana	Mkenge	All	2,393	3,743	94			15	2			500		500	13.4	
10	Kisiju	Binga	All	1,832	2,865	72			12	2			500		500	17.5	
11	Kisiju	Dondo	All	1,189	1,860	47			8	4			1,000		1,000	53.8	
12	Kisiju	Kalole	Part	1,198	1,874	47			8	2			500		500	26.7	
13	Kisiju	Kerekese	All	2,800	4,379	109			18	2			500		500	11.4	
14	Kisiju	Mpafu	All	665	1,040	26			5	4			1,000		1,000	96.2	
15	Kisiju	Sotele	All	1,917	2,998	75			12	2			500		500	16.7	
16	Kitomondo	Kikoo	All	2,395	3,746	94			15	2			500		500	13.3	
17	Kitomondo	Kitomondo	All	1,799	2,814	70			12	2			500		500	17.8	
18	Kitomondo	Kiwambo	All	1,969	3,079	77			13	2			500		500	16.2	
19	Kitomondo	Mingombe	All	992	1,551	39			7	2			500		500	32.2	
20	Kitomondo	Mitaranda	All	1,552	2,427	61			10	2			500		500	20.6	
21	Kitomondo	Miteza	All	1,819	2,845	71			12	2			500		500	17.6	
22	Kitomondo	Njia Nne	All	6,788	10,616	265			43	4			1,000		1,000	9.4	
23	Lukanga	Lukanga	All	1,983	3,101	78			13	4			1,000		1,000	32.2	
24	Lukanga	Misasa	All	2,196	3,434	86			14	2			500		500	14.6	
25	Lukanga	Mkola	All	1,107	1,731	43			7	2			500		500	28.9	
26	Lukanga	Njopeka	All	6,611	10,339	258	Spring		21	6	MKR-1	5,272	1,500		6,772	65.5	
27	Lukanga	Sangalani	All	1,678	2,624	66			11	2			500		500	19.1	
28	Magawa	Kifumangao	All	681	1,065	27			5	4			1,000		1,000	93.9	
29	Magawa	Magawa	All	4,524	7,075	177			29	4			1,000		1,000	14.1	
30	Magawa	Mdini	All	1,648	2,577	64			11	2			500		500	19.4	
31	Magawa	Msonga	All	1,197	1,872	47			8	2			500		500	26.7	
32	Magawa	Mtongani	All	591	924	23			4	2			500		500	54.1	
33	Magawa	Nasibugani	Part	97	152	4			1	1			152		152	100.0	
34	Magawa	Nyamihimbo	All	889	1,390	35			6	2			500		500	36.0	
35	Magawa	Sangasanga	All	1,006	1,573	39			7	2			500		500	31.8	
36	Mkuranga	Dundani	All	1,577	2,466	62			10	2			500		500	20.3	
37	Mkuranga	Hoyoyo	All	3,320	5,192	130			21	2			500		500	9.6	
38	Mkuranga	Kibululu	All	1,005	1,572	39			7	2			500		500	31.8	
39	Mkuranga	Kiparang'anda'A'	All	4,321	6,758	169			28	2			500		500	7.4	
40	Mkuranga	Kiparang'anda'B'	All	2,065	3,230	81			13	2			500		500	15.5	
41	Mkuranga	Kise*	All	674	1,054	26			5	2			500		500	47.4	
42	Mkuranga	Kolangwa	All	500	782	20			4	2			500		500	63.9	
43	Mkuranga	Magoza	All	2,220	3,472	87			14	2			500		500	14.4	
44	Mkuranga	Mkuranga	Part	2,823	4,415	110			18	4			1,000		1,000	22.6	
45	Mkuranga	Mkwalia	Part	1,072	1,677	42			7	2			500		500	29.8	
46	Mkuranga	Sunguvuni	All	989	1,547	39			7	2			500		500	32.3	
47	Mkuranga	Tengelea	All	2,845	4,449	111			18	2			500		500	11.2	
48	Mwalusembe	Bigwa	All	2,098	3,281	82			14	2			500		500	15.2	
49	Mwalusembe	Kitonga	All	1,500	2,346	59			10	2			500		500	21.3	
50	Mwalusembe	Kiziko	All	1,286	2,011	50			9	4			1,000		1,000	49.7	
51	Mwalusembe	Mwalusembe	All	5,886	9,205	230			37	2			500		500	5.4	
52	Nyamato	Kilmba	All	1,280	2,002	50			9	4			1,000		1,000	50.0	
53	Nyamato	Kilimahewa Kusini	All	1,920	3,003	75			13	2			500		500	16.7	
54	Nyamato	Mkiu	All	3,742	5,852	146			24	4			1,000		1,000	17.1	
55	Nyamato	Mvuleni	All	1,886	2,950	74			12	2			500		500	16.9	
56	Nyamato	Nyanduturu	All	1,668	2,609	65			11	2			500		500	19.2	
57	Nyamato	Tipo	All	1,997	3,123	78			13	8			2,000		2,000	64.0	
58	Tambani	Dondwe	All	1,951	3,051	76			13	2			500		500	16.4	
59	Tambani	Kibamba	All	1,095	1,713	43			7	2			500		500	29.2	
60	Tambani	Mipeko	All	1,418	2,218	55			9	2			500		500	22.5	
61	Tambani	Mlamleni	All	2,318	3,625	91			15	2			500		500	13.8	
62	Tambani	Mwanadilatu	All	1,560	2,440	61			10	4			1,000		1,000	41.0	
63	Tambani	Mwanambaya	All	2,466	3,857	96			16	4			1,000		1,000	25.9	
64	Tambani	Tambani	All	1,538	2,405	60			10	2			500		500	20.8	
65	Vikindu	Kipala	All	2,029	3,173	79	-	-			MKR-2	782		2,391	3,173	100.0	Own Scheme
66	Vikindu	Kisemvule	All	2,260	3,535	88	2	2	2	2	MKR-3	3,244	291		3,535	100.0	
67	Vikindu	Malela	All	1,250	1,955	49			8	8			1,955		1,955	100.0	
68	Vikindu	Morogoro	All	1,500	2,346	59	1	1	2	2	MKR-4	1,939	407		2,346	100.0	
69	Vikindu	Mfurumwambao	All	1,435	2,244	56	1	-	7	7	MKR-4	696	1,548		2,244	100.0	
70	Vikindu	Mkokozi	All	1,769	2,767	69			12	12			2,767		2,767	100.0	
71	Vikindu	Mwandege	All	1,600	2,502	63	1	1	2	3	MKR-2	1,905	597		2,502	100.0	
72	Vikindu	Vianzi	All	2,625	4,105	103	2	1	5	5	MKR-5	2,926	1,179		4,105	100.0	
73	Vikindu	Vikindu	All	5,125	8,015	200			20	13			3,206	4,809	8,015	100.0	Private schemes
74	Vikindu	Yavayava	All	1,830	2,862	72			12	12			2,862		2,862	100.0	
Total (Mkuranga)				161,263	252,203	6,306	7	5	955	237		16,764	57,964	7,200	81,928	32.5	
Total (Coast: with Cahalinze-2 & DAWASA)				391,648	552,152	13,765	18	15	1,514	542		41,530	129,966	149,022	320,518	58.0	
Total (Coast: without Cahalinze-3 & DAWASA)				286,525	411,926	10,239									171,496	41.6	

Table 5.6 Summary of Water Supply Plan (4/4)

No.	District/Municipality Ward	Villages/Mitaa		Population to be served		Water Demand (m3/day)(2015)	Neessary Number of Well (Level-2)	Exploitable Number of Well (Level-2)	Neessary Number of Well (Level-1)	Exploitable Number of Well (Level-1)	Serial No. (Level-2)	Served Population (2015) by Level-2	Served Population (2015) by Level-1	Served Population (2015) by Others(*)	Total Served Population (2015)	Coverage of Water Supply (%)	Alternative Water Supply
		Name of Village	Target Area	2002	2015												
Ilala																	
1	Chanika	Buyuni	All	6,544	11,742	294			47	6			1,500		1,500	12.8	
2	Chanika	Chanika	All	13,906	24,953	624			100	4			1,000		1,000	4.0	
3	Chanika	Majohe	All	3,122	5,602	140			23	6			1,500		1,500	26.8	
4	Ilala	Shariff Shamba	All	6,708	12,037	301	DAWASA							12,037	12,037	100.0	
5	Kinyerezi	Kinyerezi	All	5,811	10,427	261	DAWASA							10,427	10,427	100.0	
6	Kipawa	Kipunguni	All	19,275	34,586	865	DAWASA							34,586	34,586	100.0	
7	Kitunda	Kitunda	All	23,424	42,031	1,051	10	5			ILL-1	15,201		26,829	42,030	100.0	DAWASA
8	Msongola	Msongola	All	3,668	6,582	165	3	1			ILL-2	2,530		4,052	6,582	100.0	
9	Msongola	Mvuti	All	4,108	7,371	184			30	4			1,000		1,000	13.6	DAWASA
10	Pugu	Pugu Kajiungeni	Part	3,850	6,908	173			28	4			1,000		1,000	14.5	DAWASA
11	Pugu	Pugu Station	Part	1,998	3,585	90	2	1	3	3	ILL-3	2,882	703		3,585	100.0	
12	Segerea	Amani	All	4,238	7,605	190	DAWASA							7,605	7,605	100.0	
13	Segerea	Kimanga Darajani	All	19,270	34,578	864	DAWASA							34,578	34,578	100.0	
14	Segerea	Kisukulu	All	4,151	7,448	186	DAWASA							7,448	7,448	100.0	
15	Segerea	Tembomgwaza	All	6,239	11,195	280	DAWASA							11,195	11,195	100.0	
16	Tabata	Matumbi	All	4,304	7,723	193	DAWASA							7,723	7,723	100.0	
17	Tabata	Tabata	All	9,239	16,578	414	DAWASA							16,578	16,578	100.0	
18	Tabata	Tenge	All	4,750	8,523	213	DAWASA							8,523	8,523	100.0	
19	Ukonga	Gongo La Mboto	All	20,470	36,731	918	DAWASA							36,731	36,731	100.0	
20	Ukonga	Guluka Kwalala	All	12,978	23,287	582			94	4			1,000		1,000	4.3	DAWASA
21	Ukonga	Markaz	All	4,279	7,678	192			31	2			500		500	6.5	DAWASA
22	Ukonga	Mongo La Ndege	All	3,698	6,636	166			27	2			500		500	7.5	DAWASA
23	Ukonga	Mwembemadafu	All	27,648	49,611	1,240			199	4			1,000		1,000	2.0	DAWASA
24	Ukonga	Ulongoni	All	3,680	6,603	165			27	4			1,000		1,000	15.1	DAWASA
Total (Ilala) (with DAWASA)				217,358	390,020	9,751	15	7	609	43		20,613	10,703	218,312	249,628	64.0	
Total (Ilala) (without DAWASA)				156,552	280,911	7,023									31,316		
Kinondoni																	
1	Bunju	Mabwepande	All	3,100	5,227	131	DAWASA							5,227	5,227	100.0	
2	Bunju	Mbopo	All	1,868	3,149	79	DAWASA							3,149	3,149	100.0	
3	Goba	Kulangwa	All	1,220	2,057	51	DAWASA							2,057	2,057	100.0	
4	Goba	Matosa	All	25,144	42,393	1,060	16	1			KND-1	2,747			2,747	6.5	DAWASA
5	Kawe	Changanyikeni	All	17,000	28,662	717	DAWASA							28,662	28,662	100.0	
6	Kibamba	Kibwegere	All	3,000	5,058	126	DAWASA		21					5,058	5,058	100.0	
7	Kibamba	Kwembe	All	7,600	12,814	320				10			2,500		2,500	19.5	DAWASA
8	Kimara	Kimara Baruti	All	14,584	24,589	615	DAWASA							24,589	24,589	100.0	
9	Kimara	Mavurunza	All	3,974	6,700	168	DAWASA							6,700	6,700	100.0	
10	Kunduchi	Madala	All	8,932	15,059	376	DAWASA							15,059	15,059	100.0	
11	Mbezi	Mbezi-Luis	All	20,079	33,853	846	DAWASA							33,853	33,853	100.0	
12	Mbezi	Mpiji Magohe	All	2,723	4,591	115	DAWASA							4,591	4,591	100.0	
13	Mbezi	Msakuzi	All	2,797	4,716	118	DAWASA							4,716	4,716	100.0	
14	Mbezi	Msumi	All	1,330	2,242	56			9	4			1,000		1,000	44.6	DAWASA
Total (with DAWASA)				113,351	191,110	4,778	16	1	30	14		2,747	3,500	133,661	139,908	73.2	
Total (without DAWASA)				34,074	57,449	1,436									6,247	10.9	
Temeke																	
1	Chamazi	Msufini	All	6,427	11,532	288	DAWASA							11,532	11,532	100.0	
2	Charambe	Kimbangulile	All	12,500	22,430	561	DAWASA(CWSSP)							22,430	22,430	100.0	
3	Kimbiji	Kizito Huonjwa	All	1,096	1,967	49	DAWASA							1,967	1,967	100.0	
4	Makangarawe	Makangarawe	All	10,400	18,661	467	DAWASA							18,661	18,661	100.0	
5	Makangarawe	Yombo Dovya	All	15,881	28,496	712	DAWASA							28,496	28,496	100.0	
6	Mbagala	Kingugi	All	4,663	8,367	209	DAWASA							8,367	8,367	100.0	
7	Mbagala Kuu	Mbagala Kuu	All	11,540	20,707	518	DAWASA							20,707	20,707	100.0	
8	Mbagala Kuu	Mgeni Nani	All	7,020	12,596	315	DAWASA							12,596	12,596	100.0	
9	Mjimwema	Kibugumo	All	1,883	3,379	84	1	1			TMK-1	3,379			3,379	100.0	
10	Mjimwema	Mjimwema	All	5,670	10,174	254	3	1			TMK-2	3,589		6,585	10,174	100.0	Municipality
11	Pemba Mnazi	Yale Yale Puna	All	3,321	5,959	149	1	1	2	2	TMK-3	5,586	373		5,959	100.0	
12	Pembamnazi	Tundwi Songani	All	2,204	3,955	99	2	2	6	6	TMK-4	2,647	1,308		3,955	100.0	
13	Tandika	Maguruwe	All	6,599	11,841	296	DAWASA							11,841	11,841	100.0	
14	Tandika	Nyambwela	All	4,402	7,899	197	DAWASA							7,899	7,899	100.0	
15	Tandika	Tamla	All	5,814	10,432	261	DAWASA							10,432	10,432	100.0	
16	Tuangoma	Kongowe	All	3,165	5,679	142	DAWASA							5,679	5,679	100.0	
17	Vijibweni	Kibene	All	751	1,348	34	DAWASA							1,348	1,348	100.0	
18	Vijibweni	Kisiwani	All	1,060	1,902	48	DAWASA							1,902	1,902	100.0	
19	Vijibweni	Mkwajuni	All	997	1,789	45	DAWASA							1,789	1,789	100.0	
20	Vijibweni	Vijibweni	All	1,800	3,230	81	DAWASA							3,230	3,230	100.0	
21	Yombo Vituka	Machimbo	All	15,421	27,671	692	DAWASA							27,671	27,671	100.0	
22	Yombo Vituka	Sigara	All	8,024	14,398	360	DAWASA							14,398	14,398	100.0	
23	Yombo Vituka	Vituka	All	11,499	20,633	516	DAWASA							20,633	20,633	100.0	
Total (with DAWASA)				142,137	255,045	6,377	7	5	8	8		15,201	1,681	238,163	255,045	100.0	
Total (without DAWASA)				13,078	23,467	586									23,467	100.0	
Total (DSM: with DAWASA)				472,846	836,175	20,906	38	13	647	65		38,561	15,884	590,136	644,581	77.1	
Total (DSM: without DAWASA)				203,704	361,827	9,045									54,445	15.0	
Total (Total Area: with Chalinze-2 and DAWASA)				864,494	1,388,327	34,671	56	28	2,161	607		80,091	145,850	739,158	965,099	69.5	
otal (Total Area: without Chalinze-2 and DAWASA				490,229	773,753	19,284									225,941	29.2	

5.4.2 PIPED WATER SUPPLY SCHEME (LEVEL-2)

This piped scheme with public water points is known as Level-2 water supply scheme. Level-2 scheme was applied when the population is more than 2,500 in the year 2015 and yield of groundwater is more than 100 litre/min.

Finally 22 schemes are clarified as suitable in 22 villages. Two types of Level-2 scheme were planned in the Study: A scheme that supplies to one village and a scheme that supplies two villages (Two villages share a one scheme). The number of the former is 19 and the latter is 3.

The Level-2 scheme will cover the population of approximately 78.4 x 10^3 in the Study area: 39.8 x 10^3 in Coast Region and 38.6 x 10^3 in Dar es Salaam Peri-Urban in 2015. The District/Municipality wise service populations in 2015 are shown in *Table 5.7*.

Table 5.7 Population Covered by Level-2 Scheme (2015)

District	Service Population		Municipality	Service Population	
	2002	2015		2002	2015
Bagamoyo	10,098	12,154	Ilala	12,764	20,613
Kibaha	3,251	5,021	Kinondoni	2,580	2,747
Kisarawe	4,884	5,852	Temeke	8,471	15,201
Mkuranga	11,547	16,764	Total (DSM)	25,817	38,561
Total (Coast)	31,782	39,791			
			Grand Total	(2002)	53,595
			Grand Total	(2015)	78,352

Level-2 scheme will cover 6.2 % of the target population in 2002.

5.4.3 HAND PUMP (LEVEL-1)

A deep tube well with a hand pump is known as Level-1 scheme. If groundwater potential is not enough for piped scheme (Level-2) but still adequate for hand pump, deep tube well with hand pump (Level-1) was considered in the Study. Number of deep tube wells was decided depending on the water demand in the village and appropriate spacing of wells as mentioned in Chapter 4. In addition, the areas excluded from the service area of Level-2 scheme were planned to be supplied by Level-1 schemes. Number of Level-1 scheme in each village is shown in *Table 5.8*.

Table 5.8 Population Covered by Level-1 Scheme (2015)

Region	District/Municipality	Number of Scheme	Service Population
Coast	Bagamoyo	24	5,639
	Kibaha	45	10,157
	Kisarawe	236	56,206
	Mkuranga	237	57,564
	Total (Coast)	542	129,966
DSM	Ilala	43	10,703
	Kinondoni	14	3,500
	Temeke	8	1,681
	Total (DSM)	65	15,884
Total (Total Study Area)		607	145,850

Level-1 scheme will cover 16.9 % of the target population in 2002.

5.4.4 EXTENSION OF EXISTING WATER SUPPLY SCHEME

There are two major existing water supply schemes in the Study area, DAWASA and Chalinze Water Supply Scheme. The service area by DAWASA is out of the Study target area.

(1) Chalinze Water Supply Scheme

The Chalinze Water Supply Scheme was implemented in the year 2001 targeting to supply 243,000 people in 51 villages by the year 2015 and was commissioned in 2003 as the Chalinze Water Supply Project Phase I supplying to 17 villages in Bagamoyo District. The scheme is

currently supplying to 19 villages (as of November 2005). The scheme was designed and constructed with a capacity to meet the water demand for both Phase-1 and Phase-2 Projects (Bagamoyo District, 2001). 42 villages are planned to be covered by the Chalinze Water Supply Project Phase II. According to the Feasibility Study Report (MoWLD, 2005), construction of additional clarifier with capacity of 200 m^3/hour, additional rising main between Mazizi and Mboga storage tank will be provided in the implementation of phase II project. MoWLD carried out the Feasibility Study for the Phase II Project and concluded that the Project is feasible. The Phase II Project is expected to be implemented in 2006 and 2007 (MoWLD, 2005). Most of the villages in Bagamoyo District and four villages in Kibaha District (Gumba, Gwata, Magindu, and Lukenge Villages) will be covered by this scheme. The Phase II Project will cover the population of approximately 130 x 10^3 in 2005.

(2) DAWASA

The water supply by DAWASA covers the Dar es Salaam Urban area and the areas along the Morogoro Road from Dar es Salaam to Mlandizi in Kibaha District, to Bagamoyo along the Bagamoyo Road and the road between Bagamoyo and Mlandizi (See, *Figure 1.1*).

DAWASA has an intention to cover the entire area of Dar es Salaam Region by either extension of existing service area or CWSSP. However, suitable water sources have not been found. DAWASA will start a study on deep groundwater in the area along the coast of Dar es Salaam and Coast Regions. If the available groundwater source is found, the extension of the service area of DAWASA will be much accelerated.

5.4.5 REHABILITATION OF THE EXISTING WATER SUPPLY SCHEME

The survey on the existing water supply schemes revealed that there are 20 schemes in Coast Region and 73 schemes in Dar es Salaam Region. Approximately 30 % of schemes are suspended due to the problems of water source, breakdown of pump and generator, damage of pipe facilities, and others. These schemes should be properly operated and maintained. However, damaged equipment and broken materials have not been repaired or replaced for many years due to the insufficient maintenance/replacement fund.

Considering the above situation, following criteria were applied in the evaluation of schemes for improvement.

- Scheme, located in the village where the Level-2 scheme is proposed in the Study.
- Scheme, of which part of facility is available as a part of the Level-2 scheme proposed.
- Scheme, having safe and stable water source.
- Scheme, not included in other plan such as the Chalinze Water Supply Project Phase II.

Depending on the above criteria, Kibindu in Bagamoyo and Njopeka in Mkuranga were evaluated as applicable for Level-2 scheme. Facilities in those villages were too old for use as a part of Level-2 scheme to be newly constructed. Accordingly, Level-2 schemes planned will be entirely newly constructed in these villages. Other villages do not meet the criteria of above, therefore, such villages were planned to be supplied by Level-1 scheme instead of Level-2.

There was a piped scheme in Saadani Village in Bagamoyo District. Its water source was a protected well. Saadani Village does not meet the criteria of above, however, there is no suitable water source other than shallow protected well even though EC is more than 3,000 micro-S/cm. Therefore, rehabilitation plan was exceptionally prepared only for only Saadani village. The contents of rehabilitation plan are as follows:

- Construction of intake facility.
- Partial rehabilitation of transmission/distribution lines and storage tank.

5.5 PRELIMINARY DESIGN OF WATER SUPPLY SCHEMES

The four types of water supply schemes were proposed in the Water Supply Plan. Out of them, preliminary design is required for Level-2 and Level-1, because Chalinze Water Supply Project

Phase II was already designed by MoWLD and the extension of DAWASA water supply scheme was planned by DAWASA.

The Level-2 schemes (22 schemes) are all selected as the priority project as discussed in the next Chapter 6. Design for each scheme are also presented in Chapter 6. Accordingly, only preliminary design for Level-1 is presented in this Chapter.

Level-1 water supply scheme is composed of deep tube well and hand pump. Design conditions applied in the preliminary design of Level-1 scheme are shown in *Table 5.9*. Standard structure of the Level-1 scheme is shown in *Figure 5.1*.

Table 5.9 Design Condition of Level-1 Scheme

Item	Condition
Service population	250 populations/scheme
Diameter of borehole	10 inches
Depth of borehole	50 m (average)
Diameter of deep tube well (casing/screen)	5 inches
Material of casing/screen pipes	UPVC
Opening ratio of screen	Approximately 5 %
Setting depth of hand pump (depth of cylinder)	less than 50 m
Filling of annular space between borehole and casing/screen	Cement grout in casing section. Gravel packing in screen section.

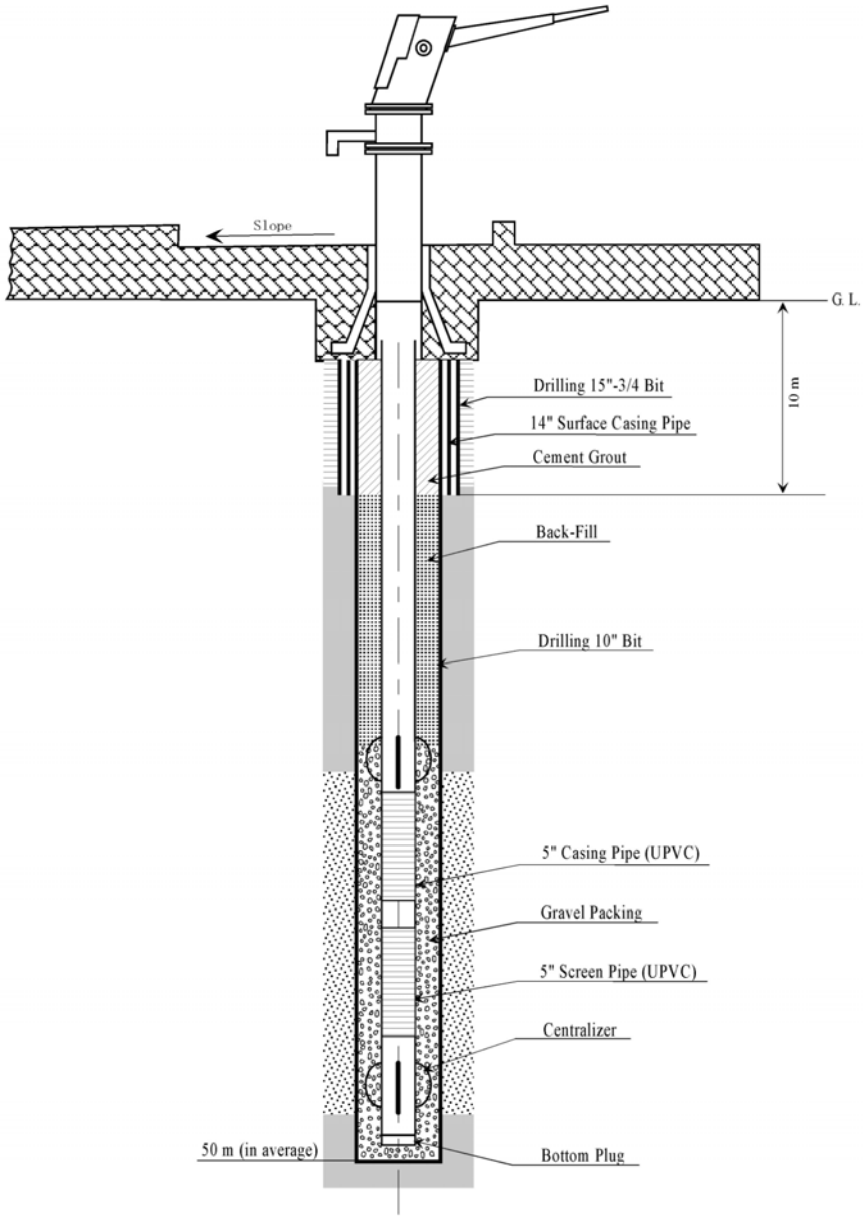

FIGURE 5.1 STANDARD DESIGN OF DEEP TUBE WELL FOR LEVEL-1 SCHEME

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5.6 WATER SUPPLY DEVELOPMENT PLAN

5.6.1 IMPLEMENTATION PLAN

(1) Approximate Cost Estimation

Project cost for Level-2, Level-1 and rehabilitation schemes is estimated, because extension of DAWASA and Chalinze Water Supply Project Phase II are going to be implemented by DAWASA and MoWLD, respectively.

The international base of cost was estimated considering the following conditions.

- The project cost consists of construction cost, engineering service cost, administration cost and physical contingencies.
- The cost for the land acquisition is not included.
- Engineering service cost is assumed to be 15 % of the total construction cost.
- The success rate of well drilling is assumed to be 70 %.
- All the costs are estimated under the economic conditions prevailing in July 2005.
- Exchange rate of currencies to be used is US$ 1.00= 1,137 Tsh.
- Construction cost for Chalinze Water Supply Project (Phase II) and schemes to be constructed by DAWASA are excluded.

Based on these conditions, the approximate cost for implementation of projects proposed in this Study is summarized in *Table 5.10*.

Table 5.10 Summary of Projects Cost

Unit: thousand USD

Type of Scheme	Construction Cost	Engineering Service (15%)	Administration Cost (3%)	Physical Contingency (10%)	Total	Note
Level-2 (Priority Project)	13,979.3	2,516.3	-	-	16,495.6	22 schemes (Priority Project)
Level-1	10,561.8	1,584.3	316.9	1,056.2	13,519.2	607 schemes
Rehabilitation	181.2	27.2	5.4	18.1	231.9	1 scheme
Chalinze (Phase II)	7,546.9	754.7	226.4	754.7	9,282.7	42 villages
Total	32,269.2	4,882.5	548.7	1,829.0	39,529.4	

Note: (1) Administration cost and physical contingency are not included in Level-2 project because it is supposed to be implemented as the Japan's Grant Aid Project.
(2) Engineering Service cost for Chalinze Water Supply Project Phase II is 10 % of the construction cost (MoWLD, 2005).
(3) Approximately 3% of construction cost was added as the cost for soft component.

(2) Implementation Plan

The implementation plan for the proposed projects in this Study shall be in concordance with Tanzania's national plans and strategies. The government of Tanzania prepared "The Tanzania Development Vision 2005" (Planning Commission, 1998). This is the stem of the framework for water sector policy, strategy and financial planning and the target of it is "Universal access to safe water" by the year 2025. This target was developed in "National Water Policy" (MoWLD, 2002). One of the target of the policy was to establish a protected, year-round potable water supply of 25 litre/capita/day through water points located within 400 m from the furthest homestead in the rural areas. The revised Poverty Reduction Strategy set out to raise the water supply level from 53 % in the year 2003 to 65% by the year 2009 (MoWLD, 2004).

Following external support will be expected in the Study area (*Table 5.11*).

Table 5.11 Expected Projects in the Study Area

(As of November 2005)

No.	Project	Implementation Agency	Donor	Status
1	Priority Project (Level-2)	MoWLD	Japan	Request
2	Chalinze Water Supply Project (Phase II)	MoWLD	BAEDA	Loan agreement was concluded
3	Mkuranga Water, Hygiene and Sanitation Project	AMREF	EU	Request
4	Community Water Supply and Sanitation Project (CWSSP)	DAWASA	WB	Ongoing
5	Extension of Distribution System	DAWASA	WB	Ongoing

MoWLD has submitted the request for the implementation of the priority project to the government of Japan. It is expected to be commenced in 2006 in case it is accepted. Chalinze Water Supply Project Phase II will be carried out by MoWLD using the fund from BAEDA in 2006 and 2007. The first phase of Mkuranga Water, Hygiene and Sanitation Project was started in 2001 and will be completed in 2005 by AMREF providing 138 tube wells and protected wells. AMREF is going to start the second phase of the project in 2006. The request for the fund was submitted to EU in June 2005. If this project and the priority project are implemented, water supply service will cover all the villages in Mkuranga District. DAWASA has an intention to provide water supply serivice in all the Mitaas in Dar es Salaam Region. It depends on the availability of water sources. DAWASA will start the study on deep groundwater in Dar es Salaam and Coast Regions in 2005. DAWASA is currently carrying out CWSSP in Dar es Salaam Region. The project targets to provide water supply schemes to approximately 30 communities.

In the Study area, the target of 53 % of water supply in 2003 is not likely attained. In order to overcome this situation, following preconditions were considered to formulate the implementation of the proposed projects in this Study.

(1) The priority project (Level-2) will be completed by the year 2008.

(2) Expansion of Chalinze Water Supply Scheme will be completed in 2007 (MoWLD, 2005)

(3) Expansion of DAWASA water supply scheme and CWWSP in Dar es Salaam Region will be completed in 2008.

(4) Mkuranga Water, Hyegine and Sanitation Project will be commenced in 2006 and completed in 2010, which was requested to EU by AMREF in June 2005. This project is carried out independently from MoWLD and will basically provide Level-1 schemes. If this project is implemented, the total number of new Level-1 scheme in the Study area other than Mkuranga District will be reduced to 370 schemes. The project cost for Level-1 will be reduced from 12.1 to 7.1 million USD.

(5) The Level-1 project will be started just after the completion of the priority project and will be completed by the year 2015, the target year of the Study.

If the projects are implemented as planned in *Table 5.12*, the service population will raise to 158.8 thousand persons (66.9%) in 2009 and 945.2 thousand persons (68.1 %) in 2015. These projection will satisfy the target of the revised Poverty Reduction Strategy as shown in *Table 5.13*.

In *Table 5.13*, service population by Level-1 scheme is separated into two projects, Mkuranga Water, Hygiene and Sanitation Project and other.

Considering these situations mentioned above, the implementation schedule is planned as shown in *Table 5.12*.

As discussed above, the Priority Project, the extension of existing supply schemes and a part of Level-1 scheme in Mkuranga will be implemented. However, Level-1 scheme in Bagamoyo, Kibaha and Kisarawe Districts are remained as not implemented because no assistance is found at this moment (as of August 2005). The implementation of water supply development by Level-1 schemes is indispensable to improve water supply environment in these areas. From this point of

view, MoWLD is requested to undertake necessary measures that would enable the implementation of Level-1 project in Bagamoyo, Kibaha and Kisarawe Districts.

Table 5.12 Implementation Schedule for Priority Project

Project	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Priority Project (Level-2)	←	—	→							
Chalinze (Phase II)	←	—	→							
Level-1				←	—	—	—	—	—	→
Rehabilitation				←	→					
Mkuranga	←	—	—	—	→					
DAWASA	←	—	→							

The service populations are estimated based on the following conditions.

- The priority project is implemented in three years from 2006 to 2008 and the water supply service starts in each year of construction.
- The construction of Level-1 scheme starts just after the completion of the priority project in 2009 except Mkuranga District. The number of scheme to be constructed is evenly allocated to every Districts and Municipalities in every year.
- Level-1 schemes in Mkuranga are constructed by AMREF within five years from 2006 in the same manner as other Level-1 schemes of above.
- Chalinze Water Supply Project Phase II starts its service in 2007.
- Rehabilitation of existing water supply scheme is carried out in 2009*.
- The service population of DAWASA is allocated evenly in each year.

Table 5.13 Increase of Water Supply Population up to 2015

Unit: population

Project \ Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Priority Project (Level-2)	19,048	34,930	61,930	64,017	66,184	68,436	70,777	73,211	75,739	78,352
Chalinze (Phase II)		108,814	111,160	113,558	116,010	118,517	121,081	123,703	126,383	129,125
Level-1				77,231	78,885	80,586	82,335	84,133	85,983	87,886
Rehabilitation				1,544	1,575	1,607	1,639	1,671	1,705	1,739
Mkuranga	8,506	17,608	27,336	37,724	48,805	50,513	52,281	54,111	56,005	57,965
DAWASA	131,234	274,541	430,755	450,570	471,296	492,976	515,652	539,372	564,184	590,136
Total Supply Population	158,788	435,893	631,181	744,643	782,755	812,635	843,765	876,201	909,999	945,203
Water Supply Rate (%)	15.9	42.1	58.8	66.9	67.8	67.8	67.9	68.0	68.0	68.1
Total Population	998,165	1,034,997	1,073,302	1,113,148	1,154,588	1,197,706	1,242,554	1,289,235	1,337,800	1,388,328

5.6.2 FINANCIAL PLAN

Table 5.14 indicates the governmental budget allocated for the development of water and livestock sectors, with its sub-sectors, during the four fiscal years (i.e. 2002/03, 03/04, 04/05 and 05/06), along with percentage in total amount of each internal and external budget. It can be observed that there is steep rise in total amount of budget during the period. It is considerable sharp increase of budget for Urban Water Supply and Sewerage sub-sector, of which internal budget amount to 91 percent and 63 percent in fiscal year of 2005/06 and 2004/05, and 2003/04, respectively. As for the Rural Water Supply sub-sector, the budget amount was rather stable in a range of approximately USD 1.04 to 1.43 million from 2002/03 to 2004/05, however, it is suddenly increased up to USD 3.16 million in 2005/06: It shows a 248 % increase over the previous year's.

It is also noted that the 2005/2006 budget prepared by MoWLD, for instance, amounts to USD 66.86 million as internal fund and a considerable amount of USD 50.49 million as external fund. Thus, it is obvious that the sector depends on external funding for its development.

Table 5.14 Development Budget for Water and Livestock Sector

Unit: thousand USD

Items	2002/2003 Budget				2003/2004 Budget				2004/2005 Budget				2005/2006 Budget			
	Internal	%	External	%	Internal	%	External	%	Internal	%	External	%	Internal	%	External	%
Research, Planning and Training	955.0	27	2,888.6	9	752.0	11	4,469.3	11	698.0	2	3,845.1	6	1,725.7	3	2,975.2	6
Urban Water Supply and Sewerage	1,075.9	30	17,904.3	55	4,285.7	60	12,368.6	31	27,033.3	91	42,000.9	60	60,573.3	91	22,027.2	44
Rural Water Supply	1,038.8	29	7,861.4	24	1,425.5	20	17,888.2	44	1,271.4	4	21,953.8	31	3,156.2	5	24,860.2	49
Veterinary Services	373.3	10	1,069.3	3	268.5	4	938.6	2	271.4	1	840.9	1	601.0	1	623.0	1
Animal Construction	153.9	4	2,746.1	8	418.7	6	4,663.2	12	437.1	1	1,238.1	2	807.6	1	-	0
Total	3,597.0	100	32,469.8	100	7,150.4	100	40,327.9	100	29,711.3	100	69,878.7	100	66,863.8	100	50,485.7	100
Grand Total	36,067				47,478				99,590				117,350			

Source: MoWLD, Proposed Annual Budget 2005/06, 2004/05 and 2003/04

Categorizing intervention under the Water Supply Plan prepared by the Study into the development of rural water supply, internal development budget for the rural water sub-sector is overviewed in order to assess its feasibility from a financial viewpoint. *Table 5.15* presents the trend of the development budget for rural water supply in the past three fiscal years. The table also indicates the development budget allocated for the Study area, Coast and Dar es Salaam Region, for the four fiscal years.

Table 5.15 Development Budget for Rural Water Supply in Four Years

(Unit: USD)

Item	2002/2003 Budget		2002/2003 Fund Released		2003/2004 Budget		2003/2004 Fund Released		2004/2005 Budget		2005/2006 Budget	
	Internal	External	Internal	External	Internal	External	Internal	External	Internal	External	Internal	External
Expansion of Rural Water Supply	195.2	3,914.5	47.6	-	466.7	5,400.0	270.7	-	352.4	3,899.0	774.3	5,803.6
Rehabilitation of Rural Water Supply	224.8	1,889.8	224.8	1,160.3	349.3	3,023.2	257.1	1,876.4	281.0	6,546.9	617.1	51.4
Borehole Drinking and Dam Construction	361.7	-	87.6	-	285.7	-	285.7	-	285.7	-	642.9	-
Rural Water Supply and Sanitation Project	71.4	2,057.1	-	-	57.1	9,465.0	-	-	57.1	9,655.4	476.2	19,005.1
Strengthening DDCA	157.1	-	79.0	-	266.7	-	266.7	-	295.2	-	645.7	-
TOTAL	1,038.8	7,861.4	283.8	1,160.3	1,425.5	17,888.2	1,137.3	1,876.4	1,271.4	21,953.8	3,156.2	24,860.2
Budget Allocated for Dar es Salaam and Coast Reagion	N.A	N.A.			85,714	-			85,714	-		-

Source: MoWLD, Proposed Annual Budget 2005/06, 2004/05 and 2003/04

As it is observed, the increase in this sub-sector development fund is rather stable and static. On the other hand, the implementation cost of the Water Supply Plan prepared by the Study is estimated at approximately USD 37.97 million. The priority project is planned to be implemented in five years from 2006 to 2010 and the implementation cost estimated at approximately USD 7.6 million/year in average. It is more than twice of the internal amount of the development budget allocated for the rural water supply sector in 2005/06. Furthermore, observing the limited budget allocation for the Study area of Coast and Dar es Salaam Regions amounting to approximately USD 86,000 for both the fiscal year of 2003/04 and 2004/05, financial capability of the government for the implementation of the Water Supply Plan prepared under the Study is considered as rather lacking. Thus, it is rather apparent that the implementation of the Plan requires additional grants from External Supporting Agencies (ESAs), such as donor agencies and NGOs.

5.6.3 ANNUAL DISBURSEMENT SCHEDULE

In order to raise the water supply level to 65 % by the year 2009, the projects shall be implemented as planned in *Table 5.12*. Taking this condition into consideration, the disbursement schedule is planned as shown in *Table 5.16*. The project period for Level-1 scheme is planned for five years from 2011 to 2015. The costs for Chalinze Water Supply Project Phase II and Mkuranga Water, Hygiene and Sanitation Project are excluded from the disbursement schedule of this Study because they are planned independent from this Study.

Table 5.16 Annual Disbursement Schedule

Unit: thousand USD

Project No.	Project		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
1	Piped Water Supply Scheme (Level-2)	Engineering	875.9	654.4	986.0								2,516.3
		Construction	4,865.8	3,635.7	5,477.8								13,979.3
		Sub-Total	5,741.7	4,290.1	6,463.8								16,495.6
2	Hand Pump (Level-1)	Engineering				138.0	138.0	138.0	138.0	138.0	138.0	138.0	965.7
		Construction				919.7	919.7	919.7	919.7	919.7	919.7	919.7	6,438.0
		Sub-Total				1,057.7	1,057.7	1,057.7	1,057.7	1,057.7	1,057.7	1,057.7	7,403.7
3	Rehabilitation	Engineering				27.2							27.2
		Construction				204.7							204.7
		Sub-Total				231.9							231.9

Note: (1) Engineering cost includes Detailed Design and construction supervision and is evenly allocated in each year according to the construction cost.
(2) Engineering cost is evenly allocated to the project periods.
(3) The cost for Level-1 excludes the cost in Mkuranga District.

5.7 EVALUATION OF WATER SUPPLY PLAN

Among the Water Supply Plan, Level-2 scheme is selected as the Priority Project which is presented in Chapter 6. Therefore, evaluation is made on the whole projects proposed in the Study except extension of water supply scheme. Detailed evaluation on the Priority Project is discussed in Chapter 10.

5.7.1 ECONOMICAL AND FINANCIAL EVALUATION

Feasibility of the projects was evaluated from both economical and financial aspects. The projects proposed in the Study aim to provide safe and stable water supply to 278 villages in the Study area.

Economic evaluation was made from the aspects of economic cost and benefit. Provision of water supply schemes will improve (1) water fetching time, (2) cost for obtaining water, (3) water quality of water used and (4) cost for medical expense. These are the expected economic benefit from the implementation of the projects. In case of Level-2 schemes, NPV and B/C ratio show the economic benefit will exceed the cost. Furthermore, EIRR is calculated as 13 % in Coast Region and 16 % in Dar es Salaam Region. These rates are higher than the opportunity cost of investment. Accordingly, Level-2 scheme is evaluated as economically viable (Chapter 10). Level-1 scheme will generate same economical benefit as Level-2. Therefore, projects proposed in the Study are considered to be economically feasible.

Full cost recovery at least for operation and maintenance is important issue in the management of water supply scheme. Water tariff is set at 1 Tsh/litre, which is same as the amount of Willingness to Pay (WTP) examined in the Study. The tariff will assure more than 80 % of recovery rate, and will assure the full operation, and maintenance cost over 10 years for Level-2 scheme including replacement cost. Amount of water tariff to be collected largely exceed the cost necessary for management, operation and maintenance of Level-2 scheme. Average recovery rates expected are 74 % in Coast Region and 51 % in Dar es Salaam Region. The cost for management, operation and maintenance for Level-1 scheme is lower than that of Level-2. Accordingly, financial situation of Level-1 scheme is much improved under the same tariff structure as Level-2, 1 Tsh/litre.

Therefore, the projects proposed in the Study are evaluated as financially feasible.

5.7.2 INSTITUTIONAL AND ORGANIZATIONAL EVALUATION

Institutional and organizational setup, described in the Institutional, Operation and Maintenance Plan (Chapter 8 and 9 of Main Report), is developed by taking into consideration the following key issues;

1) current and future institutional setup as planned under National Water Policy (2002) and Draft National Water Sector Development Strategy (2004),

2) decentralized functional responsibilities of each stakeholders in the water supply service delivery as set in the sector policy and strategies,

3) transition of the role of MoWLD from service delivery to the ones of policy making, monitoring and regulation,

4) strategy to enhance Community-Owned Water Supply Organizations (COWSOs), which shall be legal entity, to own and manage supply scheme, and

5) current approach to increase private sector participation and contracting-out in the service delivery to increase efficiency and competency in running the scheme.

Among those issues, COWSO management options with contracting-out with Service Providers (i.e. private sector participation) for part or all of management, operation and maintenance, is assessed as favourable and would considerably enhance competency and efficiency in the scheme management particularly for the piped supply scheme (Level-2). Deficiencies in management of these schemes are obvious in the past.

From those points of views, the plan can be assessed as feasible and efficient in institutional and organizational aspects.

5.7.3 Evaluation of Environmental and Social Aspects

IEE was carried out in order to clarify impact on environmental and social aspects by the formulation of water supply projects.

Environmental assessment revealed that water resource analysis evaluated groundwater balance to avoid negative impacts such as overexploitation, land subsidence, groundwater depletion, interference of wells and seawater intrusion as mentioned in Chapter 9. Besides, water quality analysis on surface water from rivers, charco-dams, shallow wells in both dry and rainy seasons and groundwater from existing wells and test wells was also conducted. Based on these results, appropriate water source that meets water quality standard for drinking was selected as described in Chapter 9.

Although there are several nature reserves in the Study area, proposed water supply facilities are not located exactly in the places where important fauna and flora are distributed as described in Chapter 12. Proposed facilities such as transmission and distribution lines are planned to be laid down under ground along the existing roads or along other pipelines. Therefore, no new routes for pipelines are necessary.

Moreover, social impact assessment was also examined on six factors, 1) women and children water users, 2) water vendors, 3) matter of sharing water facilities among adjacent villages, 4) villager's perception to the poor and attitude to water payment, 5) Indigenous group/Tribes, Massai, and 6) discrepancy of water management policy in water supply plan.

In terms of gender perspective, as widely known, main actors of water fetching are traditionally women and children, which consumes a lot of their time and make them exhausted by walking long distance along inconvenient paths including waiting for long time at the water source to get water. However, the water supply plan provides sufficient amount of clean water within a short distance from households, and saves time. This gives women and children spare time for learning or other income generating work. Therefore, the plan definitely provides positive impact on gender issues, which will very much improve women and children's predicament condition.

Regarding water vendors, if the project is implemented in the villages where water vendors are active, they will lose these opportunities to sell water to villagers. It might affect water vender's socio-economic condition. However, the water supply plan proposes mitigation measures to such situation as described in Institutional Plan (Chapter 9 in Main Report).

In Bagamoyo District, some villages may need to share the water supply scheme with other nomad tribes such as Massai, who could be temporal users. Such villages have sufficient experience to

get along with them. However, continuous close monitoring will be necessary to mitigate any social friction among them.

Thus, the construction of proposed water supply schemes dose not cause any significant adverse impact on environmental and social aspects in the Study area. However, appropriate technical and social monitoring is required. The former is the issues such as water quality and groundwater abstraction. The latter is improvement of water user's life, water vender's situation, Massai's life in sustainable manner. As a result, Categories evaluated B in the preliminary study as per JICA Guidelines fall in category C. Therefore, EIA is not required in this Study, as also agreed by NEMC.

5.7.4 TECHNICAL APPROPRIATENESS

The evaluations of the technical appropriateness are examined by the components of the proposed system of piped scheme (level-2). The results of the evaluation are shown in *Table 5.17*. The appropriateness of the technical aspect is highly dependent on the technical requrement of the operation and maintenance. As shown in *Table 5.17*, if groundwater is selected as the water source, the technical aspect in the Construction, Operation & Maintenance and Procurement are appropriate. In case of the surface water, the technical appropriateness of the Operation & Maintenance is dependent on raw water quality. The proposed plan, however in most case, is planned by the groundwater as the water source. The plan, therefore, in overall is evaluated as appropriate from the technical point of view.

Table 5.17 Evaluation of Technical Appropriateness of Water Supply Plans

Items	Facility /Type	Appropriateness
Intake	Surface Water (River intake facility)	• Construction: Appropriate • Screened pipe intake and submersible pump • Operation & Maintenance: Dependent on raw water quality • (Water quality is normally not suitable for the water supply, generally treatment facility is necessary.)
	Groundwater (well and submersible pump)	• Construction: Appropriate • The depth of the well is 50 to 100m. • Operation & Maintenance: Appropriate • (Water quality is normally suitable for the water supply without treatment facility.)
Reservoir	Elevation or Ground Tank (reinforced concrete)	• Construction: Appropriate
Transmission Pipe Line	PVC Pipe	• Construction: Appropriate • Procurement: Appropriate • (Local material is available.)
Distribution Pipe Line	PVC Pipe	• Construction: Appropriate • Procurement: Appropriate • (Local material is available.)

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Chapter 6

Priority Project

CHAPTER 6 PRIORITY PROJECT

6.1 GENERAL

Among the Water Supply Plans, Extension of Chalinze Water Supply Project Phase II and DAWASA are implemented independently from the Study. Rehabilitation of existing scheme is proposed in only one village. Therefore, discussion is focussed on the Level-1 and Level-2 schemes. The Water Supply Plan in the Study area was formulated as described in Chapter 5, proposing different types of water supply schemes like Level-2 and Level-1 schemes in 278 villages.

The Priority Project for implementation was selected by following two steps-wise procedure assuming Japan's Grant Aid.

- 1st step: Evaluation of priority villages
- 2nd step: Selection of Priority Project

6.2 EVALUATION OF VILLAGES FOR PRIORITY

6.2.1 CRITERIA AND THEIR WEIGHTING FOR EVALUATION

The Village Inventory Survey revealed the situation of the villages that are unprovided for the accessibility of safe water. In order to overcome such situation, provision of water supply schemes are urgently required. On the one hand, water resource potential in the Study area was evaluated in the Study. High priority for selection of villages for the project shall be given to the villages where water resource is available along with high degree of unprovision of water. From these points of view, urgency to provide safe and stable water, and development potential of water source were applied as the criteria for the selection of priority villages.

(1) Evaluation of Urgency to provide Water Supply Schemes

Factors for evaluation of urgency are (1) time requirement for fetching water from the existing water source even when the sources is unstable, (2) months in which period water source is available and (3) daily water consumption amount per household per day. Scoring for each factor is shown in *Table 6.1*. Factor (1) is total required time (minutes) for fetching water from the source to the household (to and from). No consideration was made whether the sources is safe and stable throughout the year or not. Factor (2) means how many months water source is available in a year. Factor (3) means how much quantity of water is consumed in a day per household.

Table 6.1 Scoring of Evaluation Factors for Urgency

Scoring	1	2	3	4	Note
Average Time	<30 min	30-59 min	60-120 min	120 min <	Time for fetching water
Reliability	10-12 month	7-9 month	4-6 month	<3 month	Available months in a year
Consumption	200 liter <	100-199 liter	50-99 liter	<50 liter	Water consumption per household

In the table above, although average fetching time is shown in minutes, it is exchangeable to be expressed in distance (meters) by assuming the typical velocity during fetching as 50 m/min: 30 minutes equal to 1,500 meters, 60 minutes to 3,000 meters and 120 minutes to 6,000 meters.

Those factors were compared and evaluated using the "Pair-Wise Ranking" method as shown in *Table 6.2*.

Table 6.2 Weighting of Evaluation Factors for Urgency

	Average Time	Consumption	Reliability	Score	Multiplication Rate
Average Time		Average Time	Average Time	2 points	3
Consumption			Consumption	1 point	2
Reliability				0 point	1

Evaluation of each village is given by using the following formula quoting the scoring and weighting presented in *Table 6.1* and *6.2*, respectively.

-Evaluation value = (Average time)x3+(Reliability)+(Consumption)x2

The maximum and the minimum values are 24 points and 6 points, respectively.

(2) Evaluation of Water Resources

The water resource potential was evaluated from the view point of available sources for water supply schemes. The Wami River has still development potential, however, the Ruvu River has no further development potential. Therefore, only groundwater resources were evaluated. The evaluation criteria and their weighting are shown in *Table 6.3*.

As shown in *Table 6.3*, the maximum and the minimum values are 12 and 0 points, respectively.

Table 6.3 Criteria and Weighting for Groundwater Sources Evaluation

			Estimated Yield (liters/min)		
			100 <	10 - 100	< 10
Water Quality EC (μS/m)		Allotment Points	Good	Fair	Poor
			4	2	1
< 1000	Good	3	**12**	**6**	**3**
1000 - 3000	Fair	2	**8**	**4**	**2**
3000 <	Poor	0	**0**	**0**	**0**
			Weighting		

Evaluation of Groundwater Resources

12	Promising water source for the Piped Scheme to serve more than 2,500 population with single well
8	
6	Fairer water source for the Piped Scheme to serve 2,500 population with multi-well system
4	
3	Can be utilized for Hand Pump
2	
0	Not suitable for drinking water

Table 6.3 is provided for the evaluation of groundwater resources. When evaluation is made following the table, some villages are assigned score 0 due to unsuitable water quality (EC>3,000 micro S/cm). In such a case, surface water source is evaluated for its availability. If it is available, evaluation was made in the following manner.

(1) Available quantity of surface water: it is considered same as yield of groundwater.
(2) Water quality: Necessity of treatment is evaluated based on the EC values. A spring water generally requires no treatment facilities. In this case, evaluation of water quality is considered as good. Surface waters other than spring water require conventional water treatment. This case is evaluated as fair.

Groundwater quality (EC) is more than 3,000 micro S/cm at Matipwili in Bagamoyo District. The water is not suitable for drinking use. Therefore, the availability of surface water in the Wami River was examined. The Wami River has development potential as mentioned in Chapter 4 on Water Resources. Available amount of the river water for development is more than 100 liter/min, but it requires treatment facility for drinking use. Therefore, scoring of 8 points was given to the water of the Wami River.

In case of Njopeka Village in Mkuranga District, there is an existing piped water supply scheme where source is a spring. Spring water basically requires no water treatment facility, but the yield is less than 100 liter/min. Accordingly, 6 points of score was given to the spring water in Njopeka.

6.2.2 EVALUATION OF VILLAGES

In order to assign District-wise priorities to the target Villages, two criteria were applied as mentioned above. Urgency to access to safe water is one of the main factors in the evaluation of Villages. In addition, availability of water sources will also be considered. From this point of view, all of the target Villages were evaluated applying following condition and evaluation criteria.

Weighting for urgency and water resource is considered as the same. The maximum point for water sources is 12: it is half of that of urgency. Therefore, point for water source was multiplied by two. The evaluation formula becomes;

Evaluation point = (Evaluation point for urgency) x 1 + (Evaluation point for water source) x 2

The maximum point and minimum point are 48 and 6, respectively.

Evaluation results are shown in *Table 6.4*.

Evaluated values are in the ranges from 35 to 8 in Bagamoyo, from 41 to 13 in Kibaha, from 38 to 15 in Kisarawe, from 42 to 13 in Mkuranga, from 37 to 10 in Ilala, from 35 to 11 in Kinondoni and from 38 to 21 in Temeke.

Characteristics of the evaluation results are as follows.

No large difference is observed on the maximum values, but large differences appeared in the minimum values. The minimum value in Temeke is high (21 points). In Temeke, factors for urgency and availability of water resources are both generally high. Bagamoyo (18 points) and Kisarawe (15 points) follow Temeke. The minimum values are low in Ilala (10 points) and Kinondoni (11 points). In these two Municipalities, Mitaas with low evaluated values have characteristics where urgency to water is not so high and availability of water sources are relatively low. The extreme case is Kinondoni where water sources are not available in several villages. This factor made the evaluation value the lowest for this village.

Although groundwater resource is evaluated as not suitable for drinking use (score 0) in two villages, Kise village in Mkuranga and Mvuti Village in Ilala as it is saline, still there are exploitable number of wells for Level-1 scheme as given in *Table 6.4*. However, such saline groundwater area is limited in and around the villages only. There are many wells having suitable groundwater for drinking in areas near the villages. Therefore, Level-1 schemes can be constructed for these two villages, provided access criteria from homesteads is not strictly followed and hence more than a maximum distance of 400m is acceptable.

Table 6.4 Evaluation of Villages (1/4)

Ward	Name of Village	Population (2002)	Population (2010)	Population (2015)	Water Demand (2015) (m3/day)	Form of Community	Dwelling Type	Other WSS Intervention				Scoring				Type of WSS	Evaluation of Priority (Urgency+(Water Source)x2)	Exploitable Number of Well (Level-2)	Exploitable Number of Well (Level-1)
								None	Agency	Period	Plan	Urgency			Water Source				
												Average Time	**Reliability**	**Consumption**					
Bagamoyo																			
KIWANGWA	FUKAYOSI	3,700	4,335	4,786	96	01: Village	03: Clustered	X				4	3	2	8	C	35		
KIWANGWA	KIDOMOLE	586	687	758	19	01: Village	03: Clustered	X				4	3	2	8	C	35		
MBWEWE	PONGWEKIONA	3,135	3,673	4,055	101	01: Village	04: Scattered	X				4	3	2	8	C	35		
MIONO	KWEIKONJE	1,124	1,317	1,454	36	01: Village	03: Clustered	X				4	3	2	8	C	35		
VIGWAZA	VIGWAZA	4,039	4,732	5,225	131	01: Village	03: Clustered	X				4	3	2	8	C	35		
CHALINZE	MSOLWA	2,672	3,131	3,457	86	01: Village	03: Clustered	X				4	2	2	8	C	34		
MBWEWE	KWANG'ANDU	2,016	2,362	2,608	65	01: Village	03: Clustered	X				4	2	2	8	C	34		
TALAWANDA	MALIVUNDO	1,166	1,366	1,508	38	01: Village	03: Clustered	X				4	2	2	8	C	34		
TALAWANDA	MSIGI	1,124	1,317	1,454	36	01: Village	03: Clustered	X				4	2	2	8	C	34		
TALAWANDA	TALAWANDA	4,124	4,832	5,335	133	01: Village	03: Clustered	X				4	2	2	8	C	34		
CHALINZE	MDAULA	2,982	3,494	3,858	96	01: Village	03: Clustered	X				4	1	2	8	C	33		
KIWANGWA	MKENGE	2,050	2,402	2,652	66	01: Village	03: Clustered	X				4	1	2	8	C	33		
KIWANGWA	MSINUNE	1,927	2,258	2,493	62	01: Village	03: Clustered	X				4	3	1	8	C	33		
LUGOBA	DIOZILE	1,631	1,911	2,110	17	01: Village	03: Clustered	X				4	1	2	8	C	33		
MAGOMENI	MAKURUNGE	1,636	1,917	2,116	53	01: Village	03: Clustered	x				4	1	2	8	C	33		
MIONO	MASIMBANI	1,181	1,384	1,528	38	01: Village	02: Concentrated along the Road	X				4	1	2	8	C	33		
MIONO	MIHUGA	1,417	1,660	1,833	46	01: Village	03: Clustered	X				4	1	2	8	C	33		
MKANGE	MKANGE	2,396	2,807	3,099	77	01: Village	03: Clustered	X				4	1	2	8	C	33		
MSATA	PONGWE MSUNGURA	1,005	1,178	1,300	33	01: Village	04: Scattered	X				4	1	2	8	C	33		
TALAWANDA	KISANGA	855	1,002	1,106	28	01: Village	03: Clustered	X				4	1	2	8	C	33		
TALAWANDA	MINDUKENI	1,438	1,685	1,860	47	01: Village	03: Clustered	X				4	1	2	8	C	33		
UBENAZOMOZI	MATULI	1,977	2,316	2,557	44	01: Village	03: Clustered	X				4	1	2	8	C	33		
VIGWAZA	KIDOGOZERO	1,077	1,262	1,393	35	01: Village	03: Clustered	X				4	1	2	8	C	33		2
VIGWAZA	VISEZI	1,281	1,501	1,657	41	01: Village	03: Clustered	X				4	1	2	8	C	33		
ZINGA	MAPINGA	195	228	252	6	01: Village	03: Clustered	X				4	1	2	8	D	33		
KIWANGWA	MASUGURU	1,768	2,071	2,287	57	01: Village	03: Clustered	X				3	2	2	8	C	31		
MBWEWE	KWARUHOMBO	2,068	2,423	2,675	32	01: Village	01: Concentrated	X				3	2	2	8	C	31		
UBENAZOMOZI	UBENAZOMOZI	2,490	2,917	3,221	81	01: Village	03: Clustered	X				4	1	1	8	C	31		
VIGWAZA	BUYUNI	1,759	2,061	2,275	57	01: Village	03: Clustered	X				4	1	1	8	C	31		
KIBINDU	KIBINDU	5,605	6,567	7,251	126	01: Village	03: Clustered	X				3	1	2	8	A	30	3	4
KIBINDU	KWAMDUMA	3,677	4,308	4,757	119	01: Village	04: Scattered	X				4	2	2	6	A	30	2	6
KIWANGWA	KIWANGWA	12,762	14,953	16,509	413	01: Village	03: Clustered	X				3	1	2	8	C	30		
MKANGE	MATIPWILI	2,698	3,161	3,490	87	01: Village	03: Clustered	X				3	1	2	8	A	30		4
UBENAZOMOZI	KALOLENI	3,210	3,761	4,152	69	01: Village	03: Clustered	X				3	1	2	8	C	30		
UBENAZOMOZI	MWIDU	1,977	2,316	2,557	64	01: Village	03: Clustered	X				3	1	2	8	C	30		
UBENAZOMOZI	TUKAMISASA	3,051	3,575	3,947	63	02: Mtaa	03: Clustered	X				3	1	2	8	C	30		
MBWEWE	KIFULETA	3,523	4,128	4,557	114	01: Village	03: Clustered	X				3	2	1	8	C	29		
UBENAZOMOZI	VISAKAZI	4,893	5,733	6,330	158	01: Village	03: Clustered	X				3	1	1	8	C	28		
CHALINZE	CHAMAKWEZA	2,152	2,521	2,784	70	01: Village	03: Clustered	X				4	3	2	4	D	27		
DUNDA	KAOLE	292	342	378	9	01: Village	01: Concentrated	X				3	1	2	6	D	26		
YOMBO	YOMBO	121	142	157	4	01: Village	03: Clustered	X				4	1	2	4	D	25		
MKANGE	MANDA MAZINGARA	3,122	3,658	4,039	101	01: Village	03: Clustered	X				4	1	2	2	D	21		
MAGOMENI	MAGOMENI	645	756	834	21	01: Village	01: Concentrated	X				1	1	2	6	D	20		2
MKANGE	SAADANI	1,344	1,575	1,739	35	01: Village	03: Clustered	X				2	1	2	4	A	19		
KIBINDU	KWAMSANJA	1,001	1,173	1,295	32	01: Village	01: Concentrated	X				3	1	2	2	D	18		6
Kibaha																			
RUVU	NGETA	1,616	2,112	2,496	62	01: Village	03: Clustered	X				4	3	1	12	D	41		2
MAGINDU	GUMBA	5,000	6,533	7,722	193	01: Village	03: Clustered	X				4	3	1	8	C	33		
RUVU	MINAZI MIKINDA	2,624	3,429	4,053	101	01: Village	02: Concentrated along the Road	X				2	1	1	12	A	33	1	
MAGINDU	GWATA	2,136	2,791	3,299	82	01: Village		X				4	2	1	8	C	32		
KIBAHA	MWENDAPOLE	854	1,116	1,319	33	01: Village	04: Scattered	X				3	4	1	8	C	31		
MAGINDU	MAGINDU	2,041	2,667	3,152	79	01: Village	01: Concentrated	X				4	1	1	8	C	31		
RUVU	LUPUNGA	1,128	1,474	1,742	44	01: Village	04: Scattered	X				4	3	2	6	D	31		2
RUVU	KITOMONDO	627	819	968	24	01: Village	03: Clustered	X				1	1	1	12	B	30	1	
MAGINDU	LUKENGE	1,050	1,372	1,622	41	01: Village	03: Clustered	X				3	1	1	8	C	28		
RUVU	KIKONGO	710	928	1,097	27	01: Village	03: Clustered	X				3	1	2	6	D	26		2
TUMBI	BOKOTIMIZA	623	814	962	24	02: Mtaa	04: Scattered	X				3	3	1	6	D	26		2
SOGA	BOKOMNEMELA	2,831	3,699	4,372	109	01: Village	04: Scattered	X				4	2	2	3	D	24		4
SOGA	MISUFINI	337	440	520	13	01: Village	01: Concentrated	X				4	1	1	4	D	23		3
KIBAHA	VIZIWAZIWA	2,124	2,775	3,280	82	01: Village	04: Scattered	X				3	3	2	3	C	22		2
KWALA	DUTUMI	1,300	1,699	2,008	50	01: Village	03: Clustered	X				1	1	1	8	B	22		9
MLANDIZI	MLANDIZI 'B'	4,040	5,279	6,239	156	01: Village	04: Scattered	X				3	3	1	4	D	22		
RUVU	MWANABWITO	1,540	2,012	2,378	59	01: Village	04: Scattered	X				2	1	1	6	D	21		4
SOGA	MPIJI	1,774	2,318	2,740	69	01: Village	04: Scattered	X				4	1	1	2	D	19		4
SOGA	KIPANGEGE	347	453	536	13	01: Village	01: Concentrated	X				3	1	2	2	D	18		3
VISIGA	ZOGOWALE	1,099	1,436	1,697	42	01: Village	04: Scattered	X				2	2	1	4	D	18		2
KWALA	MPELAMOMBI	346	452	534	13	01: Village	03: Clustered	X				2	1	1	4	C	17		3
KIBAHA	KONGOWE	362	473	559	14	01: Village	03: Clustered	X				1	2	2	2	D	13		3

Table 6.4 Evaluation of Villages (2/4)

Ward	Name of Village	Population (2002)	Population (2010)	Population (2015)	Water Demand (2015) (m3/day)	Form of Community	Dwelling Type	Other WSS Intervention				Scoring				Type of WSS	Evaluation of Priority (Urgency^(Water Source)x2)	Exploitable Number of Well (Level-2)	Exploitable Number of Well (Level-1)
								None	Agency	Period	Plan	Urgency: Average Time	Urgency: Reliability	Urgency: Consumption	Water Source				
Kisarawe																			
MSIMBU	MSIMBU	2,967	3,316	3,555	89	01: Village	04: Scattered	X				3	1	2	12	A	38	2	4
VIHINGO	MIHUGWE	310	346	371	9	01: Village	03: Clustered	X				4	3	3	8	D	37		2
MZENGA	MITENGWE	408	456	489	12	01: Village	04: Scattered	X				4	4	2	8	D	36		2
MZENGA	CHAKENGE	1,356	1,516	1,625	41	01: Village	04: Scattered	X				4	4	1	8	D	34		6
VIHINGO	MZENGA 'B'	1,231	1,376	1,475	37	01: Village	04: Scattered	X				3	3	3	8	D	34		2
KURUI	ZEGERO	738	825	884	22	01: Village	04: Scattered	X				4	3	3	6	D	33		5
MZENGA	MZENGA 'A'	1,163	1,300	1,393	35	01: Village	04: Scattered	X				3	4	2	8	D	33		2
VIHINGO	SANGWE	741	828	888	22	01: Village	03: Clustered	X				3	3	2	8	D	32		2
CHOLE	MAFUMBI	664	742	796	20	01: Village	04: Scattered	X				4	3	2	6	D	31		4
MAFIZI	MAFIZI	1,436	1,605	1,720	43	01: Village	03: Clustered	X				4	1	3	6	D	31		6
MARUMBO	KIVUKONI	1,770	1,978	2,121	53	01: Village	04: Scattered	X				4	3	2	6	D	31		2
MZENGA	VILABWA	197	220	236	6	01: Village	03: Clustered	X				2	4	2	8	D	30		1
VIHINGO	CHIMALALE	149	167	179	4	01: Village	04: Scattered	X				3	3	1	8	D	30		1
CHOLE	KWALA-CHOLE	2,245	2,509	2,690	67	01: Village	04: Scattered	X				4	3	1	8	B	33		4
MARUI	KISANGIRE	300	335	359	9	01: Village	02: Concentrated along the Road					4	3	1	6	D	29		2
MARUMBO	MARUMBO	1,115	1,246	1,336	33	01: Village	03: Clustered	X				4	3	1	6	D	29		6
MARUMBO	PALAKA	963	1,076	1,154	29	01: Village	03: Clustered	X				4	3	1	6	D	29		2
VIHINGO	KIBWEMWENDA	740	827	887	22	01: Village	03: Clustered	X				2	3	2	8	D	29		4
MAFIZI	GWATA	1,956	2,186	2,343	59	01: Village	02: Concentrated along the Road					3	1	3	6	D	28		10
MAFIZI	NYANI	861	962	1,032	26	01: Village	03: Clustered	X				3	1	3	6	D	28		5
CHOLE	KURUI-CHOLE	1,032	1,153	1,236	31	01: Village	02: Concentrated along the Road	X				4	1	1	6	D	27		4
CHOLE	YOMOBO LUKINGA	862	963	1,033	26	01: Village	04: Scattered	X				4	1	1	6	D	27		4
KURUI	KIDUGALO	532	595	637	16	01: Village	02: Concentrated along the Road	X				4	3	3	3	D	27		3
MARUMBO	KITONGA	734	820	879	22	01: Village	04: Scattered	X				4	1	1	6	D	27		2
VIHINGO	VIHINGO	340	380	407	10	01: Village	04: Scattered	X				2	3	1	8	D	27		2
KILUVYA	MLOGANZILA	1,250	1,397	1,498	37	01: Village	03: Clustered	X				4	4	1	4	D	26		2
KURUI	MTAKAYO	998	1,115	1,196	30	01: Village	03: Clustered	X				3	1	2	6	D	26		5
MAFIZI	KIMALA MISALE	720	805	863	22	01: Village	04: Scattered	X				3	3	1	6	D	26		4
MAFIZI	VING'ANDI	780	872	935	23	01: Village	03: Clustered	X				3	1	2	6	D	26		4
MANEROMANG	KIDUGALO-KANGA	857	958	1,027	26	01: Village	04: Scattered	X				3	1	2	6	D	26		2
MARUMBO	MFURU KIKWETE	3,686	4,120	4,416	110	01: Village	03: Clustered	X				3	3	1	6	D	26		2
MSIMBU	HOMBOZA	1,458	1,630	1,747	44	01: Village	04: Scattered	X				3	1	2	6	D	26		2
MSIMBU	LUHANGAI	769	859	921	23	01: Village	03: Clustered	X				2	2	3	6	D	26		2
KIBUTA	KAUZENI	1,685	1,883	2,019	50	01: Village	04: Scattered	X				4	3	1	4	D	25		4
KIBUTA	KIBUTA	2,050	2,291	2,456	66	01: Village	03: Clustered	X				4	3	1	4	D	25		2
KIBUTA	MASANGANYA	2,289	2,558	2,742	69	01: Village	04: Scattered	X				4	3	1	4	D	25		2
MARUI	MARUI-MIPERA	1,034	1,156	1,239	31	01: Village	03: Clustered	X				4	3	2	3	D	25		2
MASAKI	SUNGWI	1,573	1,758	1,885	47	01: Village	03: Clustered	X				4	3	3	2	D	25		2
KIBUTA	BWAMA	1,332	1,489	1,596	40	01: Village	03: Clustered					3	3	2	4	D	24		6
KILUVYA	KILUVYA 'A'	1,287	1,438	1,542	39	01: Village	04: Scattered	X				4	4	2	2	D	24		2
KISARAWE	KISARAWE	900	1,006	1,078	27	01: Village	04: Scattered	X				3	1	3	4	D	24		4
KISARAWE	KIFURU	544	608	652	16	01: Village	04: Scattered	X				4	1	3	2	D	23		2
MANEROMANG	MSEGAMO	777	868	931	23	01: Village	04: Scattered	X				2	1	2	6	D	23		2
MSIMBU	MAGURUWE	497	555	595	15	01: Village	04: Scattered	X				4	3	2	2	D	23		2
VIKUMBURU	MTUNANI	504	563	604	15	01: Village	02: Concentrated along the Road	X				4	3	1	3	D	23		3
VIKUMBURU	PANGALA MWINGERE	778	870	932	23	01: Village	02: Concentrated along the Road	X				4	3	1	3	D	23		2
CHOLE	SOFU	142	159	170	4	01: Village	04: Scattered	X				1	3	2	6	D	22		1
KIBUTA	MUHAGA	911	1,018	1,091	27	01: Village	03: Clustered	X				3	3	1	4	D	22		4
KILUVYA	TONDORONI	4,233	4,731	5,072	127	01: Village	03: Clustered	X				3	3	1	4	D	22		4
KISARAWE	VISEGESE	1,182	1,321	1,416	35	01: Village	04: Scattered	X				2	4	2	4	D	22		4
MSIMBU	GUMBA	1,385	1,548	1,659	41	01: Village	03: Clustered	X				3	1	2	4	D	22		2
KIBUTA	CHANG'OMBE 'B'	989	1,105	1,185	30	01: Village	02: Concentrated along the Road	X				4	3	1	2	D	21		2
KIBUTA	MTAMBA	840	939	1,006	25	01: Village	03: Clustered	X				4	3	1	2	D	21		4
MASAKI	KISANGA	2,125	2,375	2,546	64	01: Village	03: Clustered	X				3	4	2	2	D	21		8
MSANGA	MIANZI	747	835	895	22	01: Village	02: Concentrated along the Road	X				4	3	1	2	D	21		2
KISARAWE	KAZIMZUMBWI	1,678	1,875	2,010	50	01: Village	03: Clustered	X				2	4	3	2	D	20		6
MANEROMANG	MENGWA	996	1,113	1,193	30	01: Village	04: Scattered	X				3	1	2	3	D	20		2
MARUI	TITU	427	477	512	13	01: Village	02: Concentrated along the Road	X				3	3	1	3	D	20		3
MASAKI	MASAKI	2,786	3,114	3,338	83	01: Village	03: Clustered	X				2	4	3	2	D	20		4
VIKUMBURU	KORESA	689	770	825	21	01: Village	04: Scattered	X				3	3	1	3	D	20		2
MSANGA	MSANGA	1,998	2,233	2,394	60	01: Village	04: Scattered	X				4	1	1	2	D	19		4
MANEROMANG	NGONGERE	710	794	851	21	01: Village	04: Scattered	X				3	1	1	3	D	18		2
MARUMBO	CHANG'OMBE 'A'	548	612	657	16	01: Village	04: Scattered	X				3	3	1	2	D	18		2
KURUI	KURUI	584	653	700	18	01: Village	01: Concentrated	X				2	3	2	2	D	17		3
MANEROMANG	BOGA	2,038	2,278	2,442	61	01: Village	04: Scattered	X				2	1	2	3	D	17		2
MARUI	KIHARE	720	805	863	22	01: Village	03: Clustered	X				2	1	2	3	D	17		4
MSIMBU	KITANGA	486	543	582	15	01: Village	04: Scattered	X				2	3	2	2	D	17		2
VIKUMBURU	KITONGA	420	469	503	13	01: Village	04: Scattered	X				2	3	1	3	D	17		3
VIKUMBURU	VIKUMBURU	1,484	1,659	1,778	48	01: Village	03: Clustered	X				2	3	1	3	D	17		6
MSANGA	BEMBEZA	1,259	1,407	1,508	38	01: Village	02: Concentrated along the Road	X				2	4	1	2	D	16		6
MSANGA	VISIGA	1,188	1,328	1,423	36	01: Village	02: Concentrated along the Road	X				3	1	1	2	D	16		4
CHOLE	CHOLE	2,685	3,001	3,217	80	01: Village		X				2	1	1	3	D	15	2	
MANEROMANG	CHALE	516	577	618	15	01: Village	03: Clustered	X				2	1	2	2	D	15		3
MARUI	MARUI-NGWATA	1,443	1,613	1,729	43	01: Village	03: Clustered	X				2	1	1	3	D	15		2

Table 6.4 Evaluation of Villages (3/4)

Ward	Name of Village	Population (2002)	Population (2010)	Population (2015)	Water Demand (2015) (m3/day)	Form of Community	Dwelling Type	Other WSS Intervention				Scoring				Type of WSS	Evaluation of Priority (Urgency+(Water Source)x2)	Exploitable Number of Well (Level-2)	Exploitable Number of Well (Level-1)
								None	Agency	Period	Plan	Urgency			Water Source				
												Average Time	Reliability	Consumption					
Mkuranga																			
VIKINDU	MKOKOZI	1,769	2,329	2,767	69	01: Village	04: Scattered	X				4	4	1	12	B	42		12
VIKINDU	MWANDEGE	1,600	2,107	2,502	63	01: Village	04: Scattered	X				3	2	2	12	A	39	1	3
VIKINDU	KISEMVULE	2,260	2,976	3,535	88	01: Village	04: Scattered	X				2	3	2	12	A	37	2	2
VIKINDU	MALELA	1,250	1,646	1,955	49	01: Village	03: Clustered	X				2	3	2	12	B	37		8
VIKINDU	MOROGORO	1,500	1,975	2,346	59	01: Village	03: Clustered	X				2	3	2	12	B	37	1	2
VIKINDU	VIANZI	2,625	3,457	4,105	103	01: Village	04: Scattered	X				2	3	2	12	A	37	1	5
VIKINDU	YAVAYAVA	1,830	2,410	2,862	72	01: Village	04: Scattered	X				2	3	2	12	B	37	1	12
TAMBANI	MWANAMBAYA	2,466	3,247	3,857	96	01: Village	04: Scattered	X				2	2	2	12	A	36		4
VIKINDU	MFURU MWAMBAO	1,435	1,890	2,244	56	01: Village	03: Clustered	X				1	3	3	12	B	36		7
VIKINDU	VIKINDU	5,125	6,749	8,015	200	01: Village	04: Scattered	X				3	2	2	8	C	31	3	13
MKURANGA	DUNDANI	1,577	2,077	2,466	62	01: Village	03: Clustered	X				3	4	3	6	D	31		2
MKURANGA	SUNGUVUNI	989	1,302	1,547	39	01: Village	03: Clustered	X				4	3	2	6	D	31		2
LUKANGA	NJOPEKA	6,611	8,705	10,339	189	01: Village	04: Scattered	X				3	1	2	8	A	30		6
MKURANGA	TENGELEA	2,845	3,746	4,449	111	01: Village	03: Clustered	X				3	3	3	6	D	30		2
NYAMATO	KILMBA	1,920	2,528	3,003	50	01: Village	04: Scattered	X				4	4	3	4	D	30		4
NYAMATO	MKIU	3,742	4,927	5,852	146	01: Village	03: Clustered	X				4	3	3	4	D	29		4
MKURANGA	KOLANGWA	500	658	782	20	01: Village	04: Scattered	X				3	3	2	6	D	28		2
KITOMONDO	MING'OMBE	992	1,306	1,551	39	01: Village	04: Scattered	X				4	4	2	4	D	28		2
LUKANGA	MISASA	2,196	2,892	3,434	86	01: Village	03: Clustered	X				4	4	2	4	D	28		2
LUKANGA	MKOLA	1,107	1,458	1,731	43	01: Village	04: Scattered	X				4	4	2	4	D	28		2
MAGAWA	NYAMIHIMBO	889	1,171	1,390	35	01: Village	03: Clustered	X				4	4	2	4	D	28		2
MAGAWA	SANGASANGA	1,006	1,325	1,573	39	01: Village	04: Scattered	X				4	4	2	4	D	28		2
NYAMATO	KILIMAHEWA KUSINI	1,280	1,686	2,002	75	01: Village	03: Clustered	x				4	4	2	4	D	28		2
NYAMATO	NYANDUTURU	1,668	2,196	2,609	65	01: Village	03: Clustered	X				4	4	2	4	D	28		2
MKURANGA	MKWALIA/KITUMBO	1,072	1,412	1,677	42	01: Village	04: Scattered	X				3	2	2	6	D	27		2
TAMBANI	KIBAMBA	1,095	1,442	1,713	43	01: Village	04: Scattered	X				3	2	2	6	D	27		2
KIMANZICHANA	KILIMAHEWA KASKAN	3,256	4,288	5,092	127	01: Village	03: Clustered	x				4	3	2	4	D	27		2
KIMANZICHANA	KIMANZICHANA KUSIN	13,700	18,040	21,426	535	01: Village	01: Concentrated	x				4	3	2	4	D	27		2
KITOMONDO	KIKOO	2,395	3,154	3,746	94	01: Village	03: Clustered	X				4	3	2	4	D	27		2
KITOMONDO	NJIA NNE MIKERE	6,788	8,938	10,616	265	01: Village	03: Clustered	X				4	3	2	4	D	27		4
LUKANGA	SANGALANI	1,678	2,210	2,624	66	01: Village	04: Scattered	X				4	3	2	4	D	27		2
MAGAWA	MDINI	1,648	2,170	2,577	64	01: Village	03: Clustered	X				4	3	2	4	D	27		2
NYAMATO	MVULENI	1,886	2,484	2,950	74	01: Village	03: Clustered	X				4	3	2	4	D	27		2
BUPU	MAMNDI KONGO	1,421	1,871	2,222	56	01: Village	04: Scattered	X				3	3	3	4	D	26		4
KITOMONDO	KITOMONDO	1,799	2,369	2,814	70	01: Village	04: Scattered	X				4	2	2	4	D	26		2
KITOMONDO	MITEZA	1,819	2,395	2,845	71	01: Village	03: Clustered	X				3	3	3	4	D	26		2
LUKANGA	LUKANGA	1,983	2,611	3,101	78	01: Village	03: Clustered	X				4	2	2	4	D	26		4
MKURANGA	KIPARANG'ANDA'A'	4,321	5,690	6,758	169	01: Village	04: Scattered	X				4	2	2	4	D	26		2
MAGAWA	MAGAWA	4,524	5,957	7,075	177	01: Village	04: Scattered	X				3	4	2	4	D	25		4
MKURANGA	KIBULULU	1,005	1,323	1,572	39	01: Village	01: Concentrated	X				3	2	3	4	D	25		2
BUPU	BUPU	1,435	1,890	2,244	56	01: Village	04: Scattered	X				4	1	3	3	D	25		4
VIKINDU	KIPALA	2,029	2,672	3,173	79	01: Village	04: Scattered	X				1	3	1	8	C	24		
BUPU	TUNDU	1,416	1,865	2,215	55	01: Village	03: Clustered	X				3	3	2	4	D	24		8
KISIJU	BINGA	1,832	2,412	2,865	72	01: Village	03: Clustered	X				3	3	2	4	D	24		2
KITOMONDO	KIWAMBO	1,969	2,593	3,079	77	01: Village	03: Clustered	X				3	3	2	4	D	24		2
MAGAWA	KIFUMANGAO	681	897	1,065	27	01: Village	03: Clustered	X				3	3	2	4	D	24		4
MAGAWA	NASIBUGANI	97	128	152	38	01: Village	03: Clustered	X				3	3	2	4	D	24		1
TAMBANI	DONDWE	1,951	2,569	3,051	76	01: Village		X				4	2	1	4	D	24		2
TAMBANI	MWANADILATU	1,560	2,054	2,440	61	01: Village	04: Scattered	X				3	3	2	4	D	24		4
KISIJU	KALOLE	1,198	1,578	1,874	47	01: Village	03: Clustered	X				2	3	3	4	D	23		2
KISIJU	MPAFU	665	876	1,040	26	01: Village	03: Clustered	X				3	2	2	4	D	23		4
KISIJU	SOTELE	1,917	2,524	2,998	75	01: Village	03: Clustered	X				2	3	3	4	D	23		2
MKURANGA	KIPARANG'ANDA'B'	2,065	2,719	3,230	81	01: Village	04: Scattered	X				3	4	1	4	D	23		2
MWALUSEMBE	MWALUSEMBE	5,886	7,751	9,205	230	01: Village	03: Clustered	x				3	2	2	4	D	23		2
TAMBANI	TAMBANI	1,538	2,025	2,405	60	01: Village	04: Scattered	X				3	2	2	4	D	23		2
MAGAWA	MSONGA	1,197	1,576	1,872	47	01: Village	04: Scattered	X				2	4	2	4	D	22		2
MKURANGA	MKURANGA	2,823	3,717	4,415	110	01: Village	04: Scattered	X				3	3	1	4	D	22		4
NYAMATO	TIPO	1,997	2,630	3,123	78	01: Village	01: Concentrated	X				2	2	3	4	D	22		8
TAMBANI	MLAMLENI	2,318	3,052	3,625	91	01: Village	04: Scattered	X				2	1	1	6	D	21		2
BUPU	MANDI MPELA	1,820	2,397	2,846	71	01: Village	04: Scattered	X				2	3	2	4	D	21		2
KIMANZICHANA	KIMANZICHANA KASKAZ	1,006	1,325	1,573	39	01: Village	04: Scattered	x				2	3	2	4	D	21		2
KIMANZICHANA	MKENGE	2,393	3,151	3,743	94	01: Village	04: Scattered	x				2	3	2	4	D	21		2
KISIJU	KEREKESE	2,800	3,687	4,379	109	01: Village	04: Scattered	X				2	3	2	4	D	21		2
KITOMONDO	MITARANDA	1,552	2,044	2,427	61	01: Village	04: Scattered	X				2	3	2	4	D	21		2
MAGAWA	MTONGANI	591	778	924	23	01: Village	02: Concentrated along the Road	X				2	3	2	4	D	21		2
MKURANGA	MAGOZA	2,220	2,923	3,472	87	01: Village	03: Clustered	X				2	3	2	4	D	21		2
MWALUSEMBE	BIGWA	2,098	2,763	3,281	82	01: Village	02: Concentrated along the Road	x				2	3	2	4	D	21		2
MWALUSEMBE	KITONGA TOWN	1,500	1,975	2,346	59	01: Village	04: Scattered	x				2	3	2	4	D	21		2
MWALUSEMBE	KIZIKO	1,286	1,693	2,011	50	01: Village	01: Concentrated	x				2	3	2	4	D	21		4
TAMBANI	MIPEKO	1,418	1,867	2,218	55	01: Village	04: Scattered	X				3	2	1	4	D	21		2
MKURANGA	HOYOYO	3,320	4,372	5,192	130	01: Village	03: Clustered	X				3	2	2	3	D	21		2
KISIJU	DONDO	1,189	1,566	1,860	47	01: Village	03: Clustered	X				2	2	2	4	D	20		4
KIMANZICHANA	KIMBWININDI	3,250	4,280	5,083	127	01: Village	04: Scattered	X				1	2	2	4	D	17		4
MKURANGA	KISE	674	888	1,054	26	01: Village	04: Scattered	X				2	3	2	0	D	13		2

Table 6.4 Evaluation of Villages (4/4)

Ward	Name of Village	Population (2002)	Population (2010)	Population (2015)	Water Demand (2015) (m3/day)	Form of Community	Dwelling Type	Other WSS Intervention				Scoring				Type of WSS	Evaluation of Priority (Urgency+(Water Source)x2)	Exploitable Number of Well (Level-2)	Exploitable Number of Well (Level-1)
								None	Agency	Period	Plan	Urgency			Water Source				
												Average Time	Reliability	Consumption					
Ilala																			
KITUNDA	KITUNDA	23,424	33,567	42,031	1,051	01: Village	04: Scattered		Plan Intern		Cor	2	3	2	12	A	37	5	
TABATA	MATUMBI	4,304	6,168	7,723	193	02: Mtaa	01: Concentrated	X				3	1	1	8	A	28		
UKONGA	GONGO LA MBOTO	20,470	29,334	36,731	918	02: Mtaa	01: Concentrated		Plan Int'l			3	1	1	8	A	28		
MSONGOLA	MSONGOLA	3,668	5,256	6,582	165	01: Village	04: Scattered	X				2	1	2	8	A	27	1	
SEGEREA	AMANI	4,238	6,073	7,605	190	02: Mtaa	01: Concentrated	X				2	1	2	8	D	27		
CHANIKA	BUYUNI	6,544	9,378	11,742	294	01: Village	04: Scattered	X				3	2	2	6	D	27		6
SEGEREA	KISUKULU	4,151	5,948	7,448	186	02: Mtaa	01: Concentrated		Municipal		Cor	4	3	2	4	D	27		
KIPAWA	KIPUNGUNI	19,275	27,622	34,586	865	02: Mtaa	01: Concentrated		Municipal		Exp	2	2	1	8	A	26		
PUGU	PUGU STATION	1,998	2,863	3,585	90	01: Village	04: Scattered	X				2	2	1	8	A	26	1	3
ILALA	SHARIFF SHAMBA	6,708	9,613	12,037	301	02: Mtaa	01: Concentrated	X				2	1	1	8	A	25		
KINYEREZI	KINYEREZI	5,811	8,327	10,427	261	01: Village	04: Scattered	X				2	1	1	8	A	25		
SEGEREA	TEMBOMGWAZA	6,239	8,941	11,195	280	02: Mtaa	01: Concentrated	X				4	3	1	4	D	25		
CHANIKA	CHANIKA	13,906	19,928	24,953	624	01: Village	04: Scattered	X				3	2	2	4	D	23		4
CHANIKA	MAJOHE	3,122	4,474	5,602	140	01: Village	04: Scattered	X				3	2	2	4	D	23		6
UKONGA	GULUKA KWALALA	12,978	18,598	23,287	582	02: Mtaa	01: Concentrated		Plan Int'l		Cor	4	1	1	4	D	23		4
UKONGA	ULONGONI	3,680	5,274	6,603	165	02: Mtaa	01: Concentrated		Plan Int'l		Cor	3	1	2	4	D	22		4
PUGU	PUGU KAJIUNGENI	3,850	5,517	6,908	173	01: Village	04: Scattered		Ilala Munic		Exp	2	3	2	4	D	21		4
UKONGA	MWEMBEMADAFU	27,648	39,620	49,611	1,240	02: Mtaa	01: Concentrated	X				3	2	1	4	D	21		4
SEGEREA	KIMANGA DARAJANI	19,270	27,614	34,578	864	02: Mtaa	01: Concentrated	X				3	1	1	4	D	20		
TABATA	TENGE	4,750	6,807	8,523	213	02: Mtaa	01: Concentrated		World Bank		WB	3	1	1	4	D	20		
UKONGA	MARKAZ	4,279	6,132	7,678	192	02: Mtaa	01: Concentrated	X				2	3	1	4	D	19		2
UKONGA	MONGO LA NDEGE	3,698	5,299	6,636	166	02: Mtaa	04: Scattered		Plan Int'l		Cor	2	1	1	4	D	17		2
TABATA	TABATA	9,239	13,240	16,578	414	02: Mtaa	01: Concentrated	X				1	1	1	4	D	14		
MSONGOLA	MVUTI	4,108	5,887	7,371	184	01: Village	04: Scattered	X				2	2	1	0	D	10		4
Kinondoni																			
KIBAMBA	KWEMBE	7,600	10,481	12,814		Mitaa	04: Scattered		GOT&Japa		Cor	4	3	2	8	A	35		10
GOBA	MATOSA	25,144	34,677	42,393	1,060	Mitaa	04: Scattered	X				4	2	2	8	A	34	1	
MBEZI	MBEZI-LUIS	20,079	27,692	33,853	846	Mitaa	01: Concentrated	X				4	1	1	8	A	31		
MBEZI	MPIJI MAGOHE	2,723	3,755	4,591	115	Mitaa	04: Scattered	X				4	2	2	4	C	26		
MBEZI	MSAKUZI	2,797	3,857	4,716	118	Mitaa	04: Scattered	X				4	2	1	4	C	24		
GOBA	KULANGWA	1,220	1,683	2,057	51	Mitaa	04: Scattered	X				4	3	4	0	B	23		
KIBAMBA	KIBWEGERE	3,000	4,137	5,058	126	Mitaa	04: Scattered	X				3	2	1	4	C	21		
MBEZI	MSUMI	1,330	1,834	2,242	56	Mitaa	04: Scattered	X				3	1	1	4	C	20		4
KUNDUCHI	MADALA	8,932	12,318	15,059	376	Mitaa	04: Scattered	X				4	2	2	0	F	18		
BUNJU	MBOPO	1,868	2,576	3,149	79	Mitaa	03: Clustered	X				3	2	2	0	F	15		
KAWE	CHANGANYIKENI	17,000	23,445	28,662	717	Mitaa	01: Concentrated	X				3	1	1	0	F	12		
KIMARA	KIMARA BARUTI	14,584	20,113	24,589	615	Mitaa	01: Concentrated	X				3	1	1	0	F	12		
BUNJU	MABWEPANDE	3,100	4,275	5,227	131	Mitaa	04: Scattered	X				2	1	2	0	D	11		
KIMARA	MAVURUNZA	3,974	5,481	6,700	168	Mitaa	01: Concentrated	X				2	1	2	0	F	11		
Temeke																			
CHAMAZI	MSUFINI	6,427	9,210	11,532	288	02: Mtaa	03: Clustered	X				3	2	1	6	D	25		
CHARAMBE	KIBANGULILE	12,500	17,913	22,430	561	02: Mtaa	03: Clustered	X				2	3	1	12	A	35		
KIMBIJI	KIZITO HUONJWA	1,096	1,571	1,967	49	02: Mtaa	02: Concentrated along the Road	X				1	1	1	12	D	30		
PEMBA MNAZI	YALEYALE PUNA	3,321	4,759	5,959	149	01: Village	03: Clustered	X				3	3	1	12	A	38	1	2
PEMBAMNAZI	TUNDWI SONGANI	2,204	3,158	3,955	44	01: Village	03: Clustered	X				2	3	1	12	B	35	2	6
VIJIBWENI	VIJIBWENI	1,800	2,579	3,230	81	02: Mtaa	03: Clustered	X				1	3	1	12	A	32		
VIJIBWENI	KIBENE	751	1,076	1,348	34	02: Mtaa	03: Clustered	X				1	2	1	12	B	31		
MAKANGARAW	MAKANGARAWE	10,400	14,903	18,661	467	02: Mtaa	03: Clustered	X				1	1	1	12	A	30		
MBAGALA	KINGUGI	4,663	6,682	8,367	209	02: Mtaa	03: Clustered	X				1	1	1	12	A	30		
MBAGALA KUU	MGENI NANI	7,020	10,060	12,596	315	02: Mtaa	04: Scattered	X				1	1	1	12	A	30		
VIJIBWENI	KISIWANI	1,060	1,519	1,902	48	02: Mtaa	03: Clustered	X				1	1	1	12	B	30		
VIJIBWENI	MKWAJUNI	997	1,429	1,789	45	02: Mtaa	01: Concentrated	X				1	1	1	12	B	30		
YOMBO VITUKA	MACHIMBO	15,421	22,099	27,671	692	02: Mtaa	03: Clustered	X				1	1	1	12	A	30		
YOMBO VITUKA	SIGARA	8,024	11,499	14,398	360	02: Mtaa	01: Concentrated	X				1	1	1	12	A	30		
TANDIKA	NYAMWELA	4,402	6,308	7,899	197	02: Mtaa	03: Clustered	X				3	1	1	8	A	28		
MJIMWEMA	MJIMWEMA	5,670	8,125	10,174	254	02: Mtaa	03: Clustered	X				2	3	1	8	A	27	1	
YOMBO VITUKA	VITUKA	11,499	16,478	20,633	516	02: Mtaa	04: Scattered		WaterAid			4	1	1	4	D	23		
MAKANGARAW	YOMBO DOVYA	15,881	22,758	28,496	712	02: Mtaa	03: Clustered	X				1	1	1	8	A	22		
MBAGALA KUU	MBAGALA KUU	11,540	16,537	20,707	518	02: Mtaa	01: Concentrated	X				1	1	1	8	A	22		
MJIMWEMA	KIBUGUMO	1,883	2,698	3,379	84	02: Mtaa	01: Concentrated	X				1	1	1	8	A	22	1	
TANDIKA	MAGURUWE	6,599	9,457	11,841	296	02: Mtaa	03: Clustered	X				1	1	1	8	A	22		
TANDIKA	TAMLA	5,814	8,332	10,432	261	02: Mtaa	03: Clustered	X				1	1	1	8	A	22		
TUANGOMA	KONGOWE	3,165	4,536	5,679	142	02: Mtaa	03: Clustered	X				2	1	1	6	D	21		

6.3 SELECTION OF PRIORITY PROJECT

6.3.1 CRITERIA FOR SELECTION OF PRIORITY PROJECT

District wise priority of Village was evaluated as mentioned in Section 6.2.2 of this Chapter. Water supply plan is prepared for each Village. The candidate villages for Priority Project were selected applying the evaluation criteria along with appropriate scale of project in proportion to the village concerned.

(1) Appropriate Scale of Project

Among the prepared water supply plans for all of the target villages, appropriate scale of project should be selected because the Priority Project is supposed to be implemented with Japan's Grant Aid. From this point, appropriate scale of the project is considered.

(2) Proportion of Village or Population

The scale of the Priority Project should be appropriately allocated to each District/Municipality. In the consideration on appropriate scale of project, following two factors were considered.

- Factor 1: Proportion of number of villages in the District/Municipality
- Factor 2: Proportion of population of villages in the District/Municipality

6.3.2 SELECTION OF PRIORITY PROJECT

Applying the criteria mentioned in 6.3.1, four alternatives for the Priority Project were proposed. They are summarized in *Table 6.5*.

Table 6.5 Alternatives of Candidate Priority Project

Alternatives	Scheme	Factor of Scale	No. of Scheme	No. of village	Service Population
1	Level-2	Number of village	17	19	100,091
2	Level-2	Number of population	15	18	95,358
3	Level-1 and 2	Number of village	72+14	42	93,899
4	Level-1 and 2	Number of population	38+15	31	105,081

Note: Number of scheme is (Level-1) + (Level-2) in Alternative 3 and 4

Based on the discussion with MoWLD and District/Municipal Water Engineers, the Alternative-1 was evaluated as technically reasonable, because the Alternative-1 includes larger number of village and population compared with other alternatives and the construction of Level-2 requires foreign assistance.

The candidate villages for the Priority Project are further clarified from the technical and socio-economical points of view as the next step. Once the candidate villages for Priority Project were determined, supplementary survey on the candidate villages was carried out to examine the technical suitability and socio-economic condition of the villages.

In the technical survey, attention was paid to topography and dwelling type of villages, distance between Sub-Villages and elevation of Sub-Villages in order to clarify the technical suitability for Level-2 scheme. In parallel with the technical survey, community awareness survey was carried out in order to assess; 1) current water supply condition, 2) managerial status of community-based organization, 3) awareness of the community on the problems associated with current water supply, 4) communities' preference to the level of the improved water supply facilities, 5) communities' choice in the form of community-based management, 6) willingness of the communities to manage, operate and maintain the improved supply scheme, 7) willingness and affordability of the communities to pay for operation and maintenance of the scheme, and 8) communities' awareness and willingness to contribute to the construction cost.

As the results of the technical clarification, following village, Sub-village and a part of village were excluded from the service area of the Level-2 scheme. .

- A part of village and/or Sub-village where elevation is too high to supply by gravity.
- Distance of a part of village and/or Sub-village is too long and number of households are a few.
- An area where households are too scattered to supply by piped scheme.
- A village where service population becomes less than 2,500 after excluding the area mentioned above.

When a village was evaluated as not suitable for Level-2 water supply, a village standing next on the list of priority village was newly selected as a candidate of the Priority Project. The community awareness survey was also carried out when a village was selected as a candidate of the Priority Project. No unfavourable information for implementation of the Priority Project was obtained by this survey.

The name of village and sub-village excluded from the service area of Level-2 along with reason for exclusion is shown in *Table 6.6*. Finally, 22 schemes in 22 villages were selected as the Priority Project as shown in *Table 6.7* and their locations are shown in *Figure 6.1*.

Table 6.6 Village and Sub-Village Excluded from Level-2 Service Area (1/3)

	Name of Village	Name of Sub Village	Result	Population (2002)	Population (2015)	Population served (2015)	Rate of Population served	Reason excluded from survice area
BAGAMOYO								
KIBINDU	**KIBINDU**	**Total Area**		**5,605**	**7,251**			
		Service Area only		**4,904**	**6,344**	6,344	87.5	
		Chapuku	Y	1,397	1,807			
		Kikomba	Y	1,805	2,335			
		Msete	Y	1,702	2,202			
		~~Kwaikonje~~	N	343				D, E
		~~Pera~~	N	358				D, E
KWAMDUMA	**KWAMDUMA**	**Total Area**		**3,677**	**4,757**			
		Service Area only		**2,545**	**3,292**	3,292	69.2	
		Kwakilumbi	Y	988	1,278			
		Kwedi Yule	Y	1,557	2,014			
		~~Gole~~	N	87				D, E
		~~Kwavuli~~	N	627				D, S
		~~Mjembe~~	N	418				D
MKANGE	**MATIPWILI**	**Total Area**		**2,698**	**3,490**			
		Service Area only		**1,948**	**2,518**	2,518	72	
		Mkunguni	Y	615	795			
		Msikitini	Y	827	1,069			
		Mzambarauni	Y	506	654			
		~~Biga~~	N	N.A				(temporary dwelling)
		~~Gongo~~	N	641				E, D
		~~Kisauke~~	N	N.A				(migrated to other)
		~~Tumbilini~~	N	109				E, D
KIBAHA								
RUVU	**MINAZI MIKINDA (1/2)**	**Total Area**		**1,624**	**2,508**			
		Service Area only		**1,624**	**2,508**	2,508	100	
		Miniji Mikinda	Y	1,624	2,508			
RUVU	**MINAZI MIKINDA (2/2) /KITOMONDO**	**Total Area**		1,657	2,559			
		Service Area only		**1,627**	**2,513**	2,513	100	
	MINAZI MIKINDA	Mnaji	Y	1,000	1,544			
	KITOMONDO	Gumba	Y	230	355			
		Kitomondo	Y	397	613			

Table 6.6 Village and Sub-Village Excluded from Level-2 Service Area (2/3)

	Name of Village	Name of Sub Village	Result	Population (2002)	Population (2015)	Population served (2015)	Rate of Population served	Reason for exclusion from service area
KISARAWE								
MSIMBU	**MSIMBU**	**Total Area**		2,967	3,555			
		Service Area only		**2,199**	**2,635**	2,635	100	
		Kifukumko	Y	252	302			
		Mgoge	Y	753	902			
		Msimbu Mjini	Y	588	705			
		Ngwazi	Y	363	435			
		Chambasi	Y	243	291			
		~~Mwanzo Mgumu~~	N	396				D
		~~Vinyawanjwa~~	N	372				D
CHOLE	**CHOLE**	**Total Area**		2,685	**3,217**			
		Service Area only		**2,685**	**3,217**	3,217	100.0	
		Egea	Y	940	1,126			
		Mdogoyo	Y	537	643			
		Ponza	Y	402	482			
		Shuleni	Y	806	966			
MKURANGA								
VIKINDU	~~MKOKOZI~~	~~**Total Area**~~		~~1,769~~	~~**2,767**~~			S, T
VIKINDU	**MWANDEGE/KIPALA**	**Total Area**		2,100	**3,285**			
	MWANDEGE	**Service Area only**		**2,100**	**2,815**	2,687	85.7	
		Chatembo	Y	300	469			
		Kirungule	Y	400	626			
		Mwandege	Y	600	938			
	KIPALA	a part of Kipala	Y	500	782			
	MWANDEGE	~~Vicheji~~	N	~~300~~				D, E
VIKINDU	**KISEMVULE**	**Total Area**		2,260	**3,535**			
		Service Area only		**2,260**	**3,244**	3,244	91.8	
		Kisemvule	Y	850	1,330			
		Kitangwi	Y	162	253			
		Mpela	Y	660	1,032			
		Vibura	Y	402	629			
		~~Utunge~~	N	~~186~~				D
VIKINDU	~~MALELA~~	~~**Total Area**~~	N	~~**1,250**~~	~~**1,955**~~			No access
	~~YAVAYAVA~~	~~**Total Area**~~	N	~~**1,830**~~	~~**2,862**~~			S
VIKINDU	**MOROGORO**	**Total Area**		**2,935**	**4,590**			
	MFURU MWAMBAO	**Service Area only**		**1,945**	**2,635**	2,635	100	
	MAROGORO	Marogoro	Y	640	**1,001**			
		Sangatini	Y	600	**938**			
	MFURU MWAMBAO	Mfuru Mwambao	Y	445	**696**			
	MAROGORO	~~Zingezinge~~	N	~~260~~				D
	MFURU MWAMBAO	~~Kibane~~	N	~~336~~				D
		~~Kigobedi~~	N	~~228~~				D
		~~Kikonga~~	N	~~181~~				D
		~~Songola~~	N	~~245~~				D
VIKINDU	**VIANZI**	**Total Area**		2,625	**4,106**			
		Service Area only		**1,871**	**2,926**	2,926	71.3	
		Kwajokoo	Y	591	924			
		Mwajasi	Y	257	402			
		Nyamisiki	Y	268	419			
		Vianzi Town	Y	755	1,181			
		~~Changombe~~	N	~~452~~				D
		~~Honda~~	N	~~302~~				D
VIKINDU	**VIKINDU**	~~**Total Area**~~	N	5,125	8,015			(Private schemes)
LUKANGA	**NJOPEKA**	**Total Area**		**6,611**	**10,339**			
		Service Area only		**3,371**	**5,272**	5,272	51.0	
		Mikwasu	Y	1,595	**2,494**			
		Njopeka Mjini	Y	1,489	**2,329**			
		Nyamalonda	Y	287	**449**			
		~~Kingoma Mashariki~~	N	~~1,103~~				D
		~~Kingoma Magh.~~	N	~~1,025~~				D
		~~Malenda~~	N	~~1,112~~				D

Table 6.6 Village and Sub-Village Excluded from Level-2 Service Area (3/3)

	Name of Village	Name of Sub Village	Result	Population (2002)	Population (2015)	Population served (2015)	Rate of Population served	Reason for exclusion from service area
ILALA								
KITUNDA	**KITUNDA**	**Total Area**		**23,424**	**42,031**			
		Service Area only		**8,472**	**15,202**			
		Kivule (1/2)	Y	2,614	4,690	4,690	11.2	
		Kivule (2/2)	Y	1,744	3,129	3,129	7.4	
		Mzinga	Y	4,114	7,382	7,382	17.6	
		~~Kipunguni Machimbo~~	N	~~6,039~~				W
		~~Kitunda Kati~~	N	~~8,913~~				W
UKONGA	~~GONGO LA MBOTO~~	（N.A)		20,470	**36,731**			DAWASA
MSONGOLA	**MSONGOLA**	**Total Area**		**3,668**	**6,582**			
		Service Area only		**1,410**	**2,530**	2,530	38.4	
		Yange Yange	Y	1,410	2,530			
		~~Mbondole~~	N	~~990~~				D
		~~Kitonga~~	N	~~593~~				D
		~~Mvuleni~~	N	~~675~~				D
PUGU	**PUGU STATION**	**Total Area**		7,139	12,810			
		Service Area only		6,481	11,629	2,882	22.5	
		Kichangani	Y	1,340	2,404			
		Pugu Station	Y	5,141	9,225			
		~~Bangulo~~	N	~~658~~				E, D
KINONDONI								
KIBAMBA	~~KWEMBE~~	~~（N.A)~~	N	~~7,600~~	~~12,814~~			S, T
GOBA	**MATOSA**		Y	2,580	4,350	2,747	21.4	
TEMEKE								
PEMBA MNAZI	**YALEYALE PUNA**	**Total Area**		**3,321**	**5,959**			
		Service Area only		**3,113**	**5,586**	5,586	93.7	
		Kibungo	Y	419	752			
		Kwamorisi	Y	624	1,120			
		Puna Centre	Y	2,070	3,714			
		~~Potea~~	N	~~208~~				S, D
~~CHARAMBE~~	~~KIMBANGULILE~~	~~（N.A)~~		~~12,500~~	~~22,430~~			CWSSP
PEMBAMNAZI	**TUNDWI SONGANI**	**Total Area**		**2,204**	**3,955**			
		Service Area only		**1,475**	**2,647**	2,647	66.9	
		Nyange	Y	320	574			
		Songani	Y	545	978			
		Tundwi	Y	610	1,095			
		~~Kichangani~~	N	~~448~~				D, S
		~~Muhimbili~~	N	~~281~~				D, S
MBAGALA	~~KINGUGI~~	~~（N.A)~~		~~4,663~~	~~8,367~~			DAWASA
MJIMWEMA	**MJIMWEMA**	**Total Area**		**5,670**	**10,174**			
		Service Area only		**2,000**	**3,589**	3,589	35.3	
		Salanga	Y	2,000	3,589			
		~~Jiwe La Adabu~~	N					
		~~Mjimwema~~	N	~~3,670~~				W
		~~Tangwani~~	N					
MJIMWEMA	**KIBUGUMO**	**Total Area**		1,883	3,379			
		Service Area only		1,883	3,379	3,379	100	

(Note)
E: Elevation is to high compared with other Sub Villages.
D: Distance is too long from other Sub Villages.
S: Distribution of houses are too scattered.
T: Topography is not suitable for piped scheme.
W: Existing piped scheme is available.
DAWASA: Included in DAWASA extension plan.
CWSSP: Target village of CWSSP.

Table 6.7 Water Supply Plan for Priority Project

District/Municipality Village/Mitaa	Name of Village	Serial No. of Scheme	Service Population (2002)	Service Population (2010)	Service Population (2015)	Number of Wells	Water Production (m^3/day)
BAGAMOYO							
KIBINDU	KIBINDU	BGM-1	4,904	5,746	6,344	2	173
KWAMDUMA	KWAMDUMA	BGM-2	2,545	2,982	3,292	2	86
MKANGE	MATIPWILI	BGM-3	1,948	2,283	2,518	Wami	72
KIBAHA							
RUVU	MINAZI MIKINDA (1/2)	KBH-1A	1,624	2,083	2,508	1	72
RUVU	MINAZI MIKINDA (2/2) /KITOMONDO	KBH-1B	1,627	2,102	2,513	1	72
KISARAWE							
CHOLE	CHOLE	KSW-1	2,685	3,001	3,217	2	106
MSIMBU	MSIMBU	KSW-2	2,199	2,458	2,635	2	76
MKURANGA							
LUKANGA	NJOPEKA	MKR-1	3,371	4,439	5,272	Spring	132
VIKINDU	MWANDEGE/KIPALA	MKR-2	2,100	2,370	2,815	1	79
VIKINDU	KISEMVULE	MKR-3	2,260	2,731	3,244	2	86
VIKINDU	MOROGORO MFURU MWAMBAO	MKR-4	1,945	2,036	2,635	1	72
VIKINDU	VIANZI	MKR-5	1,871	2,463	2,926	1	79
ILALA							
KITUNDA	KITUNDA-Kivuke (1/2)	ILL-4A	2,614	3,746	4,690	2	126
	KITUNDA-Kivuke (1/3)	ILL-4B	1,744	2,499	3,129	1	90
	KITUNDA-Mzinga	ILL-4C	4,114	5,895	7,382	2	198
MSONGOLA	MSONGOLA	ILL-5	1,410	2,021	2,530	1	72
PUGU	PUGU STATION	ILL-6	6,481	9,287	11,629	1	72
KINONDONI							
GOBA	MATOSA	KND-1	2,580	3,558	4,350	1	72
TEMEKE							
MJIMWEMA	KIBUGUMO	TMK-1	1,883	2,698	3,379	1	84
MJIMWEMA	MJIMWEMA	TMK-2	2,000	2,866	3,589	1	90
PEMBA MNAJI	YALEYALE PUNA	TMK-3	3,113	4,461	5,586	1	150
PEMBA MNAJI	TUNDWI SONGANI	TMK-4	1,475	2,114	2,647	1	72

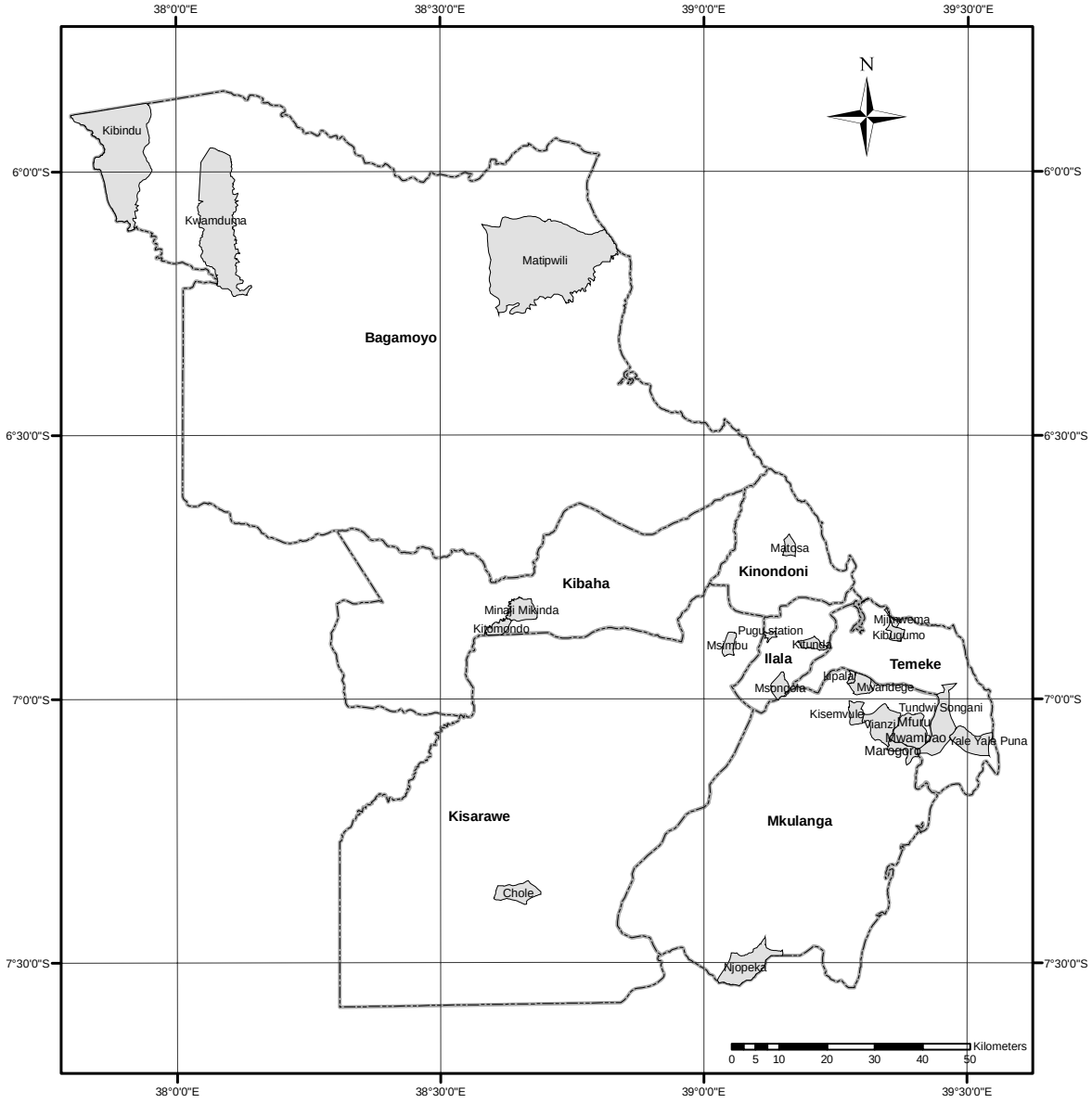

FIGURE 6.1 LOCATION OF TARGET VILLAGES OF PRIORITY PROJECT

THE STUDY ON WATER SUPPLY IMPROVEMENT IN COAST & DAR ES SALAAM | **JICA**

6.4 PRELIMINARY DESIGN OF WATER SUPPLY FACILITIES FOR PRIORITY PROJECT

6.4.1 GENERAL CONCEPT OF PRELIMINARY DESIGN

Water source is groundwater for 20 schemes, surface water for one scheme and spring water for one scheme. In order to minimize both construction and operation cost, the water treatment facilities are not included in the schemes except for the case of surface water and the water is supplied by gravity to the service area through public water points.

6.4.2 WATER DEMAND

Water demand is estimated considering the domestic water use and institution use as discussed in Chapter 5 of this report. Unit water demand for domestic use is 25 litre/capita/day. Detailed unit water demands are shown in *Table 5.14* in Chapter 5. Water demand for each scheme is cited in *Table 10.1* (Chapter 10).

6.4.3 MANUAL AND GUIDELINE APPLIED IN THE PRELIMINARY DESIGN

Design Manual (Ministry of Water, 1997) was basically adopted in designing of relevant water supply facilities. Guideline for Design of Water Supply Facilities in Japan (2000) was also applied to the design of laying depth of transmission and distribution pipes.

6.4.4 DESIGN CONDITIONS

Water facilities for priority project are composed of intake, transmission line, storage tank, distribution line and public water point. Treatment facility is planned for only one scheme in Matipwili Village, Bagamoyo District. Design conditions considered in the designing of the water supply facilities are summarized in *Table 6.8*.

Table 6.8 Design Conditions of Water Supply Scheme

1. Time period of water consumption: 6 hours (from 6:00 to 9:00a.m. and from 3:00 to 6:00 p.m.)		
2. Design Flow		
Daily average flow	Daily average flow = Daily water demand + Distribution losses	
Daily maximum flow	Daily maximum flow = Daily average flow	
Hourly maximum flow	Hourly maximum flow = Daily maximum flow / 6 hours[1)]	
3. Distribution Losses	20 % of Daily average flow	
4. Facilities	Specification	
Intake facilities	Daily operation hour	Average: 10 hours (=600 min.) Maximum: 12 hours (=720 min.)
	Capacity (m^3/min.)	Daily maximum flow (m^3/day) / 600 (min/day)
	Type of pump	Submersible pump (Centrifugal pump)
	Power source	Generator (diesel engine with generator)
Disinfection facility*	Chlorine feeder	Dropping type, Sodium hypochlorite
Transmission Line	Design Flow	Daily maximum flow (m^3/day) / 600 (min/day)
	Method of water supply	Pressure flow
	Material of pipes	P.V.C. pipe
	Earth covering depth	0.75 m (minimum)
Storage tank (Distribution tank)	Capacity (m^3)	Daily maximum flow (m^3/day) x 50% (40-120 m3)
	Type of tank	Ground tank or Elevated tank (12 m in maximum)
	Low Water Level	Ground tank (G.L+0.2 m) Elevated Tank (G.L+8.95 m in maximum)
	No. of tank	1 tank /scheme
	Material of tank	Reinforced concrete
Distribution Line	Design Flow	Hourly maximum flow
	Material of pipes	P.V.C. pipe (Galvanized pipe)
	Earth covering depth	0.75 m (minimum)
	Method of water supply	Gravity flow
Public water point (PWP)	Number of tap /PWP	One or two taps/PWP according to the population
	Number of PWP	One tap/250 persons against the population in 2010
	Maximum number of user	250 persons / tap
	Maximum distance of access	400 m from household

* : Disinfection facility is installed in Matipwili only.

6.4.5 FACILITY PLAN

Water supply facilities are designed following the finalized water supply plan for the Priority Project. Design parameters of each scheme are summarized in *Table 6.9*.

(1) Water Source and Intake Facility

The source of water is extracted by submersible pump from the intake facilities and is transmitted to the storage tanks by the pressure of the pump. They are deep tube wells for groundwater source, intake facility for spring water and intake with treatment facility for surface water.

Depth of deep tube wells ranges from 50 to 120 m according to the hydrogeological conditions. Considering the low pH value of groundwater, casing and screen pipes made of FRP was selected. Annular space between well and pipes are filled with gravel.

Spring water in Njopeka Village in Mkuranga formed a pond near the source. Water is pumped up from this pond. Spring water has no deterioration by Microbial aspects, therefore, no treatment facility is provided.

At Matipwili Village in Bagamoyo District, the source is the river water of the Wami River. Water has deterioration by Microbial aspects and its turbidity is high, therefore, water is first led to a tank and pumped up to a sedimentation tank adjacent to the intake facility.

The commercial electric power supply is available in five of the target villages: Mwandege, Kipala, Kisemvule and Vianzi in Mkuranga, and Mjimwema in Temeke. Still, their supplies are not stable in voltage and this will cause pump operational problems. Therefore, generator with diesel engine is provided as the power source in order to facilitate smooth pump operation. However, final selection of power sources should be made considering the actual situation of power supply in the villages and expansion plan of power line (TANESCO) to the villages. Such confirmation should be carried out during the later implementation stage of the project.

Design of intake facilities are shown in *Figure 6.2* to *6.4*.

As mentioned in Chapter 4 on Water Resources, groundwater quality varies depending on locations. Therefore, water quality shall be confirmed after the completion of drilling of deep tube wells. Attention should be paid to Microbial aspects, Chemicals that are of health significance as shown in Table 3.7 (Chapter 3): In particular, need salinity as Electric Conductivity (EC) in Neogene aquifers and Fluoride (F) in Precambrian aquifers need careful consideration. Analyses of these items would be carried out in the Laboratory of MoWLD, UCLAS or Japan.

(2) Treatment Facility

Treatment facility is required as described above. Therefore, disinfection with chlorine is planned. In addition sedimentation tank is proposed to reduce the turbidity for the water supply scheme in Matipwili where the Wami River water is used as the water source. It is considered that fine materials causing turbidity will be reduced with sedimentation, assuming the grain size is silt size (between 1/16 to 1/256 mm). Velocity of sedimentation of the smallest particle (1/256 mm) was assumed as 9.7 cm/min. applying the Stokes Low. Therefore, most of silty materials in the water will be removed within about 16 hours. The design of the sedimentation tank is shown in *Figure 6.5*.

(3) Transmission Line

The source water is pumped to the storage tank with the head of the submersible pump. The pipes are planned to be laid in a minimum depth of 1 m from the ground surface. No booster pump is planned in the system. Standard design is shown in *Figure 6.6.*

(4) Storage Tank

The capacity of storage tank is determined to meet 50 % of the daily maximum (Qdmax) flow which is considered same as the hourly maximum flow (Qhmax). As for type of tanks, one

Table 6.9 Summary of Design Parameter for Water Supply Facilities of Priority Project

District	Village /Mitaa	Water Sources (Well)		Transmission Pipe Line		Storage Tank		Total Length of Distribution Line (m)	Maximum Length from Water Source to the end of PWP (m)	No. of PWP	
		No. of Well	Well Depth (m)	Diameter (mm)	Total Length (m)	Capacity (m^3)	Type of Tank 1)			PWP with Single Tap	PWP with Double Taps
Bagamoyo	Kibindu	2	100	75	2,060	100	Ground tank	6,820	5,557	13	5
	Kwanduma	2	100	50	1,500	50	Ground tank	2,590	2,930	2	5
	Matipwili	Wami River	-	63	510	40	Elevated tank (A)	1,330	1,100	10	0
Kibaha	Minazi Mikinda	1	50	50	100	40	Elevated tank (A)	1,280	1,030	0	5
	Kitomondo/Minazi Mikinda	1	50	50	100	40	Elevated tank (A)	6,900	5,090	9	0
Kisarawe	Msimbu	2	120	90	4,700	50	Ground tank	18,400	8,450	11	0
	Chole	2	80	110	3,960	60	Ground tank	10,550	8,110	18	0
Mkuranga	Mwandege /Kipala	1	80	63	100	50	Elevated tank (A)	10,660	4,220	22	0
	Kisemvule	2	80	63	940	60	Ground tank	9,560	5,750	12	0
	Marogoro /Mfuru Mwambao	1	50	50	100	40	Elevated tank (B)	11,370	5,230	14	0
	Vianzi	1	100	75	100	50	Elevated tank (A)	7,420	2,640	13	0
	Njopeka	Spring	-	110	2,480	80	Ground tank	13,830	8,070	12	3
Ilala	Kitunda-1	2	80	50	400	80	Elevated tank (A)	7,930	3,980	0	8
	Kitunda-2	1	80	63	100	50	Elevated tank (A)	8,900	4,830	0	5
	Mzinga	2	80	63	400	120	Elevated tank (A)	8,440	4,800	0	12
	Msongala	1	80	75	100	40	Elevated tank (A)	6,620	3,170	9	0
	Pugu Station	1	90	75	1,420	50	Ground tank	2,230	2,870	0	5
Kinondoni	Matosa	1	120	75	2,180	50	Elevated tank (A)	5,070	5,640	4	3
Temeke	Yaleyale Puna	1	80	125	4,430	90	Elevated tank (A)	9,990	9,170	6	6
	Tundwi Songani	2	80	63	3,920	40	Elevated tank (A)	8,550	5,410	16	0
	Mjimwema	1	50	50	100	60	Elevated tank (B)	4,980	3,220	6	3
	Kibugumo	1	50	75	100	50	Elevated tank (B)	3,590	2,470	7	2
Total		28	-	-	29,800	1,290	-	167,010	-	184	62

Note: 1) Ground tank : Low water level = GL + 0.20 m
Elevated tank (A): Low water level = GL + 6.05 m
Elevated tank (B): Low water level = GL + 8.95 m

type of ground tank and two types of elevated tank are planned considering the topographic condition of the service area (*Figure 6.7* to *6.9*). Structure of the tank is planned to be of reinforced concrete. Water level gauge and flow meter will be provided in each tank to facilitate proper operation and maintenance.

(5) Distribution Line

The pipe routes are planned based on the results of the field survey by the Study Team. Precise length of pipe lines shall be reviewed based on the topographic survey during the implementation stage of the project. PVC pipes are principally proposed for the distribution lines. Diameters of pipes are determined based on gravity flow. Standard design is same as that of Transmission line (*Figure 6.6).*

6.4.6 PUBLIC WATER POINT

Locations of public water points (PWP) are proposed considering the results of the field survey. Public water point is allocated for every lot of 150 persons (single tap). Maximum access distance to a tap from households is 400 m in principle. Number of taps at Public Water Point (PWP) is two as maximum depending on the service population. Design of public water point is shown in *Figure 6.10.*

6.5 FACILITY PLAN AND LAYOUT OF WATER SUPPLY SCHEME

Facility plans of priority project is summarized in *Table 6.10.* The layout of each water supply schemes are shown from *Figure 6.11 to 6.32*.

Table 6.10 Facility Plan for Priority Project

Village /Mitaa	Water Sources (Well)		Transmission Pipe Line		Storage Tank		Total Length of Distribution Line (m)	No. of Public Water Point		
	No. of Well	Well Depth (m)	Diameter (mm)	Length (m)	Capacity (m^3)	Type of Tank 1)		PWP with Single Tap	PWP with Double Taps	Total
Kibindu	2	100	75	2,060	100	Ground tank	6,820	13	5	18
Kwanduma	2	100	50	1,500	50	Ground tank	2,590	2	5	7
Matipwili	Wami River	-	63	510	40	Elevated tank (A)	1,330	10	0	10
Minazi Mikinda	1	50	50	100	40	Elevated tank (A)	1,280	0	5	5
Kitomondo/Minazi Mikinda	1	50	50	100	40	Elevated tank (A)	6,900	9	0	9
Msimbu	2	120	90	4,700	50	Ground tank	18,400	11	0	11
Chole	2	80	110	3,960	60	Ground tank	10,550	18	0	18
Mwandege /Kipala	1	80	63	100	50	Elevated tank (A)	10,660	22	0	22
Kisemvule	2	80	63	940	60	Ground tank	9,560	12	0	12
Marogoro /Mfuru Mwambao	1	50	50	100	40	Elevated tank (B)	11,370	14	0	14
Vianzi	1	100	75	100	50	Elevated tank (A)	7,420	13	0	13
Njopeka	Spring	-	110	2,480	80	Ground tank	13,830	12	3	15
Kitunda-1	2	80	50	400	80	Elevated tank (A)	7,930	0	8	8
Kitunda-2	1	80	63	100	50	Elevated tank (A)	8,900	0	5	5
Mzinga	2	80	63	400	120	Elevated tank (A)	8,440	0	12	12
Msongala	1	80	75	100	40	Elevated tank (A)	6,620	9	0	9
Pugu Station	1	90	75	1,420	50	Ground tank	2,230	0	5	5
Matosa	1	120	75	2,180	50	Elevated tank (A)	5,070	4	3	7
Yaleyale Puna	1	80	125	4,430	90	Elevated tank (A)	9,990	6	6	12
Tundwi Songani	2	80	63	3,920	40	Elevated tank (A)	8,550	16	0	16
Mjimwema	1	50	50	100	60	Elevated tank (B)	4,980	6	3	9
Kibugumo	1	50	75	100	50	Elevated tank (B)	3,590	7	2	9
Total	28	-	-	29,800	1,290	-	167,010	184	62	246

1) Ground tank : Low water level = GL + 0.20 m
Elevated tank (A): Low water level = GL + 6.05 m
Elevated tank (B): Low water level = GL + 8.95 m

6.6 COST ESTIMATION OF PRIORITY PROJECT

The cost for implementation of the Priority Project is estimated at approximately 16.5 million USD including engineering cost assuming the implementation with Japan's Grant Aid. Estimated engineering cost is 15 % of the construction cost based on the similar projects. Breakdown of the project cost is shown in *Table 6.11*.

Table 6.11 Breakdown of Project Cost

District/Municipality	No. of Scheme	Construction Cost	Engineering Cost	Total
Bagamoyo	3	2,213.2	398.4	2,611.6
Kibaha	2	780.1	140.4	920.6
Kisarawe	2	1,872.5	337.1	2,209.6
Mkuranga	5	3,126.6	562.8	3,689.4
Ilala	5	2,950.6	531.1	3,481.7
Kinondoni	1	509.1	91.6	600.7
Temeke	4	2,527.2	454.9	2,982.1
Total	22	13,979.3	2,516.3	16,495.6

Note: Unit for Cost is thousand USD.

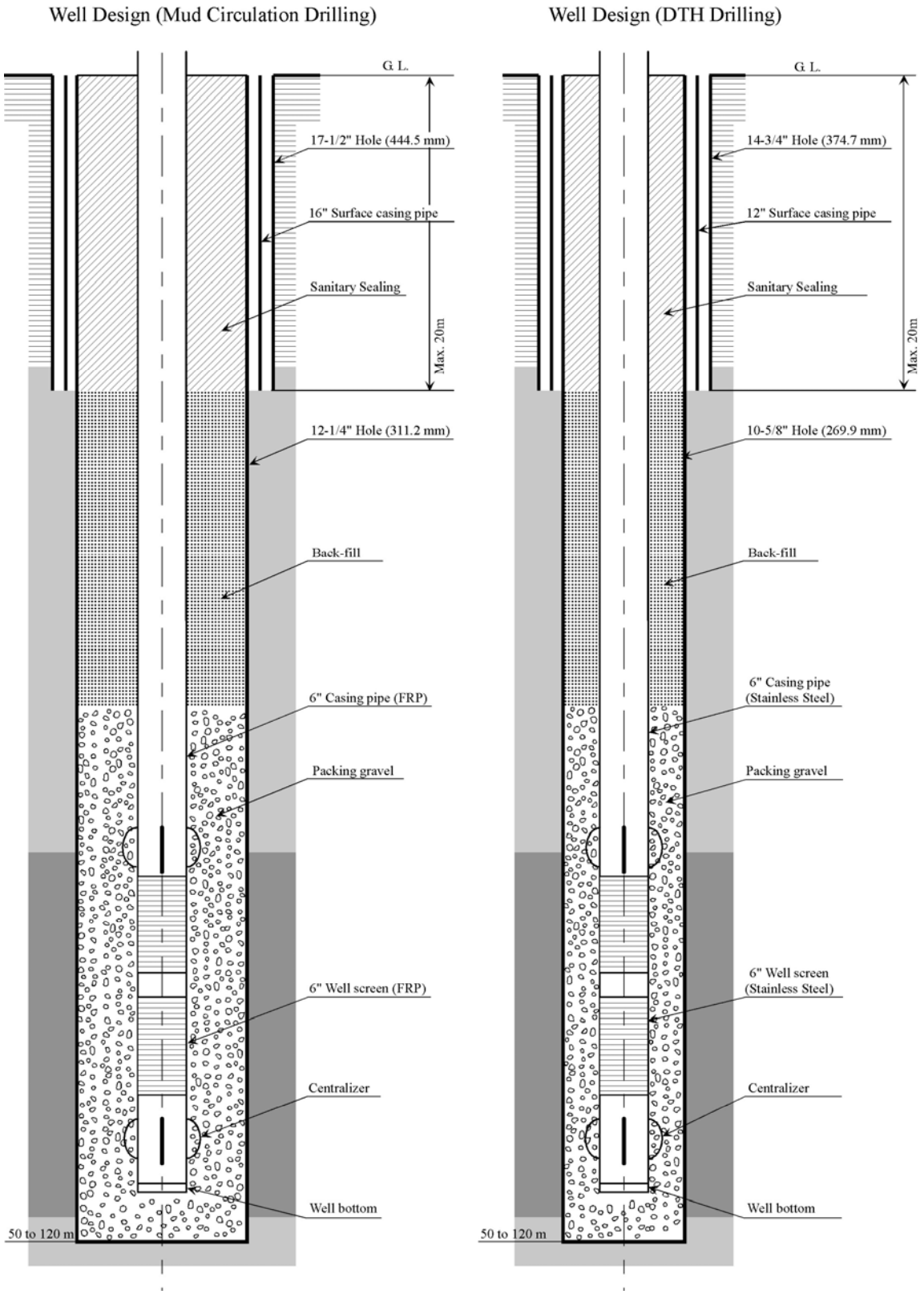

FIGURE 6.2 STANDARD DESIGN OF DEEP TUBE WELLS (INTAKE FOR GROUNDWATER)

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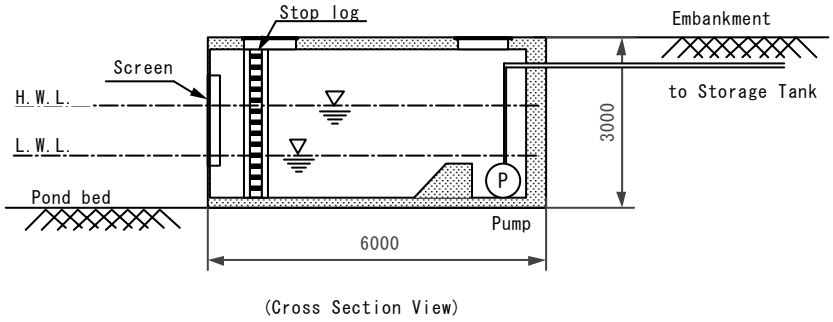

FIGURE 6.3 DESIGN OF INTAKE FACILITY FOR SPRING WATER (NJOPEKA, MKURANGA)

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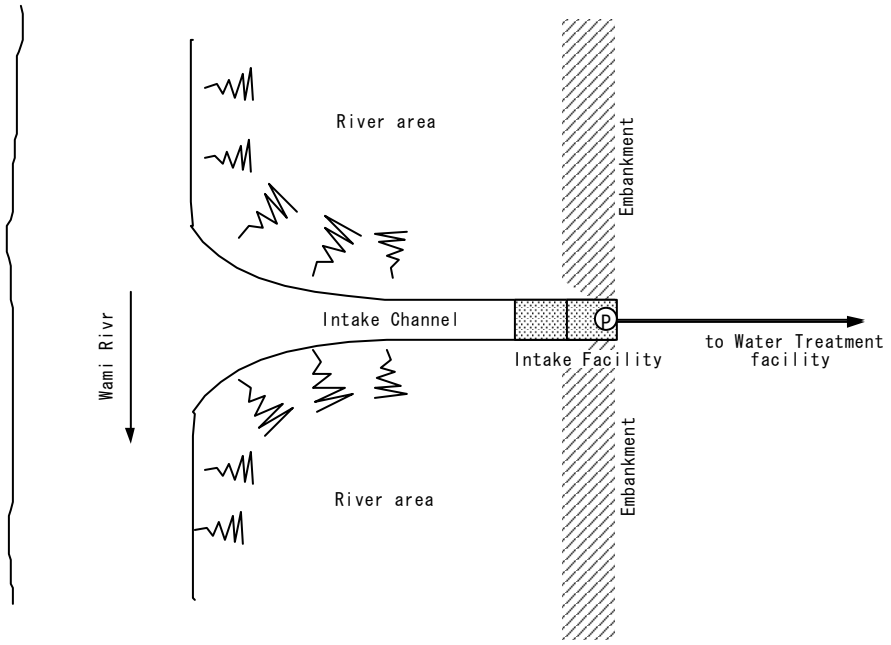


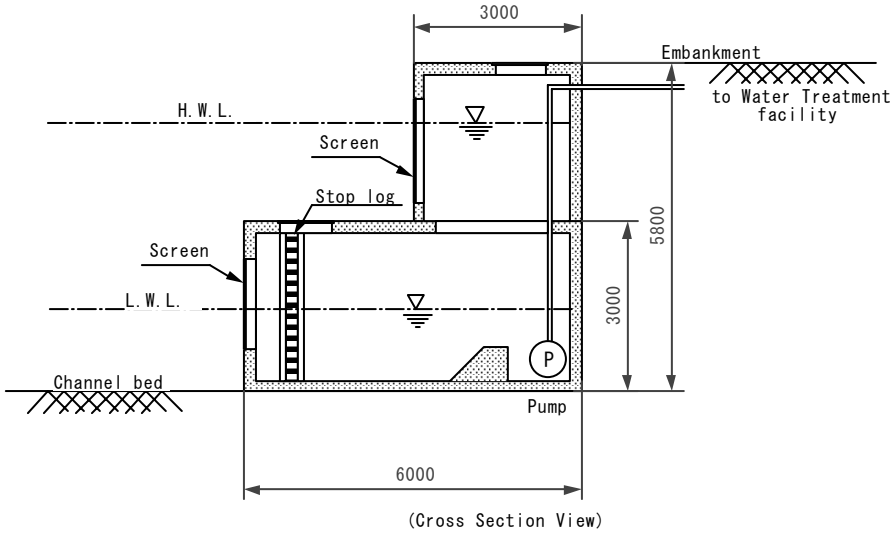
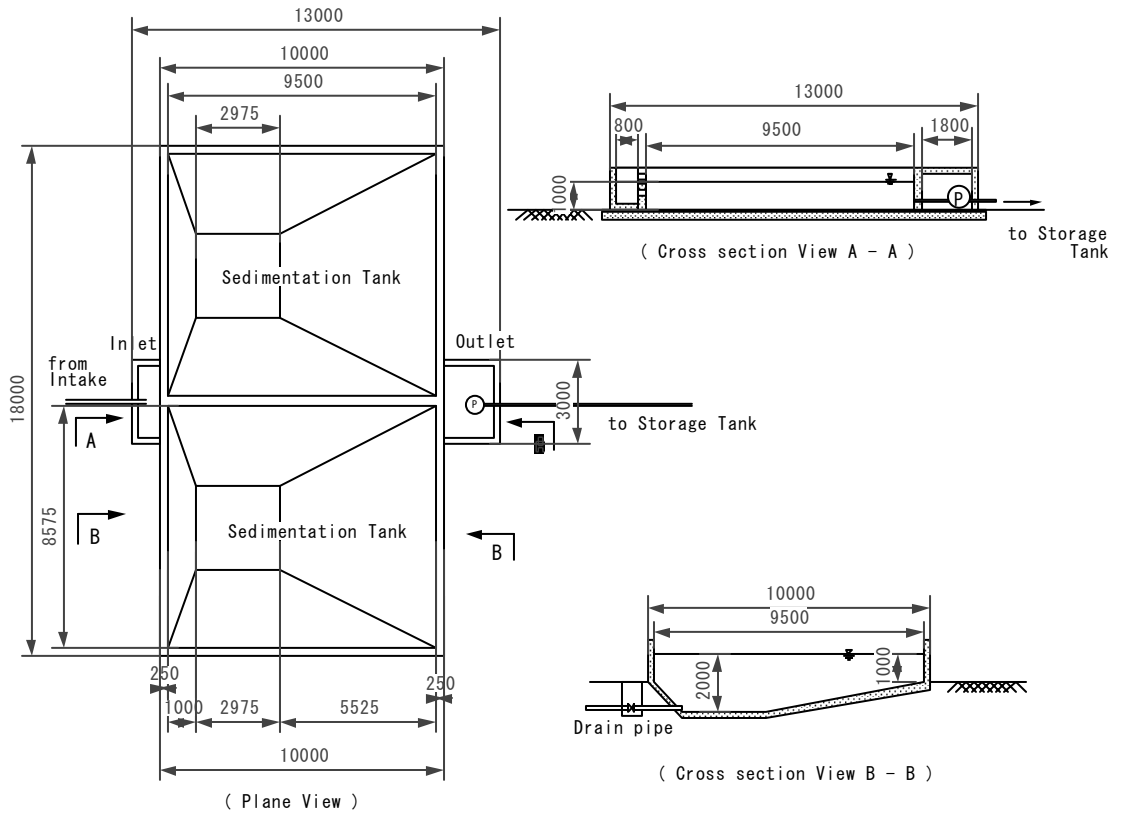


FIGURE 6.4 LAYOUT AND DESIGN OF INTAKE FACILITY FOR RIVER WATER (MATIPWILI, BAGAMOYO)

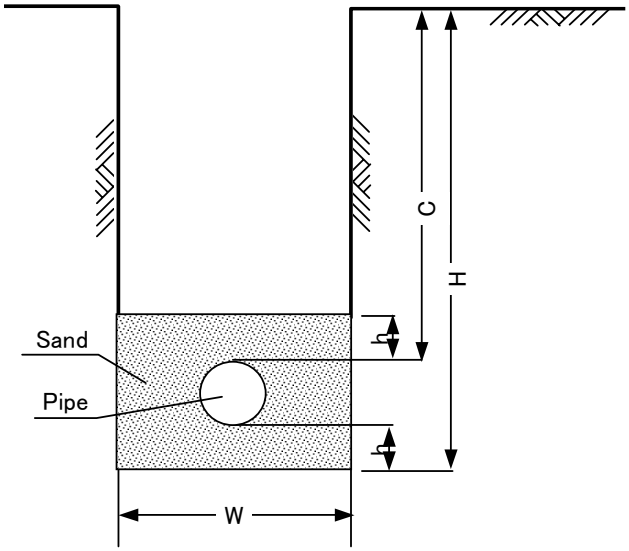


(Sedimentation Tank)

FIGURE 6.5 DESIGN OF WATER TREATMENT FACILITY (MATIPWILI, BAGAMOYO)

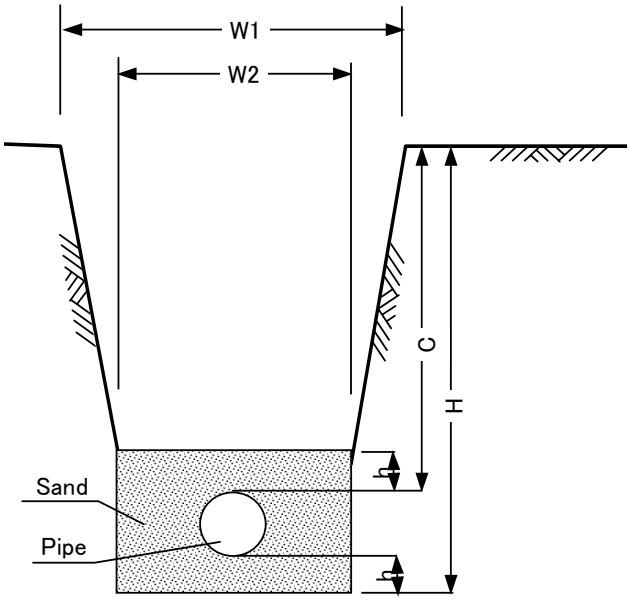
THE STUDY ON WATER SUPPLY IMPROVEMENT IN COAST & DAR ES SALAAM | **JICA**

Excavator digging



Pipe Diameter (mm)	C (m)	h (m)	H (m)	W (m)
32	0.75	0.10	1.17	0.50
40			0.40	0.55
50			0.50	0.55
63			0.63	0.60
75			0.75	0.60
90			0.90	0.65
110			1.10	0.65
125			1.25	0.70
140			1.40	0.70
160			1.60	0.75
200			2.00	0.75

Hand digging



Pipe Diameter (mm)	C (m)	h (m)	H (m)	W1 (m)	W2 (m)
32	0.75	0.10	1.17	0.60	0.5
40			0.40		
50			0.50		
63			0.63		
75			0.75		
90			0.90		
110			1.10		
125			1.25		
140			1.40		
160			1.60		
200			2.00		

FIGURE 6.6 DESIGN OF TRANSMISSION AND DISTRIBUTION LINES

THE STUDY ON WATER SUPPLY IMPROVEMENT IN COAST & DAR ES SALAAM | **JICA**

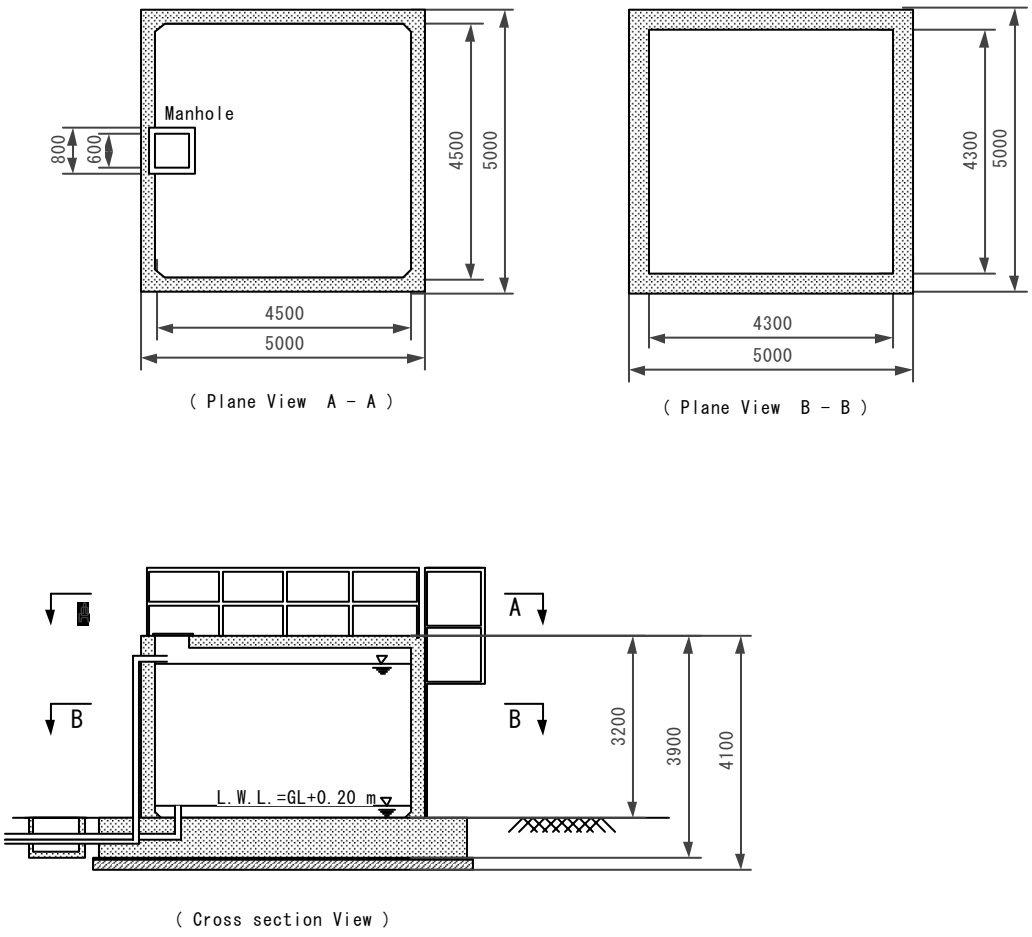
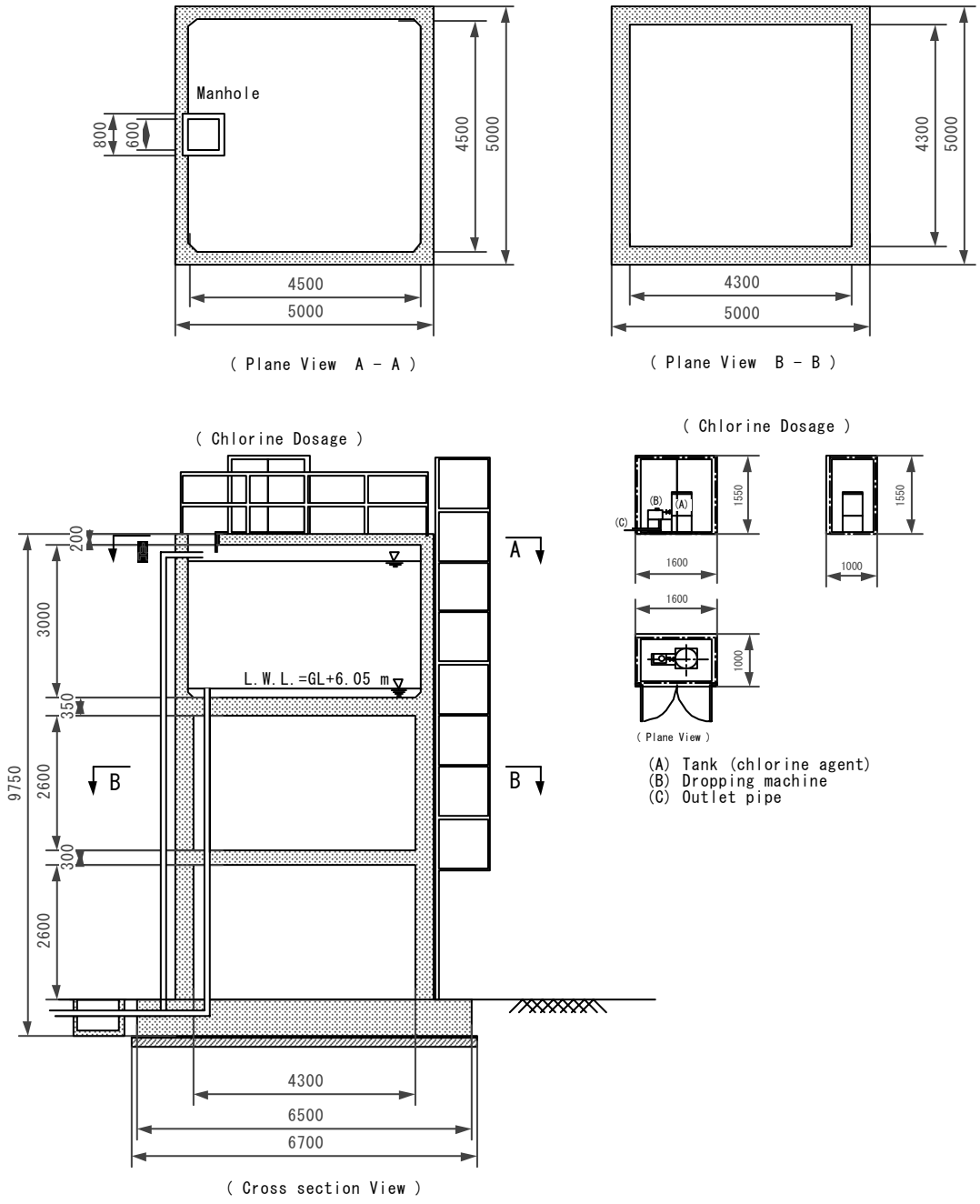


FIGURE 6.7 DESIGN OF STORAGE TANK (GROUND TANK)

THE STUDY ON WATER SUPPLY IMPROVEMENT IN COAST & DAR ES SALAAM | **JICA**



Note: Chlorine dosage is only for Matipwili.

FIGURE 6.8 DESIGN OF STORAGE TANK -ELEVATED TANK (H = 9.75M)

THE STUDY ON WATER SUPPLY IMPROVEMENT IN COAST & DAR ES SALAAM | **JICA**

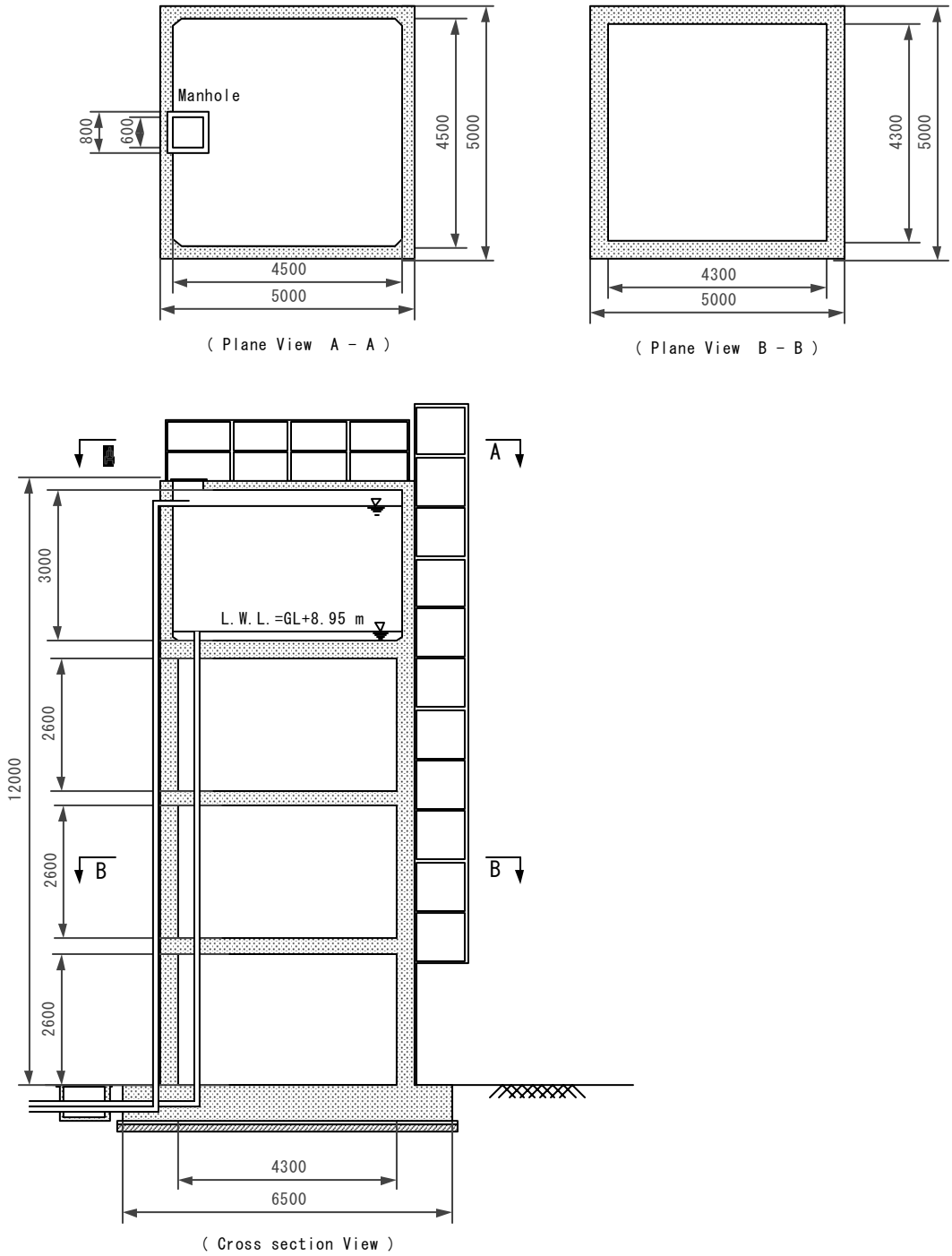


FIGURE 6.9 DESIGN OF STORAGE TANK -ELEVATED TANK (H = 12 M)

THE STUDY ON WATER SUPPLY IMPROVEMENT IN COAST & DAR ES SALAAM | **JICA**

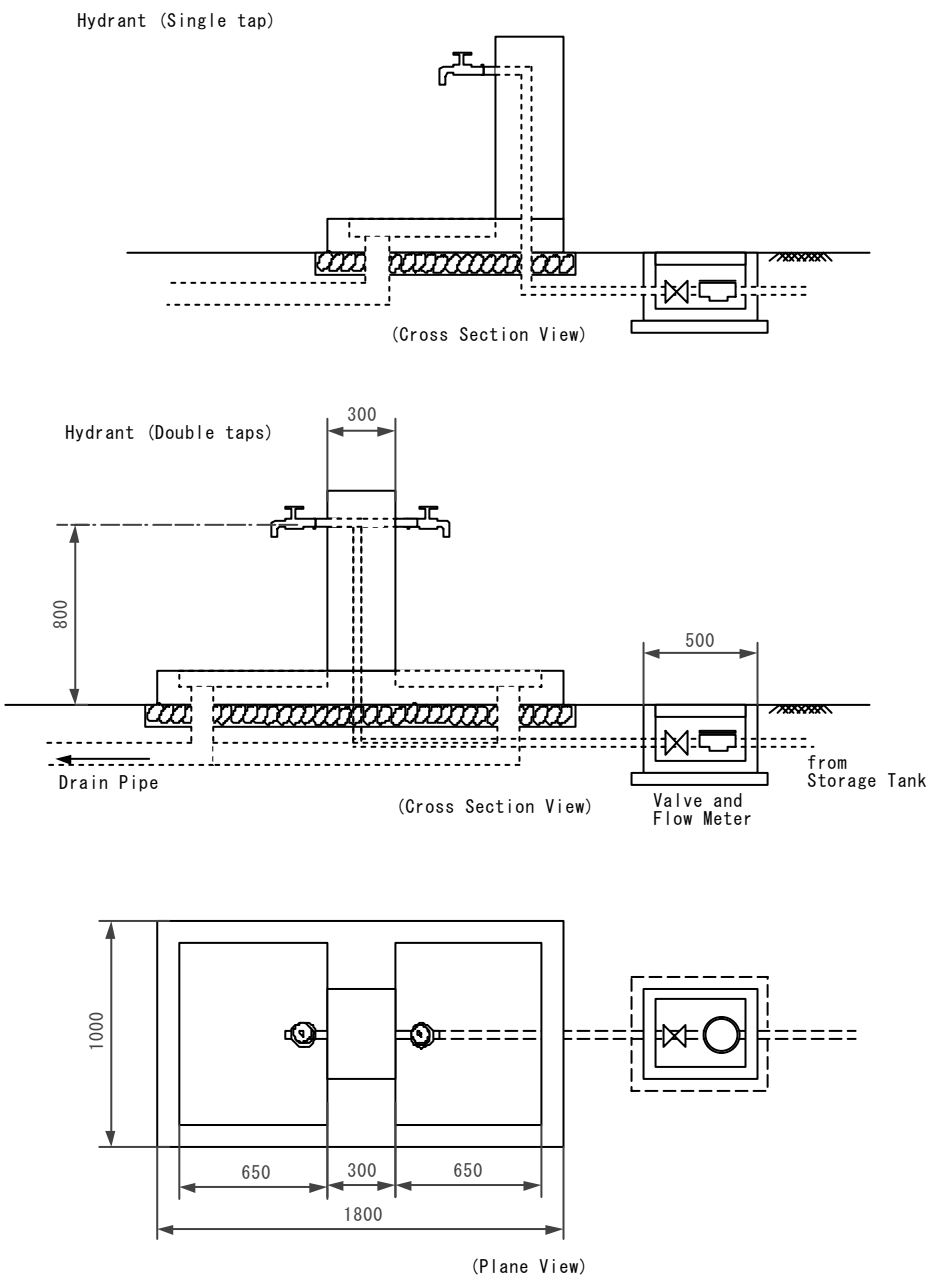
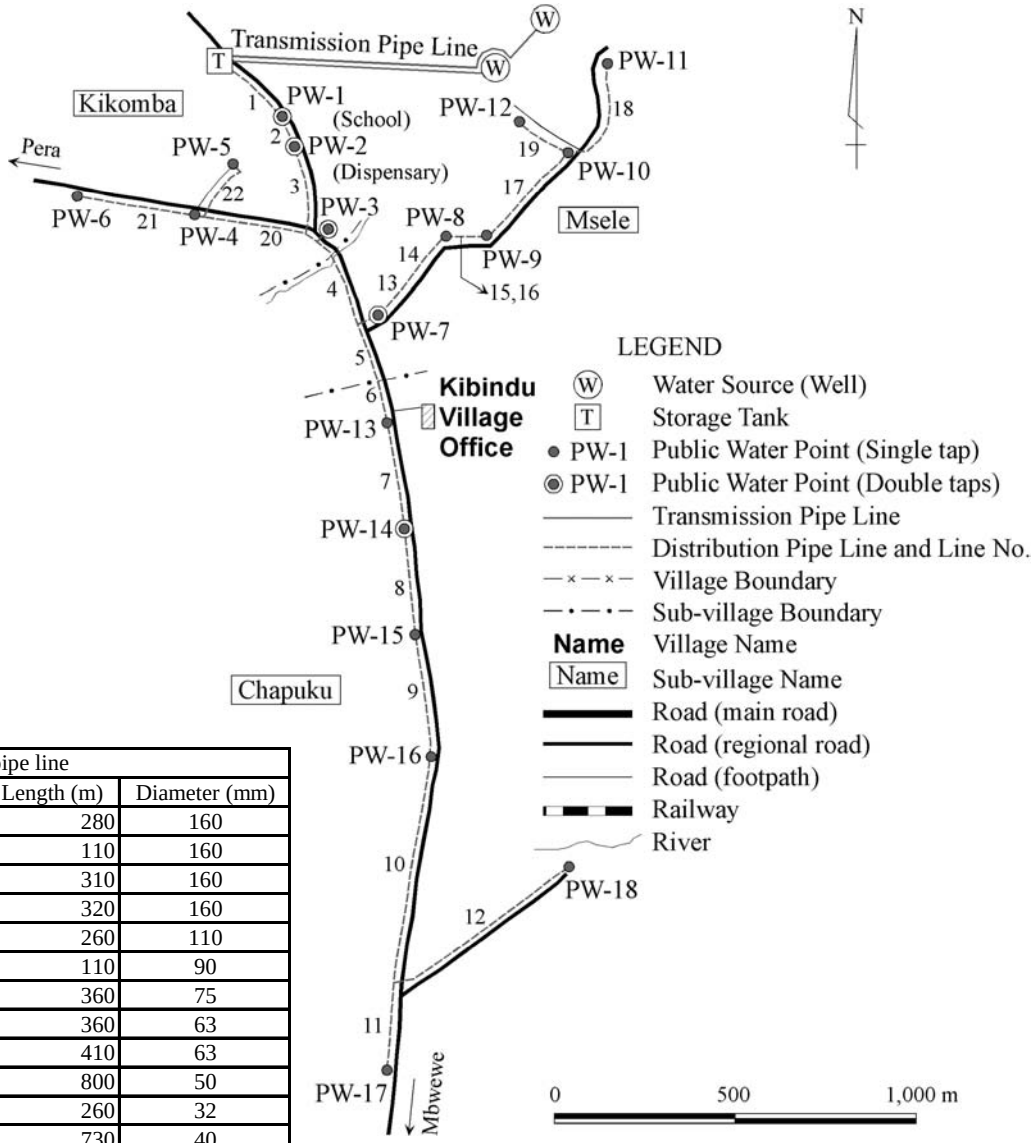


FIGURE 6.10 DESIGN OF PUBLIC WATER POINTS (PWP)

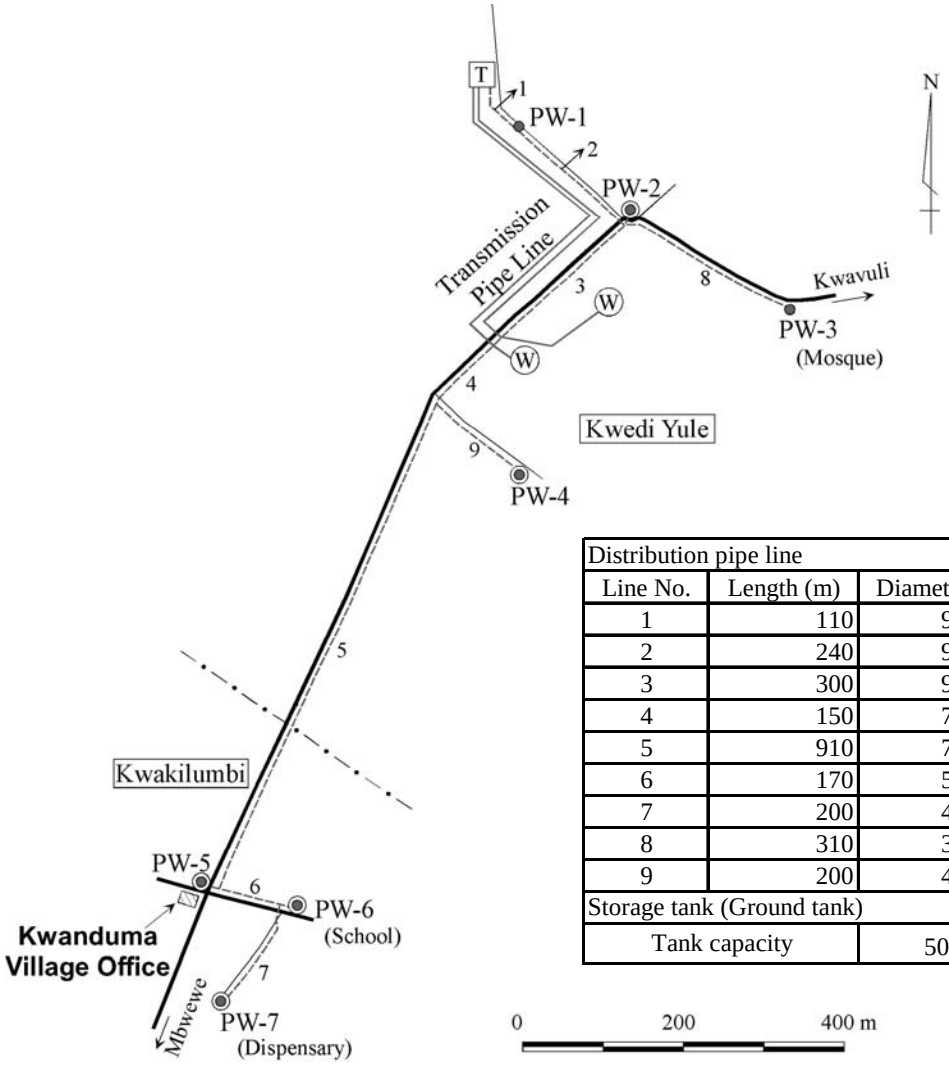
THE STUDY ON WATER SUPPLY IMPROVEMENT IN COAST & DAR ES SALAAM | **JICA**



Distribution pipe line		
Line No.	Length (m)	Diameter (mm)
1	280	160
2	110	160
3	310	160
4	320	160
5	260	110
6	110	90
7	360	75
8	360	63
9	410	63
10	800	50
11	260	32
12	730	40
13	310	110
14	40	90
15	140	75
16	60	75
17	340	75
18	380	32
19	190	32
20	440	63
21	400	40
22	210	32
Storage tank (Ground tank)		
Tank capacity	100 m^3	

FIGURE 6.11 LAYOUT OF WATER SUPPLY SCHEME (KIBINDU: BGM-1)

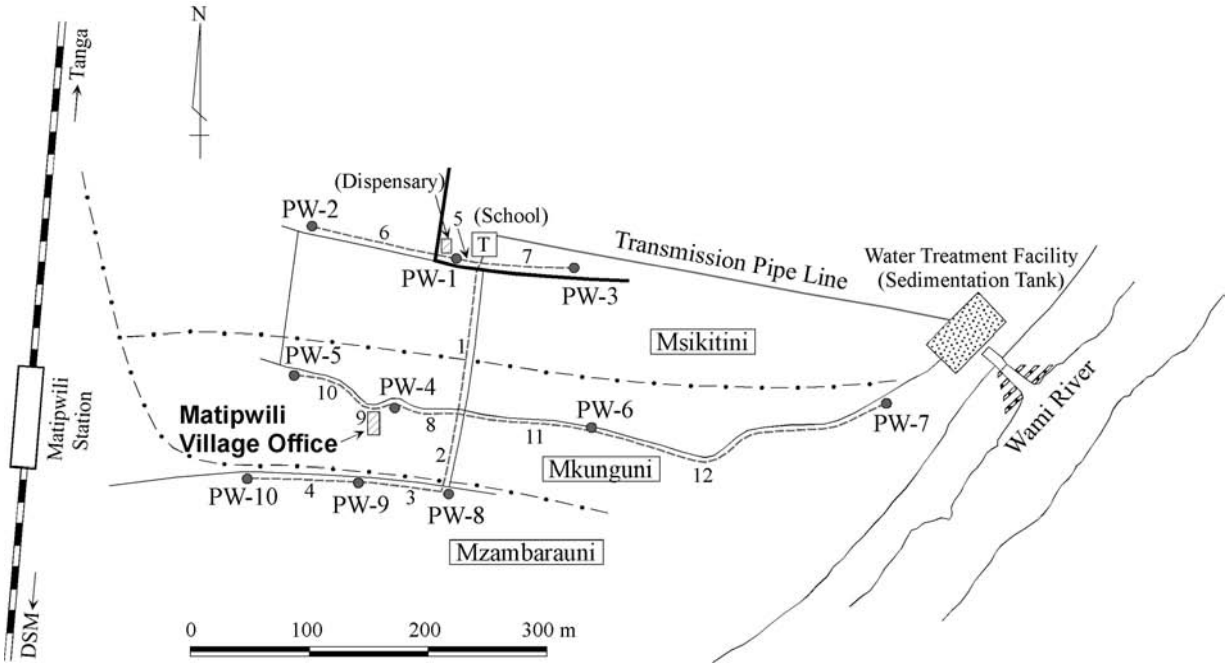
THE STUDY ON WATER SUPPLY IMPROVEMENT IN COAST & DAR ES SALAAM | **JICA**



Distribution pipe line		
Line No.	Length (m)	Diameter (mm)
1	110	90
2	240	90
3	300	90
4	150	75
5	910	75
6	170	50
7	200	40
8	310	32
9	200	40
Storage tank (Ground tank)		
Tank capacity		50 m^3

FIGURE 6.12 LAYOUT OF WATER SUPPLY SCHEME (KWAMDUMA: BGM-2)

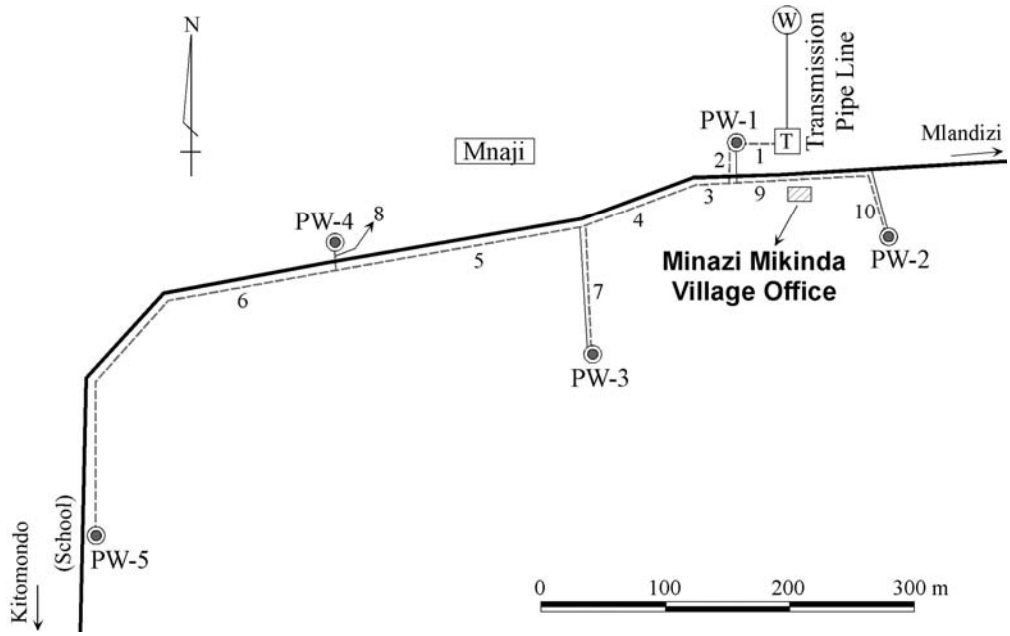
THE STUDY ON WATER SUPPLY IMPROVEMENT IN COAST & DAR ES SALAAM | **JICA**



Distribution pipe line		
Line No.	Length (m)	Diameter (mm)
1	160	90
2	80	50
3	100	40
4	110	32
5	20	40
6	150	32
7	100	32
8	70	50
9	60	50
10	50	40
11	130	50
12	300	40
Storage tank (Elevated tank: L.W.L.=6.05 m)		
Tank capacity	$40m^3$	

FIGURE 6.13 LAYOUT OF WATER SUPPLY SCHEME (MATIPWILI: BGM-3)

THE STUDY ON WATER SUPPLY IMPROVEMENT IN COAST & DAR ES SALAAM | **JICA**



Distribution pipe line		
Line No.	Length (m)	Diameter (mm)
1	100	90
2	30	75
3	30	75
4	120	63
5	240	63
6	410	50
7	120	32
8	20	32
9	140	40
10	70	40
Storage tank (Elevated tank: L.W.L.=6.05 m)		
Tank capacity		40 m^3

FIGURE 6.14 LAYOUT OF WATER SUPPLY SCHEME (MINAZI MIKINDA (1): KBH-1)

Distribution pipe line		
Line No.	Length (m)	Diameter (mm)
1	100	110
2	1,750	110
3	30	40
4	270	110
5	1,520	110
6	500	90
7	230	75
8	300	50
9	30	32
10	320	40
11	50	40
12	750	63
13	60	32
14	480	63
15	510	40
Storage tank (Elevated tank: L.W.L.=6.05 m)		
Tank capacity	40 m^3	

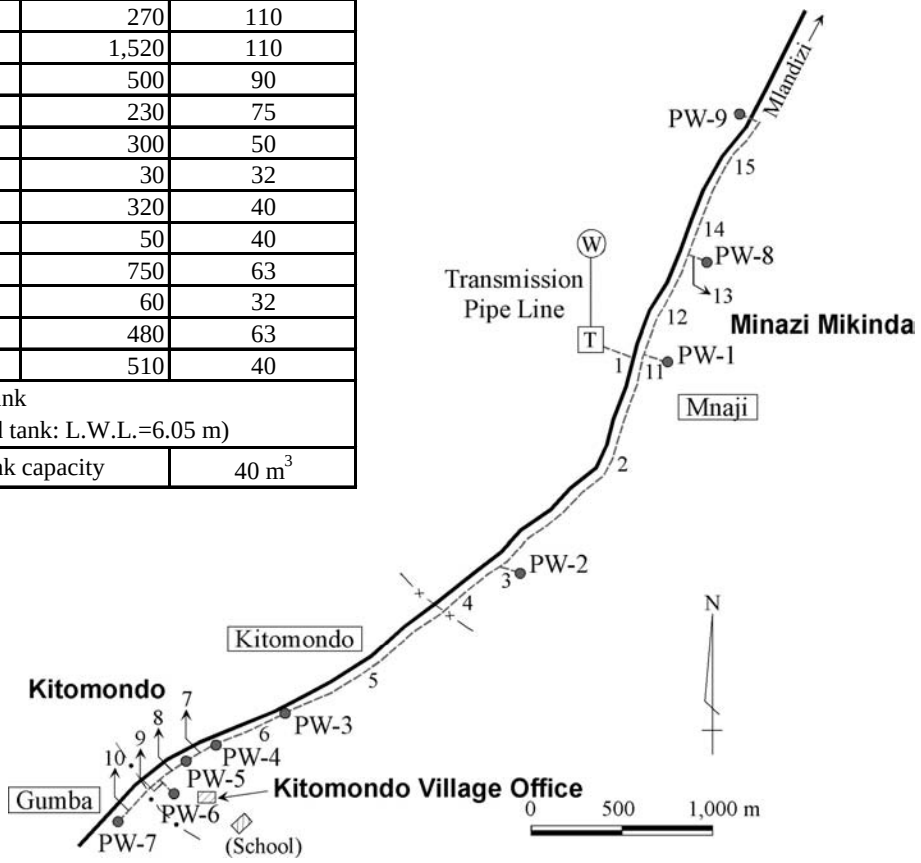


FIGURE 6.15 LAYOUT OF WATER SUPPLY SCHEME (MINAZI MIKINDA (2)/KITOMONDO: KBH-2)

Distribution pipe line		
Line No.	Length (m)	Diameter (mm)
1	100	110
2	560	110
3	80	110
4	530	110
5	420	110
6	1,000	110
7	380	32
8	760	40
9	590	90
10	150	63
11	480	50
12	340	32
13	270	63
14	160	32
15	560	63
16	470	50
17	1,040	40
18	510	40
19	1,350	40
20	400	50
21	250	40
22	150	32
Storage tank (Ground tank)		
Tank capacity		60 m^3

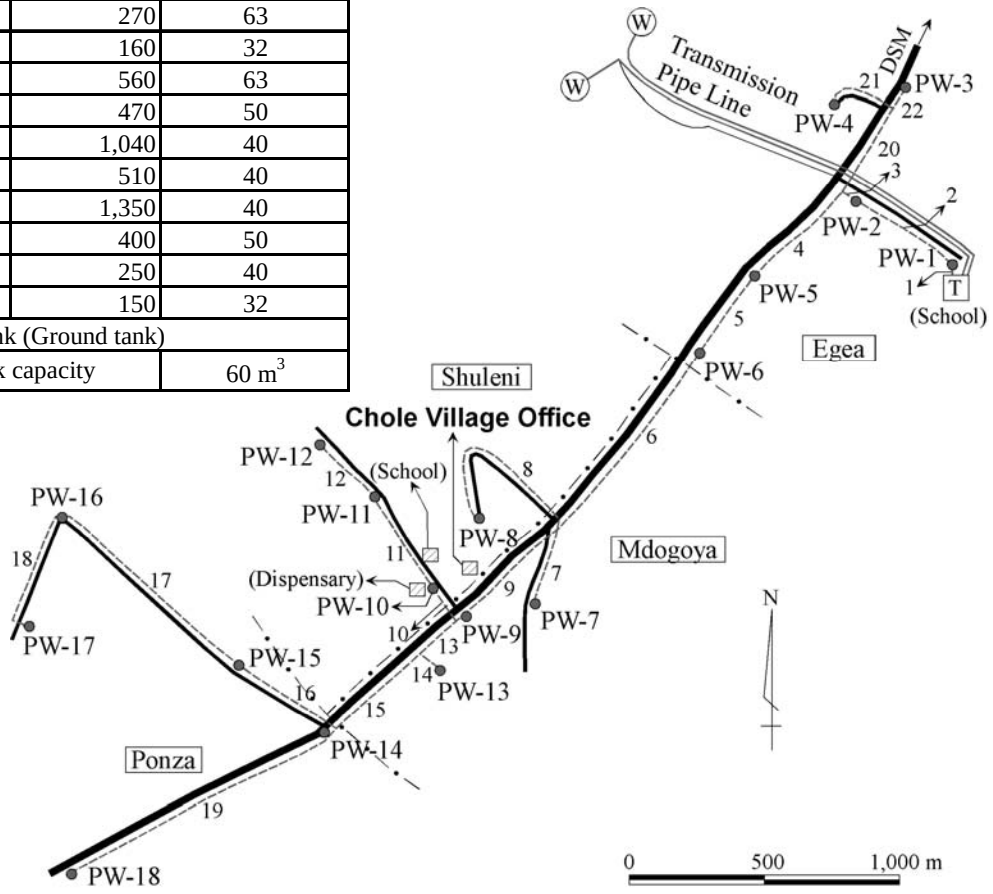


FIGURE 6.16 LAYOUT OF WATER SUPPLY SCHEME (CHOLE: KSW-1)

THE STUDY ON WATER SUPPLY IMPROVEMENT IN COAST & DAR ES SALAAM | **JICA**

Distribution pipe line		
Line No.	Length (m)	Diameter (mm)
1	100	110
2	1,110	110
3	1,860	63
4	1,000	32
5	70	50
6	1,800	50
7	1,000	40
8	1,020	40
9	230	63
10	1,700	50
11	910	50
12	1,390	32
13	2,860	32
14	1,830	40
15	1,350	40
16	170	50
Storage tank (Ground tank)		
Tank capacity		50 m^3

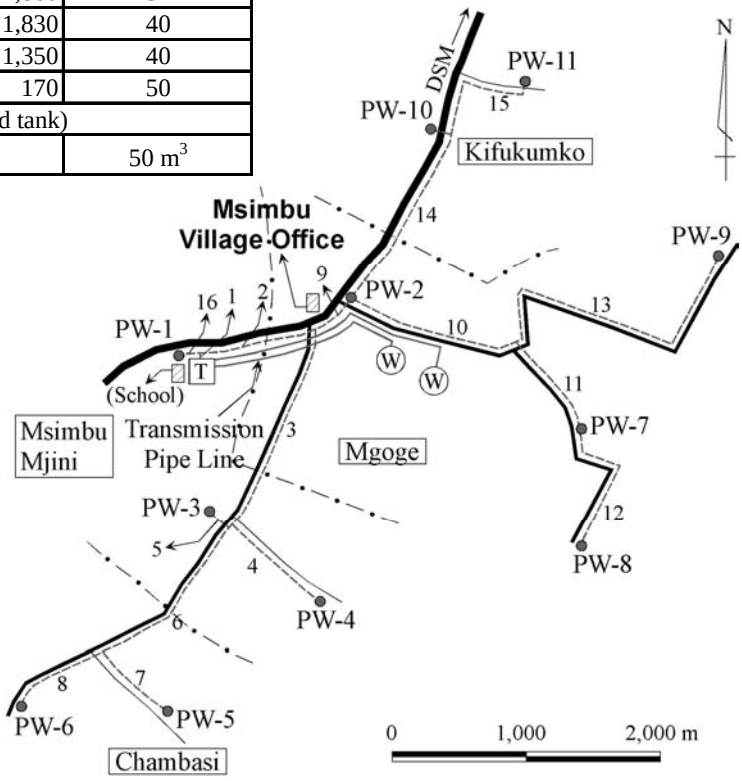
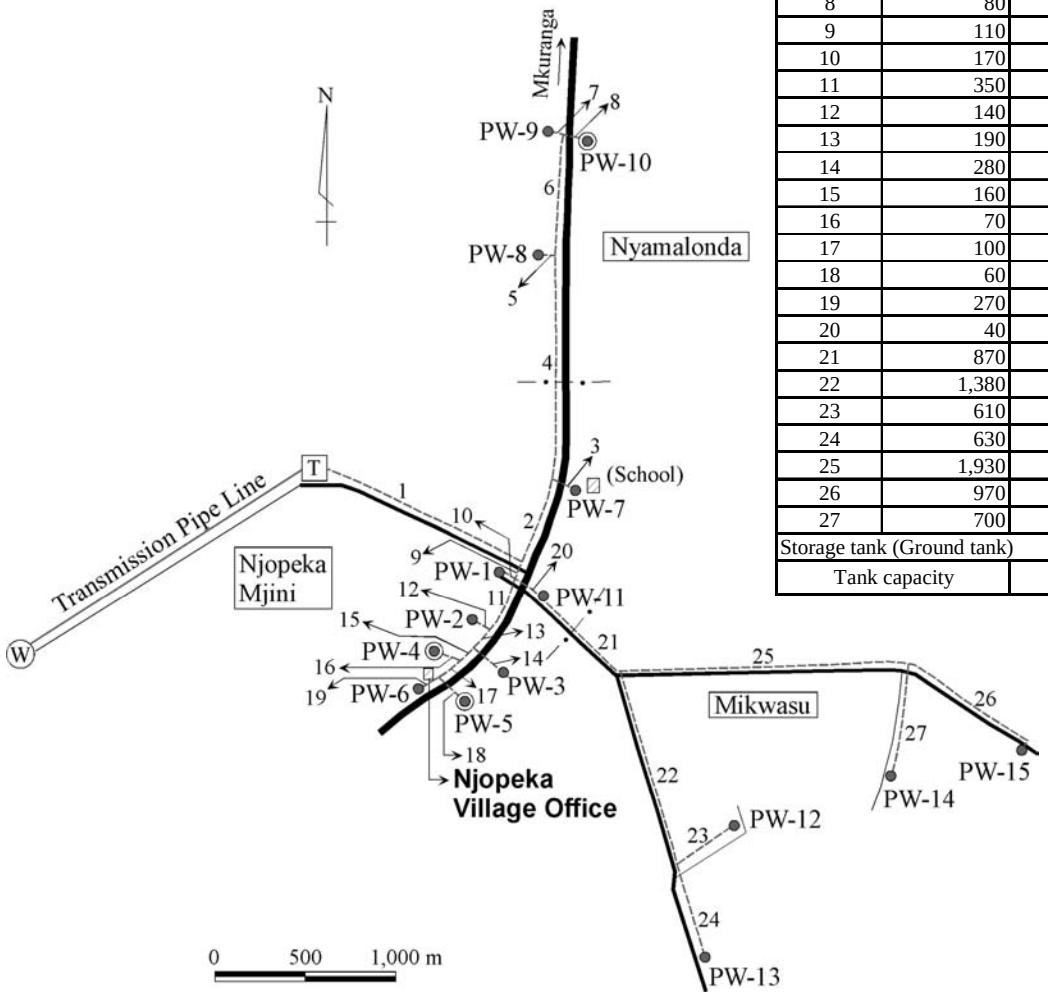


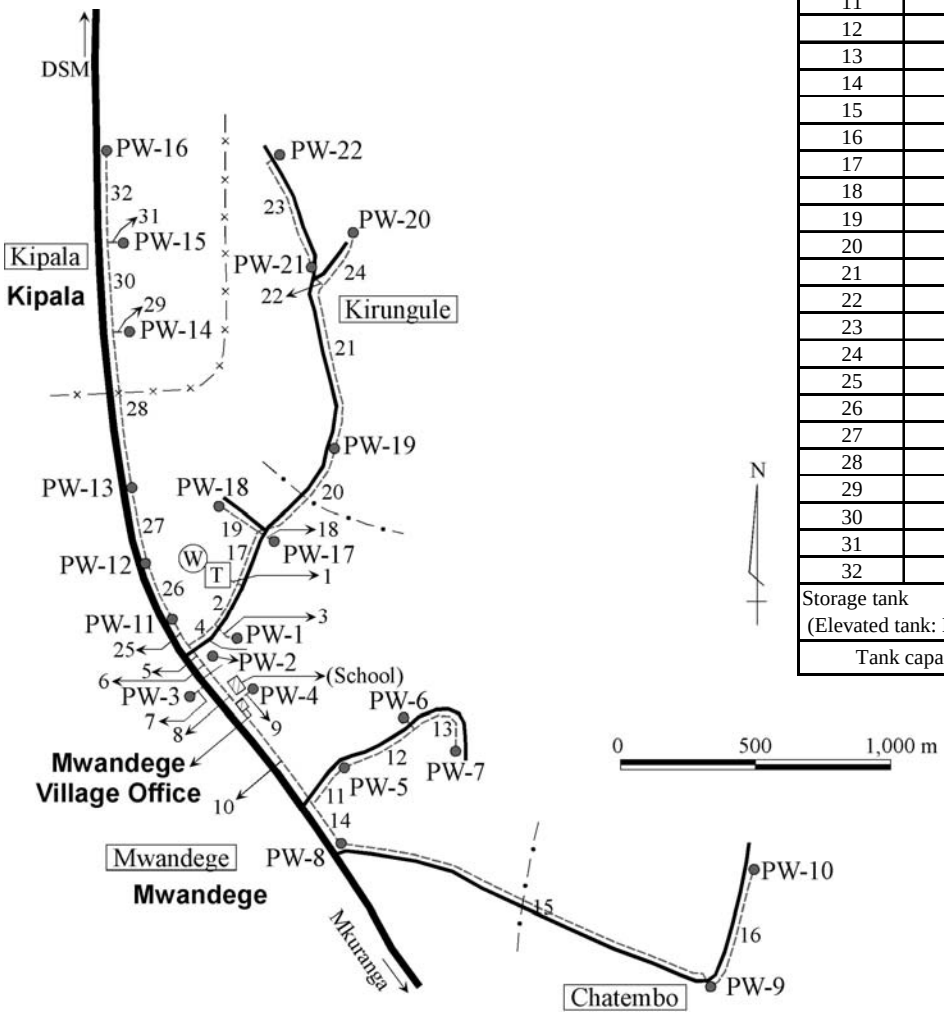
FIGURE 6.17 LAYOUT OF WATER SUPPLY SCHEME (MSIMBU: KSW-2)

THE STUDY ON WATER SUPPLY IMPROVEMENT IN COAST & DAR ES SALAAM | **JICA**



Distribution pipe line		
Line No.	Length (m)	Diameter (mm)
1	1,610	160
2	600	75
3	80	32
4	1,600	63
5	40	32
6	730	50
7	60	32
8	80	32
9	110	140
10	170	110
11	350	125
12	140	32
13	190	125
14	280	32
15	160	125
16	70	32
17	100	110
18	60	32
19	270	110
20	40	75
21	870	75
22	1,380	75
23	610	40
24	630	40
25	1,930	50
26	970	40
27	700	50
Storage tank (Ground tank)		
Tank capacity		80 m^3

FIGURE 6.18 LAYOUT OF WATER SUPPLY SCHEME (NJOPEKA: MKR-1)



Distribution pipe line		
Line No.	Length (m)	Diameter (mm)
1	100	110
2	260	110
3	80	32
4	140	90
5	40	32
6	110	75
7	90	32
8	140	75
9	40	32
10	710	75
11	260	40
12	370	40
13	450	40
14	290	50
15	1,770	40
16	560	32
17	330	50
18	20	32
19	270	32
20	480	40
21	860	40
22	80	32
23	530	32
24	200	32
25	210	75
26	280	50
27	340	50
28	500	40
29	50	32
30	500	40
31	50	32
32	550	32
Storage tank (Elevated tank: L.W.L.=6.05 m)		
Tank capacity	50 m^3	

FIGURE 6.19 LAYOUT OF WATER SUPPLY SCHEME (MWANDEGE/KIPALA: MKR-2)

THE STUDY ON WATER SUPPLY IMPROVEMENT IN COAST & DAR ES SALAAM | **JICA**

Distribution pipe line		
Line No.	Length (m)	Diameter (mm)
1	100	110
2	1,490	110
3	280	90
4	160	90
5	290	32
6	100	90
7	140	75
8	520	63
9	710	63
10	190	50
11	340	32
12	1,520	75
13	1,530	63
14	950	40
15	560	63
16	680	63
Storage tank (Ground tank)		
Tank capacity		60 m^3

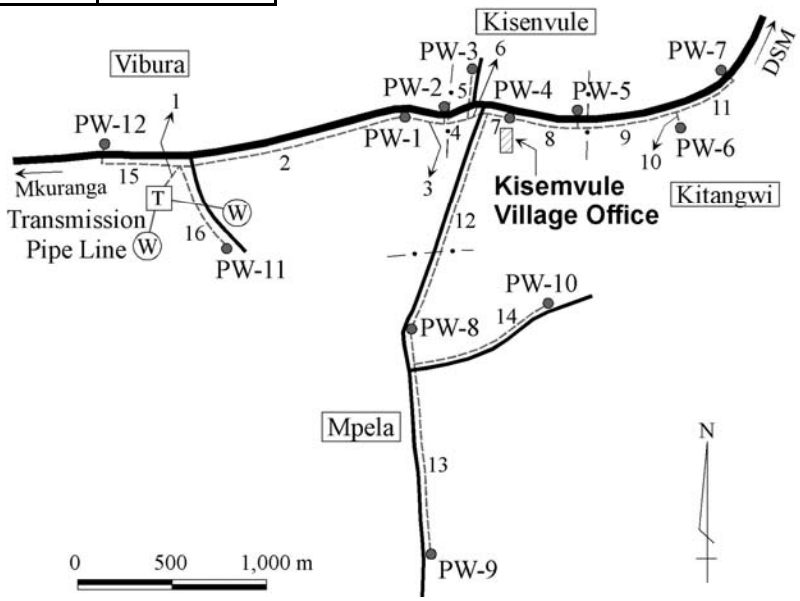


FIGURE 6.20 LAYOUT OF WATER SUPPLY SCHEME (KISEMVULE: MKR-3)

Distribution pipe line		
Line No.	Length (m)	Diameter (mm)
1	100	110
2	400	110
3	130	32
4	200	90
5	30	32
6	330	90
7	150	50
8	380	75
9	40	32
10	2,360	75
11	820	40
12	540	32
13	420	40
14	840	40
15	40	32
16	350	32
17	160	90
18	140	32
19	490	75
20	550	32
21	330	63
22	500	40
23	380	63
24	20	40
25	1,640	40
26	30	32
Storage tank (Elevated tank: L.W.L.=8.95 m)		
Tank capacity		40 m^3

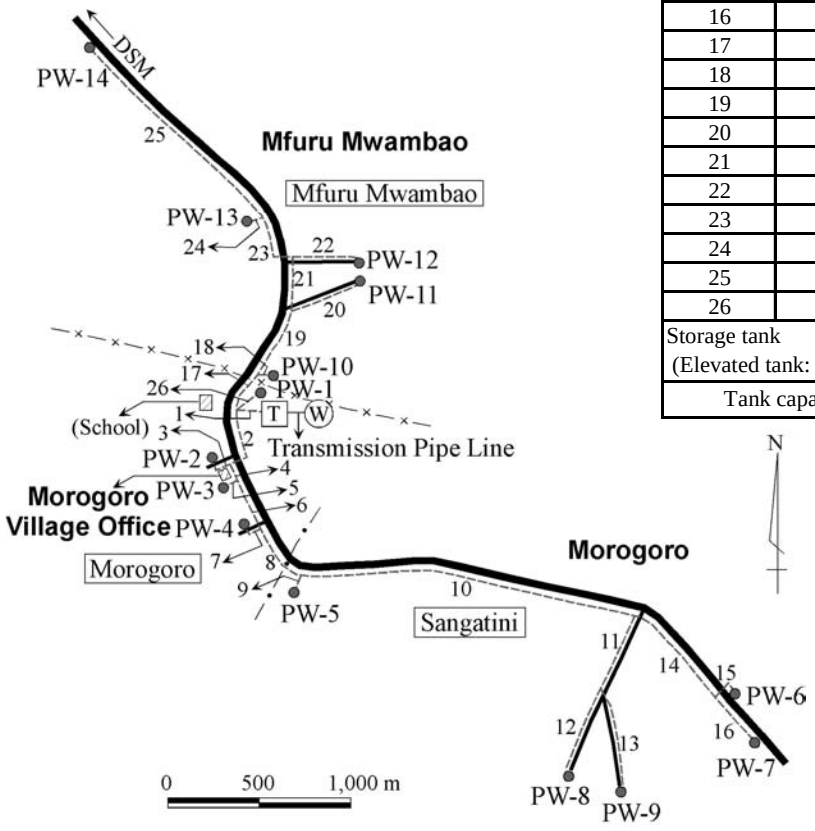


FIGURE 6.21 LAYOUT OF WATER SUPPLY SCHEME (MOROGORO/MFURU MWAMBAO: MKR-4)

THE STUDY ON WATER SUPPLY IMPROVEMENT IN COAST & DAR ES SALAAM | **JICA**

Distribution pipe line		
Line No.	Length (m)	Diameter (mm)
1	100	90
2	510	75
3	600	63
4	100	50
5	350	50
6	150	32
7	280	32
8	880	32
9	80	32
10	950	32
11	40	32
12	210	32
13	610	40
14	710	32
15	310	40
16	950	32
17	590	32
Storage tank (Elevated tank: L.W.L.=6.05 m)		
Tank capacity		50 m^3

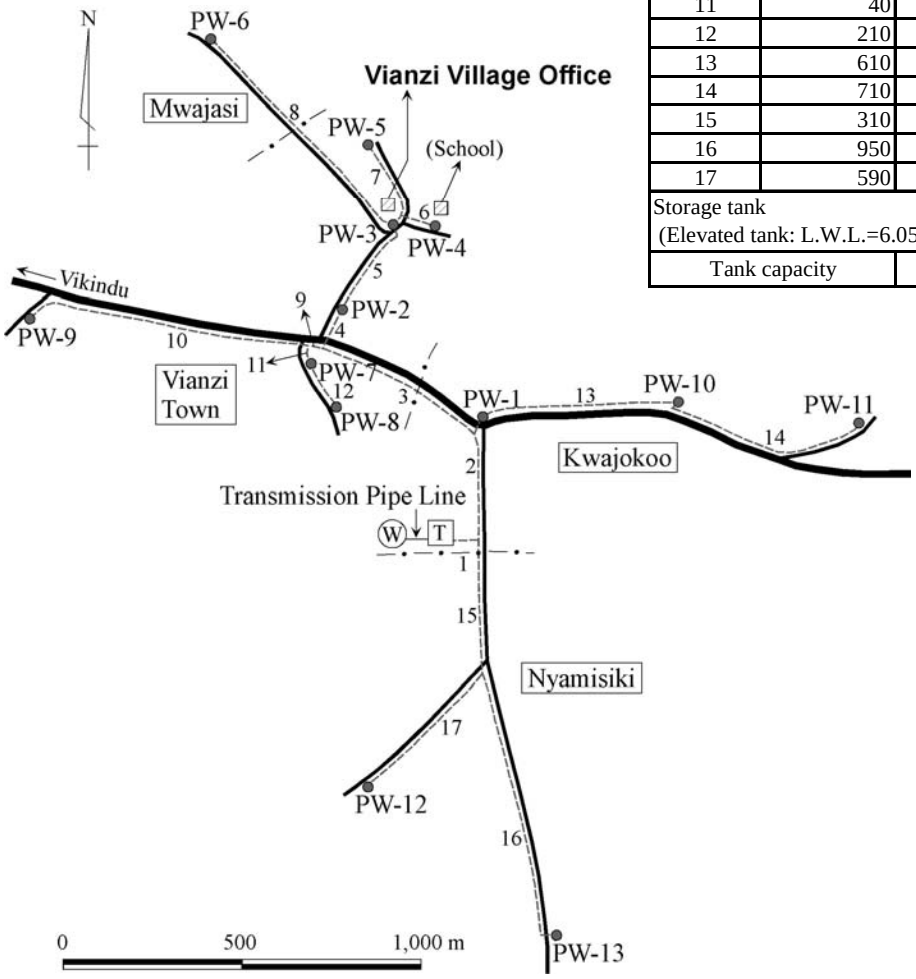


FIGURE 6.22 LAYOUT OF WATER SUPPLY SCHEME (VIANZI: MKR-5)

Distribution pipe line		
Line No.	Length (m)	Diameter (mm)
1	100	140
2	220	125
3	400	110
4	440	110
5	790	40
6	280	50
7	390	40
8	360	40
9	340	63
10	570	63
11	680	50
12	900	75
13	2,460	75
Storage tank (Elevated tank: L.W.L.=6.05 m)		
Tank capacity		80 m^3

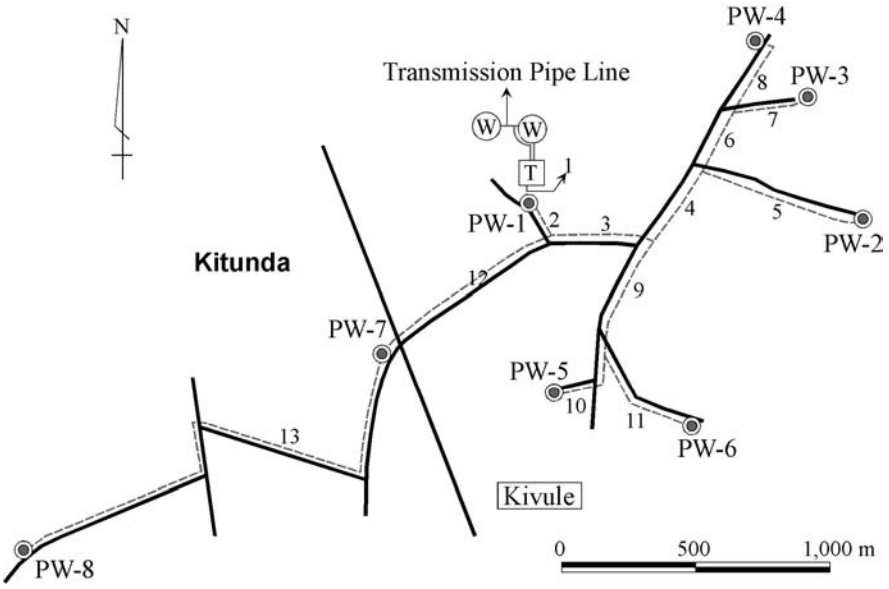


FIGURE 6.23 LAYOUT OF WATER SUPPLY SCHEME (KITUNDA-KIVULE (1/2): ILL-1A)

THE STUDY ON WATER SUPPLY IMPROVEMENT IN COAST & DAR ES SALAAM | **JICA**

Distribution pipe line		
Line No.	Length (m)	Diameter (mm)
1	100	110
2	360	110
3	560	90
4	280	50
5	510	75
6	140	75
7	310	50
8	3,060	75
9	3,580	75
Storage tank (Elevated tank: L.W.L.=6.05 m)		
Tank capacity		50 m^3

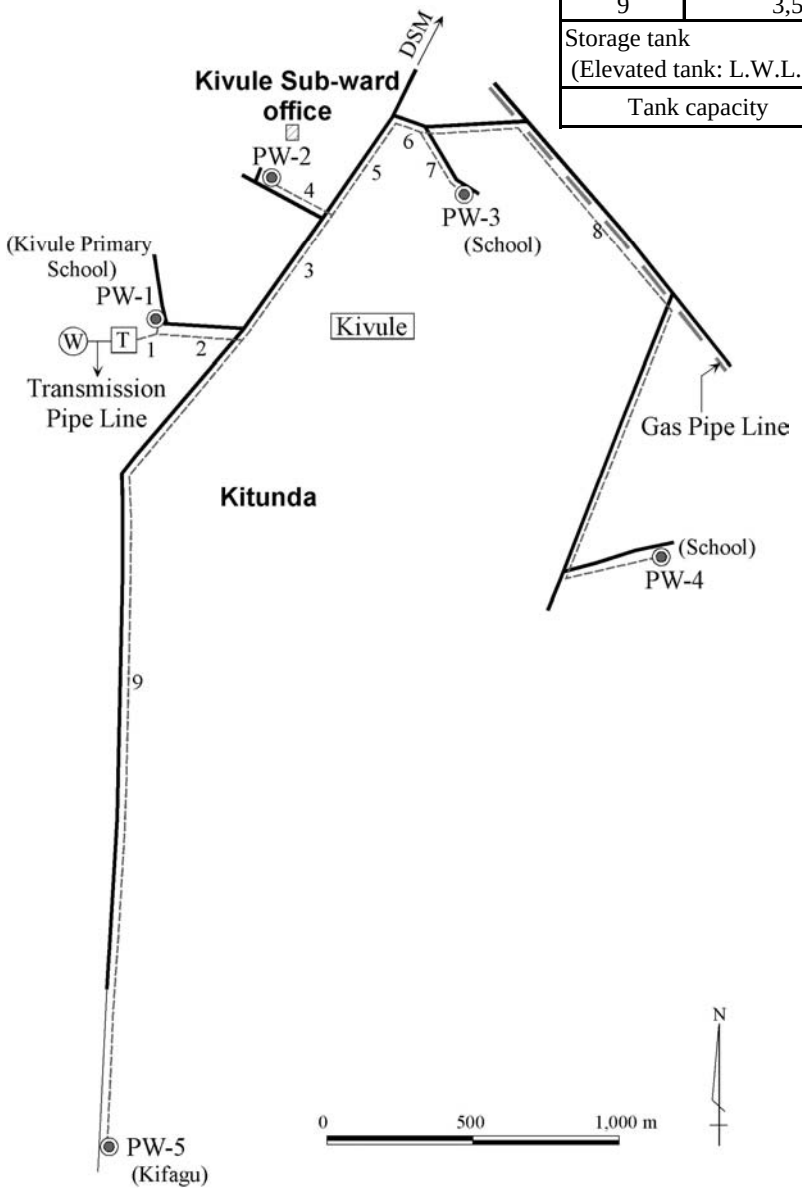
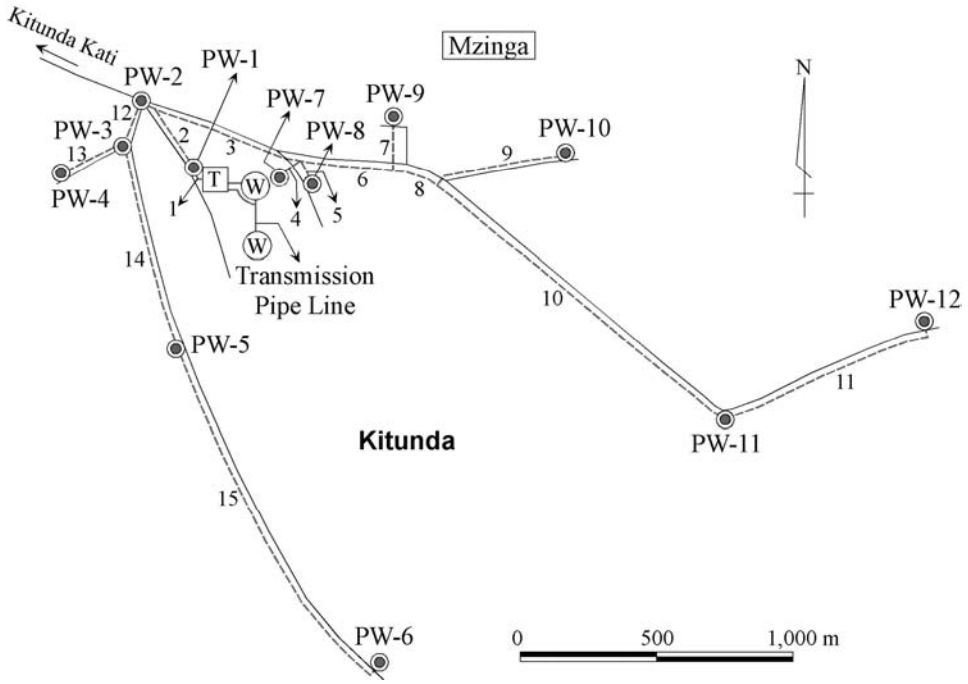


FIGURE 6.24 LAYOUT OF WATER SUPPLY SCHEME (KITUNDA-KIVULE (2/2): ILL-1B)

THE STUDY ON WATER SUPPLY IMPROVEMENT IN COAST & DAR ES SALAAM | **JICA**



Distribution pipe line		
Line No.	Length (m)	Diameter (mm)
1	100	200
2	340	200
3	650	160
4	120	75
5	210	75
6	590	140
7	290	40
8	190	110
9	560	40
10	1,650	63
11	980	50
12	220	110
13	330	75
14	950	110
15	1,260	110
Storage tank (Elevated tank: L.W.L.=6.05 m)		
Tank capacity	120 m^3	

FIGURE 6.25 LAYOUT OF WATER SUPPLY SCHEME (KITUNDA-MZINGA: ILL-1C)

Distribution pipe line		
Line No.	Length (m)	Diameter (mm)
1	100	200
2	1,220	125
3	240	40
4	220	90
5	690	63
6	130	75
7	120	75
8	340	50
9	940	50
10	870	40
11	20	110
12	850	110
13	880	125
Storage tank (Elevated tank: L.W.L.=6.05 m)		
Tank capacity		40 m^3

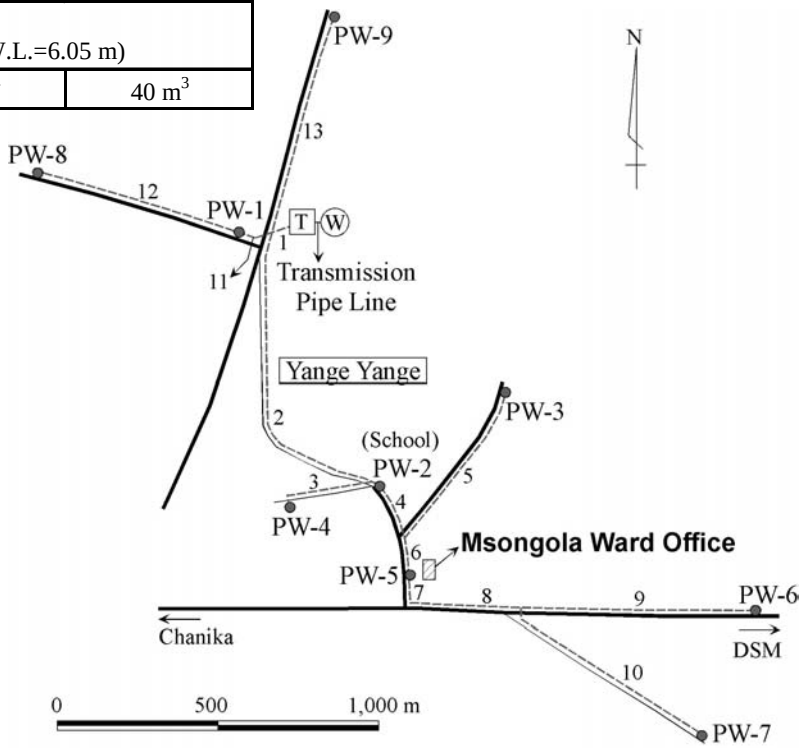
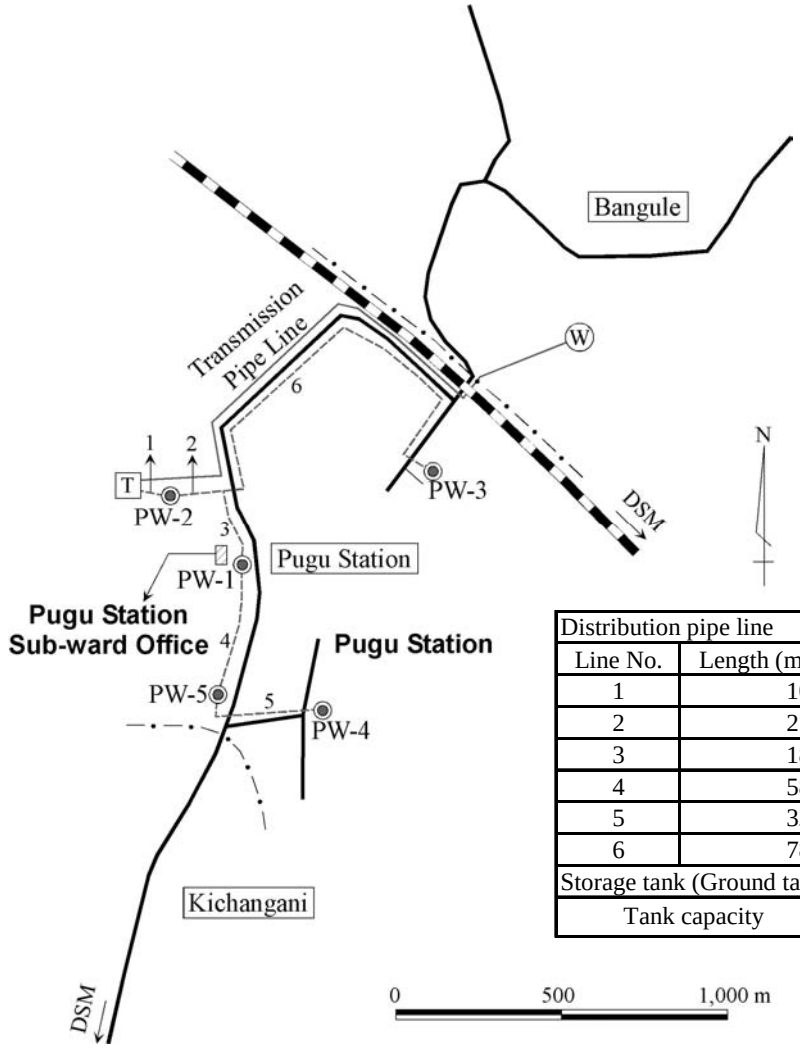


FIGURE 6.26 LAYOUT OF WATER SUPPLY SCHEME (MSONGORA: ILL-2)

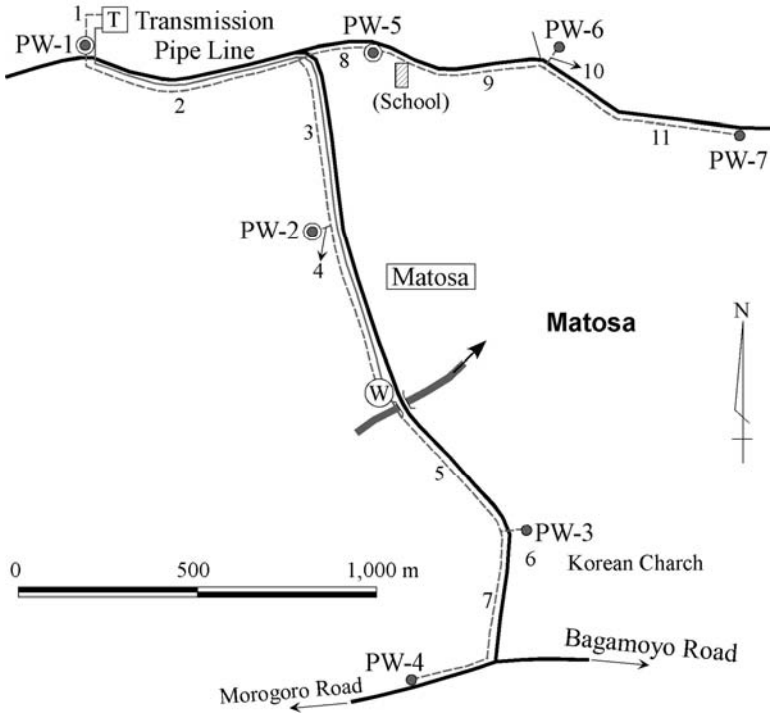
THE STUDY ON WATER SUPPLY IMPROVEMENT IN COAST & DAR ES SALAAM | **JICA**



Distribution pipe line		
Line No.	Length (m)	Diameter (mm)
1	100	110
2	270	90
3	180	75
4	580	75
5	320	50
6	780	40
Storage tank (Ground tank)		
Tank capacity		50 m^3

FIGURE 6.27 LAYOUT OF WATER SUPPLY SCHEME (PUGU STATION: ILL-3)

THE STUDY ON WATER SUPPLY IMPROVEMENT IN COAST & DAR ES SALAAM | **JICA**



Distribution pipe line		
Line No.	Length (m)	Diameter (mm)
1	100	75
2	800	75
3	610	63
4	10	32
5	1,210	50
6	20	32
7	740	32
8	190	63
9	620	50
10	40	40
11	730	32
Storage tank (Elevated tank: L.W.L.=6.05 m)		
Tank capacity	50 m^3	

FIGURE 6.28 LAYOUT OF WATER SUPPLY SCHEME (MATOSA: KND-1)

Distribution pipe line		
Line No.	Length (m)	Diameter (mm)
1	220	160
2	60	140
3	450	50
4	430	140
5	170	32
6	20	32
7	490	140
8	220	125
9	190	50
10	300	110
11	390	50
12	270	110
13	380	110
Storage tank (Elevated tank: L.W.L.=8.95 m)		
Tank capacity	50 m^3	

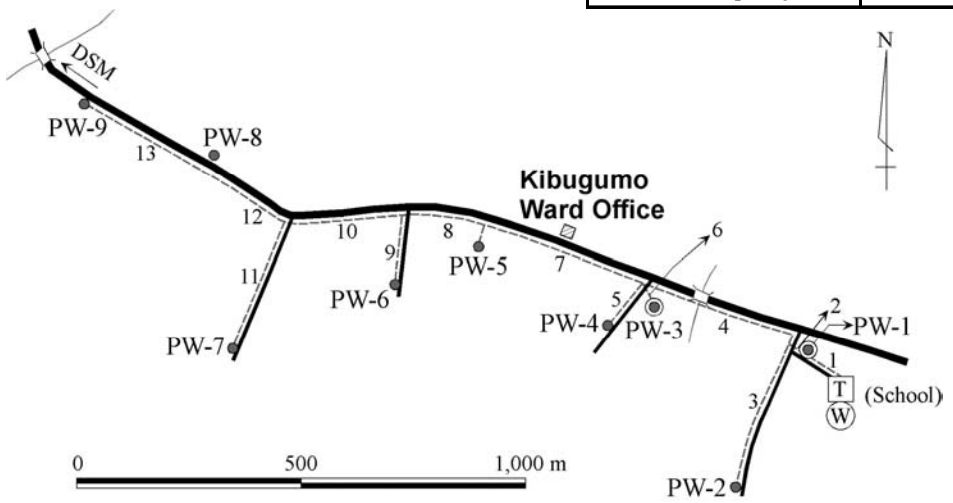


FIGURE 6.29 LAYOUT OF WATER SUPPLY SCHEME (KIBUGUMO: TMK-1)

Distribution pipe line		
Line No.	Length (m)	Diameter (mm)
1	100	160
2	230	160
3	100	32
4	200	140
5	740	140
6	490	125
7	570	110
8	140	75
9	280	75
10	100	40
11	510	50
12	740	75
13	180	50
14	230	32
15	370	32
Storage tank (Elevated tank: L.W.L.=8.95 m)		
Tank capacity		60 m^3

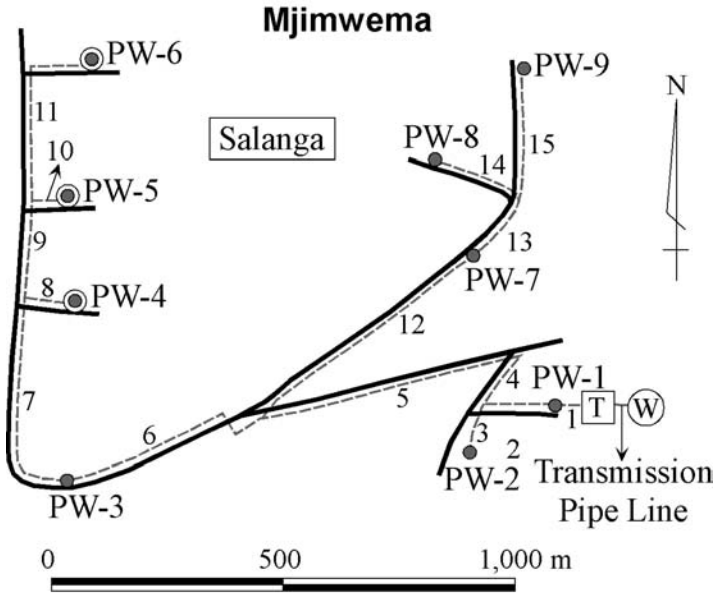


FIGURE 6.30 LAYOUT OF WATER SUPPLY SCHEME (MJIMWEMA: TMK-2)

Distribution pipe line		
Line No.	Length (m)	Diameter (mm)
1	100	140
2	620	140
3	510	110
4	600	32
5	260	90
6	680	75
7	550	63
8	20	63
9	600	63
10	370	40
11	790	40
12	1,030	40
13	160	32
14	1,110	90
15	540	32
16	1,520	75
17	530	50
Storage tank (Elevated tank: L.W.L.=6.05 m)		
Tank capacity	90 m^3	

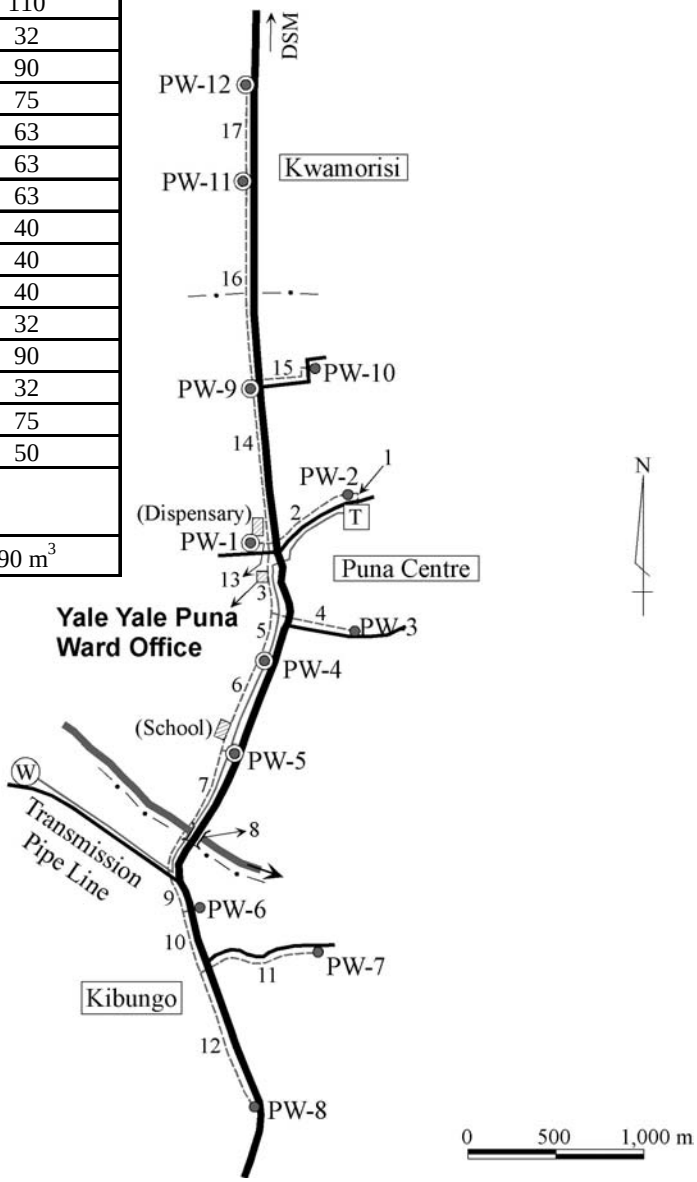


FIGURE 6.31 LAYOUT OF WATER SUPPLY SCHEME (YALE YALE PUNA: TMK-3)

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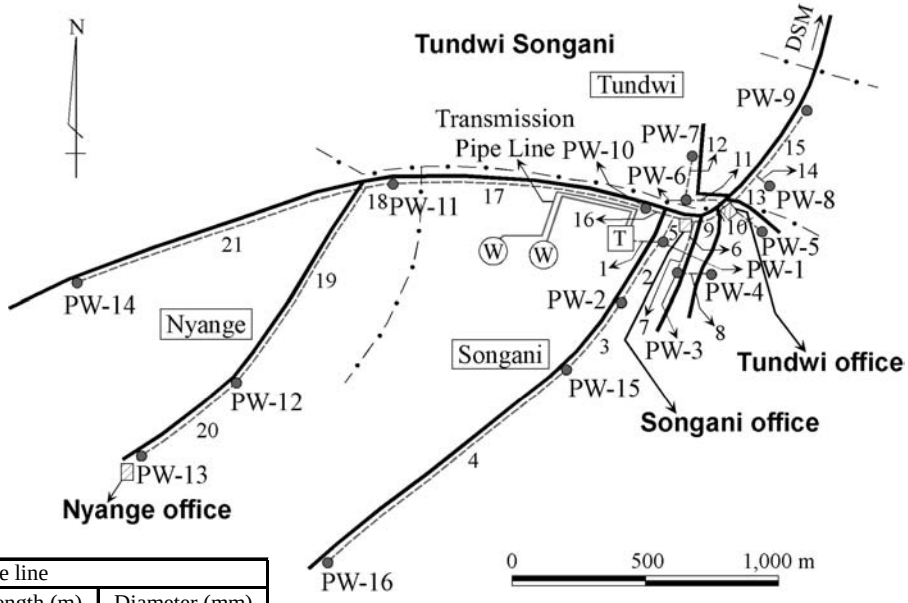

Distribution pipe line		
Line No.	Length (m)	Diameter (mm)
1	100	90
2	330	50
3	390	40
4	1,380	32
5	170	90
6	70	50
7	270	32
8	100	32
9	90	40
10	250	32
11	120	40
12	210	32
13	160	40
14	50	32
15	420	40
16	140	63
17	1,250	63
18	100	40
19	1,060	40
20	530	32
21	1,360	32
Storage tank (Elevated tank: L.W.L.=6.05 m)		
Tank capacity	40 m^3	

FIGURE 6.32 LAYOUT OF WATER SUPPLY SCHEME (TUNDI SONGANI: TMK-4)

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Chapter 7

Construction and Implementation Plan

CHAPTER 7 CONSTRUCTION AND IMPLEMENTATION PLAN

7.1 GENERAL

In this Chapter, the Construction Plan and the Implementation Plan for the Priority Project are discussed. The Construction Plan is formulated considering the natural and social conditions in the Study area, and the circumstances of the construction conditions such as local contractor, and applicable construction equipment and materials.

In the formulation of the Implementation Plan, the financial status of MoWLD, and assistance by Donors and NGOs are taken into consideration.

7.2 CONSTRUCTION PLAN

7.2.1 NATURAL CONDITIONS

- Dry and wet seasons are clearly distinguished in Tanzania with most rainfall occuring during the two wet seasons from March to May and October to December. In planning the construction schedule, it is necessary to consider the bad road conditions during wet season because almost all the road, except the Main roads, are not paved, and they become muddy and slippery in rainy season.
- The target aquifer in Bagamoyo and Kisarawe is expected to occur in fissure and faults in unweathered hard rocks. Aquifers in other area are generally semi-consolidated sedimentary rocks. Groundwater in sedimentary rocks in the Study area frequently varies in quality and yield from place to place. These geological conditions should be considered in the drilling of deep tube wells.
- Water quality, especially salinity, frequently varies within a small area in the Neogene aquifers. Contamination by Fluoride (F) was found in a few areas; In particular, attention should be paid in the Precambrian Rocks in Bagamoyo District.
- In Kibindu and Kwanduma villages in Bagamoyo District, outcrops of hard rocks are sometimes observed along the road. Therefore, attention should be paid in construction of tanks and installation of pipelines.

7.2.2 SOCIAL CONDITIONS

Village people in the Study area is well organized under the governance of the village executives. They have much experience in managing of infrastructures when developing in a village and also sharing those with adjacent villages. Therefore, it is important to involve them in the study stage and construction stage in order to ensure their cooperation for the implementation of the project.

Activity of water vendors are vigorous in the Study area although they are a part of informal sector. They will loose the job opportunity or alter their place of business by the implementation of the Project. Countermeasure to mitigate the adverse impact on them should be considered.

7.2.3 CONSTRUCTION ASPECT

Construction works of the project include drilling works, earthworks, pipe works, concrete works, mechanical/electrical works, and miscellaneous works. Most of the construction works will be carried out by conventional methods and machineries; while more advanced methods will be employed, as necessary, to shorten construction periods and to achieve high quality.

Construction constructors in Tanzania are all registered with Contractor Registration Board (CRB). Registration is made separating local and foreign contractors. They are ranked from Class 1 to Class 7 in descending order according to the type of authorized construction work.

Drilling contractors are ranked as Class 1 and 2, and could be employed in the construction of deep tube wells. As for the works other than well drilling, a total of 31 construction contractors are registered as Class 1 and 2 (Web Site of CRB, as of July 2005). These contractors have adequate capability to construct water supply facilities planned in the Study.

Machineries for construction works are owned by contractors in Tanzania. Lease of them is also possible. Most of construction materials are locally produced. Tanzania adopts the British Standards (BS) for design of structures. Concrete and asphalt are imported from abroad. Casing and screen pipes specified in the Study are not produced in Tanzania, therefore, they are also imported from foreign countries.

Machineries for intake facility such as submersible pumps and generators are also imported from abroad.

7.3 IMPLEMENTATION PLAN

7.3.1 IMPLEMENTATION SCHEDULE OF THE PRIORITY PROJECT

Overall implementation plan was presented in Chapter 5. Implementation plan for the Priority Project is described in this Chapter.

The Project is planned to be implemented in three years from 2006 to 2008 as shown in *Table 7.1*.

Table 7.1 Implementation Schedule of Priority Project

District/Municipality	2006	2007	2008	2009	2010
Bagamoyo	⟷				
Kibaha	⟷				
Kisarawe	⟷				
Mkuranga		⟷			
Ilala			⟷		
Kinondoni		⟷			
Temeke			⟷		

7.3.2 FINANCIAL PLAN OF THE PRIORITY PROJECT

Table 7.2 presents the budget allocated to rural water supply sector. Implementation cost of the Priority Project is estimated at 16.1 million USD. As financial status of MoWLD is reviewed in detail in Chapter 5, budget for MoWLD is insufficient for independent implementation of the Priority Project. Therefore, the Project is assumed to be implemented with the Japan's Grant Aid.

Table 7.2 Development Budget for Rural Water Supply in Four Years

Unit: Tousand USD

Item	2002/2003				2003/2004				2004/2005		2005/2006	
	Budget		Fund Released		Budget		Fund Released		Budget		Budget	
	Internal	External	Internal	External	Internal	External	Internal	External	Internal	External	Internal	External
Expansion of Rural Water Supply	195.2	3,914.5	47.6	-	466.7	5,400.0	270.7	-	352.4	3,899.0	774.3	5,803.6
Rehabilitation of Rural Water Supply	224.8	1,889.8	224.8	1,160.3	349.3	3,023.2	257.1	1,876.4	281.0	6,546.9	617.1	51.4
Borehole Drinking and Dam Construction	361.7	-	87.6	-	285.7	-	285.7	-	285.7	-	642.9	-
Rural Water Supply and Sanitation Project	71.4	2,057.1	-	-	57.1	9,465.0	-	-	57.1	9,655.4	476.2	19,005.1
Strengthening DDCA	157.1	-	79.0	-	266.7	-	266.7	-	295.2	-	645.7	-
TOTAL	**1,038.8**	**7,861.4**	**283.8**	**1,160.3**	**1,425.5**	**17,888.2**	**1,137.3**	**1,876.4**	**1,271.4**	**21,953.8**	**3,156.2**	**24,860.2**
Budget Allocated for Dar es Salaam and Coast Reagion	N.A	N.A.			85.7	-	-	-	85.7	-	-	-

Disbursement schedule for the implementation of the Priority Project is planned as shown in *Table 7.3* assuming the implementation with the Japan's Grant Aid.

Table 7.3 Annual Disbursement Schedule for Priority Project

Unit: Thousand USD

District/Municipality	2006	2007	2008	2009	2010	Total
Bagamoyo	2,213.2					
Kibaha	780.1					
Kisarawe	1,872.5					
Mkuranga		3,126.6				
Ilala			2,950.6			
Kinondoni		509.1				
Temeke			2,527.2			
Sub Total	4,865.8	3,635.7	5,477.8			13,979.3
Engineering	875.9	654.4	986.0			2,516.3
Total	5,741.7	4,290.1	6,463.8			16,495.6

Chapter 8

Institutional Development Plan

CHAPTER 8 INSTITUTIONAL DEVELOPMENT PLAN

8.1 GENERAL

8.1.1 OBJECTIVES

The Study for institutional development is carried out with the following major objectives:

- To comprehend and analyze problems, causes, and effects in current institutional framework for the provision of rural and peri-urban water supply services, and management options of Community-Owned Water Supply Organizations (COWSOs)
- To identify the efficient and effective institutional framework and COWSO management options, and assess their applicability and feasibility in the Study area.
- To optimize and finalize institutional development plan through the above process.

It shall be noted that the institutional development plan is prepared for each technical option of supply scheme, taking into consideration requirements in technical operation and maintenance, and institutional management, socio-economic conditions, awareness of communities, and so forth.

8.1.2 APPROACH AND METHODOLOGY

To achieve the objectives stated above, the following approaches and methodologies are employed: 1) review of existing literature, reports, and data, 2) field observation and interview to key informants in the supply scheme management, and 3) consultation with Ministry of Water and Livestock (MoWLD), Non-Governmental Organizations (NGOs), and External Support Agencies (ESAs) concerned in development of the institutional framework and COWSO management options. In consideration to institutional framework and COWSO management options, the consistency analysis is also made so that those options are in line with the national sector policy and strategies.

In this chapter, therefore, future institutional framework is reviewed to clarify functional responsibilities of each organization involved in the sector development, followed with the capacity assessment on various existing COWSO management options. Then, the suggestion is made for improved COWSO management options to be introduced in the Water Supply Plan and the Priority Project formulated in the Study.

8.2 FUTURE INSTITUTIONAL FRAMEWORK

Recognizing the problems on the current institutional framework as overviewed in the previous Chapter 3 (refer to Section 3.4), the Government of Tanzania has been undertaking significant challenges to reorganize and redefine the institutional framework for the water supply and sanitation service delivery. Under on-going initiatives towards decentralization based on Local Government Reform Policy (LGRP) and National Water Policy (2002) complemented with Draft National Water Sector Development Strategy, the functional responsibilities of MoWLD have been redefined as policy formulation, quality monitoring, evaluation and assurance, and coordination of sector development activities, instead of involvement in direct service delivery. The initiatives and movement towards water supply service and sanitation sector reform has been well consolidated and its achievement seems to be of political and national consensus.

Draft National Water Sector Development Strategy (2005-2015) sets out the institutional framework for provision of water supply and sanitation services as shown in *Figure 8.1*. The main functions and responsibilities of each organization in the framework shown in *Table 8.1*.

It is obvious from the redefined functional roles and responsibilities of each institution from the *Table 8.1*, that the following issues are emphasized and consolidated as basic principles in

development and reorganization of institutional framework, as stipulated in National Water Sector Development Strategy (2005-2015).

- Government's role will be limited to co-ordination, policy and guideline formulation, and regulation
- Regulatory and executive (i.e. service provision) functions will be separated.
- Responsibility for executive functions will be decentralized to the lowest appropriate level, whilst balancing consumer representation/participation with economies of scale.
- Responsibility for regulation will be separated from the prioritization and allocation of capital investment funds.
- Autonomous entities will be established to manage water supply and sewerage services in urban areas.
- Community organizations will own and manage supply schemes.

Table 8.1 Functional Responsibilities for Water Supply and Sanitation

Organization	Functions and Responsibilities
Ministry responsible for Water	– Policy and strategy development. – Advice EWURA in formulation of technical guidelines and standards. – Co-ordinate planning for projects of national importance. – Secure finance for projects of national importance. – Monitor performance and regulate COWSOs. – Provide technical guidance to Councils.
Water Supply and Sanitation Authorities (WSSAs)	– Own, manage and develop water supply and sanitation assets. – Prepare business plans to provide water supply and sanitation services, including capital investment plans. – Secure finance for capital investment, and relevant subsidies. – Contract and manage Service Providers. – Provide services not contracted out. – Formulate by-laws for service provision.
Service Providers	– Provide water supply and sanitation services in accordance with contractual requirements. – Collect revenue for services.
Community-Owned Water Supply Organizations (COWSOs)	– Own and manage water supply assets. – Operate and maintain water supply assets. – Determine consumer tariffs. – Collect revenue for the provision of services. – Contract and manage Service Providers.
Energy and Water Utilities Regulatory Authority (EWURA)	– Approve business plans of WSSAs – Issue operating licenses to WSSAs. – Approve service tariffs. – Publish technical guidelines and standards. – Monitors water quality and performance of WSSAs. – Collect and publish comparative performance data.
President's Office Regional Administration and Local Government	– Co-ordinate planning of projects from local government authorities. – Co-ordinate local government authority budgets. – Co-ordinate capacity building for local government authorities.
Regional Secretariats	– Representation on WSSA Boards. – Provide technical advice to local government authorities.
Municipal and District Council	– Representation on WSSA Boards. – Co-ordinate WSSA budgets within Council Budgets. – Disburse block grant funds to WSSAs. – Delegate performance monitoring and regulation of COWSOs.
Village Councils	– Promote establishment of COWSOs. – Representation on COWSO management body. – Co-ordinate COWSO budgets within Council Budgets. – Resolve conflicts within and between communities.
Ministry of Health	– Develop policy, guidelines and strategies for sanitation. – Provide technical assistance to councils for sanitation. – Prepare Acts, Regulations and Standards for sanitation. – Monitor, regulate and provide support and advice to councils and other stakeholders on sanitation issues.

Source: MoWLD 2004

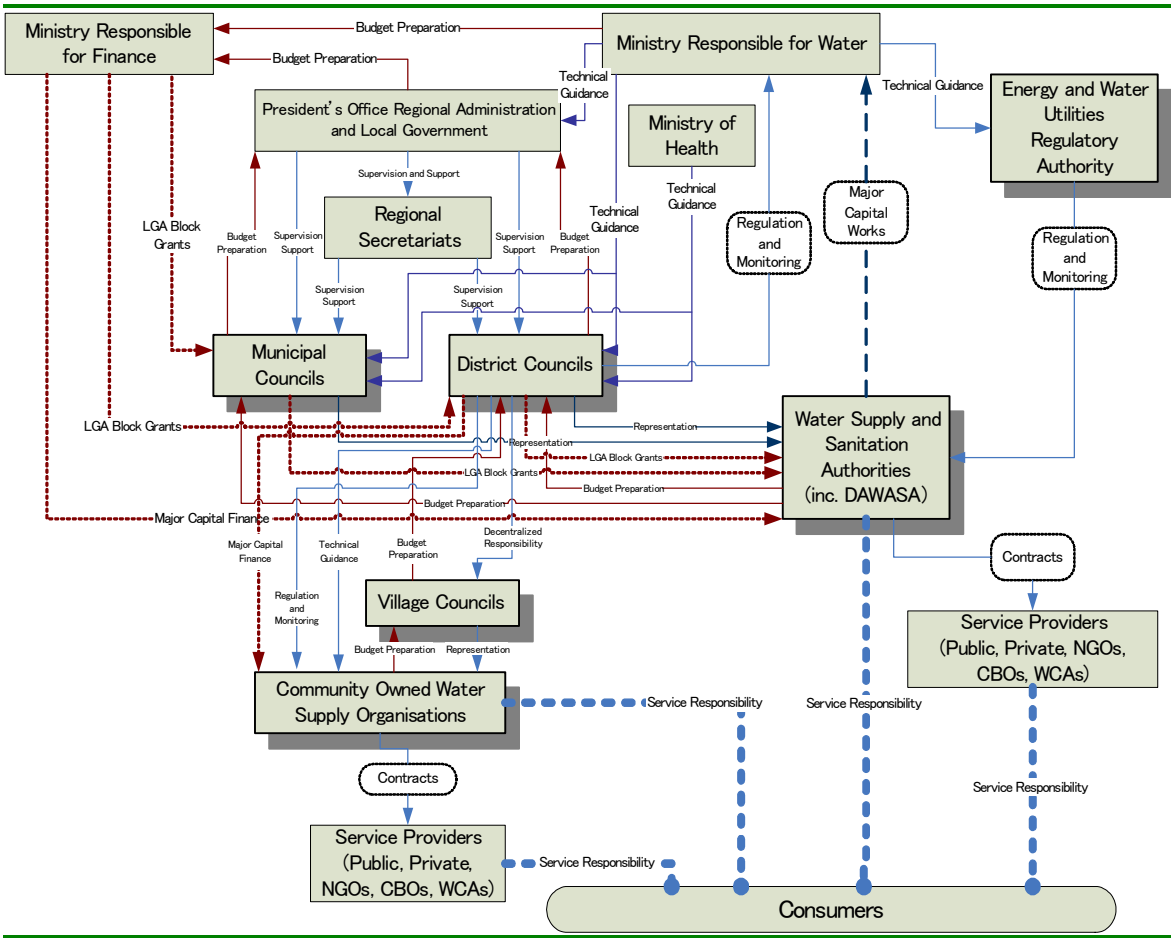

Figure 8.1 Suggested Future Institutional Framework for Water Supply and Sanitation

8.3 PERFORMANCE ANALYSIS ON COWSO AND CHALLENGES

8.3.1 COMPARATIVE PERFORMANCE ANALYSIS OF CURRENT COMMUNITY ORGANIZATION OPTIONS

The current management options of Community-Owned Water Supply Organizations (COWSOs) are reviewed in the previous Chapter 3 (refer to Section 3.4), distinguishing their characteristics by the form of organization, namely, 1) Village Water Committee, 2) Water User Group, 3) Water Users Association, 4) Water Cooperative/Trust, 5) Water Company by Guarantee, and 6) Water Company by Share. It is also observed that competence of those management options depend on their internal and external institutional arrangements. *Table 8.2* presents a synopsis of management options with comparative analysis on their performance, efficiency, competency, and guarantee in management of the water supply schemes. Management criteria employed in this comparative analysis to assess each institutional option are as follows:

(a) Business-oriented management

A business-oriented management has a high potential, in theory, to provide efficient water delivery services at low cost.

(b) Efficiency in management

Efficiency in Management refers to all managerial aspects in running the scheme, such as commercial system, institutional and administrative system, resource management and development system, financial system, as well as operation and maintenance system.

(c) Competency and confidence in management

Competent management will be able to deal effectively with the various aspects of COWSOs including technical, social, institutional, financial and environmental issues.

(d) Technical guarantee for operation and maintenance

Provision of adequate technical service level is critical for effective community involvement and participation of the community in operation, maintenance and cost recovery.

(e) Guarantee for efficient cost recovery

Cost recovery is the core input in financial sustainability and should therefore be priority for the management.

(f) Facilitation of internal and external communication, reporting and transparency

Effective communication with internal and external stakeholders and potential partners, and proper reporting and transparency are a condition for internal cohesion and networking.

(g) Facilitation of external funds acquisition

Effective capacity to attract external financing is a guarantee for future rehabilitation, expansion and growth.

Table 8.2 Comparative Analysis on Key Management Criteria for COWSO Options

	Business-Oriented Management	Efficiency in Management	Competency and Confidence in Management	Technical Guarantee for Operation and Maintenence	Guarantee for Efficient Cost Recovery	Internal and External Communication, Reporting, Transparency	External Funds Acquisition
Water Company by Share	High	High	High	High	High	High	High
Water Company by Guarantee	High / Fair	High / Fair	High / Fair	High / Fair	High / Fair	High / Fair	Fair
Water User Association	Fair	Fair	Fair	Fair	Fair	Fair	Low
Water Trust/Co-operative	Fair	Fair	Fair	Fair	Fair	Fair	Low
Water User Group	Fair / Low	Fair / Low	Fair / Low	Fair / Low	Fair / Low	Fair / Low	Low
Village Water Committee	Low	Low	Low	Low	Low	Low	Low

It can be observed from the comparative analysis that the most traditional and conventional COWSO management option of Village Water Committee (VWC) is less efficient and competent in the scheme management, while Water User Group (WUG) is entailed with relatively improved efficiency and competence if adequate capacity building and registration process as a business entity is provided. Water Users Association (WUA) and Water Trust/Co-operative have fair steadiness in management, while COWSO management options such as Water Company by guarantee and by share retain higher effectiveness and competency.

While institutional arrangements determine the efficiency and competency of COWSOs in the scheme management, contractual arrangements diversify modes of ownership and expertise in utility and risk management. Contractual arrangements are varied and ranged from service contract, management contract to more comprehensive arrangements such as lease contracts and

concession. Definition of each contractual arrangement in water supply service delivery is described below (SOHAIL, 2003):

(a) Service contract

Service contract is the simplest contractual arrangement whereby the COWSOs retain ownership, as well as overall responsibility for operation and maintenance of the scheme except for the specific system components that are contracted out. The contractor's responsibility is limited to managing its own personnel and service efficiently. Typically, service contracts are used for maintenance of components such as regular maintenance and overhaul of pump units, and meter readings. Payment is usually on a lump sum basis dependent on achieving certain agreed targets. One common variation of service contract in rural and peri-urban water supply delivery is the 'labor only' contract where the individual agents provide services such as Domestic Water Points (DWPs) attendants, fee collectors, pump operators, and security guards. WUGs, WUAs, and Water Trusts/Co-operatives utilize those contractual arrangements.

(b) Management contract

Management contracts are generally a more comprehensive arrangement, where the COWSOs transfers responsibility to a private contractor for the management and a range of activities such as the operation and maintenance of the supply scheme or entire management system, while retaining its ownership. Remuneration is usually based on a tender fee. Those contracts that also have an incentive based component, using parameters such as volume of water produced or improvements in tariff collection rates, are generally believed to be more successful. COWSOs with these types of contract in practice and in potential award include: WUAs, Water Trust/Co-operative, Water Company by guarantee and share.

(c) Lease contract

Lease contracts can be used where a private operator or lessor rents the scheme from COWSOs and is responsible for complete scheme management. The lessor effectively buys the rights to the income stream from the utility's operations and thus assume a significant share of commercial risk associated with those operations. Water Company by share can be placed in this type of contractual arrangement.

(d) Concession contract

Concession contracts tend to be more comprehensive in scope, where the private sector company takes on full responsibility not only for operating and maintaining the scheme, but also for investments to enhance and extend the assets. Formally asset ownership remains with communities, but in effect, the private sector assumes complete control during the contract period. Frequently the concessions are bid according to price – the bidder who proposes to operate the utility and meet the specific investment and performance targets, for the lowest tariff, wins the concession. Alternatively, the contract may be let according to the promised degree of service coverage within a specific time. The contract also sets out the main performance targets, particularly for quality of supply and service coverage as well as arrangements for arbitration of disputes between project partners. Water Company by share can be placed in this type of contractual arrangement.

Figure 8.2 shows a matrix indicating each COWSOs management options with variation in their institutional and contractual arrangements. It is assumed in theory that, as the institutional arrangements are elaborated ranging from VWCs, WUGs, WUAs to Water Company by guarantee and share, efficiency and competency in scheme management and operation and maintenance is enhanced as observed above, while ownership is privatized and utility/risk management is assured in an expertise manner as the contractual arrangements are elaborated ranging from service contract, management contract, to lease and concession contracts.

In the matrix, therefore, two contrasting realms are identified by strength of both institutional and contractual arrangements, namely the ones for sustainable model and less-sustainable model. As it could be observed in the matrix, WUAs and Water Trust/Co-operative are located in the turning

realm between sustainable model and less-sustainable model, indicating both potential risks and strength in their scheme management. In this case, the contractual arrangements become key factor to determine the sustainability, particularly in rural/peri-urban communities where expertise required in the scheme management, and technical operation and maintenance is limited.

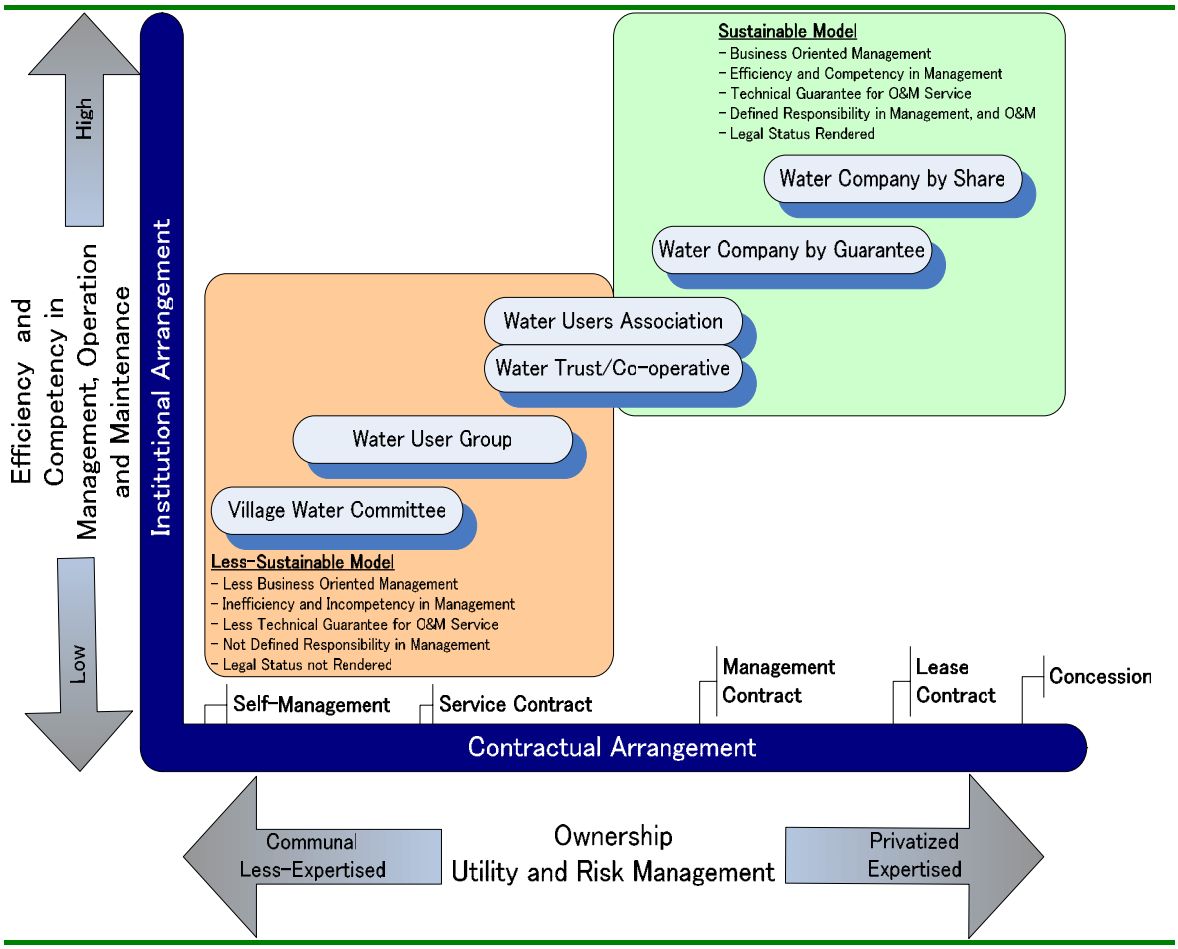

Figure 8.2 COWSOs Management Options in Institutional and Contractual Arrangements Matrix

It is suggested that in considering COWSOs management options, therefore, elaborated organizational arrangements perhaps ranging from WUAs to Water Company, with comprehensive contractual arrangement such as management contracts, are the ones desirable in the Study area.

8.3.2 CHALLENGES

Reviews on the institutional framework for water supply and sanitation service delivery, and assessments on current management options of Community-Owned Water Supply Organizations (COWSOs) allow to pinpoint challenges associated with the improvement of management, and operation and maintenance in rural/peri-urban water supply services.

Wider recognition has been increased since mid 1980s in Tanzania that the community-based management with participatory approaches is one key elements to achieve sustainable water supply service delivery in rural and peri-urban areas, and it has been main-streamlined into national sector policies and strategies. Tanzania is now in the second decades adopting the concept of community-based management, participation, and cost sharing in rural and peri-urban water supply service delivery. This two decades of experience also assist in the identification of challenges of this community based approach.

There is little doubt that the community-based management will be the predominant model for reaching the national sector development goal to provide sustainable water supplies to rural and peri-urban population. There is also a growing body of evidence to suggest that better quality participatory planning and management leads to better performing community water supplies (Lockwood 2004). However, community-based management model is by no means problem free as noted in the prior sections. Widespread evidence suggest that after an number of years of operation, a considerable number of rural system are facing a variety of problems and obstacles if they are to maintain services, even under the community-management model.

Recognizing the fact that rural and peri-urban community has limitations of expertise in the scheme management, and operation and maintenance as well as in resolving political and social conflict, the following challenges for enhancing COWSO management options can be identified:

- Increasing efficiency and competence in the scheme management (including commercial system, institutional and administrative system, resource management and development system, and financial system) by COWSOs.
- Enhancing technical guarantee for management, and operation and maintenance services provided by COWSOs.
- Separation of service provider and consumer in management model, and increasing the awareness and expertise of COWSOs as service providers.
- Harmonizing the negative interventions by political entities like local authorities (Ward and Village Councils), and interacting initiatives taken by those stakeholders in the decision making process, with the provision of registration process as a business entity and autonomous status to COWSOs

Taking into consideration on those challenges and issues, management options suitable and desirable for rural and peri-urban water supply service delivery in the Study area are delineated in the following sections.

8.4 PROPOSED INSTITUTIONAL FRAMEWORK

8.4.1 OVERVIEW OF MANAGEMENT OPTIONS

The *Figure 8.3* presents the entire overview of Community-Owned Water Supply Organization (COWSOs) management options proposed in the Study. As it can be seen, COWSOs are placed in the pivot of the structure, taking major roles and responsibilities in the scheme management in the rural and peri-urban water supply service delivery. Institutional arrangements of COWSOs are proposed in the form of Water Users Associations (WUAs) or Water Trust/Co-operative, vested with autonomous and legal status through widely recognized process of registration and constitution/by-law development in a participatory manner. Relationship between COWSO and Village Council becomes rather interactive in decision making process, and roles and responsibilities of Village Council become supervisory.

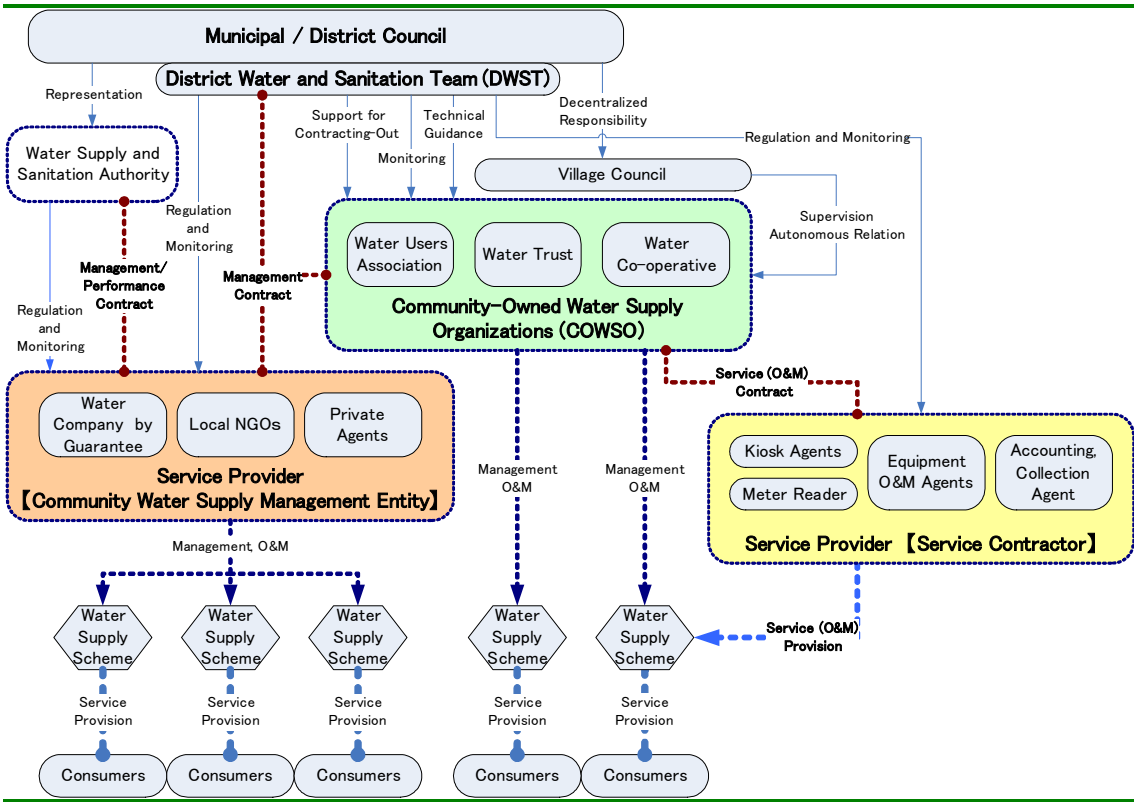

Figure 8.3 Overview of Suggested Management Options

Municipal and District Council shall provide technical and managerial guidance and monitoring services for COWSOs in their management, and operation and maintenance of the supply scheme by establishing District Water and Sanitation Team (DWST). DWST shall be composed of; 1) District Executive Officer as chairperson, 2) District Water Engineer as Secretary, 3) District Planning Officer, 4) District Health Officer, and 5) District Community Development Officer. This composition and membership can allow the integrated and sector-wide approaches in their planning, activities, and monitoring. DWST is expected to take the following roles and responsibilities in the implementation of water and sanitation project: 1) coordination of the day-to-day project activities in the district, 2) coordination, appraisal of community sub-project proposal, and selection of communities for assistance for presentation to the full council for approval, 3) coordination and provident linkage between partner organizations and the communities, 4) providing support for training and capacity building of the private sector, NGOs, CBOs (community-based organizations), and communities, and 5) assessing the capability of communities in letting and managing contract, and 6) providing technical support to communities.

Contractual arrangements, such as service contracts and management contracts, are highly advocated in this option frames to enhance the efficiency, competency, and guarantee in scheme management, and operation and maintenance, in particular, for the technologies requiring relatively elaborated expertise such as piped water supply schemes (level-2). In this arrangement, District and Municipal Council, through DWST, shall be responsible for regulation and monitoring of contractors, and for support and supervision in contracting-out for COWSOs.

Three COWSOs management options are identified as follows; 1) COWSO self-management option, 2) COWSO with Service Contractor option, and, 3) COWSO and Community Water Supply Management Entity option. Those options are illustrated in detail in the following sections.

8.4.2 COMMUNITY-OWNED WATER SUPPLY ORGANIZATION (COWSO) SELF-MANAGEMENT OPTION

(1) Institutional Arrangement

The COWSO self-management option is the simplest form, currently being in practice in Tanzania (see *Figure 8.4*). Communities form COWSOs, such as WUAs or Water Trust/ Co-operative as managing body for the scheme operation. Constitutions and by-law of the COWSOs shall be developed in a participatory manner with wider range of stakeholders such as District and Municipal Councils, Ward and Village Councils, other community-based organizations (CBOs), and Non-Governmental Organizations (NGOs). COWSOs shall be also registered as corporative body under Ministry of Water and Livestock Development (MoWLD) or local government framework, vested with autonomous and legal status.

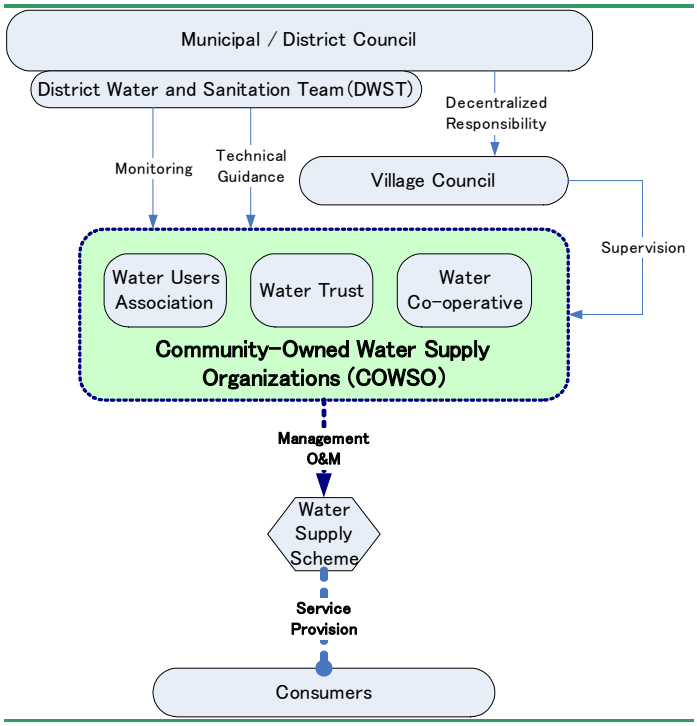

Figure 8.4 COWSO Self-Management Option

In this option, the COWSOs run the scheme by themselves without any contracting-out arrangement. In this setting, the efficiency and competency in scheme management might be low, unless considerable facilitation and capacity building packages are provided for improved scheme management, and technical operation and maintenance services. Therefore, provisions of managerial and technical support by District and Municipal Council through DWSTs becomes a significant key for the sustainability of this option.

(2) Function and Responsibility of Each Organization

In this management option, the main functions and responsibilities of each organization will be set as follows (*Table 8.3*):

Table 8.3 Function and Responsibility of Each Organization in COWSO Self-Management Option

Organization	Functions and Responsibilities
Ministry responsible for Water	– Policy and strategy development. – Advice EWURA in formulation of technical guidelines and standards. – Co-ordinate planning for projects of national importance. – Secure finance for projects of national importance. – Monitor performance and regulate COWSOs. – Provide technical guidance to Councils.
Community-Owned Water Supply Organizations (COWSOs)	– Own and manage water supply assets. – Operate and maintain water supply assets. – Determine consumer tariffs. – Collect revenue for the provision of services.
Municipal and District Council	– Form District Water and Sanitation Team (DWST) – Provide Technical Guidance to COWSOs – Identify and provide training to local artisans on repair and maintenance of hand pump – Assure availability of spare parts for hand pump. – Co-ordinate Community Water Supply budgets within Council Budgets. – Disburse block grant funds to Community Water Supply Project. – Delegate performance monitoring and regulation of COWSOs.
Village Councils	– Promote establishment of COWSOs. – Representation on COWSO management body. – Co-ordinate COWSO budgets within Council Budgets. – Resolve conflicts within and between communities.

(3) Applicability of the Option

From the technical view points, this option is best suited for the management, and operation and maintenance of point source water supply scheme such as borehole/well fitted with hand pump (level-1) with relatively simple requirements in management and technical operation and maintenance. In this option, local artisans shall be identified and provided with training in preventive maintenance.

8.4.3 COWSO WITH SERVICE CONTRACTOR OPTION

(1) Institutional Arrangement

In this management option of COWSO with Service Contractor, simple service contract arrangement is made, and certain services, that would require some degree of expertise or that can be run more efficiently by contracting-out, are provided by Service Providers or Service Contractors, while COWSO retains overall responsibilities in the scheme management (see *Figure 8.5*). Types of services which can be contracted out in this management options are possibly; 1) pump operation and regular maintenance, 2) accounting, 3) pipe plumbing, 4) meter readings, 5) public water points (PWPs) caretaking, 6) user fee collection, and, 7) water retailing, and so forth.

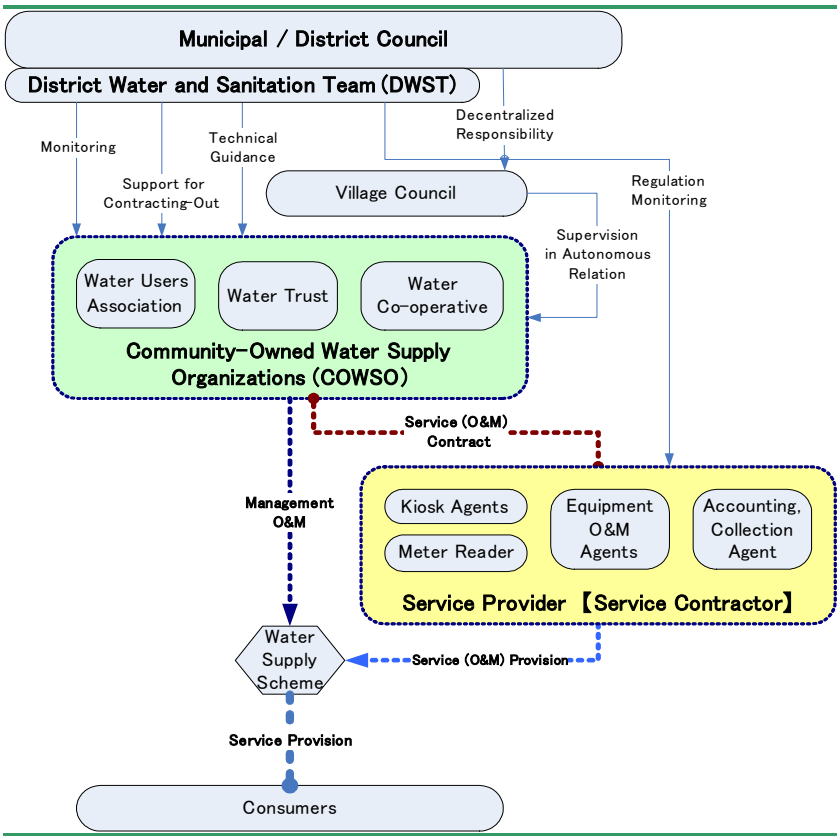

Figure 8.5 COWSO with Service Contractor Option

The COWSOs may identify the potential Service Providers among the individual agents, local artisans, and private business entities, within and/or outside of the communities, and contract-out certain services with those identified as Service Contractors. This arrangement enhances the efficiency and competence in the scheme management.

In this service contract, performance target shall be clearly stipulated, and remuneration shall be based on the degree of its achievement. In this frame, Municipal and District Council, through DWSTs, will be responsible for regulation and monitoring of those Service Contractors as well as provision of technical and managerial guidance in community contracting-out.

(2) Function and Responsibility of Each Organization

Main functions and responsibilities of each organization in this management option are as follows *(Table 8.4)*:

Table 8.4 Function and Responsibility of Each Organization in COWSO with Service Contractor Option

Organization	Functions and Responsibilities
Ministry responsible for Water	– Policy and strategy development. – Advice EWURA in formulation of technical guidelines and standards. – Co-ordinate planning for projects of national importance. – Secure finance for projects of national importance. – Monitor performance and regulates COWSOs. – Provide technical guidance to Councils.
Service Providers	– Provide water supply and sanitation services in accordance with contractual requirements. – Prepare performance target and indicators. – Disclose performance indicators and financial status.
Community-Owned Water Supply Organizations (COWSOs)	– Own and manage water supply assets. – Operate and maintain water supply assets. – Determine consumer tariffs. – Collect revenue for the provision of services. – Contract and manage Service Providers (Service Contractor).
Municipal and District Council	– Form District Water and Sanitation Team (DWST) – Provide technical guidance to COWSO. – Provide assistance to COWSO for contracting-out. – Co-ordinate Community Water Supply budgets within Council Budgets. – Disburse block grant funds to Community Water Supply Project. – Delegate performance monitoring and regulation of COWSOs and Service Providers (Service Contractor).
Village Councils	– Promote establishment of COWSOs. – Representation on COWSO management body. – Co-ordinate COWSO budgets within Council Budgets. – Resolve conflicts within and between communities.

(3) Applicability of the Option

From the technical view points and depending on the degree of contracting-out, this option may be appropriate and suitable for the scheme management of mechanized piped water supply scheme (level-2) which requires certain degree of expertise in operation and maintenance such as pump operation and regular maintenance, accounting, revenue collection and pipe plumbing.

It is also applicable for hand pump scheme management, contracting-out of regular hand pump maintenance, for instance.

8.4.4 COWSO AND COMMUNITY WATER SUPPLY MANAGEMENT ENTITY OPTION

(1) Institutional Arrangement

COWSO and Community Water Supply Management Entity option is the most comprehensive setting among all these options. In this option, COWSOs have no direct involvement in service provision and scheme running by concluding management contract with Service Provider, named as Community Water Supply Management Entity (see *Figure 8.6*). Still, COWSOs retains the asset ownership. Organization such as Water Companies by guarantee, local NGOs, and private business entities, which are competent enough in scheme management, can be the Community Water Supply Management Entity through the approval given by the District and Municipal Council.

Community Water Supply Management Entity shall be selected preferably through open bidding and tender process supported by District and Municipal Council whenever it is practical. The bidders shall prepare their business plan with performance targets and parameters / indicators.

Management contract shall be concluded in a trilateral manner among District / Municipal Council, COWSO, and Community Water Supply Management Entity, setting out main target performance in terms of both quality and quantity in supply services.

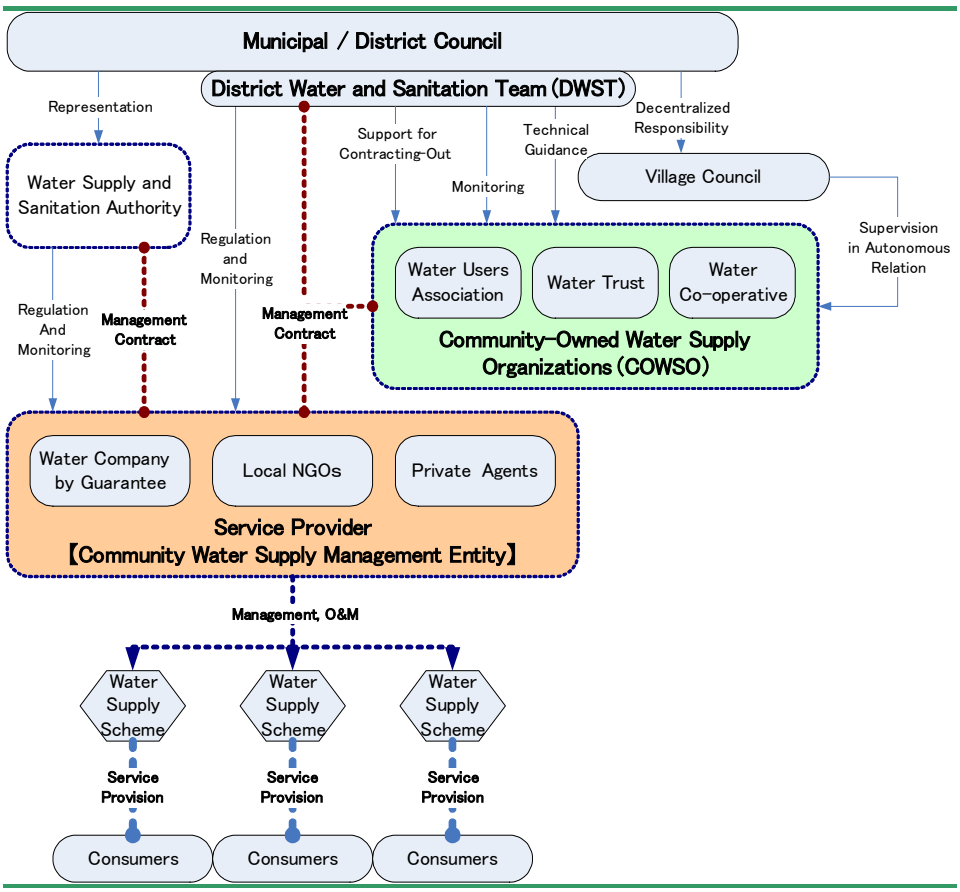

Figure 8.6 COWSO and Community Water Supply Management Entity Option

Regulation and monitoring on the performance of Community Water Supply Management Entity shall be provided by District and Municipal Council, through DWST, in particularly on tariff setting, service coverage, and quality and quantity in service provision using parameters set out in the contract. Transparency and accountability of the Entity shall also be ensured by the regulation and monitoring process.

A Community Water Supply Management Entity may be allowed to manage and run more than one supply scheme, by clustering a number of schemes by area. It would increase economics of scale in profit, as well as scale merits in the scheme management.

(2) Function and Responsibility of Each Organization

Main functions and responsibilities of each organization in this management option are as follows (*Table 8.5*):

Table 8.5 Function and Responsibility of Each Organization in COWSO and Community Water Supply Management Entity Option

Organization	Functions and Responsibilities
Ministry responsible for Water	– Policy and strategy development. – Advice EWURA in formulation of technical guidelines and standards. – Co-ordinate planning for projects of national importance. – Secure finance for projects of national importance. – Monitor performance and regulate COWSOs. – Provide technical guidance to Councils.
Service Providers	– Manage water supply scheme in administrative, technical, and financial aspects. – Prepare performance target and indicators. – Collect revenues for services. – Disclose performance indicators and financial status.
Community-Owned Water Supply Organizations (COWSOs)	– Own water supply assets, and make final decision on major management issues. – Determine consumer tariffs. – Contract and manage Service Providers (Community Water Supply Management Entity). – Monitor and regulate Service Provider (Community Water Supply Management Entity).
Municipal and District Council	– Form District Water and Sanitation Team (DWST) – Provide technical guidance to COWSO. – Provide assistance to COWSO for contracting-out. – Approve management contract between Service Provider and COWSO – Co-ordinate Community Water Supply budgets within Council Budgets. – Disburse block grant funds to Community Water Supply Project. – Delegate performance monitoring and regulation of COWSOs and Service Providers (Service Contractor).
Village Councils	– Promote establishment of COWSOs. – Representation on COWSO management body. – Co-ordinate COWSO budgets within Council Budgets. – Resolve conflicts within and between communities.

(3) Applicability of the Option

In this option, efficiency and competency in the scheme management is considerably guaranteed, if proper administrative arrangements are provided. Depending on the economic scale merit (i.e. economic viability) as examined later, this option is highly advocated for the piped water supply schemes (level-2).

(4) Introduction of the Option in the Rehabilitation Scheme

Water Supply Plan under the Study includes the rehabilitation of existing piped supply scheme (level-2). Regarding the existing water supply scheme, it is learned in this Study that the major reasons for malfunctioning of the schemes is attributed to breakdown or vandalism of intake facilities, such as diesel engines, generators and pumps. Sufficient allocation of maintenance/replacement fund by the communities and enhanced expertise are required for proper operation and maintenance of those facilities. Without those expertise and funding, schemes have been left malfunctioning for years in most of the cases.

Introduction of the management option of COWSO and Community Water Supply Management Entity is highly advocated in the rehabilitation scheme, which assures expertise and funding for proper operation and maintenance with increased private sector participation.

8.4.5 Further Analysis on Management Options

Further analysis on the community management options described above concerning their applicability and feasibility in the Study area are made. Applicability and feasibility is examined particularly for the priority areas and communities to select in the Study, with the assessment grid as shown in *Table 8.6*. Focuses are given mainly on the effects and impacts on the socio-economic, socio-cultural, institutional/administrative, political, and gender aspects.

Table 8.6 Assessment Grid for Further Analysis on the Management Options

Aspects	Considerations
Socio-Economic	– that the increase in management costs with the adoption of management options, can be off-set by enhanced revenue collection through improvement of scheme management. – that the introduction of the management options creates job opportunities in the target area, particularly in the informal sectors. – that the introduction of the options affects economic activities negatively or positively in the area, in particular in the current informal sectors such as water venders, retailers, well owners.
Socio-Cultural	– that the adopted management options can cope with enhancing hygiene and sanitation awareness and practice of user communities. – that the management options can be accepted and acknowledged in the Ward and Village Council regime, as well as rural and peri-urban communities.
Institutional/ Administrative	– that the management options are in consistent with current sector reform and reorganized institutional framework for rural and peri-urban water supply and sanitation service. – that the management options are in consistent with local government framework.
Political	– that the political support and will is obtained in the introduction of management options.
Gender	– that women and men can equally participate and interact in decision making process of the management options.

It is observed that most of the effects and impacts involved in the issues on the assessment grid of above are positively driven. However, among those assessments, two critical issues in socio-economic effects and impacts in the introduction of the management options require further clarification, which is given below.

The first critical issue is that the increase in management cost by adoption of suggested management options can be off-set by the increase in revenue collection through the improved efficiency and competency in the scheme management. As more complex and comprehensive the scheme management becomes, higher the management cost and cost for contracting-out, therefore, cost for the service provision. On the other hand, the water tariff shall be set lowest as possible within the affordability and willingness of the rural and peri-urban communities to pay. It is assessed that the improved scheme management by adoption of the options can increase revenue collection, while assuring a certain scale of benefit maintaining the water tariff within affordability and willing to pay of the user communities.

The second significant issue is that the introduction of proposed management options affects those who are involved in informal sectors both in negative and positive manners. Water supply scheme development, which enables efficient and economical supply service provision in quality and quantity, directly affects the economic activities of water venders and retailers, who are selling from existing supply source at higher price in the areas of water shortage. However, the introduction of proposed management options creates employment opportunity in formal sector, since a considerable amount of contracting-out arrangements are brought in the water supply scheme management which is also significant and has positive effect. As the mitigation and affirmative measure for the negative impacts, mechanism to reemploy those involved in the economic activities of informal sector (i.e. water venders and retailers) as Service Contractors (such as water kiosk attendant or caretaker of domestic water point) shall be promoted by the water supply management entity.

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Chapter 9

Management, Operation and Maintenance Plan

CHAPTER 9 MANAGEMENT, OPERATION AND MAINTENANCE PLAN

9.1 GENERAL

9.1.1 OBJECTIVES

The Study on management, operation and maintenance has been carried out to achieve the following major objectives:

- To analyze problems, causes and effects associated with current management, operation and maintenance system of community-owned water supply scheme.
- To optimize and finalize management, operation and maintenance plan with emphasis on the user-pay-principle, proper tariff setting and collection mechanism.
- To formulate capacity development strategy and approaches to enhance sustainable management, operation and maintenance of community-owned water supply schemes, putting emphasis also on health and hygiene promotion aspects.

9.1.2 APPROACH AND METHODOLOGY

Much of management, operation and maintenance mechanism are discussed along with Institutional Development Plan in the previous chapter. In this section, however, the focuses are given on determining factors of sustainability such as; 1) operation and maintenance cost, 2) tariff setting, and 3) tariff collection methods.

Cost recovery for operation and maintenance (O&M) is still today one of the major challenges for achieving a sustainable rural and peri-urban water supply service in Tanzania, despite major efforts in this respect. An acknowledgement that the service for water supply should be paid by users has been increased over the past decade consequent to The National Water Policy (2002) putting emphasis on “full cost-recovery for operation and maintenance, and replacement” by beneficiaries.

Thus, a ‘realistic’ cost recovery mechanism for the sustainable running of scheme shall be incorporated in the Operation and Maintenance Plan, considering real operation and maintenance cost including management cost without any underestimation, as well as affordability- and willingness-to-pay (ATP and WTP) aspects of the communities. In the following sections, operation and maintenance costs for each supply scheme of level-1 and level-2 are first analyzed, which is followed with issues of tariff setting and collection methods.

Recognizing the fact that the institutional framework for management, operation and maintenance of community-owned water supply scheme proposed in the previous chapter on Institutional Development Plan can not be created in vacuum, the relevant institutional and capacity development plan is also formulated below.

9.2 MANAGEMENT, OPERATION AND MAINTENANCE PLAN

9.2.1 OPERATION AND MAINTENANCE COST

(1) Basis of Estimation

Operation and maintenance cost is often underestimated particularly for piped water scheme (level-2), taking into account only the minimum functional operation cost such as fuel cost and minimum wages for operation. Management cost, which includes commission for community-owned water supply organization, cost for management/service contracts, shall also be included in the cost estimation for sustainable management of the management options

proposed in this chapter. Real maintenance cost, such as supply, tools, spare parts, and cost incurred in regular pump maintenance, is often underestimated. As emphasized in the National Water Policy (2002), replacement cost shall be also considered as a part of operation and maintenance cost borne by the beneficiaries. The *Table 9.1* and *Table 9.2* show the basis of the annualized cost estimation for operation and maintenance for piped water supply scheme (level-2) and hand pump (Level-1), respectively.

As a commonly applied method, percentage of capital cost is used for estimation and approximate operation and maintenance cost for piped water supply scheme (level-2) at this stage, which enables the comparative analysis on per capita O&M cost by the size of communities and the scale of the piped scheme presented in the following sections. Estimation of capital cost for piped water scheme is made, based on the wider experience in the country gained from the implementation of Rural Water Supply and Sanitation Program (RWSSP). On the other hand, O&M cost for borehole fitted with hand pump (level-1) is estimated by using experiences from similar projects instead of applying percentage approximation of capital cost.

Table 9.1 Basis of O&M Cost Estimation (Level-2: Pipe Water Supply Scheme)

Cost	Item	Approximation
Operation Cost	Fuel, Electricity Chemical Wages and Allowances Pump Operators Kiosk Attendants Security Guards	5% of Capital Cost / Year
Management Cost	Commission for COWSO Management/Service Contract Scheme Manager Accountant Secretary	5% of Capital Cost / Year
Maintenance Cost	Supply, Tools Spare Parts Pump Maintenance	10% of Capital Cost in First 5 Years 20% of Capital Cost in Later 5 Years
Replacement		10% of Capital Cost / Year
Risks and Inflation		5% of Replacement Cost

Table 9.2 Basis of O&M Cost Estimation (Level-1: Hand Pump)

Cost	Item	Value (USD)/Year
Maintenance Cost	Wage (caretaker)	150
	Tools	10
	Materials	40
	Spareparts	100
	Mechanic (big repairs)	150
	Private contract (regular maintenance of hand pump)	50
Management Cost	Commission (Treasurer)	100
Replacement Cost		130
Risks and Inflation		6.5
Total O&M Cost		736.5

(2) Operation and Maintenance Cost Projection

Annualized total and per capita operation and maintenance cost for piped scheme (level-2) is projected by the size of communities in current population (2002), which reflect to the scale of supply facilities, and proportionally to the capital cost. Assumptions and conditions made in the projection are; 1) period for depreciation is set at 10 years (2010-2020), therefore, full cost for replacement is accumulated over 10 years, and, 2) the population increase over 10 years is also taken into account for estimation of annualized per capita O&M cost, adopting the growth rate of 2.3 in Coast Region and 4.3 percent in Dar es Salaam Region. *Figure 9.1* and 9.*2* show

the correlation between annualized total O&M cost and per capita O&M by the size of communities in Coast Region and Dar es Salaam Region, respectively.

Trend can be observed in the both Regions that the annualized per capita O&M cost declines as the size of population increases even with increasing total annualized O&M cost. This trend is particularly remarkable in the range of the population size from 1,000 up to 3,500 where sharp decline in annualized per capita O&M cost is projected. It proves piped water supply scheme requires a certain scale in community size in order to realize the scale-merit in operation and maintenance cost. This aspect is further analyzed in the following section.

On the other hand, Annualized per capita O&M cost for hand pump on borehole can be estimated based on the estimated annualized total O&M cost of USD 736.5 divided by the maximum served population of 250, which amounts to approximately USD 2.9/capita/year.

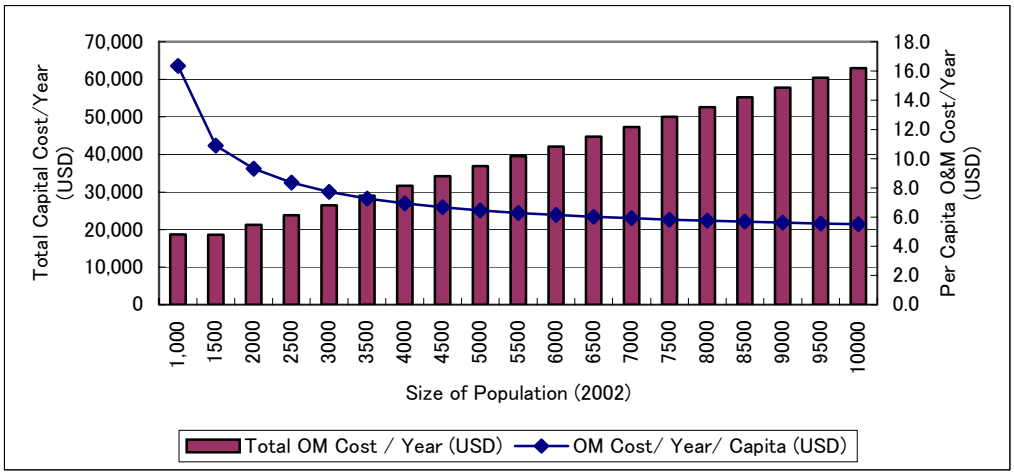

Figure 9.1 Annualized Total and Per Capita O&M Cost in Coast Region

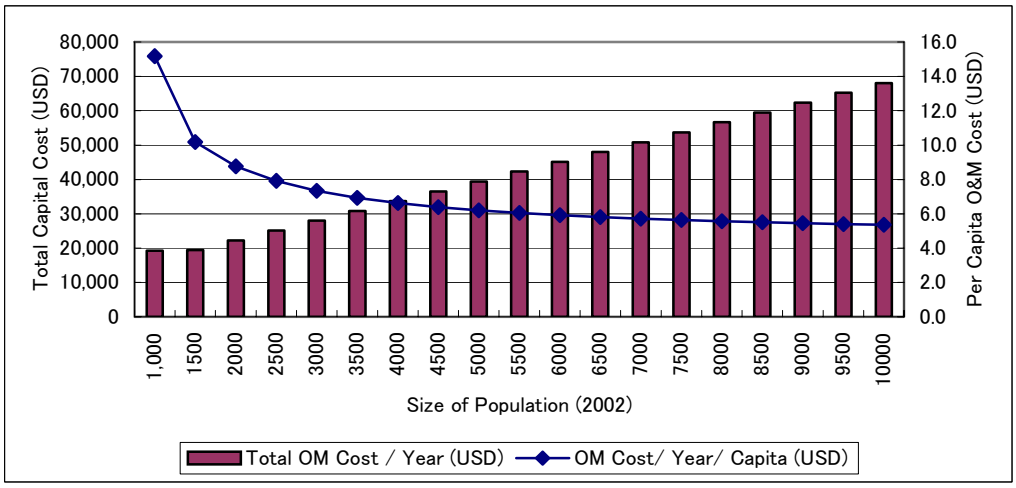

Figure 9.2 Annualized Total and Per Capita O&M Cost in Dar es Salaam Region

9.2.2 TARIFF SETTING WITH AFFORDABILITY- AND WILLINGNESS-TO-PAY ANALYSIS

In principle, tariff structure shall be determined through the consultation with beneficiary communities and other stakeholders. However, communities shall be well informed the essence of tariff setting through consultation and 'realistic' tariff setting shall be made through participatory assessment, based on the O&M cost estimation as presented in the previous section, as well as taking into consideration of affordability-to-pay (ATP) and willingness-to-pay (WTP) aspects of

the communities. This section, hereof, analyzes the realistic tariff system based on ATP and WTP aspects in order to realize full O&M cost recovery.

Willingness-to-pay (WTP) is an expression of demand for a service, while affordability-to-pay (ATP) measures the actual payment capacity of users determined by their socio-economic status and condition. Both WTP and ATP is of great significance, and indeed, operation and maintenance cost, which shall be borne by the beneficiaries. These aspects shall be examined to determine the applicability, feasibility, and sustainability of alternative systems of rural/peri-urban water supply services.

(1) Affordability to Pay (ATP) Analysis

The graphs below (*Figure 9.3, and Figure 9.4*) indicate percentage of annualized per capita O&M cost for piped scheme (level-2) in median per capita income in the Study area. Projection is made based on the annualized per capita O&M cost as estimated in the previous section, and with the current size of population (2002). Median per capita income in both Coast and Dar es Salaam Region is quoted from Household Budget Survey 2000/01 (National Bureau of Statistics Tanzania), which amounts to Tsh. 8,172 and 16,349 per month for Coast Region and Dar es Salaam Region, respectively.

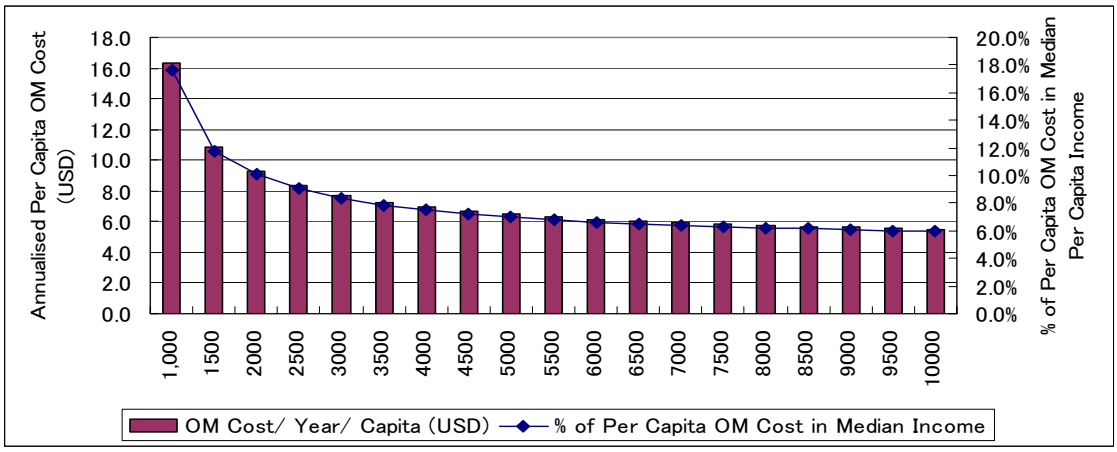

Figure 9.3 Percentage of Per Capita O&M Cost in Median Per Capita Income (Coast Region)

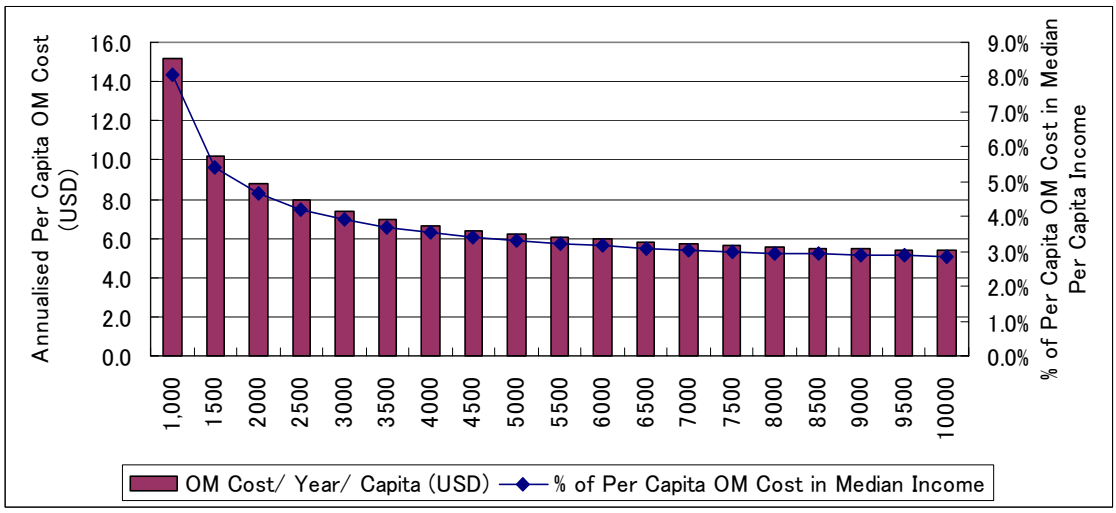

Figure 9.4 Percentage of Per Capita O&M Cost in Median Per Capita Income (Dar es Salaam Region)

World Health Organization (WHO) and other international organizations recommend a percentage less than four to five percent of per capita income be the affordable portion of expenditure for water supply service in developing countries, in general. Obvious trend in the range of the population size from 1,000 up to 3,500 is again observed where sharp decline in percentage of per capita O&M cost in per capita mean income is projected both in Coast and Dar es Salaam Region. However, as the graph shows, in Coast Region, the percentage in income never reaches the five-percent line even for the community exceeding population size of 10,000. Thus, the application of the piped water scheme (Level-2) in Coast Region requires further consideration and examination on affordability aspects. On the other hand in Dar es Salaam Region, the trend is favorable that the communities exceeding population size of 2,000 and more fall into the below-five percentage lines.

The same estimation is made for hand pump on borehole (Level-1) option serving a maximum population of 250, which requires less operation and maintenance cost. In contrast to the results of piped water supply scheme (Level-2) in Coast Region the corresponding percentage amounts to only 3.1 percent, while in Dar es Salaam it becomes to merely 1.5 percent

(2) Willingness-to-Pay (WTP) Analysis

Willingness-to-pay (WTP) is a strong pre-requisite for cost recovery because it is a measure of user satisfaction of a service and of the desire of users to contribute to its functioning.

As of regulatory and legislative order, communities in the Study area are purchasing water, in most cases, at Tsh. 10 - 20 per 20 liter bucket or Tsh. 0.5 - 1 per liter, whatever the water sources are, except in some cases where water venders charge considerably higher prices. This prevailing local customs seems to be affecting the maximum amount that the communities are willing to pay. The socio-economic survey conducted under the Study (2004) revealed that willing to pay for water from the improved water supply scheme by a majority of sample households were in the range of Tsh. 10 or 20 per 20 liter container as the maximum amount (refer to Chapter 4 for detail).

In this section, the analysis is made for the applicability of alternative technologies of rural/peri-urban water supply services with respect to the WTP aspects. *Figures 9.5* and *9.6* indicate, respectively for Coast Region and Dar es Salaam Region, the variation in water tariff set to achieve full cost recovery for operation and maintenance of piped scheme (level-2), and estimated O&M cost recovery ratio over 10 years, in which the projection are given by the current size of population and Regions (2002). For the setting and projection of water tariff, the following conditions and assumptions are made; 1) water tariff is estimated in Tsh. per liter, 2) full cost recovery for operation and maintenance shall be achieved over 10 years (2010-2020), 3) 80 percent of community member consumes 25 liter/capita/day, and pay for the same amount consumed, and, 4) population increase over 10 years is taken into account in tariff setting. On the contrary, for the estimation and projection of O&M cost recovery ratio, the following conditions and assumptions are made; 1) water tariff is set at Tsh. 1 per liter, assumed as the maximum amount of willing to pay by the communities, 2) period for O&M cost recovery is set for 10 years (2010-2020), 3) 80 percent of community members consume 25 liter/capita/day, and pay for the same amount consumed, 4) population increase over 10 years is taken into account in O&M cost to be collected.

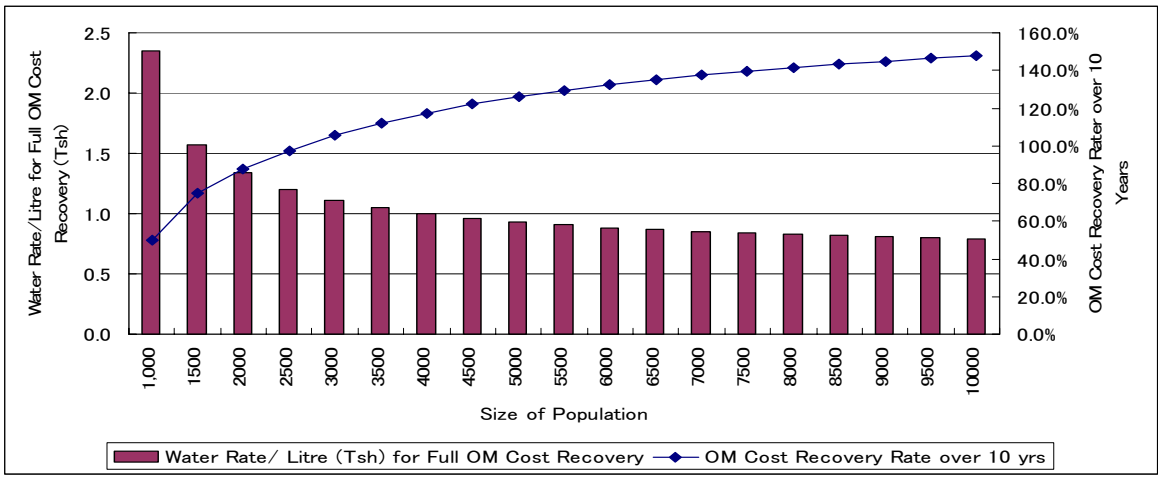

Figure 9.5 Water Tariff set for Full O&M Cost Recovery and O&M Cost Recovery Ratio over 10 years (2010-2020) in Coast Region

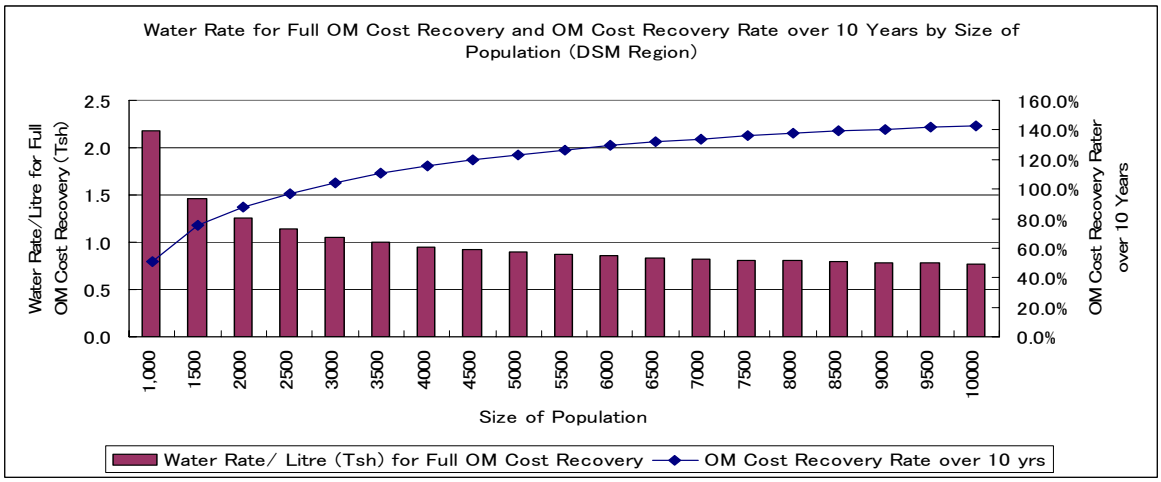

Figure 9.6 Water Tariff set for Full O&M Cost Recovery and O&M Cost Recovery Ratio over 10 years (2010-2020) in Dar es Salaam Region

As could be observed, water tariff becomes less than Tsh. 1 per liter for the communities exceeding population of 4,000 in Coast Region and 3,500 in Dar es Salaam Region, while full cost recovery for operation and maintenance is expected for the communities exceeding population of 2,500 in both Coast and Dar es Salaam Regions.

(3) Findings of Affordability- and Willingness-to-Pay Analysis

Based on the analysis made in this section on operation and maintenance cost, and applicability and sustainability of piped scheme (Level-2) and hand pump on borehole (level-1), the following findings can be made for each Region. In principle, both in the Coast and Dar es Salaam Regions, it is highlighted that communities exceeding population size of 2,500 are suitable and applicable for the provision of piped water supply scheme (Level-2) with full O&M cost recovery. In case of hand pump option (Level-1) it is promising in both affordability- and willingness-to pay aspects.

The followings are findings in Coast Region:

– Application of piped scheme (level-2) in Coast Region requires further examination since the operation and maintenance cost might exceed the affordability-to-pay (ATP) of

the target communities, while O&M cost for hand pump (Level-1) option falls within their ATP.

- Full cost recovery for O&M in piped water supply scheme (Level-2) in Coast Region can be achieved in communities exceeding population of 2,500, while full cost recovery with tariff set at one Tsh. per liter is possible in communities with population more than 4,000. The maximum amount of willing to pay by the communities is one Tsh. per liter.

The followings are findings in Dar es Salaam Region:

- Application of piped water supply scheme (Level-2) in Dar es Salaam Region is suitable for the communities exceeding population of 2,000 with respect to the ATP aspects.
- Full cost recovery for O&M in piped scheme in Dar es Salaam Region can be achieved in the communities exceeding population size of 2,500, while full cost recovery with tariff set at one Tsh. per liter is possible in the communities with population more than 3,500, provided the maximum amount which the communities are willing to pay remains at Tsh.1 per liter.

9.2.3 TARIFF COLLECTION MECHANISM

Tariff collection mechanism shall be also decided in a consultative manner with the communities, taking into consideration of its effectiveness and efficiency as well as socio-economic and socio-cultural aspects.

There are different types of tariffs which communities can choose. Socio-Economic Survey under the Study (JICA, 2005) indicates that half of the samples households prefer flat rate per litre or container as the billing method of water supply, while another 30% prefert flat rate per household per month.

Introduction of flat rate per litre or container with charge according to the volume of water consumed assures more fairness and equity for the users than the monthly flat rate per household. Still the monthly flat rate system is very simple and practical for non-metered point-source supply scheme such as borehole fitted with hand pump (Level-1).

For the piped water supply scheme (Level-2), meters are fitted in each domestic water points (water kiosks), which allows the introduction of metered rates based on actual amount of consumption. In the institutional setting suggested in the previous section, operation of domestic points can be contracted-out with service providers such as individual agents. Attendants at domestic water point sells water at flat rate per litre or container to the users, while COWSOs or Community Water Supply Management Entities would charge water bill to those service providers according to the volume of water sold at particular domestic water point.

Socio-Economic Survey (JICA, 2005) also reveals the community preference in the payment methods. 60% of the sampled households prefer to pay user fee at domestic water points. Accordingly, collection of fee at the domestic water points shall be introduced, employing attendants, in order to ensure proper tariff collection.

9.2.4 CONSIDERATION ON THE POOR AND INTRODUCTION OF INCREASING BLOCK TARIFF

Socio-Economic status is not homogeneous within and among the target communities of the project areas. As essence of the Study, significant considerations are given to the poor, thus, the priority project formulated by the Study shall be implemented, managed, and operated and maintained in a pro-poor manner.

As it is observed in previous sections, estimated expenditure for water consumption in Level-2 options exceed recommended share in total average income of four percent in Coast Region, though its ratio share in Dar es Salaam Region is lower. Furthermore, the 2000/01 Household Budget Survey reported that 18 percent and 46 percent of population live below the basic need poverty line in Coast Region and Dar es Salaam Region, respectively (People living below the basic needs poverty line are those classified as living on less than 9,203 Tsh a month or 329 Tsh a

day). Assuming water tariff is set at one Tsh per litre and consumption amounts to 30 litre per day per person, it accounts of just under 10 percent of monthly expenditure for people living on 9,203 Tsh a month.

Therefore, pro-poor tariff structure shall be formulated, while maintaining the user-pay-principle and sustainability in the scheme operation and maintenance. For this purpose, the Study suggests introduction of three correlated measures; 1) Introduction of increasing block tariff structure with lifeline minimum tariff, and 2) social aid for the poor identified by the community.

(1) Increasing Block Tariff Structure with Lifeline Minimum Tariff

Increasing block tariffs are commonly introduced in many metered water supply schemes (normally, it is applicable for Level-3: house connected water supply scheme). Increasing block structures charge successive block of consumption at different but increased volumetric rates per unit consumption. A steeply rising block ensures that those demanding most water are in the highest blocks and are meeting the cost of providing the additional capacity, while those consuming less water are in the lower blocks and are meeting the average cost of supply. The lowest block of consumption is termed a "lifeline" block (See *Figure 9.7*).

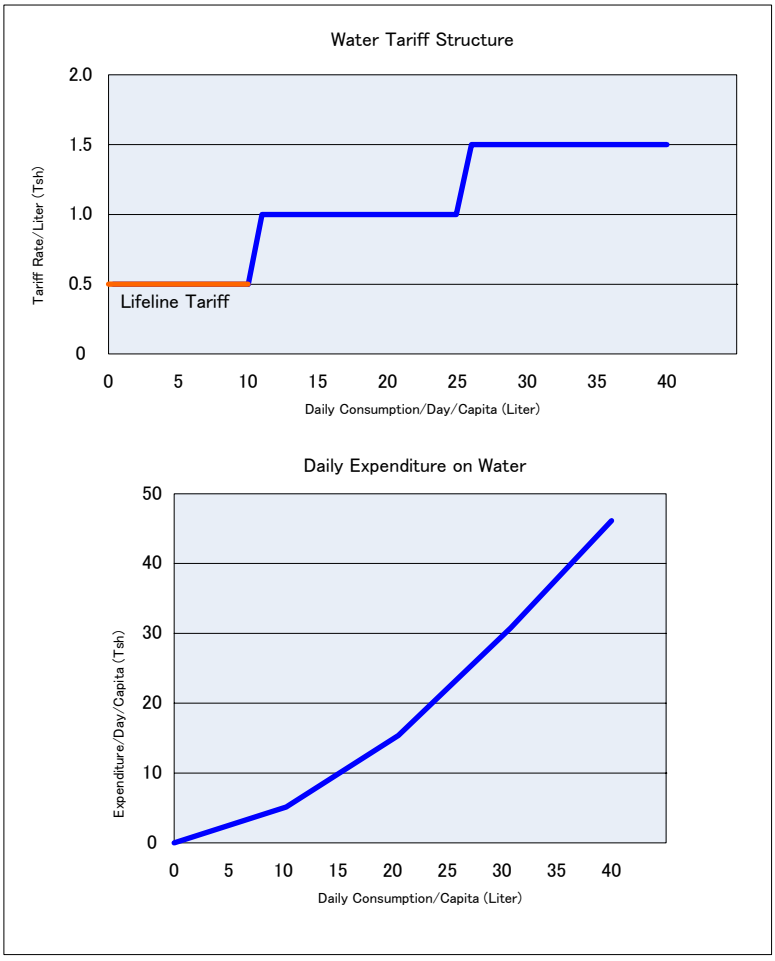

Figure 9.7 Increasing Block Tariff Structure

It is assumed that relatively better-off and business owners (i.e. market retailer, local restaurant, drinking bar, etc.) consume larger amount of water than the poor, paying for larger amount of water at higher block rate thereby cross subsidizing the minimum consumption by the poor. Lifeline block tariff shall be set at bare minimum level to ensure access to safe water for the poor, ideally at 50 percent of the estimated flat tariff (i.e. 1.0 Tsh per liter, thus, lifeline tariff is set at 0.5 Tsh per liter) up to 10 liter consumption per capita per day. It is also suggested that medium block rate is set at 1.0 Tsh per liter up to 20 liter consumption per capita per day, while higher block rate shall be

set at 1.5 Tsh per liter for more than 20 liter consumption per capita per day. In this tariff setting, the person just on the basic needs poverty line (living on 329 Tsh per day) would spend 4.5 percent and 3.0 percent of total income/expenditure for 20 liter and 15 liter consumption of water per capita per day, which is basically within the affordability to pay for water (i.e. 4 percent of income/expenditure). Although unit supply rate applied for the domestic water in the Study is 25 liter/day/capita, it is assumed the poor would cope with shortage by using alternative/existing water source for domestic use excluding drinking and cooking.

One of the challenges in the introduction of increasing block tariff in the priority project of the Study is its feasibility and applicability in the level-2 supply scheme, where the water fee is collected probably either at domestic water points (communal stand post) or by pre-paid system, while the introduction of block tariff structure is normally argued on the premise of metered individual house connection. However, introduction of increasing block tariff structure is feasible and applicable for tariff setting and collection in both Level-1 and Level-2 scheme management, if proper collection mechanism is used.

The credit card system is an option to introduce increasing block tariff and lifeline tariff in the Level-2 supply scheme. The users obtain the card at WUA (Water User Association) office or Service Provider's office by credit. The card is valid for one particular day, on which the number of bucket and incremental/payable amount is entered. Incremental/Payable amount is determined according to the concept of increasing block tariff structure and lifeline tariff, typically assuming the average number of a household is six persons and one bucket can contain 20 liter (See *Figure 9.8*). Thus, up to 3 buckets of water (i.e. 60 liter: 10 liter of lifeline/capita x 6 persons), tariff is set at 0.5 Tsh per liter. In the range of 4 to 6 buckets (i.e. 80 to 120 liter), tariff is set at 1 Tsh per liter, while the one exceeding 7 buckets is priced at 1.5 Tsh per liter.

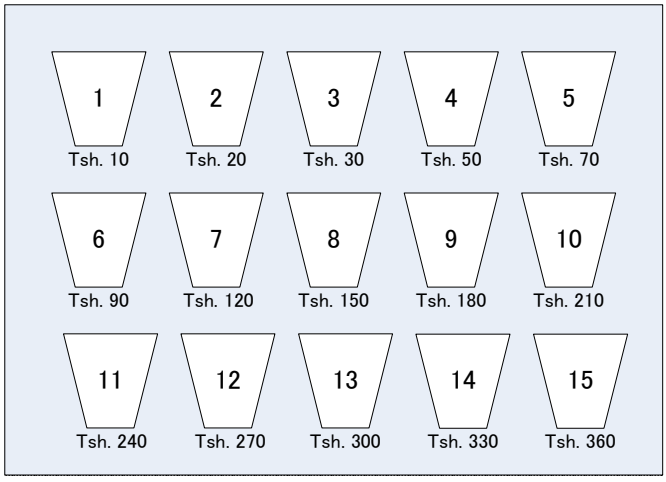

Figure 9.8 Sample of Credit Card

Caretakers or kiosk attendants at the domestic water points shall check on the card and tick the bucket-shaped columns one by one according to the consumption by users. For the users to obtain new cards on the following day, payable amount described under the bucket-shaped columns shall be paid, then, a new card is released by credit again. In the same manner, the credit cards "by week" and/or "by month" is designed, and users are allowed to select among those by their in accordance to their preference and affordability. This credit card system can introduce the increasing block tariff structure and lifeline tariff in the Level-2 supply system.

(2) Social Aid for the Poor

As for the affirmative countermeasure for the poorest of the poor, who are socially vulnerable such as disadvantaged and aged widows, mutual aid within the community shall be considered. There are several definitions for poor in the country employing different indicators such as income/expenditure, caloric intake, socio-economic vulnerability, and so forth. However, those

definitions and poverty lines are determined by outsiders. It can be also said that there is no universally agreeable definition and indicator on poverty.

The communities themselves can define the poorest of the poor developing their own indicators. For example, "wealth ranking", as one of the Participatory Rapid Appraisal (PRA) tools, can be carried out together with community members to identify the poorest of the poor with development of indicators and definition for the poorest. Those poorest identified by the community with community consensus will receive social aid for the provision of safe water in a manner determined by community.

9.3 CAPACITY DEVELOPMENT PLAN

9.3.1 EMPHASIS IN DEVELOPMENT OF FACILITATION AND CAPACITY BUILDING PLAN

In the proposed institutional framework and contractual set-up in management of the supply schemes, communities, as well as district/municipality administrations and private sector organisations including NGOs, are required to build their capacity and skills, of which particular focuses and concerns are given below:

- Communities' capacity to form and manage Community-Owned Water Supply Organizations (COWSOs), with preparation of regulations and by-laws in a participatory manner with stakeholders to define the functional roles of each organization, and legal registration to ensure their autonomy.
- Communities' capacity to manage contractual process and monitor the performance of Service Provider such as Service Contractor and Community Water Supply Management Entity.
- District/Municipality Council's capability to form and manage District Water and Sanitation Team (DWST), which provides technical and administrative guidance to the communities, support for the communities in contracting-out, and monitoring the performance of Service Providers.
- District/Municipality Council's competency to regulate contractual process between the communities and Service Providers, with setting standard contract format and performance targets.
- Service Providers' ability to provide particular services contracted-out with community, or entire scheme management in all aspects such as commercial system, institutional and administrative system, resource management and development system, financial system, as well as operation and maintenance system.
- COWSO's capacity to manage, and operate and maintain the supply scheme, when there is no Service Providers or contracting-out is not feasible such as leval-1 scheme, emphasizing on the skills in organizational management, technical operation and maintenance, and financial management.

Socio-Economic Survey conducted under the Study revealed relatively fair awareness among the sampled communities in user-pay-principle, with 50% agreeing that primary responsibility on cost recovery of O&M should be borne by the users or Village Water Committee or other form of user group. Still, another 20% responded that village government or both users and local authorities should be responsible for cost recovery for O&M. Therefore, increase in community awareness on user-pay-principle in the provision of supply services is required. The plan shall also include strategy and countermeasures to address the issue.

In the contractual and institutional set-up proposed in the Study, which is the best applicable for the management of Level-2 system, its efficiency, effectiveness, and thus sustainability is based on matured relationship between consumers and service providers. The institutional set-up system arrangement separates consumers and service providers, not like in the set-up applied in other community water supply scheme. This set-up presumes consumers increased awareness on the

need to pay for the quality supply services, while providers continue to provide supply service satisfactory to the consumers. This mutual and matured relationship will increase the awareness among consumers (i.e. communities) on user-pay-principle, while enhancing providers' capacity and competency for sustainable service provision with accountability and transparency in the management. In the development of suggested contractual and institutional set-up, due attention shall be given to build-in the mechanism to assure accountability and transparency in the management of Service Providers.

Furthermore, promotion of personal sanitation and hygiene practices shall be incorporated in the formation of the Facilitation and Capacity Building Plan, in order to maximize the impact in health and sanitation enhancement brought by the improved water supply system. Indeed, it could be a fact that this sector component receives very much priority in practice than water supply. This, and the fact that most sanitation and hygiene promotion efforts are half-hearted, and caused most such campaign to fail in the past (MoWLD, 2004). Promotion of personal sanitation and hygiene practice through awareness building is required not only for realization of benefits in health and sanitation, but also for enhancing the sustainability of the water supply scheme. Decrease in the number of consumers of improved supply schemes in rain seasons are well known phenomenon not only in Tanzania but also in other developing countries. Consumers tend to resort back to their traditional (unprotected) and unsafe water source in rainy seasons, saving the expenditure for the use of improved water supply scheme. It decreases fee collection for operation and maintenance of the scheme. Also, from the view point of sustainability of the scheme running, increasing the awareness of communities on the importance of health and sanitation is essential, which shall be achieved with conducting health and sanitation education program.

In the following section, strategies and methodologies on the issues above are further described with introduction of proposed activities and expected results. Also, some consideration on capital cost recovery aspects of the supply scheme with community contribution is made in the last part of the section.

9.3.2 STRATEGY

The development of Facilitation and Capacity Building Plan shall be coherent with National Water Policy (2002), Draft National Water Sector Development Strategy (2004), and other national sector programs. In particular, the plan shall contribute to and allow; 1) strengthening decentralized planning with project implementation and management through local government, 2) developing capacity in the demand-response approach based on community-owned management of the water supply scheme with contracting-out of part or all of the operation and maintenance responsibilities to private sector organizations, individuals, or to NGOs whenever it is applicable and effective, 3) increasing the capacity for sustained delivery of goods and services by developing and utilizing local private sector capacities in facilitation, engineering, construction, spare parts distribution, and management, operation and maintenance of the water supply schemes, 4) developing capacity of District/Municipal Councils to regulate Service Providers with preparation of standard regulation guidelines and setting of standard performance targets/indicators, and 5) a strategy for national hygiene and sanitation awareness enhancement education.

9.3.3 METHODOLOGY

A variety of methods and tools and validated information from different sources are utilized in the preparation of the Plan. Participatory tools, of which effectiveness and efficiency is widely recognized in the country, such as Participatory Rapid Appraisal (PRA) are employed in particular for the community facilitation and capacity building, as well as Participatory Health and Sanitation Transformation (PHAST) for promotion of personal hygiene and sanitation practices.

9.3.4 APPROACH

The following approaches shall be dully considered and applied during the later stages of implementation, and monitoring and evaluation of the actual project intervention plans.

(1) Advocacy and Consensus Building

Consensus shall be made among stakeholders on newly introduced institutional framework and contractual set-up prior to their implementation. Advantages and disadvantages of each options described prior shall be fully analyzed and understood. Those stakeholders include MoWLD, District/Municipal Council, Ward- and Village-level local authorities, other Donors and NGOs involved in the water supply development projects in the Study Area. In particular, consensus shall be well established with District/Municipal Council, which is primarily responsible for the implementation of the Plan, and later among local authorities, Village Councils, village leaders, influential persons, local politicians and councilors to facilitate sustained running of the water supply schemes.

(2) Enhanced Private Sector Participation and Contracting-Out

In the introduction of suggested institutional framework for management, and operation and maintenance of the water supply scheme, several contractual arrangements shall be made between Community-Owned Water Supply Organizations (COWSOs) and Service Providers. Contractual arrangements may vary from service contract, where only a part of services are contracted out, to the management contract where the entire management of the scheme is contracted-out to the Service Providers such as Community Water Supply Management Entity (i.e. Water Company by Guarantee, Local NGOs, and Private Agents). For those contractual arrangements to be effective, support from District/Municipal Council, through District Water and Sanitation Team (DWST), shall be a prerequisite, particularly on the provision of technical guidance to COWSOs for contracting-out, and on regulation and the performance monitoring of those Service Providers. There is also needs in development of standard performance targets and setting of performance indicators on the quality and quantity of the service provision by the Service Providers. In addition, the service provider shall preferably be selected through open bidding and tender procedure wherever it is practical, which shall be supported by the District/Municipal Councils.

Therefore, it is obvious that development of guidelines for contracting-out and their adoption by the District/Municipal Council is required for the process management, standardized regulation, and performance monitoring. It is recommended that those guidelines include the following items; 1) options of community contracting-out and community consultation for the selection of the suitable option (i.e. service contract, management contract, lease contract, concession), 2) identification of private sector partners (i.e. local artisans, private agents, technical service providers, private companies, local NGOs, and others), 3) public consultation and consensus building for contracting-out, 4) tender/bidding procedures (i.e. public notification, invitation for tender, pre-qualification, tender format, tender evaluation, selection of contractor, contract documents, etc.), 5) standard performance target and parameters/indicators, 6) regulation and monitoring on the performance of Service Providers, and, 7) roles and responsibilities of COWSOs and District/Municipal Councils in contracting-out. Those guidelines shall be utilized in training for the capacity building of District Water and Sanitation Team (DWST) to facilitate effective contracting-out to community and the subsequent provision of guidance to community.

(3) Capacity Building of District Water and Sanitation Team (DWST)

Facilitation and capacity building of the communities in management of community-owned water supply scheme is one of major roles of District Water and Sanitation Team (DWST) in the proposed institutional framework. While attempts to form and develop capacity of DWST have been made in some other district, in the target District and Municipality, the initiative is not yet undertaken. Thus, the needs are identified on capacity building and strengthening of DWST in

order to facilitate subsequent capacity development of the communities.

For the communities selected for the option of management contract with Community Water Supply management Entity, where entire scheme management is contracted-out, need for capacity building of communities in scheme management is relatively low. Perhaps, as described in the previous section, provision of the technical and administrative guidance and support for contracting-out and skill development in performance monitoring and audit might be adequate.

However, for the communities selected of the option of contract with Service Provider, where part of operation and maintenance is contracted-out and the communities shall take major responsibility in service provision, or those opted for self-management, the requirements for capacity building and strengthening of the communities become higher and broader. Moreover, such skills development is important for DWST as well. Necessity of capacity strengthening for DWST shall include the following aspects; 1) community mobilization and communication, 2) group dynamics, community leadership, and organizational management, 3) technical operation and maintenance, 4) tariff setting and collection, 5) accounting and financial management, 6) hygiene and sanitation education skills, and 7) community monitoring and evaluation. Manuals for community facilitation on these aspects have already been developed by MoWLD, which shall be utilized for in field implementation of capacity building.

(4) Capacity Building of Community-Owned Water Supply Organizations

Community-Owned Water Supply Organizations (COWSOs) will be bodies legally constituted by a community to own, manage, operate and maintain the water supply systems on behalf of community. These bodies may take various legal forms, such as Water Users Association or Water Trusts, and their establishment will be promoted through the local government framework of district and village councils. COWSOs will take major roles in management, and operation and maintenance with contracting-out part or all of their operation and maintenance responsibilities to private Service Providers as proposed in the institutional frameworks.

Needs for capacity building for established COWSOs varies by their institutional and contractual settings. COWSOs without any contractual arrangements, which is applicable for operation and maintenance of hand pump scheme (level-1), requires the following capacity building packages; 1) preparation of regulation/by-laws and registration, 2) group dynamics, communication, and leadership skills, 3) organizational management, 4) preventive maintenance, 5) tariff setting and collection, 6) financial aspects such as budgeting and accounting, 7) hygiene and sanitation education skill, and 8) community monitoring and evaluation. On the other hand, for COWSOs with contractual arrangement for part or all of their operation and maintenance, focuses in capacity building, in addition to the above, are as follows; 1) negotiation and interaction, 2) contract development and management, 3) performance target setting, and 4) performance indicator development and monitoring.

(5) Promotion of Personal Hygiene and Sanitation Practices

Facilitation and Capacity Development Plan shall include improvement of community awareness on health and sanitation with the use of safe water and the relevant alteration of personal behavior toward more improved hygienic practices. In the promotion of personal hygiene and sanitation practices, participatory hygiene and sanitation education tool, PHAST (Participatory Health and Sanitation Transformation) shall be introduced. PHAST is efficient and effective, which has already been widely used in the health and sanitation sector, to enhance understanding of communities on correlation between improved personal hygiene and sanitation practice and decrease in water-borne diseases.

Community Owned Resource Persons (CORPs) will be selected in the community and provided with training in PHAST skills, who will provide hygiene and sanitation education for their community.

9.3.5 ACTIVITIES AND EXPECTED OUTPUT

Facilitation and capacity building packages varies with the COWSOs' institutional and contractual arrangement. Therefore, proposed activities and expected output under Facilitation and Capacity Building Plan is described both for COWSO without any contractual arrangement that is suitable for operation and maintenance of hand pump water supply scheme (Level-1), and ones with contractual arrangement that is applicable for management of piped water supply scheme (Level-2).

(1) Facilitation and Capacity Building Package for Level-1 and Expected Output

For a COWSO where the Service Providers are unavailable or contracting-out is not feasible such as level-1 scheme, its capacity in organizational management, technical operation and maintenance, and financial management shall be fully developed. Facilitation and capacity building package for these institutional and contractual setting is described in *Table9.3* with expected output. Field activities are undertaken by DWST formed and trained under the implementation of Facilitation and Capacity Development Plan.

Table 9.3 Facilitation and Capacity Building Package for Level-1 and Output

Activity	Output
Stage 1: Pre-Planning	
Preparation of Field Impremention Manual	– Field Implementation Manual to be utilized by DWST in the implementation of activities under the Plan is developed.
Formation of District Water and Sanitation Team (DWST)	– DWST, which composes of District/Municipal Council staff involved in the development of the sector, is formed and integrated approaches can be introduced.
Provision of Training of Trainers (TOT) for DWST, and preparation of DWST Action Plan	– Utilizing Field Implementation Manual, facilitation skills of DWST are improved, and DWST Action Plan for the implementation of Facilitation and Capacity Development Plan is prepared.
Initial Advocacy Seminar with Stakeholders	– Stakeholders fully understand concepts in National Water Policy (2002) and National Water Sector Development Strategy (2004). – Concensus is made among stakeholders in introduction of the proposed institutional and contractual arrangements for improvement of scheme management.
Stage 2: Participatory Planning	
Community Consultative Meeting	– Target communities understand project purpose, expected output, and detail activities and participation is enhanced. – In particular, user-pay-principle is understood.
Participatory Community Assessment, and preparation of Community Action Plan (CAP)	– Risks and problems in management, operation and maintenance of the improved water supply scheme are identified and Community Action Plan (CAP), which indicate community task and means of implementation, is developed in a participatory manner.
Community Consultation on COWSO Management Option and Contractual Arrangement	– Most suitable, effective and efficient COWSO management option to manage the improved supply scheme is identified and adopted. – Contractual arrengement is determined, identifying the part or all of operation and maintenance to be contracted-out.
Development of COWSO Regulations and Registration	– COWSO regulations are prepared and adopted – COWSO is legally registered.

Activity	Output
Stage 3: Construction/Implementation	
Capacity Building of COWSO in Operation and Maintenance, and Hygiene and Sanitation Education	– Capacity of COWSO in management, operation and maintenance is enhanced particularly in; 1) group dynamics, communication, and leadership skills, 2) organizational management skills, 3) preventive maintenance, 4) tariff setting and collection, 5) financial aspects such as budgeting and accounting, and 6) community monitoring and evaluation. – CORPs (Community Resource Persons) are trained in PHAST (Participatory Health and Sanitation Transformation)
Stage 4: Operation and Maintenance	
Follow-up Training for COWSO	– Through the actual operation and maintenance of improved water supply scheme, weakness in management and additional training needs are identified. – Additional training program is provided and management is strengthened.
Stage 5: Monitoring and Follow-up	
Regular Follow-Up by DWST	– COWSO management is monitored and sustained.

(2) Facilitation and Capacity Building Package for Level-2 and Expected Output

For the communities selecting COWSO management options with contractual arrangement with Service Providers for part or all of operation and maintenance of the water supply scheme, emphasis in the design of capacity building program has to be put on management of the contractual process including setting of performance target and indicator, monitoring, and regulations. It is also important that capacity of Service Providers, such as private agents, local NGOs, and private company, are enhanced in management, and operation and maintenance of contracted-out works. As it is insisted in the Study, contracting-out is advocated for the management of piped scheme (level-2). *Table 9.4* indicates proposed activities involved in the Facilitation and Capacity Building Plan for the piped scheme (level-2) for COWSOs using contractual arrangements.

Table 9.4 Facilitation and Capacity Building Package for Level-2 and Output

Activity	Output
Stage 1: Pre-Planning	
Preparation of Guideline for Contracting-Out	– Guideline for contractual process, such as identification of Service Provider, bidding, bid evaluation, standard contract formats, are developed. – Standard performance targets and indicators are developed. – Regulation for Service Providers are developed with effective monitoring mechanism.
Adoption of the Guideline for Contracting-Out in the Local Government Framework	– Guideline for contracting-out is adopted by District/Municipal Council and Ministry of Water and Livestock Development.
Preparation of Field Impremention Manual	– Field Implementation Manual to be utilized by DWST in the implementation of activities under the Plan is developed.
Formation of District Water and Sanitation Team (DWST)	– DWST, which composes of District/Municipal Council staff involved in the development of the sector, is formed and integrated approaches are introduced.
Provision of Training of Trainers (TOT) for DWST, and preparation of DWST Action Plan	– Utilizing Field Implementation Manual, facilitation skills of DWST are improved, and DWST Action Plan for the implementation of Facilitation and Capacity Development Plan is prepared. – Utilizing the Guideline for Contracting-Out, capacity of DWST in managing contractual process, such as setting of performance target and indicator, regulation, and performance monitoring, is developed.

Activity	Output
Initial Advocacy Seminar with Stakeholders	– Stakeholders fully understand concepts in National Water Policy (2002) and National Water Sector Development Strategy (2004). – Concensus is made among stakeholders in the introduction of proposed institutional and contractual arrangements for improvement of scheme management.
Stage 2: Participatory Planning	
Community Consultative Meeting	– Target communities understand project purpose, expected output, and activities and participation are enhanced. – In particular, user-pay-principle is understood.
Participatory Community Assessment, and preparation of Community Action Plan (CAP)	– Risks and problems in management, operation and maintenance of the improved water supply scheme are identified, and Community Action Plan (CAP), which identify community task and means of implementation, is developed in a participatory manner.
Community Consultation on COWSO Management Option and Contractual Arrangement	– Most suitable, effective and efficient COWSO management option to manage the improved supply scheme is identified and adopted. – Contractual arrengement is determined, identifying the part or all of operation and maintenance to be contracted-out.
Development of COWSO Regulations and Registration	– COWSO regurations are prepared and adopted. – COWSO is legally registered.
Stage 3: Construction/Implementation	
Capacity Building of COWSO in Operation and Maintenance, and Hygiene and Sanitation Education	– Capacity of COWSO in management, operation and maintenance is enhanced particularly in; 1) group dynamics, communication, and leadership, 2) organizational management, 3) preventive maintenance, 4) tariff setting and collection, 5) financial aspects such as budgeting and accounting, and 6) community monitoring and evaluation. – CORPs (Community Resource Persons) are trained in PHAST (Participatory Health and Sanitation Transformation)
Community Contracting-Out	– Service Providers are identified. – Bidding is conducted, and Service Providers are selected. – Contract for operation and maintenance of the entire water supply selected part of the scheme is concluded among the Provider, COWSO, and the District/Municipal Council.
Stage 4: Operation and Maintenance	
Performance Monitoring for Service Providers	– Performance of Service Provider is monitored with indicators.
Follow-up Training for COWSO	– Through the actual operation and maintenance of improved water supply scheme, weakness in management and additional training needs are identified. – Additional training pragram is provided and management is strengthened.
Stage 5: Monitoring and Follow-up	
Regular Follow-Up by DWST	– Performance of Service Provider is monitored and sustained – COWSO management is monitored and sustained.

9.3.6 IMPLEMENTATION ARRANGEMENTS

For the introduction of Capacity Development Plan, various options in institutional and implementation arrangement are considered. Activities in Stage 1 of Pre-Planning up to Stage 3 of Construction/Implementation could be efficiently implemented, if external assistance is applied. This implementation arrangement would assure effective and timely execution of project up to completion of construction works. There is also other option for execution of the said stages. In particular, activities requiring relatively dedicated expertise, such as preparation of guideline for private sector participation (i.e. contract-out) and its introduction, could be more effectively carried out by hiring consultants apart from the design and construction supervision works. In this arrangement, effective coordination with the design and construction supervision works is required.

On the other hand, activities in Stage 4 of Operation and Maintenance and Stage 5 of Monitoring and Follow-up would be carried out by the local government, namely DWSTs, as the responsible institution for the provision of technical guidance and follow-up/monitoring for COWSOs and Service Providers.

9.3.7 CONSIDERATION ON COMMUNITY CONTRIBUTION

In the implementation of water supply and sanitation project in Tanzania, it has become a rather common strategy, or as prerequisite for the provision of service scheme, that the community contribute five percent of the construction cost of the water supply scheme in cash, and its encouragement is often incorporated in the facilitation program in many projects. It is believed that this practice increases the awareness of the community in ownership and, thus, participation. The Facilitation and Capacity Building Plan in the Study shall also encourage community contribution.

When the institutional modality and conventional system of the development assistance by the External Support Agencies (ESAs) allows, community contribution is encouraged and be incorporated in the pre-planning and participatory planning stages (Stage 1 and 2) mentioned in the facilitation and capacity building program in the previous section. District/Municipal council shall open a bank account, which may be called as District Water and Sanitation Fund (DWSF), and manage the fund contributed by the community. Communities which satisfy the condition can be selected as the target of water supply service provision. Then, District/Municipal Council will conduct initial procurement for the construction of supply scheme utilizing the DWSF in collaboration with External Support Agency (donor agency or NGOs).

However, in the case where the system of external development assistance is not suited for such an arrangement, like Japanese Official Grant Aid, further consideration is necessary in the introduction of community contribution. Difficulties and complications in the introduction of community contribution and finalization of target communities are mainly associated with rigidness in funding mechanism. Thus, there would be two options to overcome the complication. One is to include the process of community contribution and finalization of target communities in the basic design stages. The other is to implement the Facilitation and Capacity Building program prior to the basic design.

In case that the process of community contribution and determination of target communities are incorporated in the basic design, the study period can be divided into two stages. In the first stage of the study, the Facilitation and Capacity Building program including encouragement of community contribution is implemented. Taking into consideration that the communities are normally allowed for six months for the accumulation of contribution fund, the second stage of basic design can be followed after this six months period. In the second stage of the study, the communities satisfying the condition can be confirmed, and target communities be finalized.

On the other hand, in case of implementing the Facilitation and Capacity Building program prior to the basic design study, the component shall be undertaken by different scheme in terms of funding. However, the basic concept is same as described for the two-staged basic design of above. In this case, closer collaboration of two schemes is much required.

Although these two options to introduce finalization of target communities through encouragement of community contribution for capital cost sharing is practised, its applicability under Japanese Grant Aid Scheme may be impractical since practice would delay the implementation of Priority Projects. Therefore, this issue requires further consideration and consultation with stakeholders.

However, it can be said that capital cost sharing with community is not the only way to increase community participation and awareness in community ownership. There are several other approaches to increase sense of community ownership through community contribution, which may applicable for Japanese Grant Aid, such as; 1) voluntary labour contribution in the construction work, 2) contribution in procurement of construction material, and 3) accumulation of maintenance fund prior to the construction. However, these options also require further

consideration. Labour and material contribution may not always be practical to utilize available resources in the community. Also, these practices of labour and material contribution may affect quality and time schedule management of the project execution, of which satisfaction is one of the major concern in the implementation of project under Japanese Grant Aid Scheme. Furthermore, it may confuse and obscure the responsibilities to guarantee the quality of work among contractors, communities, and implementing agency.

Table 9.5 shows the forms of community contribution and consideration in their introduction under Japanese Grant Aid Scheme.

Table 9.5 Forms of Community Contribution and Consideration in Their Introduction under Japanese Grant Aid Scheme

Form of Community Contribution	Considerations
Capital Cost Sharing	– It may considerably increase the sense of community ownership. – Process of capital cost sharing and finalization of target communities can be included in the basic design study, or implemented as other program. However, its practice prolongs the implementation of the project in the identified needy areas. – The fund accumulated by the communities as capital cost can not be utilized and incorporated in the funding mechanism of Japanese Grant Aid Scheme. – Management and transaction of capital cost, shared by the donor agencies and the community, is undertaken most effectively in the local government framework, by creating and managing account by District/Municipal Council, of which practice is not suited in the funding mechanism of Japanese Grant Aid.
Labor Contribution in the Construction	– It may not necessarily increase the sense of community ownership, if communities are pressed in an obligatory manner for contribution. – Quality control and schedule management of the construction works become difficult. – Responsibility of Japanese contractor in the warranty for the project works becomes unclear.
Material Contribution	– It may not necessarily increase the sense of community ownership, if communities are pressed in an obligatory manner for contribution. – Locally available material may be limited in the particular areas. – Quality of the contributed material is not guaranteed. – Responsibility of Japanese contractor in the warranty for the project works becomes unclear.
Accumulation of Maintenance Fund prior to the Construction	– It may also increase the sense of ownership if facilitation is undertaken in an effective and participatory manner. – It is applicable in the Japanese Grant Aid Scheme. – It can not be a prerequisite for the selection of target communities for project implementation under the Japanese Grant Aid.

Among those options in community contribution, accumulation of maintenance fund prior to the construction should be best practice under Japanese Grant Aid Scheme both in modality and to increase the sense of community ownership/participation. The target communities are encouraged to accumulate a certain amount of maintenance fund prior to the construction. Utilization of this maintenance fund shall be limited for future expansion and major rehabilitation of the water supply scheme, and not for daily operation and maintenance. Accumulation of the fund is not a prerequisite for the project implementation, but one for transition of legal ownership of the scheme to COWSOs (Community-Owned Water Supply Organizations). In this manner, the sense of ownership/participation is enhanced, conforming the modality of Japanese Grant Aid Scheme.

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Chapter 10

Evaluation of Priority Project

CHAPTER 10 EVALUATION OF PRIORITY PROJECT

10.1 GENERAL

In this Chapter, the Priority Project is evaluated from the view points of (1) socio-economic, (2) financial, (3) institutional and organizational, (4) management and maintenance, (5) Social and Environmental Aspects and (6) Technical Appropriateness.

10.2 ECONOMICAL AND FINANCIAL EVALUATION

10.2.1 ECONOMICAL EVALUATION

In this section, feasibility of the priority project for Coast Region and Dar es Salaam Region is analyzed and evaluated from the aspects of economic cost and benefit. The priority project aims to provide safe and stable water supply to 14 communities in Coast Region and 8 communities located in Dar es Salaam Region which are in acute need of improved water supply among the surveyed villages. The cost-benefit analysis was applied for the evaluation of the project based on the calculation of economic cost and benefit converted into the monetary value.

(1) Precondition of the Evaluation

Factors considered in the evaluation are as follows:

1) The economic cost and benefit were estimated based on comparison of the cases of "With Project " and "Without Project". In the "With Project Case", the priority project is implemented in the target villages and 22 piped water supply schemes, 12 schemes in Coast and 20 schemes in Dar es Salaam, are constructed. Meanwhile, in the "Without Project Case", it is considered that the community members in the target villages will continue to use existing water sources without the implementation of improved water supply schemes.
2) The entire priority project is planned to be implemented during the period of 2006-2008 according to the implementation plan (See Chapter 7). Two years are allocated for construction of the piped water supply schemes in the target villages in each region. The project life (evaluation period) is set at 22 years considering two years for the project implementation and 20 years of economic life span of the water supply facilities to be constructed in the project.
3) The estimated cost and benefit of the project were converted from the market prices, which were used for financial evaluation, into the economic prices using the discount rate of 12%.
4) The foreign exchange rates of US$1 = Tsh1,050 and US$1= JY112.47 were applied for currency conversion.
5) Net Present Value (NPV), Benefit Cost Ratio (B/C Ratio) and Economic Internal Rate of Return (EIRR) were calculated to be used as the indicators of the economic evaluation.

(2) Economic Cost

Components considered as the economic cost are listed below:

1) Investment costs for construction works and engineering services
2) Replacement costs of pump, power source, pump house, rising main and distribution facilities such as pipes and public water points
3) Operation, management and maintenance costs such as spare parts, fuel, chemicals, personnel expenses, commission for COWSO and management/service contract fees.

Cost for acquisition of land required for the project is not included in the investment costs since it is assumed to be secured by the recipient country free of charge. Replacement cost for water tanks and development of new or additional water source for the constructed water schemes are not included in the economic cost. Furthermore, taxes, interest and inflation rates are not considered in the analysis.

(3) Economic Benefit

As the economic benefit of the project, four factors listed below were considered. Findings from the socio-economic survey and village inventory survey as well as existing document review were utilized in making the assumption for conversion of these project effects into the monetary value. The estimated economic benefit in annual per capita amount is indicated in *Tables 10.1* and *10.2*.

1) Time saving of water fetching from the existing water sources

In case that the project is implemented, it is assumed that the residents can save costs currently spent to obtain domestic water from the existing water sources. This benefit can be considered from the aspects of reduction of the opportunity cost to be allocated for time spent on water fetching and decrease in actual cost incurred to obtain water from water vendors.

According to the village inventory data, existing water sources for the target communities are mainly unprotected shallow well, rivers/streams/ponds/dams, and water vendors. Frequency of water fetching by the households is 3.8 times a day in Coast Region and 3.3 times a day in Dar es Salaam as per the results of the socio-economic survey. Based on the information on time spent on water fetching per household per trip and frequency of water collection, average time spent by a household per day is estimated as 5.3 hours in Coast Region and 3.1 hours in Dar es Salaam, and the relevant of per capita time is computed as 1.05 hours (Coast) and 0.5 hours (Dar es Salaam) by considering average number of household members in each region. These figures include both the time required to access to and return from water source, and queuing at the source to draw water.

The amount to be saved consequent to the proposed water supply schemes is calculated by applying the minimum rural wage of Tanzania, which is equivalent to 30 US Dollars/month. In light of low opportunity to utilize the saved time for other economic activities in the target areas, only 40 percent of the rate is applied to convert the time into the monetary value.

2) Cost saving for obtaining domestic water from alternative source

Amount of the cost to be saved for obtaining water from existing water source is estimated from present situation on financing for water by the households in the study area. The socio-economic survey results show that the daily expenditure of household to obtain domestic water is Tsh104.35 in Coast and Tsh386.5 in Dar es Salaam. Users of existing piped water scheme are not considered in this estimation.

It should be noted that per capita annual amount of cost saving from the use of existing sources is affected not only by per capita water consumption and unit cost of water but also the percentage of users who are not spending money to obtain water. The present volume of water consumption for domestic use is almost the same in two regions (i.e. 20 liter/capita/day in Coast Region and 22 liter/capita/day in Dar es Salaam Region). Also, the unit cost of water is almost the same in both regions such as Tsh 1/ liter for the use of unprotected or protected shallow well and borehole with handpump, and Tsh 6-7/ liter on average for water sold by the water vendors. Meanwhile, percentage of households spending money to obtain domestic water is about 30% in Coast Region and 63% in Dar es Salaam. This factor has lowered per capita annual amount of the cost saving in Coast region to one third of the amount of Dar es Salaam.

3) Increase in water quantity to be used by the users

In case that the new water supply schemes are constructed by the project, it is expected that water volume to be supplied to the target communities will increase while costs of such water will decrease. This incremental benefit is estimated from the amount of Willingness to Pay

(WTP) of the communities toward additional water demand for domestic use which can be satisfied by the improved water supply scheme. Approximately 35liter/household/day and 63 liter/household/day were considered as the additional water demand in Coast region and Dar es Salaam region, respectively.

Table 10.1 Estimated Economic Benefit for Coast Region

Item (Benefit)	Annual Amount / Capita (USD)	Percentage	Assumption
Time-saving of water fetching from the existing water sources	28.7	69.4%	1) 1.05 hour/day/capita is being spent to obtain water from existing water sources (Village Inventory Survey, JICA, 2004, and Socio-Economic Survey, JICA, 2004). 2) 40 percent of minimum rural wage (USD 30/ month) is applied to convert the time saved into monetary value. (USD30 / 20 working days/ 8 working hours = USD 0.1875 as minimum rural wage per hour) 3) Average household population is 5.0 persons (Socio-Economic Survey, JICA 2004).
Cost saving in obtaining water for domestic use from alternative source	7.3	17.5%	1) Tsh. 104.35/day/household is spent to obtain water for domestic use. (Socio-Economic Survey, JICA, 2004) 2) Average household population is 5.0 persons (Socio-Economic Survey, JICA 2004).
Increase in water quantity to be used by the users	2.7	6.4%	1) Additional water demand for domestic use is 35.7 litre/household in case the improved water supply facility is constructed. (Socio-Economic Survey, JICA 2004) 2) Amount of willingness to Pay (WTP) for the improved water supply service is Tsh1.075/ liter (Socio-Economic Survey, JICA 2004). 3) Average household population is 5.0 persons (Socio-Economic Survey, JICA 2004).
Cost saving in medical expense due to public health improvement	2.8	6.7%	1) Tsh 3,016/household/month is spent for medical expense (Socio-Economic Survey, JICA, 2004) 2) Average household population is 5.0 persons (Socio-Economic Survey, JICA, 2004). 3) 40 percent of medical expense will be saved.
TOTAL	**41.4**	100%	

Exchange Rate: US$1 = Tsh1,050

Table 10.2 Estimated Economic Benefit for Dar es Salaam Region

Item (Benefit)	Annual Amount / Capita (USD)	Percentage	Assumption
Time-saving of water fetching from the existing water sources	13.7	29.8%	1) 0.50 hour/day/capita is being spent to obtain water from existing water sources (Village Inventory Survey, JICA, 2004, and Socio-Economic Survey, JICA, 2004). 2) 40 percent of minimum rural wage (USD 30/ month) is applied to convert the time saved into monetary value. (USD30 / 20 working days/ 8 working hours = USD 0.1875 as minimum rural wage per hour) 3) Average household population is 6.0 persons (Socio-Economic Survey, JICA 2004).
Cost saving in obtaining water for domestic use from alternative source	22.4	48.8%	1) Tsh. 386.5/day/household is spent to obtain water for domestic use (Socio-Economic Survey, JICA, 2004). 2) Average household population is 6.0 persons (Socio-Economic Survey, JICA 2004).
Increase in water quantity to be used by the users	4.2	9.1%	1) Additional water demand for domestic use is 63.5 liter/household in case the improved water supply facility is constructed (Socio-Economic Survey, JICA 2004). 2) Amount of willingness to Pay (WTP) for the improved water supply service is Tsh1.133/ liter (Socio-Economic Survey, JICA 2004). 3) Average household population is 6.0 persons (Socio-Economic Survey, JICA 2004).

Cost saving in medical expense due to public health improvement	5.6	12.2%	1) Tsh 7,367/houshold/month is spent for medical expense (Socio-Economic Survey, JICA, 2004). 2) Average household population is 6.0 persons (Socio-Economic Survey, JICA, 2004). 3) 40 percent of medical expense will be saved.
TOTAL	**45.9**	100%	

Exchange Rate: US$1 = Tsh1,050

4) Cost saving for medical expense due to improved health status

According to the socio-economic survey, mean medical expenditure is about Tsh 3,000/household in Coast region and Tsh 7,300/ household in Dar es Salaam on a monthly basis. It is assumed that approximately 40 percent of the present medical expenditure will be saved. Thanks to the improved health status that is attributed to increased access to safe and stable water supply by the residents. However, it should be emphasized that this effect can be realized firmly when the environmental sanitation and hygienic behaviour of the residents in the target area are improved in conjunction with provision of safe water.

(4) Results of the Economic Analysis

As summarized in *Table 10.3* below, NPV and B/C ratio indicate that the economic benefit will exceed the cost in case that the project is implemented. Moreover, EIRR for Coast Region is calculated as 13% and the one for Dar es Salaam is 16%. The rates for both regions are bigger than the opportunity cost of investment (i.e. discount rate), which suggests that the project is economically viable. Moreover, *Table 10.4* and *10.5* show flows of the economic cost and benefit during the evaluation period for Coast Region and Dar es Salaam Region. Population projection used for the analysis is also indicated in *Table 10.6* and *10.7* by region, respectively.

Table 10.3 Summary of Results of the Economic Analysis

Region	NPV	B/C Ratio	EIRR
Coast	722	1.07	13%
Dar es Salaam	2,123	1.27	16%

(5) Conclusion

From the results of the analysis, implementation of the priority project in both regions is regarded as feasible from the economic view point. It is notable that the factors to influence to the total economic benefit in each region are different from each other and depends on the socio-economic condition of each region. Construction of the piped water supply scheme in the target communities in Dar es Salaam is expected to realize very significant cost saving for obtaining domestic water since the residents are currently spending three times the cost of that of Coast Region. Meanwhile, the expected benefit in Coast Region is mostly derived from time saving realized in collecting water.

In addition to these project benefits that were quantified for the economic evaluation, there are other secondary benefits of social significance. Especially, reduction of distance to the water points will significantly contribute to decrease in physical and mental burden for adult women and children, who are primary and secondary collector of domestic water in households. This will increase the opportunities for women to allocate the saved time to other household chores, communal and leisure activities or income generating activities.

Table 10.4 Economic Cost and Benefit Flow during the Evaluation Period for Coast Region

(Unit : Thousand US$)

Year		Cost (C)				Benefit (B)					B-C	Discount Rate = 12%		
		Initial Investment	Replacement	Operation, Management,&Maintenance	Sub-Total	Time Saving from Water Fetching	Cost Saving for Obtaining Water	Increase of Willingness to Pay	Cost Saving for Medical Expense	Sub-Total		Cost in Present Value	Benefit in Present Value	NPV
1	2006	5,595.6	0	0	5,595.6	0	0	0	0	0	-5,596	5,596	0	-5,596
2	2007	3,595.6	44.5	119.0	3,759.1	559.2	141.1	51.9	53.6	805.8	-2,953	3,356	719	-2,637
3	2008	0	75.6	204.7	280.3	949.7	239.7	88.2	91.1	1,368.7	1,088	223	1,091	868
4	2009	0	75.6	204.7	280.3	975.1	246.1	90.5	93.5	1,405.2	1,125	200	1,000	801
5	2010	0	75.6	204.7	280.3	1,001.2	252.7	92.9	96.0	1,442.8	1,163	178	917	739
6	2011	0	75.6	204.7	280.3	1,028.0	259.5	95.4	98.6	1,481.5	1,201	159	841	682
7	2012	0	75.6	204.7	280.3	1,055.7	266.5	98.0	101.3	1,521.5	1,241	142	771	629
8	2013	0	75.6	204.7	280.3	1,084.2	273.7	100.6	104.0	1,562.5	1,282	127	707	580
9	2014	0	75.6	204.7	280.3	1,113.6	281.1	103.4	106.8	1,604.9	1,325	113	648	535
10	2015	0	75.6	204.7	280.3	1,143.8	288.7	106.2	109.7	1,648.4	1,368	101	594	493
11	2016	0	75.6	204.7	280.3	1,174.9	296.5	109.1	112.7	1,693.2	1,413	90	545	455
12	2017	0	75.6	204.7	280.3	1,207.0	304.6	112.0	115.8	1,739.4	1,459	81	500	419
13	2018	0	75.6	204.7	280.3	1,239.9	313.0	115.1	119.0	1,787.0	1,507	72	459	387
14	2019	0	75.6	204.7	280.3	1,274.0	321.5	118.3	122.2	1,836.0	1,556	64	421	357
15	2020	0	75.6	204.7	280.3	1,308.9	330.4	121.5	125.6	1,886.4	1,606	57	386	329
16	2021	0	75.6	204.7	280.3	1,345.0	339.5	124.9	129.0	1,938.4	1,658	51	354	303
17	2022	0	75.6	204.7	280.3	1,382.2	348.9	128.3	132.6	1,992.0	1,712	46	325	279
18	2023	0	75.6	204.7	280.3	1,420.4	358.5	131.9	136.3	2,047.1	1,767	41	298	257
19	2024	0	75.6	204.7	280.3	1,460.0	368.5	135.5	140.1	2,104.1	1,824	36	274	237
20	2025	0	75.6	204.7	280.3	1,500.5	378.7	139.3	144.0	2,162.5	1,882	33	251	219
21	2026	0	75.6	204.7	280.3	1,542.4	389.3	143.2	148.0	2,222.9	1,943	29	230	201
22	2027	0	75.6	204.7	280.3	1,585.5	400.2	147.2	152.1	2,285.0	2,005	26	211	186
		9,191.2	1,556.5	4,213.0	14,960.7	25,351.2	6,398.7	2,353.4	2,432.0	36,535.3	21,574.6	10,821	11,543	722
													B/C Ratio	1.07
													EIRR	13%

Table 10.5 Economic Cost and Benefit Flow during the Evaluation Period for Dar es Salaam Region

(Unit : Thousand US$)

Year		Cost (C)				Benefit (B)					B-C	Discount Rate = 12%		
		Initial Investment	Replacement	Operation, Management,&Maintenance	Sub-Total	Time Saving from Water Fetching	Cost Saving for Obtaining Water	Increase of Willingness to Pay	Cost Saving for Medical Expense	Sub-Total		Cost in Present Value	Benefit in Present Value	NPV
1	2007	585.4	0.0	0.0	585.4	0	0	0	0	0.0	-585	585	0	-585
2	2008	6,299.5	5.7	15.8	6,321.0	28.4	29.2	8.6	11.6	77.8	-6,243	5,644	69	-5,574
3	2009	0	66.3	182.5	248.8	403.8	416.2	123.0	165.6	1,108.6	860	198	884	685
4	2010	0	66.3	182.5	248.8	422.2	435.2	128.6	173.1	1,159.1	910	177	825	648
5	2011	0	66.3	182.5	248.8	441.5	455.1	134.5	181.1	1,212.2	963	158	770	612
6	2012	0	66.3	182.5	248.8	461.7	475.8	140.6	189.3	1,267.4	1,019	141	719	578
7	2013	0	66.3	182.5	248.8	482.7	497.5	147.0	197.9	1,325.1	1,076	126	671	545
8	2014	0	66.3	182.5	248.8	504.7	520.2	153.7	207.0	1,385.6	1,137	113	627	514
9	2015	0	66.3	182.5	248.8	527.8	544.0	160.7	216.4	1,448.9	1,200	100	585	485
10	2016	0	66.3	182.5	248.8	551.9	568.8	168.1	226.3	1,515.1	1,266	90	546	457
11	2017	0	66.3	182.5	248.8	577.1	594.8	175.7	236.6	1,584.2	1,335	80	510	430
12	2018	0	66.3	182.5	248.8	603.4	621.9	183.8	247.4	1,656.5	1,408	72	476	405
13	2019	0	66.3	182.5	248.8	631.0	650.3	192.1	258.7	1,732.1	1,483	64	445	381
14	2020	0	66.3	182.5	248.8	659.8	680.0	200.9	270.5	1,811.2	1,562	57	415	358
15	2021	0	66.3	182.5	248.8	689.9	711.0	210.1	282.9	1,893.9	1,645	51	388	337
16	2022	0	66.3	182.5	248.8	721.4	743.5	219.7	295.8	1,980.4	1,732	45	362	316
17	2023	0	66.3	182.5	248.8	754.3	777.5	229.7	309.3	2,070.8	1,822	41	338	297
18	2024	0	66.3	182.5	248.8	788.8	812.9	240.2	323.5	2,165.4	1,917	36	315	279
19	2025	0	66.3	182.5	248.8	824.8	850.1	251.2	338.2	2,264.3	2,016	32	294	262
20	2026	0	66.3	182.5	248.8	862.4	888.9	262.6	353.7	2,367.6	2,119	29	275	246
21	2027	0	66.3	182.5	248.8	901.8	929.4	274.6	369.8	2,475.6	2,227	26	257	231
22	2028	0	66.3	182.5	248.8	943.0	971.9	287.2	386.7	2,588.8	2,340	23	240	217
		6,884.9	1,331.7	3,665.8	11,882.4	12,782.4	13,174.2	3,892.6	5,241.4	35,090.6	23,208.2	7,888	10,012	2,123

B/C Ratio 1.27

EIRR 16%

Table 10.6 Projection of Population to be Served by the Priority Project in Coast Region

District/ Municiparity	Village/ Mitaa	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Bagamoyo	Kibindu	4,904	5,002	5,102	5,204	5,308	5,414	5,523	5,633	5,746	5,861	5,978	6,098	6,219	6,344	6,471	6,600	6,732	6,867	7,004	7,144	7,287	7,433	7,581	7,733	7,888	8,046	8,206
	Kwanduma	2,545	2,596	2,648	2,701	2,755	2,810	2,866	2,923	2,982	3,042	3,102	3,164	3,228	3,292	3,358	3,425	3,494	3,564	3,635	3,708	3,782	3,857	3,935	4,013	4,093	4,175	4,259
	Matipwili	1,948	1,987	2,027	2,067	2,109	2,151	2,194	2,238	2,282	2,328	2,375	2,422	2,471	2,519	2,570	2,622	2,674	2,728	2,782	2,838	2,895	2,953	3,012	3,072	3,133	3,196	3,260
Kibaha	Mnaji Mikinda	1,624	1,679	1,736	1,795	1,856	1,920	1,985	2,052	2,122	2,194	2,269	2,346	2,426	2,508	2,593	2,682	2,773	2,867	2,965	3,065	3,170	3,277	3,389	3,504	3,623	3,746	3,874
	Kitomondo/Minaji Mikinda	1,627	1,682	1,740	1,799	1,860	1,923	1,988	2,056	2,126	2,198	2,273	2,350	2,430	2,513	2,598	2,687	2,778	2,872	2,970	3,071	3,175	3,283	3,395	3,510	3,630	3,753	3,881
Kisarawe	Msimbu	2,199	2,230	2,261	2,293	2,325	2,357	2,390	2,424	2,458	2,492	2,527	2,562	2,598	2,635	2,672	2,709	2,747	2,785	2,824	2,864	2,904	2,945	2,986	3,028	3,070	3,113	3,157
	Chole	2,685	2,723	2,761	2,799	2,839	2,878	2,919	2,959	3,001	3,043	3,085	3,129	3,172	3,217	3,262	3,308	3,354	3,401	3,448	3,497	3,546	3,595	3,646	3,697	3,748	3,801	3,854
Mkuranga	Mwandege /Kipala	1,718	1,778	1,840	1,905	1,971	2,040	2,112	2,186	2,262	2,341	2,423	2,508	2,596	2,687	2,781	2,878	2,979	3,083	3,191	3,303	3,418	3,538	3,662	3,790	3,923	4,060	4,202
	Kisemvule	2,074	2,147	2,222	2,299	2,380	2,463	2,549	2,639	2,731	2,827	2,926	3,028	3,134	3,244	3,357	3,475	3,596	3,722	3,852	3,987	4,127	4,271	4,421	4,575	4,736	4,901	5,073
	Marogoro /Mfuru Mwambao	1,685	1,744	1,805	1,868	1,934	2,001	2,071	2,144	2,219	2,296	2,377	2,460	2,546	2,635	2,728	2,823	2,922	3,024	3,130	3,239	3,353	3,470	3,592	3,717	3,847	3,982	4,121
	Vianzi	1,871	1,936	2,004	2,074	2,147	2,222	2,300	2,380	2,464	2,550	2,639	2,732	2,827	2,926	3,029	3,135	3,244	3,358	3,475	3,597	3,723	3,853	3,988	4,128	4,272	4,422	4,576
	Njopeka	3,371	3,489	3,611	3,737	3,868	4,004	4,144	4,289	4,439	4,594	4,755	4,922	5,094	5,272	5,457	5,648	5,845	6,050	6,262	6,481	6,708	6,942	7,185	7,437	7,697	7,966	8,245
Sub-Total (Coast)		28,251	28,993	29,757	30,541	31,352	32,183	33,041	33,923	34,832	35,766	36,729	37,721	38,741	39,792	40,876	41,992	43,138	44,321	45,538	46,794	48,088	49,417	50,792	52,204	53,660	55,161	56,708

Implementation period of the priority project in Coast Region

Target year of the project

Table 10.7 Projection of Population to be Served by the Priority Project in Dar es Salaam Region

District/ Municiparity	Village/ Mitaa	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Ilala	Kitunda-1	2,614	2,734	2,860	2,992	3,129	3,273	3,424	3,581	3,746	3,918	4,098	4,287	4,484	4,690	4,906	5,132	5,368	5,615	5,873	6,143	6,426	6,722	7,031	7,354	7,692	8,046	8,416
	Kitunda-2	1,744	1,824	1,908	1,996	2,088	2,184	2,284	2,389	2,499	2,614	2,734	2,860	2,992	3,129	3,273	3,424	3,581	3,746	3,918	4,099	4,287	4,484	4,691	4,907	5,132	5,368	5,615
	Mzinga	4,114	4,303	4,501	4,708	4,925	5,151	5,388	5,636	5,895	6,167	6,450	6,747	7,057	7,382	7,722	8,077	8,448	8,837	9,243	9,669	10,113	10,579	11,065	11,574	12,107	12,664	13,246
	Msongala	1,410	1,475	1,543	1,614	1,688	1,766	1,847	1,932	2,021	2,114	2,211	2,312	2,419	2,530	2,646	2,768	2,896	3,029	3,168	3,314	3,466	3,626	3,792	3,967	4,149	4,340	4,540
	Pugu Station	1,606	1,680	1,757	1,838	1,923	2,011	2,103	2,200	2,301	2,407	2,518	2,634	2,755	2,882	3,014	3,153	3,298	3,450	3,608	3,774	3,948	4,130	4,320	4,518	4,726	4,944	5,171
Kinondoni	Matosa	1,629	1,696	1,765	1,838	1,913	1,991	2,073	2,158	2,247	2,339	2,435	2,534	2,638	2,747	2,859	2,976	3,098	3,225	3,358	3,495	3,639	3,788	3,943	4,105	4,273	4,448	4,631
Temeke	Yaleyale Puna	3,113	3,256	3,406	3,563	3,727	3,898	4,077	4,265	4,461	4,666	4,881	5,105	5,340	5,586	5,843	6,112	6,393	6,687	6,994	7,316	7,653	8,005	8,373	8,758	9,161	9,582	10,023
	Tundwi Songani	1,475	1,543	1,614	1,688	1,766	1,847	1,932	2,021	2,114	2,211	2,313	2,419	2,530	2,647	2,768	2,896	3,029	3,168	3,314	3,467	3,626	3,793	3,967	4,150	4,341	4,540	4,749
	Mjimwema	2,000	2,092	2,188	2,289	2,394	2,504	2,620	2,740	2,866	2,998	3,136	3,280	3,431	3,589	3,754	3,926	4,107	4,296	4,494	4,700	4,917	5,143	5,379	5,627	5,886	6,156	6,440
	Kibugumo	1,883	1,970	2,060	2,155	2,254	2,358	2,466	2,580	2,698	2,823	2,952	3,088	3,230	3,379	3,534	3,697	3,867	4,045	4,231	4,425	4,629	4,842	5,065	5,298	5,541	5,796	6,063
Sub-Total (Dar es Salaam)		21,588	22,573	23,602	24,681	25,807	26,983	28,214	29,502	30,848	32,257	33,728	35,266	36,876	38,561	40,319	42,161	44,085	46,098	48,201	50,402	52,704	55,112	57,626	60,258	63,008	65,884	68,894

Implementation period of the priority project in Dar es Salaam Region

Target year of the project

10.2.2 FINANCIAL EVALUATION

Full cost recovery for operation and maintenance is one of the most significant concerns in the scheme management. Willingness to pay (WTP) and Affordability to pay (ATP) is carefully examined in the Study. The amount for WTP is set at one Tsh per litre, which is assessed by the socio-economic study conducted under the study, while the one for ATP is determined at four to five percent of median income per person based on internationally accepted criteria. In WTP aspect, it is assessed that, with the minimum rate charge of one Tsh per litre same as the amount for community's willingness to pay, more than 80 percent of recovery rate would be assured for the full operation and maintenance cost including replacement of Level-2 facility over 10 years period. In ATP aspects, expense for water remains at lower than four percent of total personal income in Dar es Salaam Region, which is within the acceptable ratio set by international standard. However, the ATP for Coast Region exceeds four percent of total personal income, where the poverty level is rather high. Thus, pro-poor measure in cost recovery shall be applied. The rate of water charge can be set within the affordability of the poorest of the poor with the introduction of increasing block tariff structure with low lifeline tariff, as described in Management, Operation and Maintenance Plan (Chapter 9).

In financial assessment particularly on the priority project and communities, unit water price is set in the same manner at 1.0 Tsh per liter, assuming the consumption of 25 liter/day/capita, while the operation and maintenance cost is estimated in a realistic manner, including such items of management and operation cost, maintenance cost, depreciation and replacement cost, and risks and inflation. Each item of maintenance cost is calculated as a percentage of the capital cost. Percentage assigned to these costs vary as followed; 1) 5 percent of capital cost for operation cost, which includes fuel, electricity, chemicals, and wage and allowance for the operators and attendants, 2) 5 percent of capital cost for management cost including commission for COWSO (Community-Owned Water Supply Organization), and management/service contract, 3) 10 percent of capital cost for maintenance cost that covers supply, tools, and spare parts for first 5 years, and 20 percent for the one after 5 years, 4) 10 percent of capital cost for depreciation and replacement, and 5) 5 percent of capital cost for risks and inflation (refer to Chapter 9, *Table 9.1*). It shall be noted the replacement cost is estimated on local procurement bases, instead of international procurement of contractors for construction works, in order to avoid overestimation of the overall cost. Also, the replacement cost to construct water reservoir/tank is excluded in this over-20 year estimation, where the reinforced concrete structure is durable for more than 50 years with no significant maintenance cost requirement.

It is found, as shown in *Table 10.8*, that in all of the priority projects, amount collected as water fee exceeds significantly the cost of management, operation and maintenance of the water supply schemes. However, the figure is estimated on the basis of 100% revenue-collection. Thus, to be realistic, the profit-loss break-even point of revenue collection rate required to ensure full cost recovery is also estimated for each water supply scheme. The recovery ratios assuring full cost recovery in Coast Region is 74 percent in average ranging from 53 to 84 percent among the communities, while for Dar es Salaam Region it is 51 percent in average ranging from 32 to 70 percent among the communities. The trend is that the water supply scheme serving larger communities in population can generate higher financial surplus by increasing revenue collection ratio, which would also require much efficiency and competency in scheme management with comprehensive but costly contracting-out arrangement. It shall attract private sector participation in the scheme management as proposed in the Study.

It is concluded all the priority projects could generate financial surplus, thus financially viable, in the running and management of the schemes with realistic revenue collection ratio.

Table 10.8 Projection of the Income and Management, O&M Cost (USD)

Operation and Maintenance Cost by Size of Community / Coast Region

(Unit: US$)

District/ Municipality	Ward	Village/ Mitaa	Served Population (2008) by Level 2*1	Served Population (2015) by Level 2	Construction Cost (Local Procurement Basis)							Operation & Management Cost*2								
					Borehole Drilling	Pump Complete	Power Source	Pump House	Raising Main	Storage Tank	DWP	Operation & Management Cost	Maintenance Cost	Depriciation/ Replacement	Risks and Inflation	Total OM Cost / Year	Per Capita OM Cost / Year	% in Median Income*3	OM Cost Over 20 Years*4	Water FeeCollection over 20 years	Benefit over 20 years
Bagamoyo	Kibindu	Kibindu	5,507	6,344	12,000	4,000	9,000	2,500	20,000	45,677	50,752	8,625	15,094	9,825	491	34,036	5.0	5.4%	680,715	1,307,666	626,950
	Kibindu	Kwanduma	2,858	3,292	12,000	4,000	9,000	2,500	20,000	23,702	26,336	6,184	10,821	6,184	309	23,498	6.6	7.2%	469,954	678,647	208,693
	Mkange	Matipwili	2,186	2,518	12,000	4,000	9,000	2,500	20,000	18,130	20,144	5,564	9,738	5,564	278	21,145	7.8	8.4%	422,894	519,077	96,183
Kibaha	Ruvu	Mnazi Mikinda	1,969	2,508	12,000	4,000	9,000	2,500	20,000	18,058	20,064	5,556	9,724	5,556	278	21,114	7.4	8.0%	422,286	546,015	123,729
		Kitomondo/Minazi Mikinda	1,973	2,513	12,000	4,000	9,000	2,500	20,000	18,094	20,104	5,560	9,731	5,560	278	21,130	7.4	8.0%	422,590	547,125	124,534
Kisarawe	Msimbu	Msimbu	2,387	2,635	12,000	4,000	9,000	2,500	20,000	18,972	21,080	5,658	9,902	5,658	283	21,500	7.8	8.4%	430,008	531,004	100,996
	Chole	Chole	2,915	3,217	12,000	4,000	9,000	2,500	20,000	23,162	25,736	6,124	10,716	6,124	306	23,270	6.9	7.4%	465,394	648,461	183,068
Mkuranga	Vikindu	Mwandege /Kipala	2,094	2,687	12,000	4,000	9,000	2,500	20,000	19,346	21,496	5,700	9,974	5,700	285	21,658	7.1	7.7%	433,170	519,555	86,386
		Kisemvule	2,528	3,244	12,000	4,000	9,000	2,500	20,000	23,357	25,952	6,145	10,754	6,145	307	23,352	6.3	6.8%	467,035	627,238	160,203
		Marogoro /Mfuru Mwambao	2,053	2,635	12,000	4,000	9,000	2,500	20,000	18,972	21,080	5,658	9,902	5,658	283	21,500	7.2	7.8%	430,008	509,383	79,375
		Vianzi	2,280	2,926	12,000	4,000	9,000	2,500	20,000	21,067	23,408	5,891	10,309	5,891	295	22,385	6.7	7.3%	447,701	565,705	118,004
	Lukanga	Njopeka	4,108	5,272	12,000	4,000	9,000	2,500	20,000	37,958	42,176	7,768	13,593	7,768	388	29,517	4.9	5.3%	590,338	1,019,262	428,924

Operation and Maintenance Cost by Size of Community / DSM Region

District/ Municipality	Ward	Village/ Mitaa	Served Population (2008) by Level 2*1	Served Population (2015) by Level 2	Construction Cost (Local Procurement Basis)							Operation & Management Cost*2								
					Borehole Drilling	Pump Complete	Power Source	Pump House	Raising Main	Storage Tank	DWP	Operation & Management Cost	Maintenance Cost	Depriciation/ Replacement	Risks and Inflation	Total OM Cost / Year	Per Capita OM Cost / Year	% in Median Income*3	OM Cost Over 20 Years*4	Water FeeCollection over 20 years	Benefit over 20 years
Ilala	Kitunda	Kitunda-1	3,373	4,690	12,000	4,000	9,000	2,500	20,000	33,768	37,520	7,302	12,779	7,302	365	27,748	5.0	2.6%	554,952	1,071,661	516,709
		Kitunda-2	2,250	3,129	12,000	4,000	9,000	2,500	20,000	22,529	25,032	6,053	10,593	6,053	303	23,002	6.2	3.3%	460,043	714,864	254,821
		Mzinga	5,309	7,382	12,000	4,000	9,000	2,500	20,000	53,150	59,056	9,456	16,547	9,456	473	35,931	4.1	2.2%	718,626	1,686,761	968,136
	Msongala	Msongala	1,820	2,530	12,000	4,000	9,000	2,500	20,000	18,216	20,240	5,574	9,755	5,574	279	21,181	7.1	3.7%	423,624	578,246	154,622
	Pugu	Pugu Station	2,073	2,882	12,000	4,000	9,000	2,500	20,000	20,750	23,056	5,856	10,247	5,856	293	22,251	6.5	3.5%	445,026	658,628	213,602
Kinondoni	Goba	Matosa	2,049	2,747	12,000	4,000	9,000	2,500	20,000	19,778	21,976	5,748	10,058	5,748	287	21,841	6.8	3.6%	436,818	614,925	178,107
Temeke	Pemba Mnazi	Yaleyale Puna	4,017	5,586	12,000	4,000	9,000	2,500	20,000	40,219	44,688	8,019	14,033	8,019	401	30,471	4.6	2.4%	609,429	1,276,270	666,842
	Pembamnazi	Tundwi Songani	1,904	2,647	12,000	4,000	9,000	2,500	20,000	19,058	21,176	5,668	9,918	5,668	283	21,537	6.9	3.6%	430,738	604,934	174,196
	Mjimwema	Mjimwema	2,581	3,589	12,000	4,000	9,000	2,500	20,000	25,841	28,712	6,421	11,237	6,421	321	24,401	5.7	3.0%	488,011	820,028	332,017
	Mjimwema	Kibugumo	2,431	3,380	12,000	4,000	9,000	2,500	20,000	24,336	27,040	6,254	10,945	6,254	313	23,765	5.9	3.1%	475,304	772,371	297,067

*1: Served population at the completion of the priority project
*2: Replacement costs for borehole drilling and storage tank are not considered in the operation and maintenance costs.
*3: Per capita household monthly income: Tsh 8,102 for Coast region, Tsh 16,473 for Dar es Salaam Region (Median)
*4: 20 years as the project life

10.3 INSTITUTIONAL AND ORGANIZATIONAL EVALUATION

Institutional and organizational setup proposed in the Study shall be evaluated taking into consideration on relevance, effectiveness and efficiency, and sustainability of the said institutional framework.

Institutional and organizational framework, proposed in the Institutional Plan (Chapter 8), is formulated considering its relevance to the set-up as envisaged by the Draft National Water Sector Development Strategy (2005) and decentralized setup under Local Government Reform Strategy (2002). As emphasized by the National Water Sector Development Strategy, the following issues are mainstreamed into the principle in formulating Institutional and Organizational Plan of the Study; 1) Government's role will be limited to co-ordination, policy and guideline formulation, and regulation, 2) Regulatory and executive (i.e. service provision) functions will be separated, 3) Responsibility for executive functions will be decentralized to the lowest appropriate level, whilst balancing consumer representation/participation with economies of scale, 4) Regulatory function will be further separated from the prioritization and allocation of capital investment funds, 5) Autonomous entities will be established to manage water supply and sewerage services.

Relevance, efficiency, and sustainability is considered and the relevant key issues are incorporated into Institutional Plan of the Study, in particular the followings; 1) current and future institutional setup formulated under Water Policy (2002) and Draft National Water Sector Development Strategy (2005), 2) decentralized functional responsibilities of each stakeholders in the water supply service delivery as set in the sector policy and strategies, 3) transition of the role of MoWLD from service delivery to the one of policy making, monitoring and regulation, 4) strategy to enhance Community-Owned Water Supply Organizations (COWSOs), which shall be legal entity, to own and manage water supply schemes, and 5) current approach to increase private sector participation and contracting-out in the service delivery to increase efficiency and competency in the scheme running.

Formation of COWSO (Community-Owned Water Supply Organization), which shall be autonomous legal entity and vested with ownership of the scheme management, establishment of DWST (District Water and Sanitation Team) that provides technical guidance to the COWSO and conducts monitoring and regulation activities of COWSO and service providers, and introduction of contracting-out setting that enhance efficiency and competence in the scheme management, are all in line with the national strategies and aimed to ensure effectiveness, efficiency, and sustainability of the water supply service.

In addition to those, effectiveness, efficiency, and sustainability of the institutional and organizational setup in the scheme management is further ensured with the Management, Operation and Maintenance Plan, as explained more detail in the following section.

10.4 MANAGEMENT AND MAINTENANCE EVALUATION

Effectiveness and efficiency in the scheme management would be achieved through decentralizing of functions and responsibilities in management of the scheme to the lowest appropriate institution, developing capacity of COWSO and DWST in their technical and administrative skills, and enhancing private sector participation in operation and maintenance.

In the formation of COWSO, either WUA (Water User Association) or Water Cooperative/Trust is recommended in the Institutional Plan. Those COWSO management options guarantee the legal status to own and manage the water supply scheme with development of regulations and by-laws. Where it deems necessary, education package for capacity building of COWSO on operation and maintenance is provided to enhance its competence and effectiveness in the management of the water supply scheme.

Legal status of the COWSO can allow contracting-out with private sector agencies for a part or entire management, operation and maintenance of the scheme. With this contracting-out

arrangement by COWSO, private Service Provider and the local government expertise and competence in the scheme management is considerably enhanced. However, in order for the contracting setup is effective, selection of Service Providers through open bidding process, setting of performance requirement with development of performance indicators, and regulation and monitoring on Service Providers become key, as proposed in the Management, Operation and Maintenance Plan.

DWST, which is formed at district and municipality level among the departments involved in water development (district planning officer, water engineer, community development officer, health and sanitation officer, etc), ensures provision of technical guidance to COWSO, and monitoring and regulation of the Service Providers.

In order to make those institutional and organizational framework function in effective and efficient manner, the Management, Operation and Maintenance Plan also consider capacity development of each institution in their respective functions and responsibilities. Capacity Building Plan, formulated under the Management, Operation and Maintenance Plan, is developed with the main packages of; 1) advocacy and consensus building, 2) enhanced private sector participation and contracting-out, 3) capacity building of DWST, 4) capacity building of COWSO, and 5) promotion of personal hygiene and sanitation practices. Implementation of these whole activities will create environment favourable to the introduction of proposed institutional framework composed of COWSO management, DWST's technical guidance and monitoring/regulation, and contracting-out arrangement, all of which would increase effectiveness and efficiency of the water supply scheme management.

Thus, it can be said that providing facilitation package for capacity development of COWSO and DWST (District Water and Sanitation Team) as proposed in the Capacity Building Plan under the Study along with decentralization of the responsibilities in the scheme management shall enhance effectiveness, while contracting-out arrangement for part or all of management increases competency and expertise in operation and maintenance of the scheme.

Full cost recovery for operation and maintenance is one of the most significant concerns in the scheme management. Willingness to pay (WTP) and Affordability to pay (ATP) is carefully examined in the Study. The amount for WTP is set at one Tsh per liter, which is assessed by the socio-economic study conducted under the study, while the one for ATP is estimated at three to five percent of median expenditure per person based on international experienc. In WTP aspect, it is assessed that, with the minimum charge of one Tsh per liter, same as the amount for community's willingness to pay, 85 percent of revenue collection rate would ensure the full operation and maintenance cost for Level-2 facility (priority project) including future expansion and replacement cost. In ATP aspects, expenditure for water remains lower than four percent of total personal expenditure in Dar es Salaam Region, which is well within the affordability of water consumers (i.e. four percent of total personal expenditure) set by international standard. However, the expenditure for Coast Region exceeds four percent, where the poverty level is higher than other area. Thus, pro-poor measure in cost recovery is required. The rate of water charge can be set within the affordability of the poorest of the poor with the introduction of increasing block tariff structure with low lifeline tariff, as proposed in Management, Operation and Maintenance Plan (Chapter 9).

Sustainability is also maintained through the introduction of monitoring and regulation mechanisms, as proposed in the Institutional Plan under the Study with such tools as performance contracting with indicators, monitoring and regulation activities, and monitoring check-sheet.

10.5 SOCIAL AND ENVIRONMENTAL EVALUATION

As the result of Environment and Social assessment, Positive and Negative Impact Matrix was formulated as summarized in *Table 10.9*. Detailed methodology and results are presented in Chapter 12 of Supporting Report.

Table 10.9 Positive and Negative Impact Matrix

Screening Subjects			Social Aspects							Environmental Aspects			
Water Supply Plan Impact	Degree of Impact ◎: High Impact ○:Fair Impact	Issues	Women and Children in Water Use	Water Vendors	Indigenous Group/ Tribe - Massai	Management for Sharing Water Supply /facilities	Village Perceptions and Attitude to Payment	Discrepancy of Water Management	Water Rights and Right of Common	Groundwater	Land subsidence	Hydrological Situation	Fauna and Flora
Impact													
Positive	Direct Positive Impact		◎										
	Indirect Positive Impact												
	Positive Direct Positive Impact with Appropriate Considerations/Mitigation Measures					◎	○	○		◎		◎	
	Positive Indirect Positive Impact with Appropriate Considerations/Mitigation Measures			◎	○						○		○
No Impact													
Negative	Indirect Negative Impact												
	Direct Negative Impact												

Through IEE in the Study, screening results are evaluated as Category C as a whole as shown in *Table 10.10.* The remarks reflect assessment and evaluation linked to mitigation measures and follow-up activities. Accordingly, it is concluded that no detailed EIA study at further stage of project implementation is required. The water supply plan has absolute positive impacts with due consideration to relevant mitigation measures.

Although the IEE reveals that water supply plan would fall into Category C, it dose not automatically mean that adverse impact will never occur in future *unless* continuous environmental and social monitoring is properly carried out in a long-term. For this reason, relevant institutional initiatives for monitoring the priority projects implementation is very important. The necessary measures for establishment of monitoring system by related agencies on environmental and social considerations in Tanzania is recommended to be initiated.

Table 10.10 The Final Screening Results in the IEE

No.	Environmental Item	Evaluation	Reasons
Social Environment			
1	Resettlement	C	The Water Supply Plan dose not include any large-scale of resettlement plan.
2	Economic activities	C	For water venders, which is one concerned aspect in the Study, mitigation and follow-up activities are clearly presented through the IEE. By carrying out these measures adverse imapct could be mitigated.
3	Traffic and public facilities	C	The Water Supply Plan dose not include activity conmponents which affect trafic or public facilies.
4	Split of community	C	New construction, which might split community, will not be conducted while pipelines exisit already, which have not affected the community.
5	Cultural property	C	In the Study area, there is no valuable cultural heritage such as important churches, temples, shrines etc.
6	Water rights and Rights of common	C	IEE has evaluated the Water Supply Plan at preparation stage, the relevant issues are already covered carefully.
7	Public health condition	C	IEE has evaluated that the Water Supply Plan will have positive impact to improve currently affected public health and sanitation.
8	Waste	C	Sludge is processed appropriately.
9	Hazards (risk)	C	Large- scale consutracution is not carried out in the Water Supply Plan.
Natural l Environment			
10	Topography and geology	C	Not relevant (the Plan is not such a large scale).
11	Soil erosion	C	Not relevant (the Plan is not such a large scale).
12	Groundwater	C	IEE has evaluated that the Water Supply Plan will have positive impact with appropriate consideration and mitigations.
13	Hydrological situation	C	IEE has evaluated that the Water Supply Plan will have positive impact to improve current hydrological situation.
14	Coastal zone	C	The Study are is not directly related to coastal zone.
15	Fauna and flora	C	IEE has evaluated that the Water Supply Plan has no negative impact on Fauna and Fora.
16	Meteorology	C	Not relevant (the Plan is not such a large scale).
17	Landscape	C	Not relevant (the Plan is not such a large scale).
18	Air pollution	C	Not relevant (the Plan is not such a large scale), For drilling of test wells, the subject was carefully considered.
19	Water pollution	C	Not relevant (the Plan is not such a large scale), For drilling of test wells, the subject was carefully considered.
20	Soil contamination	C	Not relevant (the Plan is not such a large scale), For drilling of test wells, the subject was carefully considered.
21	Noise and vibration	C	Appropriate treatment during construction works.
22	Land subsidence	C	IEE has evaluated that the Water Supply Plan has no negative impact with mitigation measure.
23	Offensive odor	C	Not relevant (the Plan is not such a large scale).

Note 1: Evaluation categories:

A: Serious impact is expected.

B: Potential impact may occur or Extent of impact is unknown.

C: No impact is expected. EIA is not necessary.

10.6 TECHNICAL APPROPRIATENESS

Construction works of the Priority Project are composed of drilling works, earthworks, pipe works, concrete works, mechanical/electrical works, and miscellaneous works. These works requires no special techniques. These will be carried out by conventional methods and machineries widely applied in Tanzania. Equipment and materials required for the Priority Project are generally procured in Tanzania, although some of them are imported from abroad such as EU countries, South Africa and Japan.

The evaluations of the technical appropriateness are examined on each component of the Priority Project. The results are shown in *Table 10.11*.

Table 10.11 Evaluation of Technical Appropriateness of Water Supply Plans

Items	Facility /Type	Evaluation Item	Evaluation of Appropriateness
Intake	Groundwater (deep tube well)	Construction of Well	DTH and Mud Rotary method: Appropriate.
		Casing/Screen Pipes	Easily imported: Appropriate
		Generator and Submersible Pump	Easily imported: Appropriate
		Operation & Maintenance	Easy: Appropriate
		Water Quality	No treatment facility is required: Appropriate
Intake	Surface Water (River intake)	Construction of Intake	Construction: Appropriate
		Generator and Submersible	Easily imported: Appropriate
		Treatment Facility	Necessary for river water. Not required for spring water.
		Operation & Maintenance	Easy: Appropriate
Reservoir	Elevation or Ground Tank	Construction	Conventional construction method: Appropriate
		Material	Reinforced concrete: Appropriate
		Operation & Maintenance	Easy: Appropriate
Transmission Line & Distribution Line	PVC Pipe	Installation	Conventional construction method: Appropriate
		Material	Local material is available: Appropriate
		Operation & Maintenance	Easy: Appropriate

REFERENCE

Contractor Registration Board (2005), Proceedings, Annual Consultative Meeting, 189p.

MoWLD (2002), Economic analysis of water supply options in Kilosa, Mpwapwa and Rufiji Districts (Final Report), Dar es Salaam

National Bureau of Statistics Tanzania (2002), Household budget survey 2000/01, Dar es Salaam, 180p.

Chapter 11

Conclusion and Recommendation

CHAPTER 11 CONCLUSION AND RECOMMENDATION

11.1 CONCLUSION

(1) Water resources were evaluated and the "Water Resources Evaluation Maps" were constructed for future development.

(2) Groundwater is considered as the main water source for the water supply schemes proposed in the Study. In case of surface water, only the Wami River was evaluated to have development potential.

(3) The Water Supply Plan was formulated for 278 villages considering the availability of water sources and population of villages. The plan is composed of piped water supply scheme (Level-2), Hand pump scheme (Level-1: deep tube well), rehabilitation of existing water supply scheme, and extension of Chalinze Water Supply Scheme and DAWASA.

(4) A total of 22 Level-2 schemes were planned in 22 villages. The service population is 78,352 in 2015. Areas evaluated as not suitable for piped water supply were excluded from the service area of Level-2. Such areas were planned to be supplied by Level-1 schemes.

(5) Number of proposed Level-1 schemes (deep tube well) was 607 with a total service population of 145,850 in 2015.

(6) The Revised Poverty Reduction Strategy of Tanzania sets out to raise the water supply service level from 53 % in 2003 to 65 % by the year 2009. If the proposed Water Supply Plan is implemented, it will improve the water supply rate up to 66.9 % in 2009 which meets the target of nation strategy.

(7) Among the Water Supply Plan, 22 Level-2 schemes were selected as the Priority Project, which is supposed to be implemented with the Japan's Grant Aid. The estimated cost is 16.5 million USD.

(8) Allocation of budget by MoWLD for rural water supply sector is inadequate to implement the proposed Water Supply Plan, therefore, foreign assistance is necessary to call. Especially, implementation of Level-1 project except for Mkuranga needs foreign assistance in order to attain the target of the Revised Poverty Reduction Strategy.

(9) As the most prospective management option, COWSO management option with contracting-out with Service Providers (i.e. private sector participation) for a part or all of management, operation and maintenance, was proposed in the Study.

(10) Water tariff is set at 1 Tsh/liter, which is same as Willingness to Pay (WTP) surveyed in the Study area. Under this condition, the Priority Project was evaluated as economically feasible. NPV and B/C exceed the project cost. EIRR is 13 % in Coast Region and 16 % in Dar es Salaam.

(11) Applying the tariff, 1 Tsh/liter, amount of water tariff to be collected exceeds the cost for management operation and maintenance of Level-2 scheme. More than 80 % of recovery rate would assure the recovery of full operation and maintenance cost over 10 years including replacement cost. Therefore, the Priority Project was evaluated as financially feasible.

(12) As the results of the Initial Environmental Evaluation (IEE), all the Categories, including categories evacuated as "B" in the Preliminary Study, fall under Category "C". Therefore, Environmental Impact Assessment (EIA) is not required for the implementation of the Priority Project. However, it is indispensable to continue the environmental and social monitoring in order to mitigate the occurrence of adverse impact.

11.2 RECOMMENDATION

(1) Water Resources Development

Groundwater quality, especially salinity, frequently changes in the Neogene aquifers from place to place due to the frequent changes of lithology. In the selection of drilling site of deep tube well, detailed geophysical exploration should be carried out under the supervision of a Hydrogeologist.

In the hard rock area (Precambrian to Cretaceous aquifers), groundwater is occurred in the linear structures like fissures or faults. In order to detect these structures effectively, hydrogeological field reconnaissance and geophysical survey are indispensable.

It is desirous to drill test wells in the area where hydrogeological conditions are considered to be critical for groundwater development such as Kibaha, Kisarawe and Kinondoni Districts. As for Bagamoyo District, the deep wells suitable for Level-2 scheme were in Kibindu and new well was constructed in Kwanduma, therefore, drilling of test well is not required in Bagamoyo District.

(2) Water Quality

Prior to the construction of water supply schemes, water quality of water sources (deep wells, the Wami River and Njopeka Spring) should be carefully analyzed for the following items: Microbial aspects and Chemicals that are of health significance (refer to *Table 3.7*), especially salinity as Electric Conductivity (EC) in the Neogene aquifers and Fluoride (F) in the hard rock area.

Turbidity and Colour of water of the Wami River is high, therefore, sedimentation tank was planned in Matipwili for their reduction. Sedimentation velocity was obtained by applying the Stokes Law. Prior to the detailed design of sedimentation tank, effectiveness of the sedimentation tank should be experimentally confirmed by using the river water. Should turbidity and colour cannot be reduced to less than the value of the Tanzanian Standard by the treatment facility (sedimentation pond), further consideration on treatment method will be required.

(3) Designing of Water Supply Facilities

Water supply facilities were designed based on the elevation data obtained by GPS in the field and distance measured on the map. Locations of storage tanks were also decided based on these data. Therefore, topographic survey should be carried out prior to the detailed design of those facilities.

(4) Implementation of Project

Priority Projects composed of Level-2 water supply scheme were proposed in the Study. Though Level-1 project is not included in the Priority Projects, still Level-1 is an important component of Water Supply Plan formulated in the Study. In order to attain the target defined in the Revised Poverty Reduction Strategy, to raise the 53% of water supply level in 2003 to 65% by 2009, the implementation of Level-1 project is indispensable.

Therefore, MoWLD is advised to allocate the necessary budget if necessary with foreign assistance to implement the Level-1 schemes.

(5) Consideration on villages where some sub-villages were excluded from the service area of the Priority Projects

Some sub-villages were excluded from the service area of Priority Projects (Level-2) due to various reasons. Such sub-villages were still recommended to be provided with Level-1 schemes in the Water Supply Plan, though none of the Level-1 scheme implementation is included in the Priority Project.

Implementation of Level-1 schemes is planned only in Mkuranga District from the year 2006 but no plan in other Districts and Municipality. These situations may cause a kind of conflict on the water supply situation in the villages, and between Districts/Municipalities. Considering these situations, it is desirable to implement the Level-1 schemes also in these villages as soon as possible in order to facilitate equality in the water supply service level in the villages and Districts/Municipalities.

In the implementation of Level-1 project, the highest priority is given to the villages where some sub-villages were excluded from the service area of Level-2 scheme. Priority for the other villages will be assigned based on the priority ranking presented in Table 6.4.

(6) Water Right

Both surface water and groundwater are exploited at many places in the Study area. However, water right for these uses is not properly organized. This situation will cause improper management of water resources. The Ruvu River was evaluated no potential for further development. In Dar es Salaam city area, sea water intrusion is observed caused by overexploiting of groundwater. It is recommended that water right should be properly registered following the "Water Utilization (Control and Regulation) Act in Tanzania (1974)".

The implementation of the Priority Project needs the organization of water right. The water right should be properly organized prior to the commencement of the project, considering the water demand estimated in the Water Supply Plan.

(7) Environmental and Social Consideration

All the categories to be evaluated in IEE fall in Category "C", which means EIA is not required. However, adverse impacts will not be automatically avoided without continuous environmental and social monitoring. Such monitoring should be properly planned and conducted.

(8) Implementation Arrangements for Capacity Development Plan

For the introduction of Capacity Development Plan suggested in Chapter 9, various options in institutional and implementation arrangement are considered. Activities in Stage 1 of Pre-Planning up to Stage 3 of Construction/Implementation could be efficiently implemented by the scheme consolidated in the construction and supervision works, if external assistance is applied. This implementation arrangement would assure effective and timely execution of activities as far as communication and funding mechanism are concerned. There is also other option in implementation arrangement for execution of the said stages. In particular, activities requiring relatively dedicated expertise, such as preparation of guideline for private sector participation (i.e. contract-out) and its introduction, could be more effectively carried out by the technical cooperation hiring consultants apart from the construction and supervision scheme. In this implementation arrangement, coordination with the construction and supervision scheme shall be enhanced.

On the other hand, activities in Stage 4 of Operation and Maintenance and Stage 5 of Monitoring and Follow-up would be carried out by the local government, namely DWSTs, since their functional roles and responsibilities are provision of technical guidance and follow-up/monitoring for COWSOs and Service Providers.

(9) In-House Study and Training for Introduction of Improved COWSO Management Options

As explained in Chapter 8, there are various successful cases of COWSO (Community-Owned Water Supply Organization) management options in the country. Examples are Water User Group formed in each domestic water points in Sinyaga Region, Water User Association established in Hanan, Singida Rural, Igunga, and Manyoni Districts, and Water Company by Guarantee actively evolved in Morogoro Region. Although there are several studies on those successful institutional arrangements, those studies reflect only on a particular COWSO management option. Thus, MoWLD shall facilitate comparative and comprehensive study on those successful cases in COWSO management, reviewing advantages and disadvantages of each management option, and applicability and feasibility of those options in particular settings. The study results shall be widely disseminated in the country, followed with the provision of in-house training for the ministry and local government staff for effective introduction of those identified management options. The training shall include on-site investigation at the successful scheme and provision of lecture by management staff of the schemes.

(10) Utilization of local contractors in implementation of projects

Construction and drilling contractors in Tanzania are all registered with the Contractor Registration Board (CRB). Registration is made separating local and foreign contractors. They are ranked from Class 1 to Class 7 in descending order in each type of construction work.

Both construction contractors and drilling contractors ranked as Class 1 and 2 have adequate experience and capability to construct water supply facilities planned in the Study. It is desirable to employ such registered contractors in the construction of water supply facilities.