4.4 Groundwater Development Plan

Formulation of a groundwater development plan is difficult compared with areas that have thick sands and gravel sedimentation as a stratum aquifer, especially along large rivers. The porous and permeable layer in the alluvial and tertiary deposits does exist only in limited areas.

In addition to the geological point of view, the water quality is largely affected by the mineralization and sedimentation that occurs in areas which have the potential of dissolving toxic substances such as fluoride, NO3 and saline minerals.

However, there are certain areas which provide safe and sustainable groundwater. Therefore, the villages close to the high potential area in reference with the water availability map have a higher possibility of developing groundwater sources.

4.4.1 Evaluation of Exploitable Amount of Groundwater

The mass balance of groundwater recharge of 35 years (1970-2004) is shown in the following table. The water balance calculation was made both for general mass balance calculation and application of the Tank Model, and the results have been obtained from the Tank Model calculation result.

The extraction of groundwater in each district is estimated in the following table.

Table 4.4-1: Potential Volume of Groundwater Exploitation and Extraction

Region	District	total	Recharge to Groundwater	*Extractable Groundwater	**Potential Discharge of Existing Hand Pump		***Potential Discharge of Existing Motorized Pump		****Planned Hand Pump Exploitation	*****Planned Motorized Pump Exploitation	Total Exploitation from Groundwater	Persentage in the Explotable Amount
		m^3/sec	m^3/day	m^3/day	Number	m^3/day	Number	m^3/day	m^3/day	m^3/day	m^3/day	%
Mwanza	Missungwi	126.78	10,953,978	5476989	267	1922.4	59	1982.4	477	528	4909.8	0.0896441
	Sengerema	147.16	12,714,442	6357221	205	1476	5	168	2195	312	4151	0.0652958
	Kwimba	196.78	17,002,010	8501005	612	4406.4	18	604.8	1042	2016	8069.2	0.0949205
	Magu	195.39	16,881,811	8440905	791	5695.2	42	1411.2	885	388	8379.4	0.0992713
	Geita	270.59	23,378,909	11689454	198	1425.6	49	1646.4	3233	416	6721	0.0574963
	Ilemela-Nyamang	28.02	2,421,064	1210532	90	648	0	0	143		791	0.0653432
	Ukerewe	93.52	8,080,247	4040123	268	1929.6	0	0	75	0	2004.6	0.0496173
Mara	Bunda	169.89	14,678,128	7339064	173	1245.6	3	100.8	795	70	2211.4	0.0301319
	Musoma	189.38	16,362,690	8181345	60	432	6	201.6	2207	696	3536.6	0.0432276
	Tarime	221.08	19,101,607	9550804	16	115.2	7	235.2	7117	623	8090.4	0.0847091
	Serengeti	733.38	63,364,255	31682128	52	374.4	8	268.8	1331	830	2804.2	0.008851

** Extractable Groundwater = Groundwater Recharge * 0.5*

*** Assuming all wells have hand pumps with 15 l/min discharge operating 8 hours a day*

**** Assuming all wells have functioning motorized pumps with 70 l/min discharge operating 8 hours a day*

***** Planned hand pumps exploitation in the year 2015*

****** Planned motorized pumps exploitation in the year 2015*

The total existing and planned volume for the exploitation of groundwater and the ratio (percentage) to the total recharge is less than 0.1 %. The highest percentage is in Magu District, which has only a small catchment area.

Therefore, the amount of current and future (year of 2015) exploitation is still in reasonable proportion to the total volume of groundwater. However, from June to September (dry season), no potential recharge can be expected. It should be noted that even the medium and deep boreholes may experience a decline in the water level (not all of the deep wells, but some of the medium wells which are highly affected by seasonal fluctuations) in some cases.

4.4.2 Remarkable Points for the Groundwater Development Plan

a. Groundwater Development Plan for 428 Villages

The groundwater development plan was formulated for the 428 villages of the water supply plan, based on the natural conditions and surveys. From the location of the village, the following are interpreted from the potential area for groundwater development.

- Aquifer Type
- Estimated yield at the location of the village
- Estimated well depth to the target aquifer

The results are compiled in Figure 4.4-1.

Formulation of the water supply plan, by comparison of the facility cost, the natural conditions and the available water sources, is described in the section on the Water Supply Plan.

The groundwater development is relatively difficult, especially estimating the yield and the depth to the water strike zones. Therefore, for villages within 9 km of Lake Victoria, lake water will be used instead of groundwater.

Most of the facilities for groundwater extraction are boreholes drilled up to 50 meters and installed with a hand pump (as the yield of the well is very difficult to predict, a motorized pump is not planned unless certain data is available to assure a yield of more than 70 l/m).

There are risks to the groundwater development by means of yield, water level and water quality of the aquifer. However, utilizing the useful well information and the interpretation results, exploitation of the safe groundwater shall be possible by further detailed analysis and surveys.

b. Groundwater Development Plan for the Priority Project.

A total of 61 villages were surveyed in detail for the examination of the water development potential for groundwater source. The purpose of this detailed hydrogeological field reconnaissance is to identify the potential well site at each village within the village boundary. The method of the survey is outlined as follows (Location is shown in Figure 4.4-2)

- Detailed hydrogeological field reconnaissance to identify the additional wells and springs to review the water source development potential in the village.
- Interview the village leaders to locate most appropriate site for water source (about 6-8 points in the village).
- Review respective points from the hydrogeological point of view with the rank of A (good), B (fair) and C (poor).
- Additional recommended sites are marked on the topographical map in case that the requested site does not have good potential.

The 61 copies of maps are attached in the Data Book for use in the implementation phase.

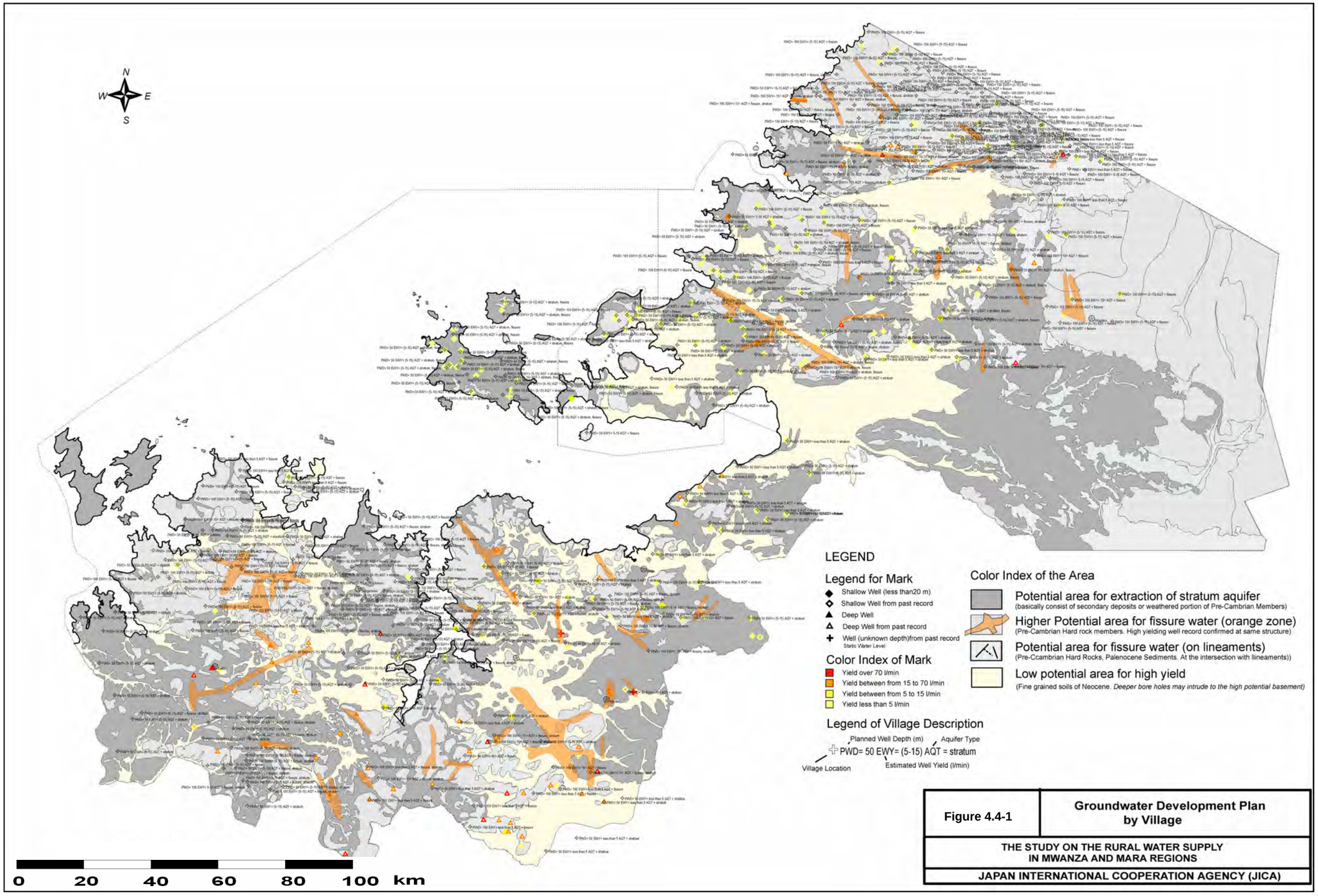


Figure 4.4-1 **Groundwater Development Plan by Village**

THE STUDY ON THE RURAL WATER SUPPLY IN MWANZA AND MARA REGIONS

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

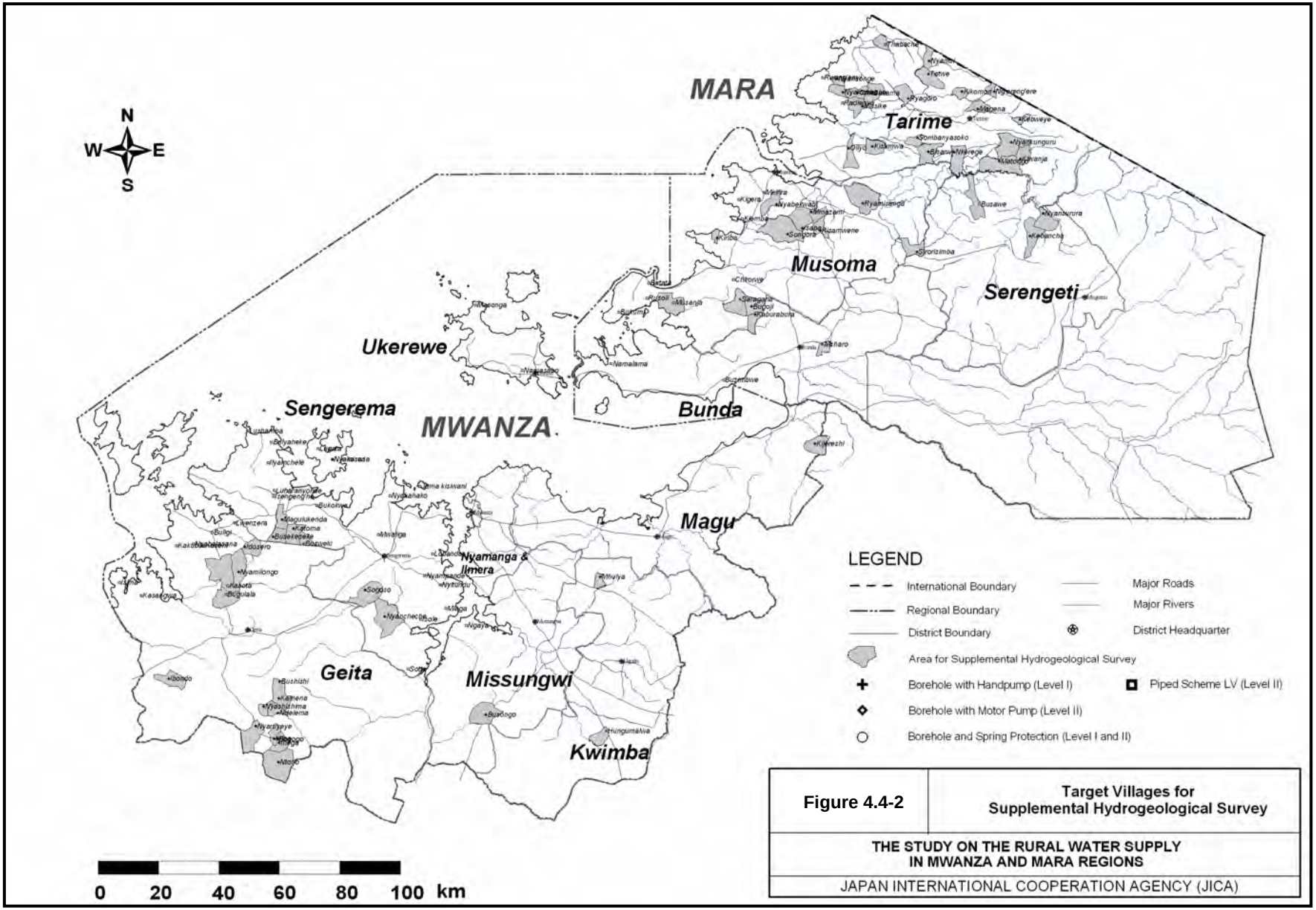


Figure 4.4-2 **Target Villages for Supplemental Hydrogeological Survey**

THE STUDY ON THE RURAL WATER SUPPLY IN MWANZA AND MARA REGIONS

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

4.5 Water Quality in Study Area

Water quality analysis was conducted on groundwater and surface water (lake water, river water, pond water, dam water, etc.) to confirm the nature and safeness of the water for potable purposes. In addition to examination of the safety of the water, the quality was examined to determine whether there is a seasonal fluctuation during the year.

4.5.1 Methodology and Water Quality Items

The water quality survey consists of water sampling at the site, and the laboratory tests. The sampling schedule was divided into four phases, I, II, III, IV, of which phase I and IV and phase II and III represent the analysis value in the wet and dry season respectively.

The total number of the samples are 154, 68 samples taken in the dry season, 68 in the wet season and 18 samples from the test wells.

The 14 parameters for on site water quality measurements are as follows:

Temperature, electric conductivity (EC), pH, oxidation-reduction potential (ORP), Fe, Mn, F, NO_3^-, As, NH_4^+, coliform, general bacteria, taste and odour.

In the laboratory, the following 40 parameters were analyzed for each sample:

Coliform group, coliform （E.Coli or heat-resistant coliform bacteria）, Pb, As, Se, Cr, Cn, Cd, Ba, Hg, F, NO_3^-, color, turbidity, pH, total filterable residue (TFR), total dissolved solids (TDS), total hardness (as $CaCO_3$), Ca, Mg, SO_4^{2-}, Cl^-, Fe, Mn, Cu, Zn, BOD, Oxygen as $KMnO_4$, ammonia ($NH_3 + NH_4^+$), Bo, Ni, Mo, NO_2^-, residual chlorine, Na^+, water temperature, EC, K^+, HCO_3^- and Total Phosphorus (TP).

Total Suspended Solids (TSS) was measured instead of TFR, as TFR and TDS indicate similar meaning values despite a different method of analysis.

The parameters analyzed were considered from the drinking water standards of Tanzania with reference to WHO guideline, and major ions which may affect human health.

4.5.2 Characteristic of Water Quality

The results of the water quality analysis in the field and laboratory in respective water sources are summarized as follows; detailed description of the water quality is attached in the supporting report.

a. Characteristic of Water Quality by Water Source

a.1 Well

Deep wells are not so much affected by bacteria but they contain a series of metal ions such as Fe, Pb, Cr, Se, Ba and F. Looking at the Standards of Water Quality of Tanzania and WHO, some of the parameters exceed the allowable values. Granite fissure type aquifers in Kwimba and Magu indicated a high content of Fluoride. Shallow Wells have a large variation by area. The shallow well in Bunda (Tamau Borehole), which extracts water from an aquifer in Neocene deposits, has an extremely high concentration of Cl^-, SO_4^{2-}, Cd, Na^+, and K^+, and the EC value exceeds 40,000 μ S/m. The well shall not be used as a drinking water source. Shallow wells also have a high concentration of coliform and bacteria, and also indicate a high EC value. This is largely depending on the well structure for protection against surface

contamination.

a.2 Lake

Samples from 12 points on the coast of Lake Victoria indicate that the water is safe in general. BOD is generally high and turbidity is high in some areas. Most of the locations are influenced by bacteriological contamination, such as general bacteria and coliform. The water from the lake shall be treated and filtered for potable purposes. In addition, supplementary water analysis indicates

a.3 River

River samples were taken from the Simiyu, Rubana, Ryamisanga, Mori and Grumeti Rivers. It is also noted that the water itself is safe except for the rivers of Mara and Grumeti, which contain Hg above the allowable value of Tanzanian standards. The river water also indicates a high value for colour, turbidity, BOD, SO_4^{2-} and some bacteriological contamination. The treatment of those items is necessary.

a.4 Scheme

The water from the outlet of schemes also varies. It mostly presents the character of water sources such as lakes, springs and boreholes. The high value of color and bacteriological contamination shows that the treatment procedure is not functioning adequately. The variation of the values also indicates the degree of maintenance.

b. Seasonal Deference of Water Quality by Source

b.1 Well

Shallow wells have the most particular difference of reduction of EC, TSS, Ca, Cl^-, K^+, PO_4 in wet season and an increase of coliform, bacteria, F, NH_4^+, B, NO_2^-, HCO_3^- and Na^+ in dry season. In the wet season, the value of Deep wells, EC, TDS, total hardness, Mg, K^+, PO_4 and F increased, and B was reduced. This fact suggests that even the deep boreholes are affected by seasonal deference.

b.2 Piped Scheme

The value varies by scheme, but in general, most of the substances tend to be reduced in the wet season.

b.3 Lake Victoria

The tendency of seasonal change is a reduction in value for most of the parameters. However, some sampling points show an increase of coliform, B, F, and Na^+.

b.4 River

As with Lake Victoria, most of the values tend to decrease. However, boron, color and turbidity increase in the rainy season. Fe and Hg which are categorized as toxic substances are also found in the dry season. Dams and ponds also fall into this category.

Chapter 5

Water Supply Plan

5 Water Supply Plan

5.1 General

The Ministry of Water on the Tanzanian side is investigating the water supply conditions for the Mwanza and Mara regions, requested the 929 villages and the 110 existing piped schemes in the 10 districts submitted to the Study Team. The water supply plan was executed for the 428 villages and also 57 existing piped schemes were selected from the requesting villages and the existing piped schemes in accordance with the selection criteria. Alternatives for the water supply plan are selected in consideration with the water sources plan in the Study area, such as the piped scheme utilizing the groundwater and Lake Victoria water, wells with hand pumps, and protection springs.

5.2 Target Year and Served Population

5.2.1 Target Year

The priority project of the water supply plan, which is the construction of water facilities in the implementation phase, will be completed by the year 2010. The water facilities will be designed to meet the water demand anticipated in the year 2015. The target year of the Tanzanian side for water supply program, increasing the coverage of water supply has three time-specific goals: 65% coverage by 2010, 74% coverage by 2015, and 90% coverage by 2025 (refer to the NRWSSP, 2006). The terms of water supply coverage and target villages are divided into three terms based on the above target year of the Tanzanian Government. The priority project of the water supply plan in urgent villages contributes to the achieving water supply coverage of Tanzania, while the water supply plans are expected to be implemented independently by the Tanzanian Government.

5.2.2 Served Population of the Study Area

a. Target Village in Study Area

There are 205 selected target villages for water supply plan in the Mwanza region and 223 villages in the Mara region, totaling 428 villages in the study area. The area of the water supply plan is indicated in the location map in Chapter 1. Also, the number of existing piped schemes for water supply plan is identified as a total of 57 piped schemes, consisting of 37 in the Mwanza region and 20 in the Mara region. The main utilization of water resources in the villages for water supply plan is the traditional dug well and shallow well.

b. Served Population

The administrative population for the year 2015 and 2025 of the 428 villages and the 57 piped schemes identified in the water supply plan are estimated by calculating the population growth rate (refer to Table 5.2-1) from the 1988 to 2002 population census. The population estimated for the year 2005 is calculated as approximately 2.22×10^6, composing of about 1.33×10^6 in the Mwanza region and about 0.89×10^6 in the Mara region, and is estimated at approximately 2.93×10^6 in the year of 2015 and 3.89×10^6 in the year of 2025 (refer to Table 5.2-1). The district population estimated to use hand pumps, others and piped schemes is shown in Table 5.2-1. The overall population which uses piped schemes is more than those which uses hand pumps. However, in the Mara region, it is obvious that the opposite phenomenon can be seen for the estimation of population between both years.

Table 5.2-1: Estimated Population Using Hand Pump and Piped Scheme

(The Year of 2005, 2015 and 2025)

	Annual Growth	HP+Spring			Piped Scheme			Total		
		2005	2015	2025	2005	2015	2025	2005	2015	2025
Misungwi	1.30%	21,117	24,072	27,391	80,094	91,290	103,877	101,211	115,362	131,268
Sengerema	3.60%	86,476	123,684	176,161	338,330	483,903	689,217	424,806	607,587	865,378
Kwimba	2.80%	28,089	37,113	48,917	124,319	164,251	216,491	152,408	201,364	265,408
Magu	2.10%	45,707	56,284	69,286	112,586	138,640	170,665	158,293	194,924	239,951
Geita	3.50%	114,233	161,344	227,592	183,469	259,135	365,535	297,702	420,479	593,127
Ukerewe	3.00%	2,990	4,023	5,406	185,165	249,138	334,820	188,155	253,161	340,226
Nyamagana+Ilemela	6.4%(Nya)+ 4.7%(Ile)	5,012	9,323	17,337	0	0	0	5,012	9,323	17,337
Mwanza Region	Ave3.3%	303,624	415,843	572,090	1,023,963	1,386,357	1,880,605	1,327,587	1,802,200	2,452,695
Bunda	1.90%	41,612	50,034	60,396	120,338	144,692	174,657	161,950	194,726	235,053
Musoma	2.10%	92,546	114,022	140,361	166,183	204,747	252,043	258,729	318,769	392,404
Tarime	2.70%	293,233	381,334	497,749	102,528	133,333	174,037	395,761	514,667	671,786
Serengeti	3.20%	53,832	73,924	101,294	21,070	28,926	39,636	74,902	102,850	140,930
Mara Region	Ave2.4%	481,223	619,314	799,800	410,119	511,698	640,373	891,342	1,131,012	1,440,173
Amount		784,847	1,035,157	1,371,890	1,434,082	1,898,055	2,520,978	2,218,929	2,933,212	3,892,868

5.3 Water Demand

5.3.1 Unit Water Demand

The unit water demand is calculated based on Tanzania's "Design Manual for water supply and waste water disposal (1997)". The unit water demand is applied to the following categories for water connections:

- Boreholes with hand pumps: 25 l/capita/day
- Public taps: 25 l/capita/day
- House connections: 70 l/capita/day
- Connections for public and private institutions:
  - －School: 10 l/pupil/day
  - －Health center: 10 l/person/day
  - －Health center: 50 l/bed/day（Hospitalization）
  - －Dispensary: 10 l/person/day
  - －Prison: 25 l/capita/day

5.3.2 Water Demand Projection

The total water demand is estimated for the Mwanza region of the year 2005 as approximately 11.6×10^3 m^3/day and as about 6.2×10^3 m^3/day in the Mara region in the same year. In the year 2015, the overall water demand is projected as approximately 56.4×10^3 m^3/day, consisting of 34.1×10^3 m^3/day in the Mwanza region and of 22.3×10^3 m^3/day in the Mara region. Out of the overall water demand in the year 2015 (about 56.4×10^3 m^3/day), the water demand is divided into the hand pump and protection spring as 20.3×10^3 m^3/day and piped scheme as 36.2×10^3 m^3/day.

5.4 Water Sources

5.4.1 Water Sources

The water sources existing in the Mwanza and Mara regions can generally be classified as surface water, groundwater and rain water. The surface water sources from which water is collected include rivers, streams, Lake Victoria, and small-scale dams, while the groundwater resources include springs, shallow wells, and deep wells (Boreholes). As mentioned in the evaluation of water sources in the Study area in Chapter-4, Lake Victoria water is suitable for the water sources of surface water, while river water is not considered due to seasonal variations in water volume, risks for water quality and high costs of water facilities. The assessment of groundwater potential is divided into deep (over 50m deep), middle (from 20 to 50m deep), and shallow aquifer (under 20m deep). It is found that many shallow wells dry up in the dry season, and are easily contaminated by surface water and there is a issue with water quality. In the case of deep wells using deep aquifers, the feature of geological conditions in Study area needs to be considered. Especially, the deep aquifers classified as “Fissure water”, and are available for potable water. The middle aquifers are also classified as “Stratum aquifers”, and are suitable for drinking water, as mentioned in Chapter-4. In the case of springs, it is better to take the water directly from cracks in the basement rock.

5.4.2 Water Sources Development Plan

Water sources are available for groundwater, spring water and Lake Victoria water in the Study area. A feature of the Mwanza and Mara regions is the existence of Lake Victoria as a surface water source. The important factors in considering water sources are (1) Sustainability for water use, (2) Availability through out the year, and (3) Safety of water quality. Utilization of the water sources are basically carried out in consideration with the above factors. Regarding the utilization of groundwater for water sources, fissure type aquifers using deep wells and stratum aquifers using medium depth wells are targeted in the water supply plan. However, judging from the drilling results, there are some wells with little water, indicating the difficulty of water abstraction in the basement rock area of the Study area. If the development potential of groundwater sources is not high, the served population is determined based on the groundwater potential. Therefore, for the drilling of deep wells, accurate surveys of fissure system are absolutely necessary and drilling focused on fissure system is being conducted. In any event, the actual exploitable yield and number of wells is decided according to the hydrogeological interpretation and analysis.

In regard to springs, protected springs for safety are planned at two spring sites, seeping over 30liters/min from the basement rock directly.

The utilization of river water and other surface water excluding Lake Water is not planned for reasons mentioned above. The water of Lake Victoria is utilized for the water supply plan. The types of piped schemes using Lake Victoria Water are included in the expanded, rehabilitated, and newly installed piped schemes. In case of newly installed piped schemes, the service area from Lake Victoria is within 9km, based on the comparison of cost effectiveness between the existing piped schemes.

5.5 Water Supply Plan

Classification of the 428 villages by water supply plan is shown in Table 5.5-1. The water supply plan for the 428 villages shown in Table 5.5-4 is projected based on the water sources development plan.

Table 5.5-1: Classification of 428 Villages by Water Supply Plan

Region	No.of Villages	428villages for water supply plan			Existing piped schemes for water supply plan
		HP & others	Newly piped scheme	Integreted & involved to the existing piped schemes	
Mwanza	205	89	61	55	37 piped schemes
Mara	223	158	37	28	20 piped schemes
Total	428	247	98	83	57 piped schemes

The water supply plan is grouped into the following types in the study area.

(1) Spring Protection

(2) Medium and Deep Well with Hand Pump

(3) Newly Installed Piped Scheme

(4) Expanded Piped Scheme

(5) Rehabilitated Piped Scheme

5.5.1 Spring Protection

The spring sites are located in basement rock cliffs and produce water at a rate of 30liters/min or more and water can be continuously fetched through out the year. However as spring water is often of poor quality and tends to become a sparse amount of water, it is necessary to grasp the current condition, water volume and quality of spring and to protect them. A standard design for spring protection is shown in Figure 5.5-1.

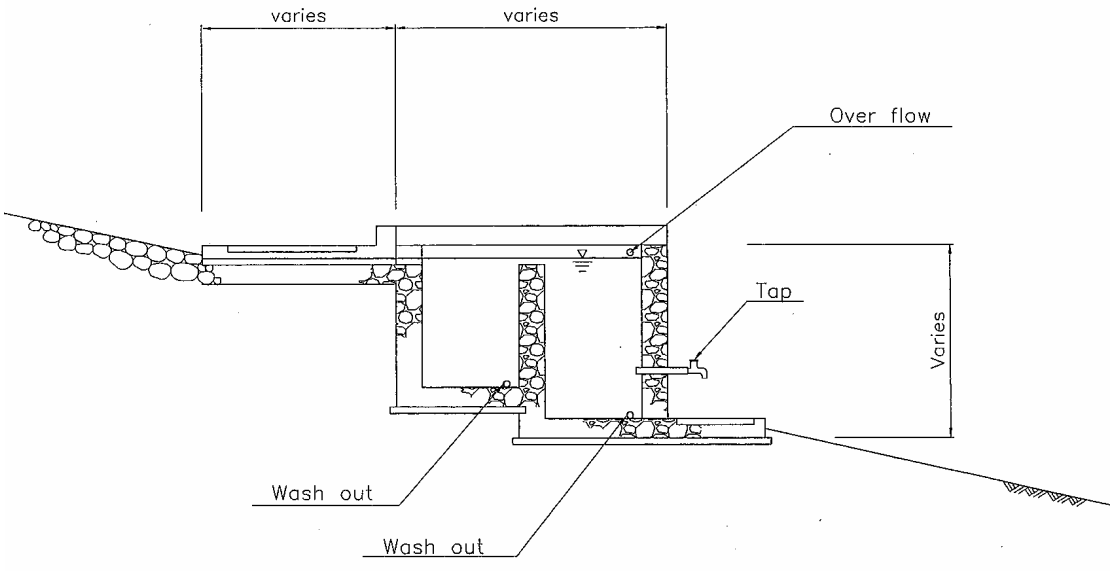


Figure 5.5-1: Typical Design of Spring Protection

In the water supply plan, the villages for which spring protection is planned are as follows;

Table 5.5-2: Villages Using Spring in the Water Supply Plan

Region	District	Villages	No. of spring	Water volume
Mwanza	Geita	Kasota	1	About 40liters/min
Mara	Serengeti	Busawe	1	About 30liters/min

5.5.2 Medium and Deep Well with Hand Pump

This type is to be adopted in Study areas where the potential of deep aquifers is estimated not to be very high. There are point water sources, targeting deep wells (fissure aquifer type of about 100m deep) and medium wells (stratum aquifer type of about 30-40m and 50m deep). In the case of hand pumps, the well capacity at a pumping rate of 15 liters/min for 8h/day of the standard hour is basically 7,200 liters/day. According to the results of a SIDA project and detail survey in the supplement survey of year 2006, the water potential of groundwater in the Study area is not high. Therefore the final number of wells with hand pumps is decided based on the groundwater potential in consideration with the detail hydrogeological investigation of each village in the supplementary survey. The number of hand pumps and population served by hand pump in the water supply plan is indicated in Table 5.5-3.

Table 5.5-3: Number of Hand Pump in the Water Supply Plan

Region	District	Number of HP	Served population in 2025 by HP	Number of Motorized Pump
MWANZA	Misungwi	43	16,334	6
	Sengerema	195	61,997	4
	Kwimba	66	20,701	12
	Magu	80	33,106	4
	Geita	242	69,614	0
	Ukerewe	6	1,500	0
	Nyamagana & Ilemela	11	7,084	0
	Mwanza Total	**643**	**210,336**	**26**
MARA	Bunda	94	34,697	1
	Musoma (Rural)	230	72,009	3
	Tarime	766	218,965	9
	Serengeti	136	45,101	1
	Mara Total	**1226**	**370,772**	**14**
Total		1,869	581,108	40

Table 5.5-4: Water Supply Plan (1/5)

Region	DISTRICT	No. by District	Village	Population in 2025	Water Sources type					served coverage rate(%) in 2005	served coverage rate(%) in 2025	Served Population in 2025
					HP=Hand pump MP=Motor pump	No. of HP or MP	Additional Medium BH	Total (HP)	Water Sources			
Mwanza	MISUNGWI	6	Mapilinga	3,192	Newly Piped Scheme				Lake V.	11	77	2,455
	MISUNGWI	10	Ibongoya A	5,303	HP	4	4	8	Deep BH	31	69	3,644
	MISUNGWI	17	Mwasagela	3,455	HP	3	3	6	Medium BH	19	62	2,156
	MISUNGWI	21	Mwamaguha	3,462	HP	3	2	5	Deep BH	19	55	1,908
	MISUNGWI	22	Buhingo	2,754	Expanded Piped Scheme MP	1		1	BH	23	89	2,448
	MISUNGWI	23	Kabale	4,648	Expanded Piped Scheme MP	2		2	BH	7	73	3,389
	MISUNGWI	24	Nyamainza	5,677	HP	6	4	10	Medium BH	6	50	2,841
	MISUNGWI	25	Busongo	6,361	Newly Piped Scheme MP	2		2	BH	5	93	5,916
	MISUNGWI	26	Isenengeja	2,163	HP	2	2	4	Medium BH	15	61	1,324
	MISUNGWI	27	Mbarika	3,799	Expanded Piped Scheme				Lake V.	17	83	3,150
	MISUNGWI	28	Ngaya	4,974	Newly Piped Scheme				Lake V.	13	100	4,974
	MISUNGWI	30	Usagara	3,242	Expanded Piped Scheme MP	1		1	BH	28	94	3,045
	MISUNGWI	31	Kanyelele	5,253	HP	4	3	7	Medium BH	31	64	3,379
	MISUNGWI	33	Budutu	2,078	HP	2	1	3	Medium BH	16	52	1,082
	MISUNGWI	35	Isamilo	5,997	Newly Piped Scheme				Lake V.	16	82	4,912
	MISUNGWI	36	Mwalogwabagole	4,514	Expanded Piped Scheme				Lake V.	15	81	3,652
	SENGEREMA	5	Ibondo	9,921	Expanded Piped Scheme				Lake V.	0	59	5,845
	SENGEREMA	6	Iusunganghol o	4,699	HP	5	2	7	Medium BH	0	37	1,750
	SENGEREMA	7	Mwabaluhi	5,879	Expanded Piped Scheme				Lake V.	0	59	3,463
	SENGEREMA	8	Sima	10,821	Rehabilitated Piped S. MP	2		2	BH	16.9	76	8,204
	SENGEREMA	10	Igulumuki	4,480	HP	5	5	10	Medium BH	0	56	2,500
	SENGEREMA	11	Ijinga	3,639	HP	4	2	6	Medium BH	0	41	1,500
	SENGEREMA	12	Ishishang'holo	3,489	HP	3	3	6	Medium BH	0	43	1,500
	SENGEREMA	13	Sogoso	7,306	HP	6	3	9	Deep BH	0	31	2,250
	SENGEREMA	14	Tabaruka	6,931	Expanded Piped Scheme				Lake V.	11.5	70	4,880
	SENGEREMA	15	Mayuga	3,160	HP	3	3	6	Medium BH	16.4	64	2,018
	SENGEREMA	16	Kishinda	8,255	HP	7	4	11	Medium BH	11.1	44	3,666
	SENGEREMA	17	Nyasenga	7,596	Newly Piped Scheme				Lake V.	23.5	82	6,260
	SENGEREMA	18	Nyampande	6,532	Newly Piped Scheme				Lake V.	9.2	68	4,449
	SENGEREMA	19	Busurumwangili	4,942	HP	5	4	9	Deep BH	6	52	2,547
	SENGEREMA	20	Tunyenye	6,566	HP	6		6	Deep BH	0	23	1,500
	SENGEREMA	21	Mauri	2,047	HP	2	4	6	Medium BH	0	73	1,500
	SENGEREMA	22	Kahumulo	6,043	Newly Piped Scheme				Lake V.	11.2	70	4,237
	SENGEREMA	23	Nyamasale	4,279	Expanded Piped Scheme				Lake V.	0	59	2,521
	SENGEREMA	24	Nyitundu	3,864	Newly Piped Scheme				Lake V.	0	59	2,276
	SENGEREMA	26	Lubanda	4,545	Newly Piped Scheme				Lake V.	0	59	2,678
	SENGEREMA	30	Juma kisiwani	5,394	Newly Piped Scheme				Lake V.	0	59	3,178
	SENGEREMA	31	Kasomeko	6,467	Newly Piped Scheme				Lake V.	0	59	3,810
	SENGEREMA	32	Ilekanilo	7,829	Newly Piped Scheme				Lake V.	0	59	4,612
	SENGEREMA	36	Nyamizeze	7,452	Expanded Piped Scheme				Lake V.	37.3	96	7,170
	SENGEREMA	37	Mwaliga	2,741	Newly Piped Scheme				Lake V.	0	59	1,615
	SENGEREMA	38	Kijuka	5,938	Expanded Piped Scheme				Lake V.	0	59	3,498
	SENGEREMA	43	Nyamahona	8,838	Newly Piped Scheme				Lake V.	0	59	5,207
	SENGEREMA	44	Nyakahako	9,400	Newly Piped Scheme				Lake V.	0	59	5,538
	SENGEREMA	47	Ngoma B	5,240	Newly Piped Scheme				Lake V.	32.2	91	4,775
	SENGEREMA	48	Irunda	5,123	Newly Piped Scheme				Lake V.	12.8	72	3,674
	SENGEREMA	50	Karumo	7,174	Newly Piped Scheme				Lake V.	12.7	72	5,138
	SENGEREMA	56	Bulyhilu	7,934	Newly Piped Scheme				Lake V.	16.6	76	5,991
	SENGEREMA	58	Igakamba	13,292	Newly Piped Scheme				Lake V.	7.8	67	8,868
	SENGEREMA	59	Bupandwa	26,219	Newly Piped Scheme				Lake V.	0	59	15,447
	SENGEREMA	61	Bilulumo	4,109	Newly Piped Scheme				Lake V.	0	59	2,421
	SENGEREMA	62	Luhorongoma	6,469	Newly Piped Scheme				Lake V.	0	59	3,811
	SENGEREMA	65	Ngoma A	11,141	HP	9	0	9	Medium BH	18.1	38	4,267
	SENGEREMA	66	Lubungo	3,537	Newly Piped Scheme				Lake V.	14.2	73	2,586
	SENGEREMA	67	Sotta	5,605	HP	5	2	7	Deep BH	0	31	1,750
	SENGEREMA	69	Isole	6,392	HP	5	2	7	Deep BH	17.8	45	2,888
	SENGEREMA	71	Bitoto	5,297	Newly Piped Scheme				Lake V.	0	59	3,121
	SENGEREMA	72	Kalangalanga	2,424	Newly Piped Scheme				Lake V.	0	59	1,428
	SENGEREMA	73	Mlaga	3,616	Newly Piped Scheme				Lake V.	0	59	2,131
	SENGEREMA	75	Buswelu	4,812	Newly Piped Scheme MP	2		2	Deep BH	12.4	82	3,946
	SENGEREMA	76	Migukulama	3,892	Expanded Piped Scheme				Lake V.	11.3	70	2,733
	SENGEREMA	77	Nyanzenda	7,219	Expanded Piped Scheme				Lake V.	7.4	66	4,787
	SENGEREMA	78	Isaka	11,281	HP	7	5	12	Medium BH	33.4	60	6,768
	SENGEREMA	79	Ruharanyonda	6,288	HP	5	0	5	Deep BH	10	30	1,879
	SENGEREMA	80	Kayenze	6,574	HP	5	0	5	Deep BH	23.2	42	2,775
	SENGEREMA	81	Nyamadoke	7,346	Newly Piped Scheme				Lake V.	23.2	82	6,032
	SENGEREMA	83	Busekeseke	4,354	HP	4	3	7	Deep BH	0	40	1,750
	SENGEREMA	84	Katoma	5,151	HP	5	3	8	Deep BH	0	39	2,000
	SENGEREMA	86	Magulukenda	6,483	HP	6	2	8	Deep BH	0	31	2,000
	SENGEREMA	87	Buzilasoga	4,543	HP	4	1	5	Deep BH	10.7	38	1,736
	SENGEREMA	88	Ikoni	3,160	HP	3	0	3	Deep BH	17.3	41	1,297
	SENGEREMA	89	Igaka	4,865	HP	5	3	8	Medium BH	0	41	2,000
	SENGEREMA	90	Kanyelele	3,916	HP	4	0	4	Deep BH	0	26	1,000
	SENGEREMA	93	Bukokwa	13,908	Newly Piped Scheme				Lake V.	0	59	8,194
	SENGEREMA	94	Kagunga	8,028	HP	8	0	8	Medium BH	0	25	2,000
	SENGEREMA	95	Lwenge	4,024	HP	4	1	5	Medium BH	0	31	1,250
	SENGEREMA	96	Nyancheche	9,773	HP	5	4	9	Deep BH	0	23	2,250
	SENGEREMA	97	Nyanzumla	6,495	HP	6	3	9	Medium BH	0	35	2,250
	SENGEREMA	99	Nyamiswi	4,156	Newly Piped Scheme				Lake V.	0	70	2,909
	SENGEREMA	100	Nyakasasa	7,267	Newly Piped Scheme				Lake V.	0	70	5,087
	SENGEREMA	102	Bugoro	7,271	Newly Piped Scheme				Lake V.	0	59	4,284
	SENGEREMA	103	Nyakabanga	4,768	Newly Piped Scheme				Lake V.	0	59	2,809
	SENGEREMA	104	Lugata	22,204	Newly Piped Scheme				Lake V.	0	59	13,081

Table 5.5-4: Water Supply Plan (2/5)

Region	DISTRICT	No. by District	Village	Population in 2025	Water Sources type					served coverage rate(%) in 2005	served coverage rate(%) in 2025	Served Population in 2025
					HP=Hand pump MP=Motor pump	No. of HP or MP	Additional Medium BH	Total (HP)	Water Sources			
Mwanza	SENGEREMA	106	Lushamba	19,250	Newly Piped Scheme				Lake V.	0	59	11,341
	SENGEREMA	108	Bulyaheke	9,382	Newly Piped Scheme				Lake V.	0	59	5,527
	SENGEREMA	110	Ilyamchele	3,093	Newly Piped Scheme				Lake V.	0	59	1,822
	SENGEREMA	114	Luharanyonga	6,288	Newly Piped Scheme				Lake V.	17.9	77	4,830
	SENGEREMA	115	Isengeng'he	5,575	Newly Piped Scheme				Lake V.	0	59	3,284
	SENGEREMA	118	Nyakasungwa	11,103	Expanded Piped Scheme				Lake V.	4.6	64	7,052
	SENGEREMA	119	Igwanzozu	2,641	Newly Piped Scheme				Lake V.	0	59	1,556
	KWIMBA	3	Ilumba	3,893	Rehabilitated Piped S.MP	1		1	BH	29	90	3,513
	KWIMBA	22	Hungumalwa	8,711	Newly Piped Scheme MP	2		2	BH	35	100	8,711
	KWIMBA	24	Manayi	5,979	Rehabilitated Piped S.MP	1		1	BH	7	68	4,080
	KWIMBA	25	Ilula	5,158	Rehabilitated Piped S.MP	1		1	BH	16	77	3,984
	KWIMBA	31	Kijida	5,022	Rehabilitated Piped S.MP	1		1	BH	28	89	4,482
	KWIMBA	34	Igumangobo	3,103	HP	3	3	6	Deep BH	0	48	1,500
	KWIMBA	35	Shigongama	4,590	HP	5	0	5	Medium BH	0	27	1,250
	KWIMBA	40	Mwamitinje	1,580	HP	2	0	2	Medium BH	0	32	500
	KWIMBA	44	Izizimba A	6,097	Expanded Piped Scheme				Deep BH	0	61	3,734
	KWIMBA	45	Izizimba B	4,591	Expanded Piped Scheme				Deep BH	0	61	2,812
	KWIMBA	55	Sanga	5,536	Rehabilitated Piped S.MP	1		1	BH	0	61	3,390
	KWIMBA	61	Nyamikoma	2,681	HP	3	2	5	Medium BH	6	53	1,411
	KWIMBA	66	Mwampulu	4,799	HP	5	2	7	Medium BH	9	45	2,182
	KWIMBA	68	Ngulla	4,820	HP	5	3	8	Medium BH	9	50	2,434
	KWIMBA	69	Nyamatala	5,714	HP	5	3	8	Medium BH	7	42	2,400
	KWIMBA	70	Nyambuyi	3,348	HP	3	2	5	Medium BH	0	37	1,250
	KWIMBA	71	Mhulya	3,756	HP	4	4	8	Deep BH	0	53	2,000
	KWIMBA	72	Mwangika	3,381	HP	3	0	3	Deep BH	13	35	1,190
	KWIMBA	74	Ngogo	5,342	HP	4	1	5	Medium BH	32	55	2,960
	KWIMBA	82	Bungandando	6,254	Rehabilitated Piped S.MP	1		1	BH	34	95	5,956
	KWIMBA	83	Icheja	2,338	HP	2	2	4	Deep BH	14	57	1,327
	KWIMBA	84	Nqwaswengele	8,354	Rehabilitated Piped S.MP	2		2	BH	0	61	5,116
	KWIMBA	85	Nyamigamba	7,839	Newly Piped Scheme MP	2		2	Deep BH	22	83	6,525
	MAGU	1	Nyamahanga	3,523	Expanded Piped Scheme				Lake V.	32.2	96	3,367
	MAGU	6	Inolelo	3,127	HP	3	0	3	Medium BH	12	36	1,125
	MAGU	13	Kitongosima	6,219	HP	4	0	4	Deep BH	37	53	3,301
	MAGU	22	Bubinza	5,911	Newly Piped Scheme				Lake V.	12.5	76	4,484
	MAGU	26	Bugatu	6,595	HP	4	0	4	Medium BH	39.3	54	3,592
	MAGU	32	Mahaha	11,882	HP	9	2	11	Medium BH	21.6	45	5,316
	MAGU	33	Nyasoto	4,722	HP	4	4	8	Medium BH	23	65	3,086
	MAGU	37	Igekemaja	3,889	HP	4	0	4	Medium BH	9.6	35	1,373
	MAGU	38	Kitumba	6,367	Rehabilitated Piped S.MP	2		2	BH	14.2	78	4,939
	MAGU	43	Mwagulanja	4,426	Rehabilitated Piped S.MP	1		1	BH	34	97	4,310
	MAGU	44	Bulima	8,462	Rehabilitated Piped S.MP	1		1	BH	24.4	88	7,428
	MAGU	50	Ihayabuyaga B	4,679	HP	5	2	7	Medium BH	8	45	2,124
	MAGU	51	Lwagwe	2,273	HP	3	3	6	Medium BH	0	66	1,500
	MAGU	55	Simanilwe	3,345	Expanded Piped Scheme				Lake V.	22.2	86	2,862
	MAGU	58	Badugu	7,097	HP	6	1	7	Medium BH	16	41	2,886
	MAGU	59	Manala	2,380	HP	3	3	6	Medium BH	6.2	69	1,648
	MAGU	66	Lukungu	4,384	Newly Piped Scheme				Lake V.	8.4	72	3,146
	MAGU	67	Mayenga	3,660	Expanded Piped Scheme				Lake V.	10.1	73	2,689
	MAGU	74	Mwakiloba	4,071	Newly Piped Scheme				Lake V.	9.1	72	2,950
	MAGU	75	Kijereshi	8,759	HP	8	2	10	Deep BH	8.4	37	3,236
	MAGU	78	Nyangili	3,715	Expanded Piped Scheme				Lake V.	0	63	2,354
	MAGU	80	Malili	2,530	HP	2	3	5	Medium BH	21.1	71	1,784
	MAGU	83	Mwamgomba	2,462	HP	2	3	5	Medium BH	15.4	66	1,629
	GEITA	2	Igate	8,376	HP	8	0	8	Deep BH	0	24	2,000
	GEITA	3	Idosero	7,324	HP	6	4	10	Deep BH	0	34	2,500
	GEITA	4	Lwenzera	21,354	Newly Piped Scheme				Lake V.	0	59	12,641
	GEITA	5	Nzera	13,599	Expanded Piped Scheme				Lake V.	20.2	79	10,798
	GEITA	6	Buligi	13,764	Newly Piped Scheme				Lake V.	0	59	8,148
	GEITA	8	Kakubilo	26,458	Newly Piped Scheme				Lake V.	0	59	15,663
	GEITA	9	Nyabalasana	10,102	Newly Piped Scheme				Lake V.	0	59	5,980
	GEITA	10	Kaseni	5,768	Newly Piped Scheme				Lake V.	0	59	3,414
	GEITA	14	Nyamboge	13,986	Expanded Piped Scheme				Lake V.	0	59	8,280
	GEITA	15	Katoma	12,917	Newly Piped Scheme				Lake V.	23	82	10,617
	GEITA	16	Nyakasenze	4,513	Newly Piped Scheme				Lake V.	0	59	2,672
	GEITA	17	Bugulala	11,440	HP	5	6	11	Deep BH	0	24	2,750
	GEITA	18	Kasota	12,942	HP,Spring	5	4	9	Deep BH、S	0	17	2,250
	GEITA	19	Nyamilongo	10,793	HP	6	2	8	Deep BH	0	19	2,000
	GEITA	20	Nyalwanzaja	9,590	HP	7	4	11	Deep BH	22.1	51	4,869
	GEITA	21	Imalampaka	4,388	HP	3	7	10	Medium BH	25	82	3,597
	GEITA	22	Kamera	10,966	HP	5	3	8	Deep BH	0	18	2,000
	GEITA	23	Bushishi	6,260	HP	4	5	9	Deep BH	0	36	2,250
	GEITA	24	Ndelema	5,537	HP	3	7	10	Deep BH	0	45	2,500
	GEITA	25	Nyashishima	2,616	HP	2	3	5	Deep BH	0	48	1,250
	GEITA	26	Bogogo	13,151	HP	6	2	8	Deep BH	13	28	3,710
	GEITA	27	Ikina	3,160	HP	2	5	7	Deep BH	0	55	1,750
	GEITA	28	Butombula	5,498	HP	5	5	10	Deep BH	0	45	2,500
	GEITA	29	Ntono	12,343	HP	6	4	10	Deep BH	0	20	2,500
	GEITA	30	Ihega	5,023	HP	3	8	11	Deep BH	0	55	2,750
	GEITA	31	Nyakangwe	6,117	HP	6	3	9	Deep BH	0	37	2,250
	GEITA	32	Nyaruyeye	7,347	HP	5	3	8	Deep BH	0	27	2,000
	GEITA	34	Mhama	3,130	HP	3	3	6	Medium BH	0	48	1,500
	GEITA	35	Rukarakata	8,715	HP	8	2	10	Medium BH	0	29	2,500
	GEITA	38	Kashishi	7,439	HP	5	0	5	Deep BH	36.7	54	3,980
	GEITA	40	Kasungamile	3,422	HP	3	3	6	Medium BH	0	44	1,500
	GEITA	42	Ibondo	9,713	HP	7	6	13	Deep BH	0	33	3,250
	GEITA	43	Inyara	9,928	HP	9	4	13	Medium BH	0	33	3,250

Table 5.5-4: Water Supply Plan (3/5)

Region	DISTRICT	No. by District	Village	Population in 2025	Water Sources type				served coverage rate(%) in 2005	served coverage rate(%) in 2025	Served Population in 2025
					HP=Hand pump MP=Motor pump	No. of HP or MP	Additional Medium BH	Total (HP)	Water Sources			
Mwanza	GEITA	45	Shilabela	3,648	HP	4	2	6	Medium BH	0	41	1,500
	GEITA	51	Mabamba	8,314	HP	8	5	13	Medium BH	0	39	3,250
	GEITA	52	Chikobe	7,919	Expanded Piped Scheme				Lake V.	37	96	7,618
	GEITA	53	Kasangwa	12,095	Newly Piped Scheme				Lake V.	0	59	7,160
	GEITA	54	Isima	5,357	Expanded Piped Scheme				Lake V.	0	59	3,171
	GEITA	57	Lulama	2,711	HP	3	3	6	Medium BH	0	55	1,500
	GEITA	59	Kharumwa	9,223	Expanded Piped Scheme				Lake V.	38.2	97	8,983
	GEITA	61	Bukungu	5,291	Expanded Piped Scheme				Lake V.	33	92	4,878
	GEITA	63	Ikangala	2,642	Expanded Piped Scheme				Lake V.	0	59	1,564
	GEITA	64	Mwamakiliga	1,975	HP	2	0	2	Deep BH	26.8	52	1,029
	UKEREWE	2	Chankamba	4,987	Newly Piped Scheme				Lake V.	15.6	76	3,803
	UKEREWE	3	Bwasa	4,656	Expanded Piped Scheme				Lake V.	6.5	67	3,127
	UKEREWE	5	Murutilima	8,284	Expanded Piped Scheme				Lake V.	0	61	5,025
	UKEREWE	9	Busangu	6,049	Expanded Piped Scheme				Lake V.	31.5	92	5,574
	UKEREWE	12	Namasabo	3,772	Newly Piped Scheme				Lake V.	0	61	2,288
	UKEREWE	14	Bugala	11,446	Expanded Piped Scheme				Lake V.	27.4	88	10,078
	UKEREWE	15	Itira	4,354	Expanded Piped Scheme				Lake V.	12.5	73	3,185
	UKEREWE	16	Ihebo	4,591	Expanded Piped Scheme				Lake V.	6.8	67	3,096
	UKEREWE	17	Igongo	4,267	Expanded Piped Scheme				Lake V.	0	61	2,588
	UKEREWE	18	Muriti	4,374	Expanded Piped Scheme				Lake V.	31.3	92	4,022
	UKEREWE	21	Nyamanga	4,974	HP	4	2	6	Medium BH	0	30	1,500
	UKEREWE	22	Nyang'ombe	6,919	Newly Piped Scheme				Lake V.	21.1	82	5,656
	UKEREWE	38	Masonga	9,478	Expanded Piped Scheme				Lake V.	5	66	6,222
	UKEREWE	45	Bukonyo	2,832	Expanded Piped Scheme				Lake V.	25.7	86	2,445
	UKEREWE	48	Malegea	5,835	Expanded Piped Scheme				Lake V.	29.5	90	5,260
	UKEREWE	49	Mukasika	3,086	Expanded Piped Scheme				Lake V.	0	61	1,872
	UKEREWE	50	Muhande	4,063	Expanded Piped Scheme				Lake V.	29.5	90	3,663
	UKEREWE	51	Kweru	6,311	Newly Piped Scheme				Lake V.	0	61	3,828
	UKEREWE	54	Sizu	3,663	Newly Piped Scheme				Lake V.	0	61	2,222
	UKEREWE	58	Bulamba	6,675	Expanded Piped Scheme				Lake V.	0	61	4,048
	UKEREWE	67	Bugombe	2,954	Expanded Piped Scheme				Lake V.	0	61	1,791
	UKEREWE	68	Nantare	4,511	Newly Piped Scheme				Lake V.	0	61	2,736
	UKEREWE	72	Halwego	8,750	Expanded Piped Scheme				Lake V.	7.6	68	5,972
	UKEREWE	73	Buhima	9,094	Expanded Piped Scheme				Lake V.	0	61	5,515
	UKEREWE	74	Chamuhunda	4,465	Newly Piped Scheme				Lake V.	24.3	85	3,793
	NYAMAGANA & ILEMELA	2	Kishili	13,562	HP	9	2	11	Deep BH	25	45	6,141
Mara	BUNDA	9	Kinyambwiga	4,867	Expanded Piped Scheme				Lake V.	0	64	3,115
	BUNDA	16	Marambeka	4,584	HP	5	2	7	Medium BH	24.2	62	2,859
	BUNDA	17	Mugeta	2,995	HP	3	0	3	Midium BH	25	50	1,499
	BUNDA	18	Sanzate	4,258	HP	5	2	7	Midium BH	17.6	59	2,499
	BUNDA	19	Nyang'aranga	4,504	HP	6	2	8	Midium BH	0	44	2,000
	BUNDA	20	Kyandege	5,131	HP	6	2	8	Midium BH	14.5	53	2,744
	BUNDA	23	Manchimweru	5,522	HP	6	2	8	Midium BH	20.7	57	3,143
	BUNDA	26	Ligamba B	2,319	HP	3	3	6	Deep BH	10	75	1,732
	BUNDA	27	Misisi	3,476	Newly Piped Scheme MP	1		1	Deep BH	23.13	87	3,028
	BUNDA	30	Kangetutya	3,153	HP	4	2	6	Midium BH	10.87	58	1,843
	BUNDA	33	Mcharo	1,518	HP	4	1	5	Deep BH	11.36	94	1,422
	BUNDA	37	Nyamatoke	2,666	HP	4	3	7	Midium BH	0	66	1,750
	BUNDA	42	Kabasa	4,297	HP	4	3	7	Midium BH	27.69	68	2,940
	BUNDA	46	Hunyari	6,029	HP	6	2	8	Midium BH	24.88	58	3,500
	BUNDA	48	Mariwanda	6,201	HP	7	2	9	Midium BH	17.45	54	3,332
	BUNDA	51	Buzimbwe	3,171	Newly Piped Scheme				Lake V.	0	64	2,029
	BUNDA	52	Kabainja	2,572	Newly Piped Scheme				Lake V.	0	64	1,646
	BUNDA	62	Kiroreli	5,464	HP	5	0	5	Deep BH	34	57	3,108
	BUNDA	67	Karukekere	5,595	Expanded Piped Scheme				Lake V.	0	64	3,581
	BUNDA	68	Muranda	4,518	Expanded Piped Scheme				Lake V.	0	64	2,892
	BUNDA	69	Haruzale	2,000	Expanded Piped Scheme				Lake V.	0	64	1,280
	BUNDA	84	Nafuba	3,531	Newly Piped Scheme				Lake V.	0	64	2,260
	BUNDA	85	Igundu	4,812	Newly Piped Scheme				Lake V.	7.3	71	3,431
	BUNDA	88	Namalama	2,194	Newly Piped Scheme				Lake V.	0	64	1,404
	BUNDA	93	Sunsi	6,073	Newly Piped Scheme				Lake V.	0	64	3,887
	MUSOMA	1	Wegero	4,761	HP	6	0	6	Midium BH	10	42	1,976
	MUSOMA	2	Baranga	4,008	HP	5	2	7	Midium BH	12	56	2,231
	MUSOMA	5	Kitalamanka	4,666	HP	4	3	7	Midium BH	30	68	3,150
	MUSOMA	6	Sirorisimba	4,730	HP	4	4	8	Deep BH	0	42	2,000
	MUSOMA	8	Ryamisanga	5,644	HP	6	2	8	Deep BH	18	53	3,016
	MUSOMA	14	Mirwa	4,188	HP	5	0	5	Midium BH	17	47	1,962
	MUSOMA	15	Magunga	5,728	HP	8	0	8	Midium BH	0	35	2,000
	MUSOMA	17	Kinyariri	2,630	Expanded Piped Scheme				Lake V.	0	63	1,666
	MUSOMA	19	Ikibubwa	3,774	HP	5	5	10	Deep BH	0	66	2,500
	MUSOMA	20	Busegwe	7,223	HP	9	7	16	Deep BH	0	55	4,000
	MUSOMA	21	Kisamwene	5,239	HP	6	5	11	Deep BH	0	52	2,750
	MUSOMA	23	Bukabwa	4,333	Expanded Piped Scheme MP	1		1	BH	0	63	2,746
	MUSOMA	24	Mmazami	5,918	HP	7	4	11	Deep BH	0	46	2,750
	MUSOMA	25	Kirumi	3,662	Newly Piped Scheme				Lake V.	0	63	2,321
	MUSOMA	26	Mwiringo	4,106	Newly Piped Scheme				Lake V.	29	92	3,793
	MUSOMA	27	Bwaikwitururu	6,293	Newly Piped Scheme				Lake V.	25	88	5,561
	MUSOMA	28	Bwaikumsoma	7,794	Newly Piped Scheme				Lake V.	0	63	4,939
	MUSOMA	31	Chirorwe	3,859	HP	5	3	8	Deep BH	0	52	2,000
	MUSOMA	32	Wanyere	4,587	HP	6	5	11	Deep BH	0	60	2,750
	MUSOMA	33	Bugoji	6,450	HP	7	3	10	Deep BH	22	61	3,919
	MUSOMA	35	Saragana	5,492	Newly Piped Scheme MP	2		2	Deep BH	9	72	3,975
	MUSOMA	36	Kaburabura	2,661	HP	4	3	7	Deep BH	0	66	1,750
	MUSOMA	42	Mwanzaburiga	3,572	HP	5	2	7	Deep BH	0	49	1,750
	MUSOMA	45	Kwigutu	4,112	HP	5	3	8	Medium BH	10	59	2,411
	MUSOMA	46	Nyasirori	4,989	Expanded Piped Scheme				Lake V.	21	84	4,210
	MUSOMA	47	Nyamikoma	6,206	HP	6	3	9	Medium BH	27.5	64	3,957

Table 5.5-4: Water Supply Plan (4/5)

Region	DISTRICT	No. by District	Village	Population in 2025	Water Sources type					served coverage rate(%) in 2005	served coverage rate(%) in 2025	Served Population in 2025
					HP=Hand pump MP=Motor pump	No. of HP or MP	Additional Medium BH	Total (HP)	Water Sources			
Mara	MUSOMA	50	Nyankanga	7,951	HP	7	5	12	Deep BH	32	70	5,544
	MUSOMA	52	Nyarukoru	1,728	HP	2	2	4	Medium BH	0	58	1,000
	MUSOMA	53	Bisumwa	5,759	HP	8	3	11	Medium BH	0	48	2,750
	MUSOMA	54	Nyabekwabi	6,340	HP	8	3	11	Deep BH	0	43	2,750
	MUSOMA	55	Isaba	4,906	HP	3	7	10	Deep BH	20	71	3,481
	MUSOMA	56	Songora	8,726	HP	8	6	14	Deep BH	20	60	5,245
	MUSOMA	58	Ryamugabo	3,269	Expanded Piped Scheme				Lake V.	0	63	2,072
	MUSOMA	59	Bugwema	2,762	Newly Piped Scheme				Lake V.	0	63	1,750
	MUSOMA	60	Masinono	3,946	Newly Piped Scheme				Lake V.	0	63	2,501
	MUSOMA	61	Muhoji	2,655	HP	4	0	4	Medium BH	0	38	1,000
	MUSOMA	64	Mabuimerafu	2,962	Expanded Piped Scheme				Lake V.	0	63	1,877
	MUSOMA	65	Musanja	6,112	Newly Piped Scheme				Lake V.	0	63	3,873
	MUSOMA	67	Butata	7,666	Newly Piped Scheme				Lake V.	0	63	4,858
	MUSOMA	68	Buanga	3,851	Newly Piped Scheme				Lake V.	0	63	2,441
	MUSOMA	69	Rusoli	4,403	Newly Piped Scheme				Lake V.	0	63	2,790
	MUSOMA	70	Kwikerege	1,506	Newly Piped Scheme				Lake V.	0	63	954
	MUSOMA	72	Bukumi	3,527	Newly Piped Scheme				Lake V.	0	63	2,235
	MUSOMA	74	Maneke	5,132	Newly Piped Scheme				Lake V.	15	78	4,022
	MUSOMA	75	Tegeruka	3,463	Newly Piped Scheme				Lake V.	28	91	3,164
	MUSOMA	77	Katario	4,063	HP	4	3	7	Medium BH	26	69	2,806
	MUSOMA	80	Bulinga	5,571	Newly Piped Scheme				Lake V.	8	71	3,976
	MUSOMA	82	Chitare	5,447	Newly Piped Scheme				Lake V.	35	98	5,359
	MUSOMA	83	Chimati	3,153	Newly Piped Scheme				Lake V.	0	63	1,998
	MUSOMA	84	Makojo	3,277	Newly Piped Scheme				Lake V.	0	63	2,077
	MUSOMA	87	Seka	4,312	Newly Piped Scheme				Lake V.	0	63	2,733
	MUSOMA	88	Mikuyu	2,180	Expanded Piped Scheme				Lake V.	0	63	1,381
	MUSOMA	91	Mmahale	1,680	Expanded Piped Scheme				Lake V.	0	63	1,064
	MUSOMA	92	Mkirira	4,077	Newly Piped Scheme				Lake V.	0	63	2,583
	MUSOMA	93	Rubuka	2,597	Newly Piped Scheme				Lake V.	0	63	1,646
	MUSOMA	94	Kabegi	3,437	Newly Piped Scheme				Lake V.	23	86	2,969
	MUSOMA	97	Kiemba	4,971	Newly Piped Scheme				Lake V.	0	63	3,150
	MUSOMA	98	Kigera	8,844	Expanded Piped Scheme				Lake V.	0	63	5,604
	MUSOMA	99	Kwikuba	2,262	Newly Piped Scheme				Lake V.	21	84	1,908
	MUSOMA	103	Kiriba	4,309	Newly Piped Scheme				Lake V.	13	76	3,291
	TARIME	5	Kenyamanyori	6,619	HP	7	3	10	Deep BH	17.1	55	3,632
	TARIME	7	Nkende	5,352	HP	6	0	6	Deep BH	13.1	41	2,201
	TARIME	8	Magena	3,968	HP	3	6	9	Deep BH	24.7	81	3,230
	TARIME	12	Mogabiri	9,073	HP	8	2	10	Deep BH	33.2	61	5,512
	TARIME	14	Nyasaricho	1,758	HP	2	3	5	Deep BH	17.6	89	1,559
	TARIME	15	Kemakorere	7,477	HP	9	3	12	Deep BH	0	40	3,000
	TARIME	16	Nyarero	4,707	HP	5	3	8	Deep BH	14.2	57	2,668
	TARIME	17	Soroneta	4,536	HP	6	3	9	Deep BH	0	50	2,250
	TARIME	18	Rosana	2,186	HP	3	1	4	Deep BH	8.3	54	1,181
	TARIME	19	Magoto	6,010	HP	8	2	10	Deep BH	0	42	2,500
	TARIME	20	Borega A	5,402	HP	6	0	6	Deep BH	9.6	37	2,019
	TARIME	21	Ganyango	4,791	HP	6	3	9	Deep BH	0	47	2,250
	TARIME	22	Kebweye	3,610	HP	3	9	12	Deep BH	0	83	3,000
	TARIME	23	Nyarwana	6,499	Rehabilitated Piped S.MP	2		2	BH	0	62	4,000
	TARIME	24	Nyankunguru	7,034	HP	5	4	9	Deep BH	0	32	2,250
	TARIME	25	Wegita	4,886	Newly Piped Scheme MP	2		2	Deep BH	0	62	3,007
	TARIME	29	Muriba	9,011	HP	11	4	15	Deep BH	6	48	4,291
	TARIME	30	Bungurere	4,246	HP	5	2	7	Deep BH	2.7	44	1,865
	TARIME	31	Kobari	3,152	HP	4	3	7	Deep BH	0	56	1,750
	TARIME	32	Nyantira	11,105	HP	13	2	15	Deep BH	7.2	41	4,550
	TARIME	33	Mangucha	8,946	HP	11	2	13	Deep BH	4.7	41	3,670
	TARIME	34	Itiryo	9,853	HP	12	0	12	Deep BH	0	30	3,000
	TARIME	35	Kegonga	7,324	HP	9	2	11	Deep BH	6.9	44	3,255
	TARIME	36	Gibasa	10,481	HP	12	3	15	Deep BH	5	41	4,274
	TARIME	37	Genkuru	8,867	HP	11	5	16	Deep BH	0	45	4,000
	TARIME	38	Kangariani	5,692	HP	7	2	9	Deep BH	0	40	2,250
	TARIME	39	Kitawasi	8,986	HP	10	2	12	Deep BH	8	41	3,719
	TARIME	40	Masanga	8,079	HP	10	5	15	Deep BH	0	46	3,750
	TARIME	41	Matongo	5,031	HP	4	2	6	Deep BH	0	30	1,500
	TARIME	43	Kerende	6,264	HP	7	2	9	Deep BH	8.2	44	2,764
	TARIME	44	Kiwanja	6,309	HP	4	1	5	Deep BH	24	44	2,764
	TARIME	45	Murito	6,127	HP	7	2	9	Deep BH	15	52	3,169
	TARIME	47	Remagwe	3,908	HP	5	4	9	Deep BH	8	66	2,563
	TARIME	49	Kitagasembe	2,699	HP	3	1	4	Deep BH	9.3	46	1,251
	TARIME	50	Ng'ereng'ere	3,605	HP	5	1	6	Deep BH	0	42	1,500
	TARIME	51	Getenga	5,637	HP	7	0	7	Deep BH	0	31	1,750
	TARIME	52	Kyoruba	4,369	HP	6	2	8	Deep BH	0	46	2,000
	TARIME	53	Pemba	3,361	HP	4	1	5	Deep BH	8.2	45	1,526
	TARIME	54	Nyabitocho	3,598	HP	4	2	6	Deep BH	10.6	52	1,881
	TARIME	55	Nyabisaga	7,089	HP	9	2	11	Deep BH	0	39	2,750
	TARIME	56	Borega B	3,699	HP	4	0	4	Deep BH	11.9	39	1,440
	TARIME	57	Kiongera	5,287	HP	7	2	9	Deep BH	0	43	2,250
	TARIME	58	Nyabirongo	5,642	HP	7	3	10	Deep BH	0	44	2,500
	TARIME	59	Kikomori	3,282	HP	4	2	6	Deep BH	0	46	1,500
	TARIME	60	Kubiterere	5,381	HP	7	3	10	Deep BH	0	46	2,500
	TARIME	61	Korotambe	5,554	HP	7	3	10	Deep BH	0	45	2,500
	TARIME	62	Nyamhunda	3,488	HP	5	2	7	Deep BH	0	50	1,750
	TARIME	63	Kewamamba	2,790	HP	4	2	6	Deep BH	0	54	1,500
	TARIME	64	Nkerege	4,256	HP	5	4	9	Deep BH	0	53	2,250
	TARIME	65	Nyagisya	3,099	HP	4	0	4	Deep BH	0	32	1,000
	TARIME	66	Gamasara	3,707	HP	4	3	7	Deep BH	11.9	59	2,191
	TARIME	67	Kemange	6,314	HP	7	3	10	Deep BH	8.1	48	3,011
	TARIME	68	Mtama	3,135	HP	4	2	6	Deep BH	14.2	62	1,945

Table 5.5-4: Water Supply Plan (5/5)

Region	DISTRICT	No. by District	Village	Population in 2025	Water Sources type					served coverage rate(%) in 2005	served coverage rate(%) in 2025	Served Population in 2025
					HP=Hand pump MP=Motor pump	No. of HP or MP	Additional Medium BH	Total (HP)	Water Sources			
Mara	TARIME	69	Sombanyasoko	1,452	HP	1	3	4	Deep BH	14.9	84	1,216
	TARIME	70	Surubu	4,378	HP	4	2	6	Deep BH	21	55	2,419
	TARIME	71	Bisarwi	4,489	HP	3	5	8	Deep BH	16.6	61	2,745
	TARIME	73	Nyamirambaro	2,540	HP	3	2	5	Deep BH	0	49	1,250
	TARIME	74	Kiterere	1,597	HP	2	0	2	Deep BH	0	31	500
	TARIME	75	Turgeti	2,937	HP	3	2	5	Deep BH	15.7	58	1,711
	TARIME	76	Kwisarara	3,925	HP	5	3	8	Deep BH	0	51	2,000
	TARIME	77	Kitenga	5,280	HP	7	4	11	Deep BH	0	52	2,750
	TARIME	78	Buganja	5,237	HP	6	0	6	Deep BH	10	39	2,024
	TARIME	79	Mika	4,263	HP	5	0	5	Deep BH	0	29	1,250
	TARIME	80	Nyasoro	3,759	HP	3	2	5	Deep BH	30	63	2,378
	TARIME	81	Utegi	3,452	HP	4	0	4	Deep BH	14.9	44	1,514
	TARIME	83	Mnag'ore	1,849	HP	2	0	2	Deep BH	28	55	1,018
	TARIME	84	Osiri	3,292	HP	3	1	4	Deep BH	27	57	1,889
	TARIME	85	Nyambogo	5,213	HP	7	4	11	Deep BH	0	53	2,750
	TARIME	86	Sakana	5,722	HP	7	3	10	Deep BH	0	44	2,500
	TARIME	87	Kitembe	3,769	HP	5	2	7	Deep BH	0	46	1,750
	TARIME	88	Roche	4,685	HP	6	0	6	Deep BH	7.8	40	1,865
	TARIME	89	Ng'ope	3,764	HP	5	2	7	Deep BH	0	46	1,750
	TARIME	90	Kogaja	4,448	HP	5	2	7	Deep BH	0	39	1,750
	TARIME	91	Nyamasanda	3,994	HP	5	0	5	Deep BH	0	31	1,250
	TARIME	92	Ikoma	5,457	HP	7	3	10	Deep BH	0	46	2,500
	TARIME	93	Kwibuse	4,297	HP	6	3	9	Medium BH	0	52	2,250
	TARIME	94	Kisumwa	3,279	HP	2	3	5	Deep BH	15.1	53	1,745
	TARIME	95	Nyanchabakenye	4,148	Rehabilitated Piped S.MP	1		1	BH	12.1	74	3,055
	TARIME	96	Mrasibora	3,539	Expanded Piped Scheme MP	1		1	BH	0	62	2,178
	TARIME	97	Nyanjagi	2,183	HP	3	3	6	Medium BH	0	69	1,500
	TARIME	108	Lolwe	2,504	HP	3	0	3	Deep BH	0	30	750
	TARIME	110	Minigo	3,970	Expanded Piped Scheme				Lake V.	0	62	2,443
	TARIME	111	Nyabikonda	3,322	Expanded Piped Scheme				Lake V.	0	62	2,044
	TARIME	112	Nyankonge	2,524	HP	2	3	5	Deep BH	0	50	1,250
	TARIME	113	Omoche	5,609	HP	5	6	11	Deep BH	0	49	2,750
	TARIME	114	Ryagati	3,363	Expanded Piped Scheme				Lake V.	15	77	2,574
	TARIME	116	Bwiri	3,431	Newly Piped Scheme				Lake V.	9.3	71	2,431
	TARIME	117	Kirongwe	6,141	Rehabilitated Piped S.				Lake V.	0	62	3,779
	TARIME	118	Nyambori	3,042	HP	3	2	5	Deep BH	15.1	56	1,709
	TARIME	119	Thabache	2,689	HP	2	7	9	Deep BH	0	84	2,250
	TARIME	120	Kyangasaga	7,538	Rehabilitated Piped S.				Lake V.	0	62	4,639
	TARIME	122	Muharago	6,069	Expanded Piped Scheme				Lake V.	0	62	3,735
	TARIME	127	Bureta	3,015	Newly Piped Scheme				Lake V.	0	62	1,855
	TARIME	128	Radienya	2,913	Newly Piped Scheme				Lake V.	0	62	1,793
	TARIME	129	Masike	4,045	HP	5	6	11	Deep BH	0	68	2,750
	TARIME	130	Randa	6,686	HP	8	5	13	Deep BH	0	49	3,250
	TARIME	131	Bukama	6,367	HP	4	7	11	Deep BH	0	43	2,750
	TARIME	133	Raranya	5,784	Expanded Piped Scheme				Lake V.	0	62	3,560
	TARIME	135	Busanga	5,520	Rehabilitated Piped S.				Lake V.	0	62	3,397
	TARIME	136	Manira	2,334	Expanded Piped Scheme				Lake V.	0	62	1,436
	TARIME	137	Nyarombo	3,248	HP	4	6	10	Deep BH	10.7	88	2,848
	TARIME	138	Rwang'enyi	5,095	Expanded Piped Scheme				Lake V.	11.7	73	3,731
	TARIME	143	Makongoro	5,848	HP	7	3	10	Medium BH	6.4	49	2,874
	TARIME	144	Oliyo	5,537	HP	5	4	9	Deep BH	0	41	2,250
	TARIME	146	Omuga	3,900	HP	5	0	5	Deep BH	0	32	1,250
	TARIME	148	Detti	2,579	HP	3	1	4	Medium BH	0	39	1,000
	TARIME	149	Ochuna	2,210	Rehabilitated Piped S.MP	1		1	BH	0	62	1,360
	TARIME	150	Chereche	5,439	HP	7	1	8	Medium BH	0	37	2,000
	TARIME	151	Ryagoro	4,599	HP	4	6	10	Deep BH	0	54	2,500
	TARIME	152	Balongo	2,896	HP	4	2	6	Deep BH	0	52	1,500
	TARIME	154	Sudi	7,434	Rehabilitated Piped S.MP	2		2	BH	0	62	4,575
	TARIME	155	Nyamsi	2,799	HP	2	7	9	Deep BH	0	80	2,250
	TARIME	156	Panyakoo	5,902	HP	7	2	9	Deep BH	9.4	48	2,805
	TARIME	157	Tatwe	6,477	HP	5	6	11	Deep BH	0	42	2,750
	SERENGETI	3	Nyamisingisi	2,727	HP	3	0	3	Medium BH	4.3	32	867
	SERENGETI	5	Kono	1,690	HP	2	1	3	Medium BH	0	44	750
	SERENGETI	6	Motukeri	3,364	HP	4	2	6	Deep BH	0	45	1,500
	SERENGETI	8	Makundusi	4,187	HP	4	3	7	Deep BH	22	64	2,671
	SERENGETI	13	Burunga	3,694	HP	4	0	4	Deep BH	14.5	42	1,536
	SERENGETI	15	Kyambahi	1,407	HP	2	1	3	Deep BH	0	53	750
	SERENGETI	23	Matare	3,436	Rehabilitated Piped S.MP	1		1	BH	23	83	2,854
	SERENGETI	27	Monuna	3,029	HP	4	4	8	Medium BH	4.98	71	2,151
	SERENGETI	28	Nyambureti	4,055	HP	4	0	4	Medium BH	17	42	1,689
	SERENGETI	30	Kenyana	3,504	HP	4	1	5	Medium BH	8.19	44	1,537
	SERENGETI	34	Magange	2,836	HP	4	1	5	Medium BH	0	44	1,250
	SERENGETI	35	Nyamitita	2,914	HP	4	2	6	Medium BH	6.05	58	1,676
	SERENGETI	37	Busawe	2,076	HP,Spring	3		3	Deep BH	0	73	1,516
	SERENGETI	38	Nyamakobiti	4,771	HP	6	3	9	Medium BH	0	47	2,250
	SERENGETI	42	Nyiboko	4,700	HP	5	1	6	Medium BH	22	54	2,534
	SERENGETI	46	Mesaga	4,090	HP	4	2	6	Medium BH	26	63	2,564
	SERENGETI	50	Bisarara	3,530	HP	3	0	3	Medium BH	25	46	1,633
	SERENGETI	54	Merenga	5,348	HP	6	2	8	Medium BH	8.2	46	2,439
	SERENGETI	62	Kwitete	3,644	HP	4	6	10	Medium BH	14.6	83	3,032
	SERENGETI	66	Nyansurura	5,333	HP	3	6	9	Deep BH	4.72	47	2,502
	SERENGETI	67	Kebancha	8,615	HP	4	3	7	Deep BH	6.2	27	2,284
	SERENGETI	72	Bonchugu	8,375	HP	10	0	10	Medium BH	0	30	2,500
	SERENGETI	76	Nyamatare	3,930	HP	4	1	5	Medium BH	11.22	43	1,691
	SERENGETI	78	Nyamatoke	4,487	HP	4	2	6	Medium BH	27.4	61	2,729

5.5.3 Piped Scheme

The facility plans of the piped scheme for the water supply plan are classified into three categories “New Plan”, “Expansion Plan”, and “Rehabilitation Plan”. The New Plan is the newly installed piped scheme selected out of the 428 villages. The New Plan is basically formulated on the villages which are located within 9km or less from the shore of the lake in the case of using Lake Victoria water. The Expansion and Rehabilitation Plan are targeted with the existing piped scheme for the improvement and expansion.

The number of the piped schemes for the water supply plan is shown in Table 5.5-5. Lake Victoria water is utilized in approximately 80% of piped schemes.

Table 5.5-5: Number of Target Piped Schemes for Water Supply Plan

Type	Target area	Water source	Target piped schemes	Target villages
New Plan	9km or less from shore of the Lake Victoria	Lake	57	91
	Farther away (greater than (9km) from shore of the lake	Borehole	7	7
Sub total			64	98
Expansion Plan	Entire areas with existing piped scheme	Lake	29	199
		Borehole	7	24
		Spring	0	0
Sub total			36	223
Rehabilitation Plan	Entire areas with existing piped scheme	Lake	9	24
		Borehole	10	21
		Spring	2	2
Sub total			21	47
Total by water source		Lake	95	314
		Borehole	24	52
		Spring	2	2
Total			121	368

a. Newly Installed Piped Scheme

Whether to adopt the newly piped scheme or not depends on the location of the service area. Because the operational capacity of the new installed piped schemes and their cost effectiveness are examined from a topographical viewpoint based on the distance between the water sources and service areas, as well as the capacity of the water sources, because the cost of pipe materials accounts for most of the total construction cost in piped schemes.

One condition for the utilization of Lake Victoria water is that the distance to the service area from the lake should not be further than about 9km. The distance is decided as the model of existing piped schemes with boreholes as the water source for the purpose of cost

effectiveness.

The served population in 2025 by newly installed piped schemes is shown in Table 5.5-6.

Table 5.5-6: Served Population by Newly Piped Scheme

	District	Lake Water		Borehole(Groundwater)	
		No of Scheme	Served Population	No of Scheme	Served Population
Mwanza	Misungwi	3	8,918	1	5,345
	Sengerema	19	154,742	1	3,452
	Kwimba	0	0	2	8,964
	Magu	2	8,089	0	0
	Geita	5	61,665	0	0
	Ukerewe	7	19,006	0	0
Mara	Bunda	5	14,057	1	1,655
	Musoma(R)	13	58,953	1	4,302
	Tarime	3	14,391	1	3,007
Total		57	339,821	7	26,725

b. Expanded Piped Scheme

This plan aims at expanding the 36 existing piped schemes of the 223 villages in the service area to meet the demands of the increasing population. However, possibilities of expansion must be planned from the aspect of economic and topographical conditions. Moreover, because the condition of the facilities will have been deteriorating, it is preferable to implement a rehabilitation program along with the expansion program on all the piped schemes. The expansion plan should be based on the flow of facility planning (Rehabilitation plan below). In the case of the current water sources being boreholes and springs, the capacity of the sources, such as groundwater potential, shall be studied carefully to ensure the projected amount of raw water at the design stage. As a result of the study, eventually 78 villages out of the 223 villages that are in the targeted expansion plan were added as service areas.

c. Rehabilitated Piped Scheme

This plan aims at rehabilitating the 21 existing piped schemes of the 47 villages because most of them were constructed decades ago and have deteriorated so much that they cannot adequately provide water to their respective service areas. In addition, their capacity no longer meets future demand. In principle, plans for water sources shall be based on the existing water sources. However, in order to secure the appropriate amount of raw water for the system, the study must also focus on groundwater potential along with boreholes and springs.

Accordingly, even if partial rehabilitation was carried out, as some of the pumps and pipes that were replaced since 2000 and 1985 respectively, the functionality of facilities cannot be restored. Therefore, complete improvement is proposed for this plan.

The served population in 2025 by expanded and rehabilitated piped schemes is shown in Table 5.5-7.

Table 5.5-7: Served Population by Expanded and Rehabilitated Piped Scheme

		No. of Scheme	Served Population	No. of Water Source		
				Lake	Borehole	Spring
Mwanza	Misungwi	5	44,539	3	2	0
	Sengerema	7	173,967	6	1	0
	Kwimba	6	95,812	1	5	0
	Magu	7	65,630	6	1	0
	Geita	4	99,214	3	1	0
	Ukerewe	8	148,329	8	0	0
Mara	Bunda	4	91,552	4	0	0
	Musoma(R)	5	85,109	3	2	0
	Tarime	9	73,697	4	4	1
	Serengeti	2	21,510	0	1	1
Total		57	899,359	38	17	2

5.6 Design Criteria of Water Supply Plan

5.6.1 Design Criteria

Since the design criteria of the water supply plan are the same as the preliminary design, they are presented in Chapter 6. The design year of the piped scheme for the water supply plan is basically 2015, but the capacity of some facilities such as transmission pipelines will focus on 2020 from the economic aspect. In any event, the final completed year of the overall water supply plan is the year of 2025.

5.6.2 Facility Plan

Overview of a typical facility flow is conceptualized by water sources of groundwater and lake water in Figure 5.6-1 and Figure 5.6-2 respectively. The specification of each facility on water supply plan is summarized in the Supporting Report. Moreover, the service area of each piped scheme is conceptualized in the Data Book.

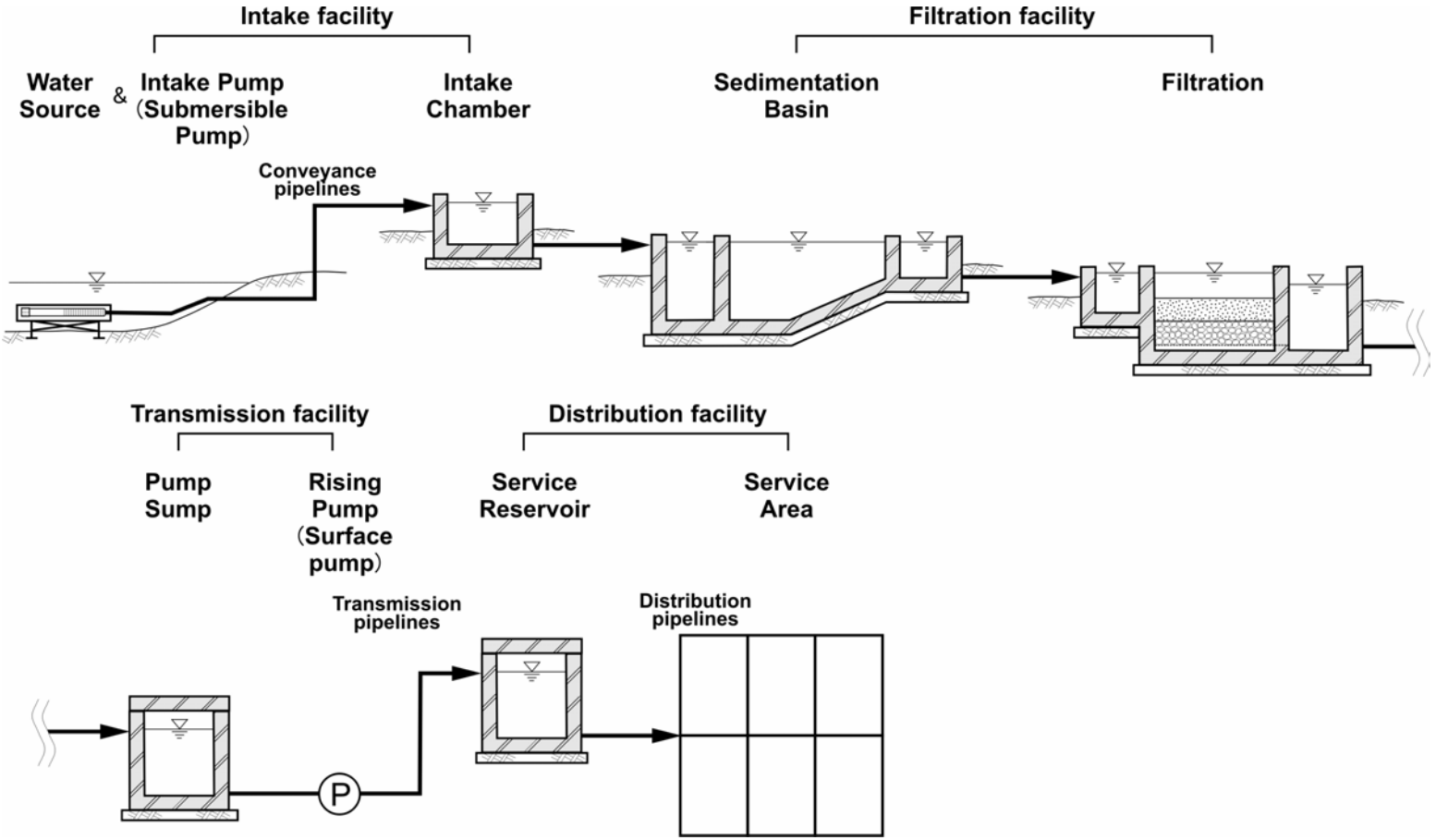


Figure 5.6-1: Typical Flow of Piped Scheme Using Lake Water

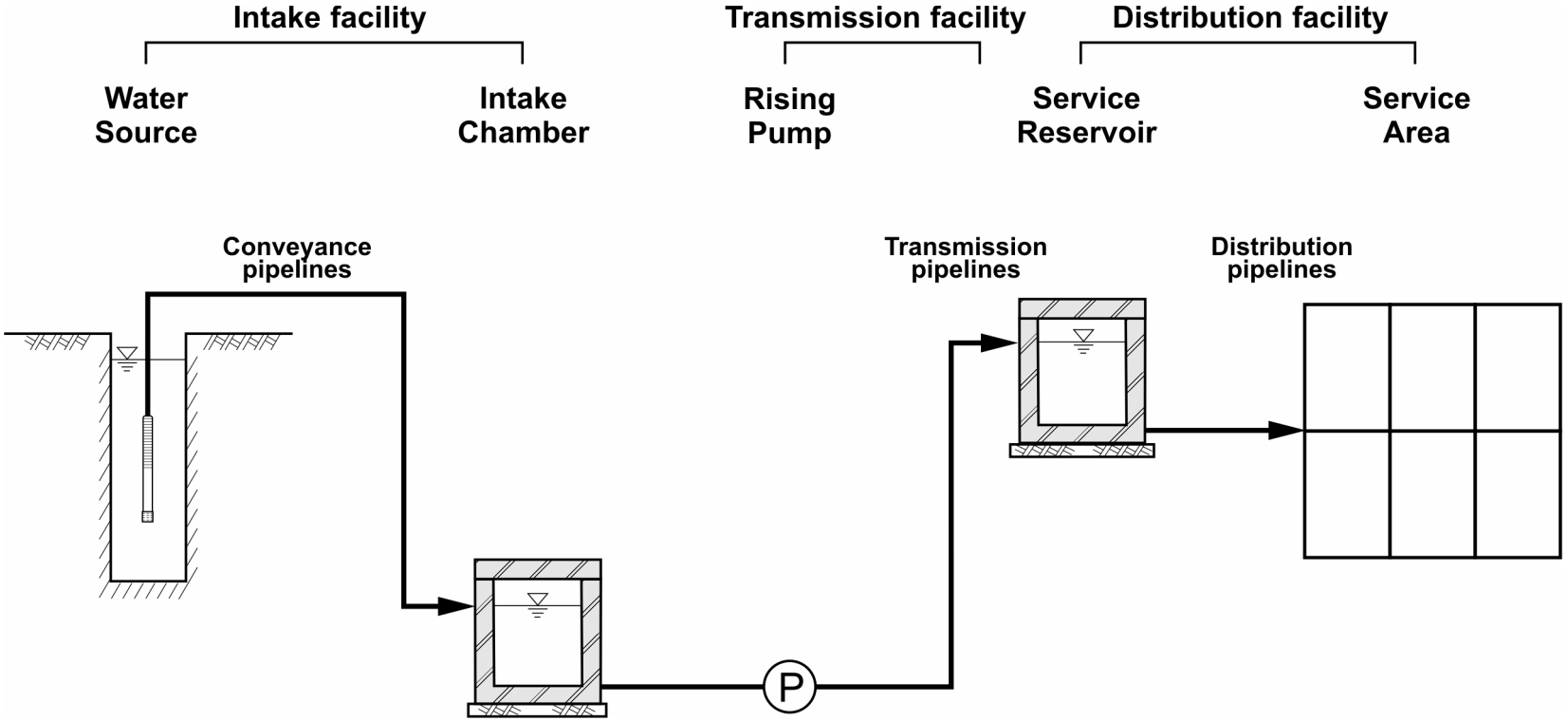


Figure 5.6-2: Typical Flow of Piped Scheme Using Groundwater

5.7 Water Supply Development Plan

5.7.1 Cost Estimation for Water Supply Plan

a. Composition of Cost

The project cost is estimated by the following component (refer to the Figure 5.7-1).

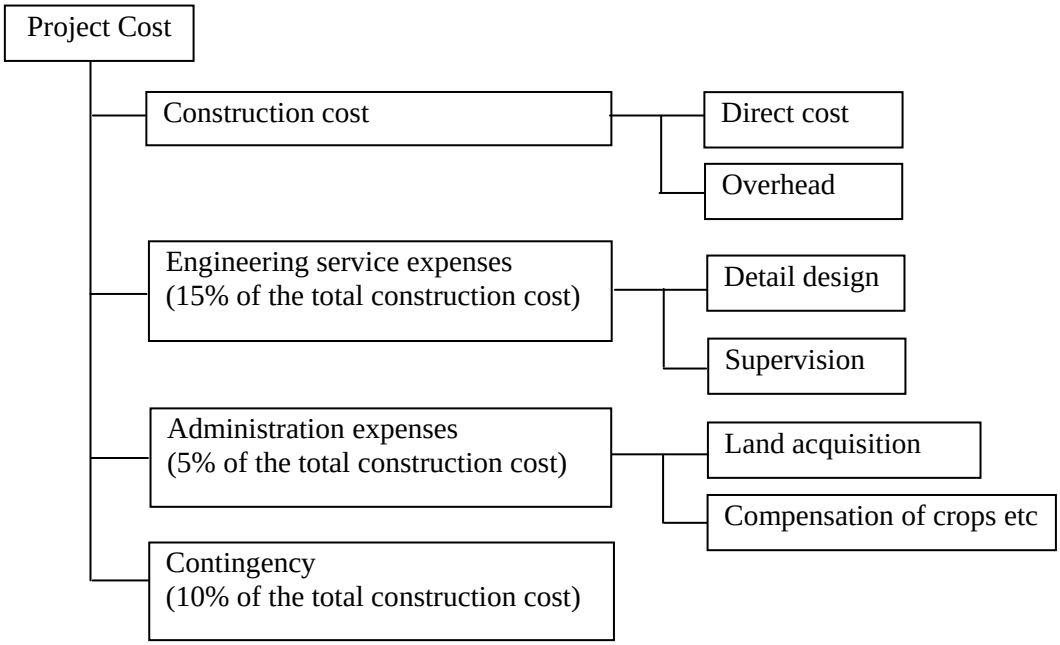


Figure 5.7-1: Component of Project Cost

b. Conditions for the Cost Estimation

The project cost for the water supply plan is estimated in regard to the wells with hand pumps, newly piped schemes using Lake Victoria water and boreholes, and the expanded and rehabilitated existing piped schemes. The costs are based on the international cost on NRWSSP, 2006 in principle. The conditions for the cost estimation are shown in the following items.

- The project cost consists of the components shown in the Figure 5.7-1.
- The cost of land acquisition is not included.
- The success rate of borehole drilling is assumed to be 70%.
- All the costs are estimated under the economic conditions prevailing in February 2006.
- Exchange rate of local currency is US$ 1.00=1,181 Tsh by Control Rate of May, 2006.

c. Classification of Unit Cost

The project cost is estimated in consideration with the specifications of each facility type. The main facility type is as follows; (excluding the priority project)

(1) Medium and Deep Well with hand pump (New plan for well with hand pump)

The depth of wells is classified into three types, such as 30-40m, 50m and 100m deep.

(2) Newly Installed Piped Scheme from Lake Victoria water

This type is the planned piped scheme in the villages located 9km or less from the shore of Lake Victoria. This type is divided into four types based on the distance between the intake facilities and service area, future demand, filtration process and efficiency of pipe used (service population/pipe length of 100m).

(3) Newly Installed Piped Scheme from Borehole water

This type is the planned piped scheme in the villages located farther away from the shore of Lake Victoria using groundwater sources. This type is classified into two types according to the efficiency of pipe used.

(4) Expanded and Rehabilitated Existing Piped Scheme

This type consists of the expanded and rehabilitated existing piped scheme divided into nine types in terms of the water sources (Lake or groundwater), filtration types, and efficiency of pipe used.

The estimated project cost is summarized in the Table 5.7-1 in consideration with the compositions, conditions, and the feature of types.

Table 5.7-1: Summary of Project Cost for Water Supply Plan

P/J No.	Type of plan	Construction cost (US$)	Engineering service (15%)	Administration expenses* (5%)	Contingency (10%)	Total (US$)	Remarks
1	Priority Project (Piped scheme and HP)	15,156,000	2,273,000	151,000	-	17,580,000	45 villages (289 wells and 8 piped schemes)
2	Medium & Deep Wells with Hand Pump	20,231,000	3,035,000	1,011,000	2,023,000	26,300,000	1580 wells
3	New Installed Piped Schemes using Lake Victoria water	35,309,000	5,296,000	1,765,000	3,530,000	45,900,000	54 piped schemes
4	New Installed Piped Schemes using Groundwater	756,000	113,000	37,000	75,000	981,000	3 piped schemes
5	Rehabilitation and expansion plan for the existing piped schemes	107,580,000	16,137,000	5,379,000	10,758,000	139,854,000	56 piped schemes
	Total amount	179,032,000	26,854,000	8,343,000	16,386,000	230,615,000	

Source: Ministry of Water for % of "Engineering service", "Administration expeses" and "Contigency"

Note: Assuming that prioritized project is carried out by Japanese asistance, administration expenses and contingency are not included in its project.
*The rate of administration expenses of Priority Project is estimated for 1% of Construction Cost.

The table of the project cost using the local cost is shown in the Chapter 10 of the Supporting report.

5.7.2 Implementation Plan

The implementation plan for the water supply plan of this Study shall be formulated in consideration with Tanzania's national policy and strategies. The Government of Tanzania in achieving its Millennium Development Goals, emphasizes at reducing by half the number of people without access to reliable, achieving water supply coverage of about 65% by the year 2010 (refer to NRWSSP) and safe water supply (i.e. increasing water supply coverage to about 74%) by the year 2015. The goal on the context of the country's development vision by the year 2025 is achieving 90% water supply coverage.

The donors and GOT projects are required for the achievement of the implementation plan. MoW requests the implementation of the priority project to the government of Japan. If this

project is accepted, it is expected to commence in 2007. With World Bank support, the NRWSSP project is expected to be accelerated in the four years. For instance, a sample of external support agency (ESA) is indicated in Table 5.7-2.

Table 5.7-2: Major GoT-ESA Investment in NRWSS-2004/2005

No.	ESA	Name of Project	ESA Support (USD)
		New Projects	
1	IDA/World Bank	RWSSP (12 districts)	8,913,200
2	France(AFD)	Small Towns WSSP	179,400
		Expansion	
3	Japan (JICA)	Mtwara/Lindi WSS Project (8 districts)	2,735,400
4	Germany	Hai District WS Project (1 district)	936,300
		Rehabilitation	
5	AfDB	Monduli WS Project (1 district)	1,318,400
6	Netherlands	Shinyanga Rural WS Programme (7 districts)	3,139,000
7	Germany	East Kilimanjaro WS Project (2 districts)	1,636,000
	total		18,857,700

Source: NRWSSP (January 2006), MoW

The new direction in the ESA is as follows in the Mwanza and Mara regions.

(1) The priority project will be completed by the year 2009.

(2) MoW executes the NRWSSP based on the support of WB, IDA and AfDB which is budgeted with 150 and 80 million USD respectively for the four years from the year 2006.

(3) The prospects for the other donors in the Mwanza and Mara regions are that AFD, EU, UNICEF, GEF, SIDA, IFAD, and et al. are expected for the investment requirement in consideration with the results of the past conditions of support.

(4) The support of the NGO can be seen in the activity of Plan International in Mwanza. NGO is continuously supporting the past funding.

The implementation schedule is shown in Table 5.7-3 in accordance with the prediction of the total budget with donor and GoT in Tanzania.

Table 5.7-3: Implementation Schedule for Water Supply Plan

Type of Scheme	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Priority Project																			
Medium & Deep Well with HP																			
Newly Installed Piped Scheme from Lake																			
Newly Installed Piped Scheme from BH																			
Expanded & Rehabilitated Piped Scheme																			

The planned implementation project for the water supply plan contributes to the achievement of water supply coverage in Tanzania's strategy. The priority project of the water supply plan will be implemented by the year 2009, and the other implementation schedules are discussed regarding the possibility of the project in the Mwanza and Mara regions in term of the overall budget in Tanzania. As the total cost of piped schemes (excluding the piped schemes using BH) is high, the term of schedule in regard to the existing piped schemes are expanded to the year 2025.

5.7.3 Financial Plan

External and internal sub-sector funding is identified for 2005-2008, as shown in Table 5.7-4.

The funding of sub-sector for rural water supply increased from 15.3 million USD in fiscal year (FY) 2005/2006 to 24.4 million USD in FY 2007/2008. As shown in the table below, the donor's budget is showing rising tendency from 2005, and it will be expected that the GoT budget hereafter for the water development will also increase in accordance with the operation of NRWSSP.

Table 5.7-4: Summary of Funding Identified for RWSS Sub-Projects Plan (USD)

Source	2005/2006	2006/2007	2007/2008	Total
GoT	1,968,000	5,672,000	6,239,200	13,879,200
Donors	11,570,000	14,013,000	15,414,300	40,997,300
NGO	1,800,000	2,400,000	2,700,000	6,900,000
Total	15,338,000	22,085,000	24,353,500	61,776,500

Table 5.7-5 shows the detail types of the development budget for rural water supply from 2005 to 2008. This table indicates that the funding rate of the drilling of boreholes and rehabilitation of piped schemes increase more than that of the construction of new schemes.

Table 5.7-5: Summary of Funding for GoT and Donors to Rural Water Sector (USD)

Activity Type	2005/2006			2006/2007			2007/2008		
	GoT	Foreign	Total	GoT	Foreign	Total	GoT	Foreign	Total
Construction of new schemes	1,182,000	10,517,000	11,699,000	1,832,000	12,673,000	14,505,000	2,015,200	13,940,300	15,955,500
Drilling of Boreholes	157,000	0	157,000	2,354,000	0	2,354,000	2,589,400	0	2,589,400
Rehabilitation of existing scheme	523,000	0	523,000	1,168,000	0	1,168,000	1,284,800	0	1,284,800
Design and studies	106,000	1,053,000	1,159,000	318,000	1,340,000	1,658,000	349,800	1,474,000	1,823,800
Total	1,968,000	11,570,000	13,538,000	5,672,000	14,013,000	19,685,000	6,239,200	15,414,300	21,653,500

Project costs have been estimated on the basis of international prices. The project costs consist of costs for drilling works, construction of water supply systems (including water intake, water storage facilities, distribution lines, service pipes, public taps, boreholes, hand-pump and platforms), engineering services and administration.

The base costs of the project amount to 179.0 million USD, and total project costs including engineering services, administration expenses and physical contingency amount to 230.6 million USD (refer to Table 5.7-1). Out of the total amount, priority project (including HP and piped schemes), cost estimation of hand pump is 26.3 million USD, that of newly piped schemes is 45.9 million USD, and the estimated cost of existing piped schemes is 139.9 million USD.

Financial resources for the Project will be derived from the government budget and financial assistance from foreign countries and/or international lending institutions. Although the funds from the government (central as well as local government authorities) and water charges collected from beneficiaries will not be sufficient to cover the major part of the capital costs, the latter (water charges to be collected) will contribute significantly to the recovery of operation and maintenance costs.

The annual disbursement schedule of the project costs has been finalized in Table 5.7-6 collating the implementation schedule in each type. The MoW has the draft plan for the funding of External Support Agencies (ESAs) until FY 2009/2010 and indicates the Investment Requirement Plan from 2007 to 2025 in NRWSSP 2006. Based on such ideas, the expected financing of ESAs is shown in Table 5.7-6 in parallel and the expected funding in the Mwanza and Mara regions is also estimated by the rate of investment in the Mwanza and Mara regions, which is approximately 12% of the entire investment in Tanzania shown in Table 5.7-6. In any event, external assistance in term or loans will be necessary to cover the

entire foreign currency portion (about 78% suggested in Table 5.7-4) and part of the local currency portion of project costs.

The initial plan was formulated for the water supply plan with 2015 as the year of completion. However, it is impossible to complete the implementation of the water supply plan by 2015 due to the high expenses for the implementation of the initial plan within the planned time frame (2015). Therefore progressive payment is needed of the necessary funds into the payment schedule until 2025 in terms of the annual disbursement of the project cost in the Mwanza and Mara regions.

Table 5.7-6: Annual Disbursement Schedule and Expected Financing of Donor, NGO and GoT

Type of Scheme	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	
Priority Project																				
Medium & Deep Well with HP																				
Newly Installed Piped Scheme from Lake																				
Newly Installed Piped Scheme from BH																				
Expanded & Rehabilitated Piped Scheme																				
Type of Scheme	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Total
Priority Project		17.6																		17.6
Medium & Deep Well with HP		2.7	1.85	1.85	2.4	2.8	2.1	2.1	1.85	1.73	1.73	1.73	1.73	1.73						26.3
Newly Installed Piped Scheme from Lake			2.59	7.27	7.27	4.3	1.93	1.93	1.93	3.73	3.73	3.73	3.73	3.73						45.9
Newly Installed Piped Scheme from BH			0.98																	0.98
Expanded & Rehabilitated Piped Scheme		5.28	2.42			2.72	5.96	5.96	6.51	9.01	9.01	9.01	9.01	9.01	13.2	13.2	13.2	13.2	13.2	139.90
Total (Excluding Priority Project)		7.98	7.84	9.12	9.67	9.82	9.99	9.99	10.3	14.5	14.5	14.5	14.5	14.5	13.2	13.2	13.2	13.2	13.2	230.7
Expected Financing of External Support Agencies & NGO **(USD million)** by NRWSSP	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	
Assumed to be implemented as JGA		17.6																		
WB & IDA	20	20	20																	
AfDB	20	20	20																	
AFD, EU, UNICEF, GEF, SIDA, IFAD & Others	18	19	20	73	78	78	78	78	78	121	121	121	121	121	110	110	110	110	110	
Plan International & Others	3	3	3																	
GOT	6.2	6.7	7																	
Total	67	69	70																	
Expected Financing of External Support Agencies & NGO in Mwanza and Mara Regions **(USD million)**	7	8	8	9	10	10	10	10	10	14.5	14.5	14.5	14.5	14.5	13.2	13.2	13.2	13.2	13.2	

5.8 Operation and Maintenance Plan of Villages and Piped Schemes

5.8.1 Establishment of Institutional Framework

a. Institutional Framework for the Water Supply Plan

The institutional framework for the water supply plan of the Study shall be formulated in consideration of Tanzania's national policy and strategies. The 2002 NAWAPO and initiatives of NRWSSP affirms that water supply development and the operation and maintenance of the rural water supply facilities are the community's responsibility, and government sectors are no longer direct service delivery agents but facilitators to coordinate rural water supply programmes. The new institutional framework, which shall be established in the Mwanza and Mara regions, is as shown in Figure 5.8-1.

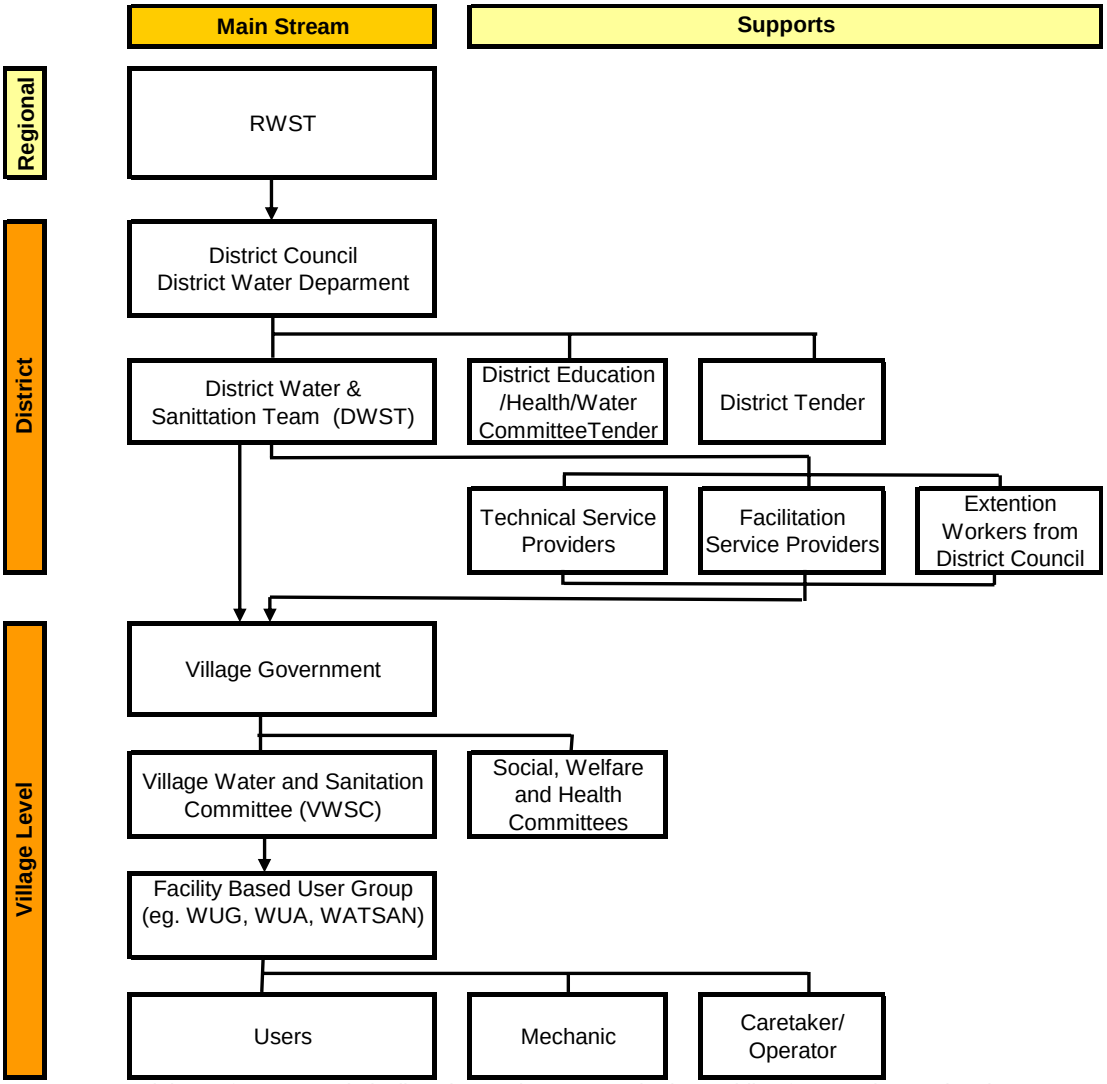
The significant changes from the current institutional framework to the newly proposed institutional framework are as follows:

(1) **Communities**, as users, become the main responsible actors for operation and maintenance of water supply facilities.

(2) A **District Water Sanitation Team (DWST)** is established in all districts, as a coordinator of water supply and sanitation activities within the district.

(3) A **Regional Water Sanitation Team (RWST)** is established at the regional level within the Regional Secretariat as a regional equivalent of the DWST.

(4) **Private Service Providers (PSPs)** such as 'Technical Service Providers (TSPs)' are adopted for the 'hard dimension' and **Facilitation Services Providers (FSPs)** for the 'soft dimension.' Consultancy by private sectors on water supply and sanitation will be introduced at the district level in the future.



Source: Ministry of Water and Livelistock Development, United Republic of Tanzania, "National Water Policy 2002", July 2002., Ministry of Water, United Republic of Tanzania, "National Rural Water Supply and Sanitation Programme (NRWSSP)" Main Report and Annexes, January 2006., Ministry of Water, United Republic of Tanzania, "National Rural Water Supply and Sanitation Programme: Guidelines for Facilitating communities in Estalishing Water User Entities", January 2006.

Figure 5.8-1: Future Institutional Framework for the Water Supply Plan

b. Expected Roles and Responsibilities of Responsible Bodies for O&M

b.1 Regional Level

The current water supply service and management of water supply facilities are quite different from district to district. Since the District Councils, the DWST and the District Water Department have different capabilities under the progress of the decentralization process, the level of performance is different. A coordination body for water and sanitation promotion at the regional level shall serve as a coordinator at the regional level to provide support and guidance for water and sanitation promotion at the district level.

Currently, the Mwanza region has a coordination mechanism such as the Regional Project Implementation and Supervision (RPISC) within the Regional Administrative Secretary

(RAS) to supervise and monitor the HESAWA activities at the regional level. Considering the experiences and efforts of the RPISC, it is suggested that a regional coordination body such as the RWST be established and function in both the Mwanza and Mara regions.

c. District Level

c.1 The District Water and Sanitation Team (DWST)

Attaining the support from the regional coordination body, the DWST shall provide technical and financial support to communities in operating and maintaining water facilities. Currently, the DWST has already been organized in six districts (Sengerema, Kwimba, Misungwi, and Magu in the Mwanza region; Musoma and Serengeti in the Mara region). However, most of the established DWSTs still do not function well due to the lack of defined responsibilities, and the different financial and human resources and capabilities of personnel at the District Councils.

c.1.1 Expected Responsibilities of the DWST

The expected roles and responsibilities of the DWST, based on the national policy to support community based operation and maintenance of the water supply facilities, are as follows:

(1) Facilitate communities to establish an appropriate management system for water supply

(2) Assist community owned water supply organizations, such as WUA and WUG to obtain the registration certificate

(3) Coordinate, monitor, and evaluate water and sanitation activities at the district level

(4) Maintain and operate the district level management of information

c.1.2 Re-promotion of Community Water Supply Organizations by the DWST

As for the facilitation of community water supply organizations (such as VWCs, WUGs, and WUAs) to provide technical guidance and monitor the progress of their activities, at least a quarterly visit needs to be carried out. The required resources and cost are summarized in the table below. The expenditures are estimated as a basis for further computation, which will be required for all types of water supply facilities.

Table 5.8-1 Annual Cost Estimation for Technical Guidance, Facilitation and Follow-up

	Activities	Item	Time	Allowance
DWST	Guidance and Facilitation of community water supply organizations (VWC, WUGs , etc.) As for 1st and 3rd visit 5 hours @ village As for 2nd and 4th visit Half a day @ village	Personnel @village 1 Water Technician 1 Community Development Officer 1 Community Development Assistant (Ward) Driver Transportation @village Vehicle with Fuel	4 times a year	(Tsh) 25,000 25,000 10,000 20,000 30,000
			Total	440,000

A total of Tsh 440,000 per village is estimated for one of the annual water and sanitation activities by the DWST. The guideline needs to be finalized accordingly, in consultation with the relevant stakeholders; however, all districts and regions in the study area should take account of the financial arrangement for supporting the community activities, which depends

on the number of water supply facilities.

c.2 The District Water Department (the DWE office)

In the new institutional framework, the District Water Department shall lead the DWST to coordinate water and sanitation development at the community level, and provide mainly technical guidance and support, and periodical checking and monitoring of water supply facilities. Currently in most districts, the District Water Department hires pump attendants and operators for the piped scheme facilities to operate and maintain the facilities; however, adequate technical guidance and substantial maintenance have not been provided.

c.2.1 Proposed Organizational Arrangement and Capacity Development for the District Water Department

To provide technical support to communities in operating and maintaining water facilities as a focal point, organizational arrangement and capacity development programmes for the District Water Department (DWE office) shall be required as follows:

(1) Establishment of an Operation and Maintenance Section in the District Water Department

(2) Training for personnel of the District Water Department to achieve the above suggestions, in terms of planning and management of rural water supply; technical operation and maintenance; and Participation Hygiene and Sanitation Transformation (PHAST) and gender issues.

The capacity of the District Water Department greatly contributes to the achievement of the water supply plan in the Study, and the priority project shall be implemented particularly along with the capacity development suggested above. Details of the above suggestions are presented in Chapter 8: Organization and Institutional Plan.

d. Community Level

Water users take on the responsibility of carrying on water and sanitation activities, as well as the operation and maintenance of water supply facilities, under the established community owned water supply organizations such as VWCs, WUAs, Board or WUGs.

Considering the advantages and disadvantages of the proposed options in the policy, the expected responsibilities of users and communities, the existing community organizations in the study area, and technologies applied in the Water Supply Plan, the suggested responsible bodies for O&M in the Water Supply Plan are as shown in Table 5.8-2.

As for the hand pump facilities, the WUG shall be established at each domestic point, and manage the water fee and fund collection as shown in Figure 5.8-3. As for the piped scheme facilities, it is principally expected that the WUA or Board shall be established at each piped scheme to operate and manage the water supply, and a tap committee shall also be formulated at each domestic point under the WUA, in order to collect the water fee and funds for operation and maintenance (refer to Figure 5.8-4). Since the concept of a WUA for the piped scheme is new to all targeted villages in the Study area, and the legal status of the WUA may require considerable time, the VWC will be responsible for the management of the piped schemes at the initial stage of the project implementation.

d.1.1 Expected Responsibilities of Community Water Organizations (WUG, WUA, VWC)

(1) Operate and maintain water facilities

(2) Protect the facilities and hire necessary caretakers

(3) Raise fund for operation and maintenance, keep finance and meet records

(4) Facilitate hygiene, sanitation education and planning of activities

Table 5.8-2: Suggested Responsible Bodies of Community Water Organization

Type of technology	Water source	Type of O&M organization
Protected spring Hand pump	Spring, Groundwater	WUG
Piped scheme	Groundwater, Lake Victoria	WUA

e. Institutional Framework for Procurement of Spare Parts

The most serious problem for villagers concerning spare parts is the accessibility and travel costs for purchasing the spare parts. Due to the expenses for transportation and the replacement costs of spare parts, spare parts are not often purchased to repair the facilities. To solve the above issue, it is recommended to establish a 'Spare Parts Centre for O&M' by collecting the O&M funds through the VWCs in districts and operating them as a joint fund contributed by communities. The proposed institutional arrangement and flow of the fund from WUGs/WUAs to DWEOs is shown in Figure 5.8-2.

Although the detailed system of the Spare Parts Centre for O&M is proposed in Chapter 9, it is suggested to set-up at least a spare-parts centre for each district in order to ensure accessibility to the rural population. The system shall be designed referring to the existing spare parts shop in Kwimba district.

The initial cost for the proposed Spare Parts Centre such as the shop premises will be prepared by using a storage container owned by most of the District Water Departments. Only the initial procurement cost needs to be contributed by the WUGs, WUAs or Boards in the target area.

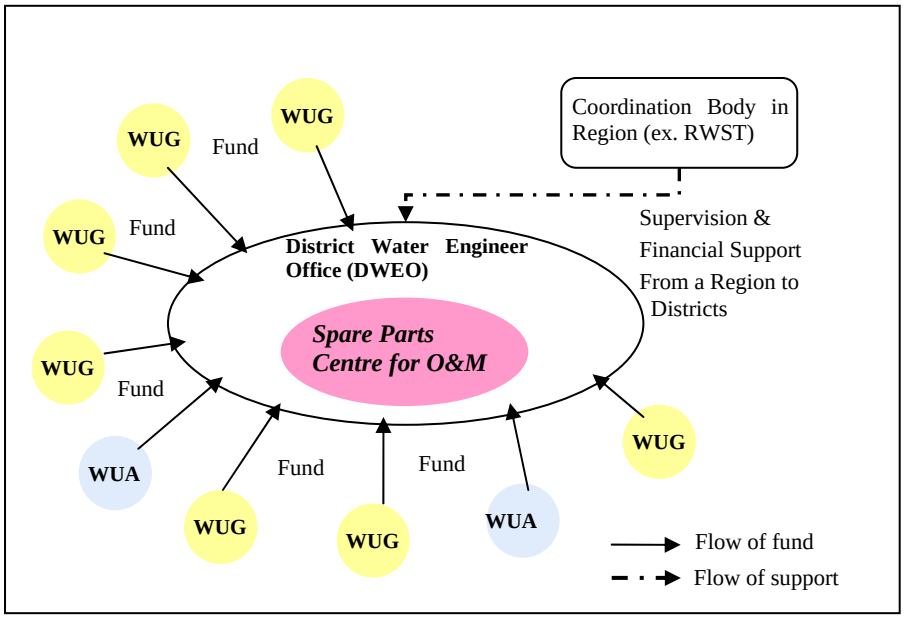


Figure 5.8-2: Recommended Institutional Framework for Procurement of Spare Parts

5.8.2 Cost Estimation for Operation and Maintenance

In order to ensure the sustainability of water supply facilities, the recovery of the operation and maintenance cost is a prerequisite. In the Water Supply Plan proposed in the Study, the beneficiary water users in the target communities are expected to collect water fees to recover the operation and maintenance cost.

a. Itemization of Operation and Maintenance Cost

The operation and maintenance cost basically consists of operation, maintenance and replacement costs for the equipment and facilities. However, it generally underscores the cost for daily operation, such as wages for the caretakers of domestic water points, collectors of water fees, minor spare parts and tools for hand pumps, and various supplies for periodical operation and maintenance. All items to be included for the recovery of the operation and maintenance cost in the proposed main water facilities are summarized in and .

Table 5.8-3: Basis of O&M Cost (Borehole with hand pump)

Types of Cost	Item
Operation Cost	Wages for collector/caretaker, Supplies (rubber, etc.), Tools
Maintenance Cost	Repair of Hand Pump, Spare Parts
Management Cost	Stationary (ex. Cash Box, Receipt book, Note book)
Replacement Cost	Hand Pump, etc.

Table 5.8-4: Basis of O&M Cost (Piped Scheme)

Types of Cost	Item
Operation Cost	Wages for pump attendant, caretaker, and collector, Fuel
Maintenance Cost	Spare Parts, Supplies (oil, filters, chemical, etc.)
Management Cost	Stationary (ex. Cash Box, Receipt book, Note book)
Replacement Cost	Pump, Pipes, Generator, etc.

b. Operation and Maintenance Cost Estimation for Each Type of Facility

The operation and maintenance costs for the '18 types of facilities in the Water Supply Plan' are estimated in Table 5.8-5. The rationale of the annual operation and maintenance rates on water supply facility assets, such as pumps and engines, storage tanks, and domestic points, are based on figures shown in 'the recommended economic life time of certain W/S assets' in MOW(1997), "Design Manual for Water Supply and Waste Water Disposal". The monthly operation and maintenance cost is estimated except for wages for the caretaker, collector, and pump attendant; and fuel for the generator of the piped scheme facilities. However it is estimated that the additional expenses shown in Table 5.8-3 and Table 5.8-4 can be added to the monthly OM&R cost. If the estimated operation and maintenance cost is within the limits of willingness to pay, the cost shall be covered by the collection of water fees from the beneficiaries.

Table 5.8-5: Monthly O&M Cost per Household for 18 types of Water Supply Facilities

Type of facilities	Specification	Monthly OM cost/ household (Tsh)	Montly Replacement cost/ household (Tsh)	Monthly OM&R cost /household (Tsh)
Type-1	Bore hole with hand pump, well depth is 30-40m	177	161	338
Type-2	Bore hole with hand pump, well depth is 50m	233	161	393
Type-3	Bore hole with hand pump, well depth is 100m	366	161	526
Type-4	Newly piped scheme with pre-treatment and filtration using lake water and efficiency of pipes to be used: over 49 capita per 100m	648	1,103	1,751
Type-5	Newly piped scheme with pre-treatment and filtration using lake water and efficiency of pipes to be used: 49 or less capita per 100m	1,092	1,984	3,075
Type-6	Newly piped scheme with filtration using lake water and efficiency of pipes to be used: over 49 capita per 100m	947	1,701	2,649
Type-7	Newly piped scheme with filtration using lake water and efficiency of pipes to be used: 49 or less capita per 100m	1,424	2,599	4,023
Type-8	Newly piped scheme without treatment using groundwater and efficiency of pipes to be used: over 67 capita per 100m	742	1,064	1,806
Type-9	Newly piped scheme without treatment using groundwater and efficiency of pipes to be used: 67 or less capita per 100m	1,285	2,028	3,313
Type-10	Rehabilitation and expansion piped scheme with pre-treatment and filtration by using lake water and efficiency of pipes to be used: over 49 capita per 100m	842	1,934	2,776
Type-11	Rehabilitation and expansion piped scheme with pre-treatment and filtration by using lake water and efficiency of pipes to be used: 49 or less capita per 100m	1,280	3,053	4,333
Type-12	Rehabilitation and expansion piped scheme with filtration by using lake water and efficiency of pipes to be used: over 49 capita per 100m	975	2,017	2,992
Type-13	Rehabilitation and expansion piped scheme with filtration by using lake water and efficiency of pipes to be used: 49 or less capita per 100m	1,380	2,876	4,255
Type-14	Rehabilitation and expansion piped scheme without treatment using groundwater and efficiency of pipes to be used: over 67 capita per 100m	936	1,734	2,671
Type-15	Rehabilitation and expansion piped scheme without treatment using groundwater and efficiency of pipes to be used: 67 or less capita per 100m	1,036	1,928	2,964
Type-16	Rehabilitation and expansion piped schemewithout treatment by using lake, receive water from Shinyanga scheme	499	1,479	1,978
Type-17	Rehabilitation and expansion piped scheme without treatment by using spring	449	759	1,208
Type-18	Rehabilitation and expansion piped scheme without treatment by using water source of other scheme	626	1,036	1,662

Note: 1. Number of household is estimated on the basis of average household size recorded in the 2002 population census (5.63 persons in average; 5.73 persons in Mwanza; 5.41 persons in Mara).
Note 2. The currency exchange rate is based on the rate of May 2006 (USD1.00=Tsh1,181, USD1.00= Yen 114.58)

Table 5.8-6: Monthly O&M Cost per Bucket 18 types of Water Supply Facilities

Type of facilities	Specification	Monthly OM cost per bucket (Tsh)	Montly Replacement cost per bucket	Monthly OM&R cost per bucket (Tsh)
Type-1	Bore hole with hand pump, well depth is 30-40m	0.84	0.76	1.60
Type-2	Bore hole with hand pump, well depth is 50m	1.10	0.76	1.86
Type-3	Bore hole with hand pump, well depth is 100m	1.73	0.76	2.49
Type-4	Newly piped scheme with pre-treatment and filtration using lake water and efficiency of pipes to be used: over 49 capita per 100m	3.07	5.22	8.29
Type-5	Newly piped scheme with pre-treatment and filtration using lake water and efficiency of pipes to be used: 49 or less capita per 100m	5.17	9.40	14.57
Type-6	Newly piped scheme with filtration using lake water and efficiency of pipes to be used: over 49 capita per 100m	4.49	8.06	12.54
Type-7	Newly piped scheme with filtration using lake water and efficiency of pipes to be used: 49 or less capita per 100m	6.74	12.31	19.05
Type-8	Newly piped scheme without treatment using groundwater and efficiency of pipes to be used: over 67 capita per 100m	3.52	5.04	8.56
Type-9	Newly piped scheme without treatment using groundwater and efficiency of pipes to be used: 67 or less capita per 100m	6.09	9.61	15.69
Type-10	Rehabilitation and expansion piped scheme with pre-treatment and filtration by using lake water and efficiency of pipes to be used: over 49 capita per 100m	3.99	9.16	13.15
Type-11	Rehabilitation and expansion piped scheme with pre-treatment and filtration by using lake water and efficiency of pipes to be used: 49 or less capita per 100m	6.06	14.46	20.52
Type-12	Rehabilitation and expansion piped scheme with filtration by using lake water and efficiency of pipes to be used: over 49 capita per 100m	4.62	9.55	14.17
Type-13	Rehabilitation and expansion piped scheme with filtration by using lake water and efficiency of pipes to be used: 49 or less capita per 100m	6.53	13.62	20.16
Type-14	Rehabilitation and expansion piped scheme without treatment using groundwater and efficiency of pipes to be used: over 67 capita per 100m	4.44	8.21	12.65
Type-15	Rehabilitation and expansion piped scheme without treatment using groundwater and efficiency of pipes to be used: 67 or less capita per 100m	4.91	9.13	14.04
Type-16	Rehabilitation and expansion piped schemewithout treatment by using lake, receive water from Shinyanga scheme	2.36	7.01	9.37
Type-17	Rehabilitation and expansion piped scheme without treatment by using spring	2.13	3.60	5.72
Type-18	Rehabilitation and expansion piped scheme without treatment by using water source of other scheme	2.97	4.91	7.87

Note: Calculations are based on the same conditions as Table 5.8-5.

c. Factors to be considered for setting the Water Fee

The rate of water fee waivers for socially vulnerable villagers, such as lone families, female headed households, and elderly and disabled families, should be considered by the responsible community water organizations of the water supply facilities.

5.8.3 Cost Collection Methods/Modes of Payment

Cost collection methods shall be decided and chosen through the process of consultative meetings with the beneficiaries and the appropriated community water supply organizations, in principle. However, in order to ensure the recovery of the operation and maintenance cost as indicated in 5.8.2, influential factors related to collection methods and modes of payment are to be considered in advance with the beneficiaries. Considering those factors including the timing of cash income, types of facilities and ease of payment and collection by users, the collection methods and modes of payment are suggested in Table 5.8-7

a. Suggested Collection Methods for Water Fee

Table 5.8-7 shows suggested options for methods of collection and modes of payment in consideration of the above factors. For both the piped scheme and hand pump, the modes of payment need to be carefully decided on based on the timing of cash income in communities.

Table 5.8-7: Suggested Modes of Payment/Water Fee Collection Methods

Types of Facilities	Spring Protection	Hand Pump		Piped Scheme	
Timing of Cash Income		Villages with cash incomes all year around	Villages with cash incomes seasonal	Villages with cash incomes all year around	Villages with cash incomes seasonal
Ease of payment	Monthly HH	Per Bucket or Monthly	Annual or Semi-Annual	Per Bucket or Monthly	Annual or Semi-Annual
Ease of Collection	Monthly HH	Per Bucket	Per Bucket	Per Bucket	Per Bucket

b. Suggested Collection Structure of Water Fee

Figure 5.8-3 and Figure 5.8-4 summarize the suggested structures of water fee collection by type of water supply facility. The differences in the structures are interrelated with the community based management institutions suggested according to suggested responsible bodies of community water supply organizations as shown in Table 5.8-2 (refer to Section 5.8.1). The practical cases of the following suggested collection structures for the targeted villages of the priority projects are described in the Operation and Maintenance Plan (Chapter 9).

b.1 Protected Springs and Boreholes with Hand Pumps

In the case of the hand pump facilities, users pay the water fee to the collector deployed by the Water User Group (WUG) or the treasurer of the WUG, and the WUG treasurer reports to the VWC monthly about the WUG's financial status.

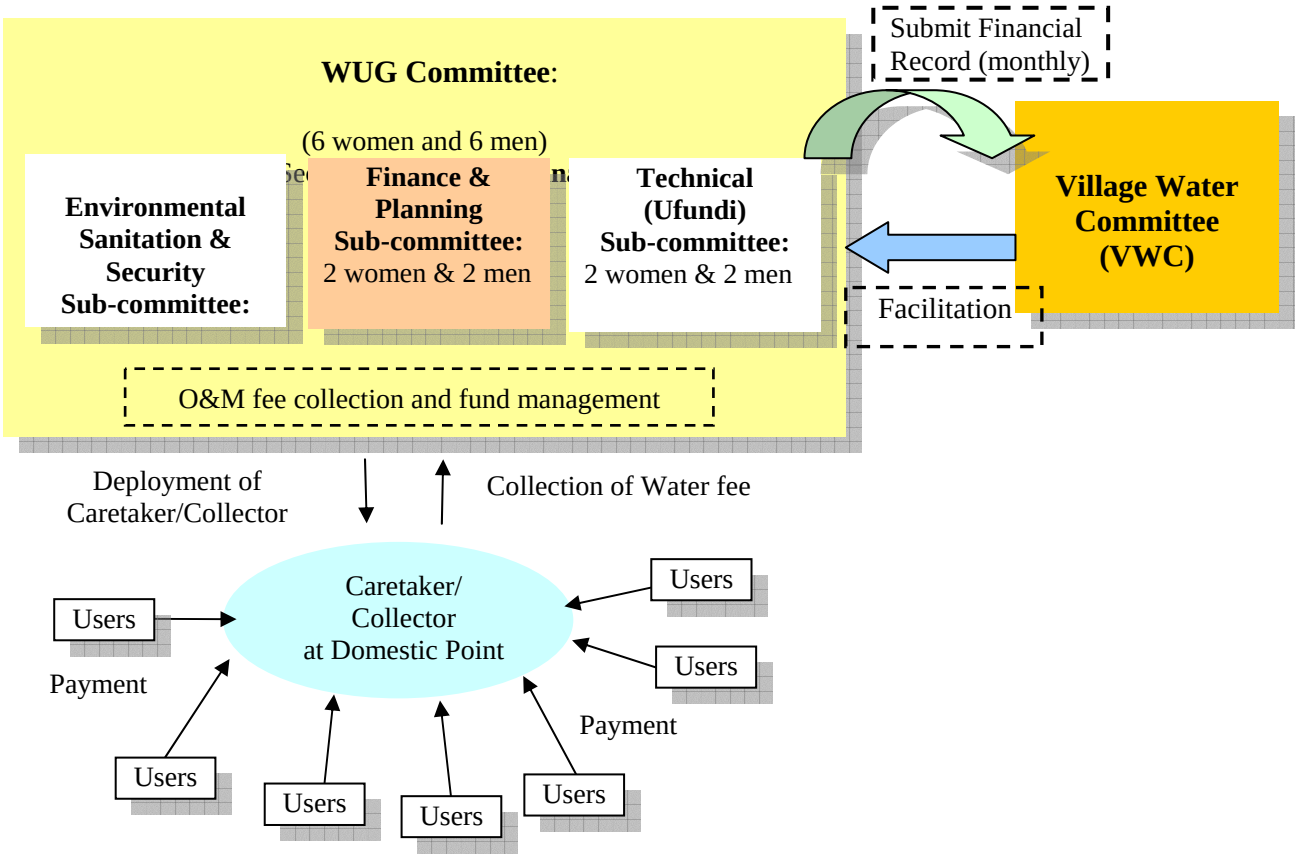


Figure 5.8-3: Suggested Structure of Water Fee Collection (Hand Pump)

b.2 Piped Scheme

For the piped scheme facility, in the case of payment per bucket, water users will pay the water fee to the water fee collector of the tap committee at the domestic point, and the treasurer of the WUA will manage the water fees and make monthly reports to the relevant VWC on the WUA's status. In the case of flat rate such as monthly, semi-annual and annual payments, water fees will be collected by a treasurer of respective tap committee, and the treasurer of the WUA will manage the water fees and make reports to the relevant VWC on the WUA's status.

The collector, the treasurer of the Tap Committee and the treasurer of Finance & Planning Sub-committee of the WUA shall issue receipts for all payments and also records of the water fee collection shall be kept in order to secure transparency of the flow of collected money. The following figure suggests the structure of collecting water fee for piped scheme.

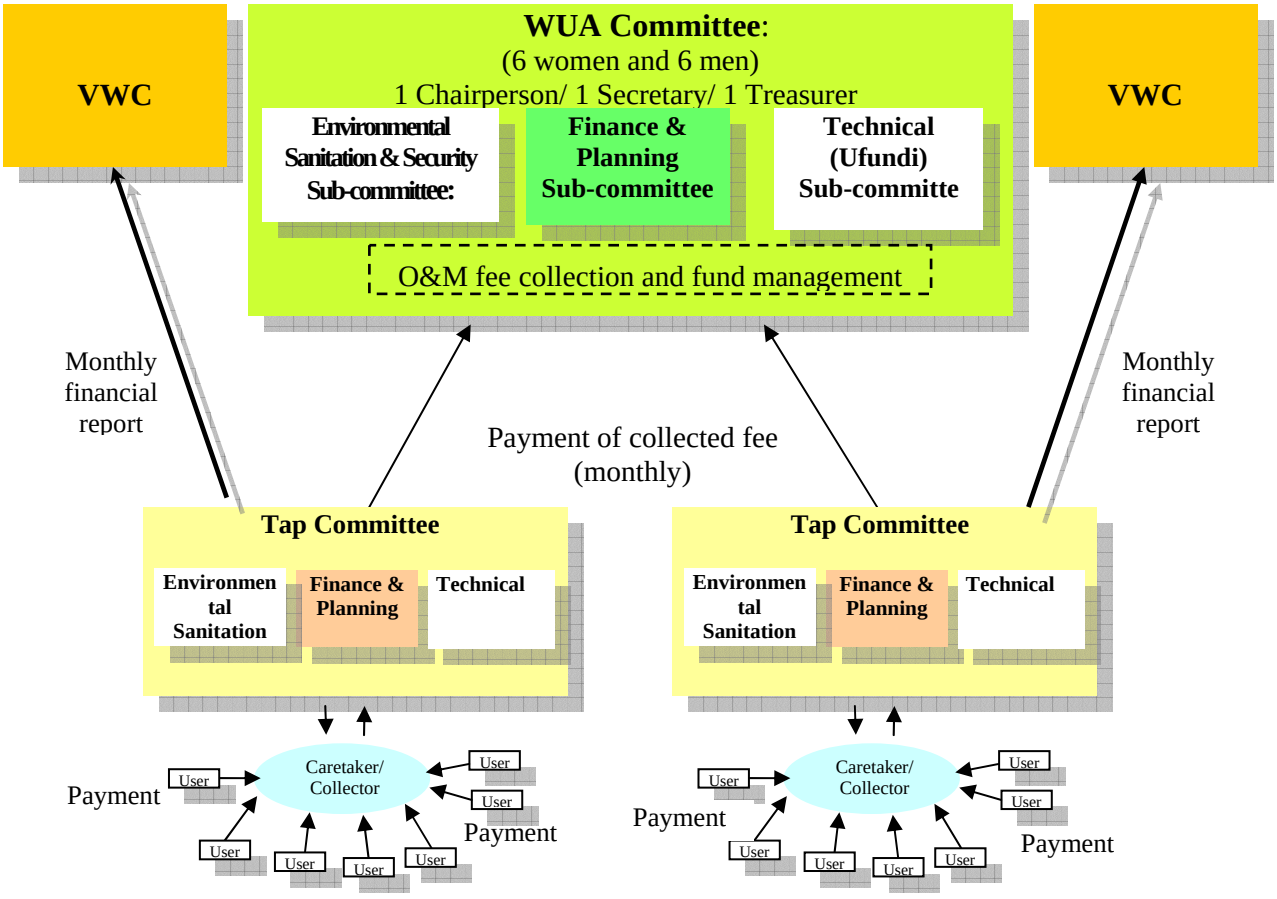


Figure 5.8-4: Suggested Structure of Water Fee Collection (Piped Scheme)

5.8.4 Community Awareness Plan

The Village Water Committee (VWC), one of the responsible bodies for the current water supply activities, has been formed in most of the villages of the Study area. However, due to the immature sense of ownership of the water users, and limited support from the DWE offices and relevant government officers, the existing community water supply organizations have failed to meet their expected roles and responsibilities. Based on the institutional arrangement and framework to support communities, a structured community awareness plan shall be carried out in order to strengthen the sense of ownership by users and community water supply organizations of facilities, and increase awareness of the benefit of using safe water. Two interwoven approaches of the suggested community awareness plan are outlined for all targeted villages in the Water Supply Plan.

a. Capacity Development for Water Supply Facility Management

The objectives of capacity development for water supply facility management is to raise awareness among villagers of the benefits of using water supply facilities and management through appropriate operation and maintenance as well as the formation and strengthening of community water supply organizations. In line with the proposed Water Supply Plan, the expected training at the village level is summarized in Table 5.8-8. The training consists of strengthening the managerial capacity and technical capacity of community water supply organizations. The training on management shall be organized at the ward executive office

except for the general assembly guidance; thereby several villages can receive the training together in order to save time and effort for the facilitators. For community mobilization and technical capacity building of VWC and WUG, there are the existing guidelines and manuals as presented earlier. Based on the existing manuals, revised manuals need to be prepared for the respective training. For piped scheme water facilities, a new training program and manual for mobilizing the community are necessary.

b. Awareness Raising on Use of Safe Water and Sanitary/Hygiene Practice

The District Water and Sanitation Team (DWST) holds the key to implementing the community awareness plan in the villages successfully. The objective of awareness raising on the use of safe water and sanitary/hygiene practices is to foster awareness on the benefit of using safe water, based on the on-going PHAST approach promoted by the MoH in cooperation with water sector across the nation. As summarized in Table 5.8-8, the PHAST training shall take about 3 days with the injection of allowances for the district staffs and facilitators, training materials, latrine construction materials, and transportation costs, etc. The cost is estimated at 3,140,000 Tsh per village for the environmental health/ sanitary education.

c. Required Term/duration for Activity and Training of the Community Awareness Plan

It shall take about one month to prepare for manuals for training. However, the manual for the priority project can be an exemplar for the training of the rest of the villages which the priority project shall not cover for facility construction. For the establishment and revitalization of VWC activities, one cycle of mobilization needs about 1.5 months while a series of guidance for mobilization and activation of WUG/WUA shall also take 1.5 months plus another three months for proceeding with application for legal entity. The process to be taken for water user entities is available in 'Guidelines for Facilitating Communities in Establishing Water User Entities' in NRWSSP (2006). Training activities for VWC and WUG/WUA include:

- Information delivery and consultation to village leaders
- Holding of the village assembly
- Selection of leaders of VWC and WUG/WUA (WUA is for piped scheme)
- Managerial training to the VWC and WUG/WUA members (community mobilization and finance)
- PHAST training for health and sanitary education
- Making by-laws
- Collection of fund for each WUG
- Opening of bank account of each WUG
- Registration of the VWC and WUG to the District Water Department
- Quarterly reporting (facility status, repair records, financial record etc) to the District Water Department through the VWC and WUA
- Application for legal entity of the WUG/WUA to the Basin Water Office

It is recommended to implement the community awareness plan after the type of water facility is fixed in each village since the timing of training is important in terms of sustainability and the reality of the set of trainings.

Table 5.8-8: Summary of Training Needs and Budget related to Community Awareness Plan at Community Level

Types of Training		Target	Required Duration	Injection	Breakdown	Tsh	Total (Tsh)
Management	1) VWC	a Village Assembly	0.5 Day	① Allowance :WT and CDO	25,000 Tsh/day x 2 p x 3 day =	150,000	516,000
				② Allowance: Driver	20,000 Tsh/day x 1 p x 3 day =	60,000	
		b VWC members (12)	2 Days	③ Allowance: Participants	2,000 Tsh/day x 12 p x 3 day =	72,000	
				④ Manuals/guides	2,000 Tsh/ person x 12 p x 1 set =	24,000	
				⑤ Transportation	70,000 Tsh/day x 3 day =	210,000	
	2) WUG for Hand Pump	a WUG Assembly	0.5 Day	① Allowance :WT and CDO	25,000 Tsh/day x 2 p x 4 day =	200,000	656,000
				② Allowance: Driver	20,000 Tsh/day x 1 p x 4 day =	80,000	
		b WUG Committee (12)	3 Days	③ Allowance: Participants	2,000 Tsh/day x 12 p x 3 day =	72,000	
				④ Manuals/guides	2,000 Tsh/ person x 12 p x 1 set =	24,000	
				⑤ Transportation	70,000 Tsh/day x 4 day =	280,000	
	3) WUA for Piped Scheme	a WUA Assembly	0.5 Day	① Allowance :WT and CDO	25,000 Tsh/day x 2 p x 4 day =	200,000	656,000
				② Allowance: Driver	20,000 Tsh/day x 1 p x 4 day =	80,000	
		b WUA Committee (12)	3 Days	③ Allowance: Participants	2,000 Tsh/day x 12 p x 3 day =	72,000	
				④ Manuals/guides	2,000 Tsh/ person x 12 p x 1 set =	24,000	
				⑤ Transportation	70,000 Tsh/day x 4 day =	280,000	
Technical Repair & Maintenance	1) WUG for Hand Pump	a WUG Committee (all) +VWC	1 Day	① Allowance :WT and CDO	25,000 Tsh/day x 2 p x 4 day =	200,000	592,000
				② Allowance: Driver	20,000 Tsh/day x 1 p x 4 day =	80,000	
		b WUG Committee (Technical sub-committee)(4)	3 Days	③ Allowance: Participants	2,000 Tsh/day x 4 p x 3 day =	24,000	
				④ Manuals/guides	2,000 Tsh/ person x 4 p x 1 set =	8,000	
				⑤ Transportation	70,000 Tsh/day x 4 day =	280,000	
	2) WUA for Piped Scheme	a WUA Committee(All)+VWC	1 Day	① Allowance :WT and CDO	25,000 Tsh/day x 2 p x 4 day =	200,000	592,000
				② Allowance: Driver	20,000 Tsh/day x 1 p x 4 day =	80,000	
		b WUA Committee (Technical sub-committee)(4)	3 Days	③ Allowance: Participants	2,000 Tsh/day x 4 p x 3 day =	24,000	
				④ Manuals/guides	2,000 Tsh/ person x 4 p x 1 set =	8,000	
				⑤ Transportation	70,000 Tsh/day x 4 day =	280,000	
PHAST	1) Environmental Health and sanitary practices	a Village Assembly	0.5 Day	① Allowance: WT, CDO, DHO	25,000 Tsh/day x 3 p x 4 day =	300,000	3,140,000
		b VWC, WUG Committee (Environmental sanitation/ security sub-committee) (15)	3 Days	② Allowance: Facilitators	25,000 Tsh/day x 2 p x 4 day x 4 session =	800,000	
				③ Latrine construction materials (Cement, Weldmesh, Vent pipe)	220,000 Tsh/ latrine x 6 unit =	1,320,000	
		c Community Owned Resource Persons (CORPS) (10)		④ PHAST tools	15,000 Tsh/day x 25 p =	375,000	
				⑤ Stationaries	1,000 Tsh/day x 25 p =	25,000	
				⑥ Transportation	80,000 Tsh/day x 4 day =	320,000	

Table 5.8-9: Required Terms for activities and Training for Community Awareness Plan at Community Level

	Mobilization and Training Activities	Days/Terms Required	Required Terms for a cycle of activities
Prep	Preparation of manual for Trainings	1 month	1 month
VWC	Information delivery and consultation to village leaders	1 day	45 days + Quarterly Monitoring
	Holding of the Village Assembly	0.5 day	
	Selection of VWC leaders	0.5 day	
	Training to the VWC members and Assembly		
	1) Management (Community mobilization and finance)	3.5 days	
	2) PHAST (Health/sanitary Improvement)	3.5 days	
	Making by-laws of the VWC	1 day	
	Collection of the VWC fund	15 days	
	Opening of the bank account of the VWC	10 days	
	Registration of the VWC to District Water Department	10 days	
	Quarterly reporting (facility status, repair records, financial record) to District Water Department	Every 3 months	
	Monitoring of Sanitary/hygiene promotion	Every 3 months	
WUG/ WUA	Information delivery and consultation to village leaders	1 day	44 days + Quarterly Monitoring + 3 months legal entity process
	Holding of the WUG/WUA Assembly Meeting	0.5 day	
	Selection of WUG/WUA leaders	1 day	
	Training to the WUG/WUA members and Assembly		
	1) Management (Community mobilization and finance)	3.5 days	
	Making by-laws of the WUG/WUA	1 day	
	Collection of the WUG/WUA fund	15 days	
	2) Technical Repair & Maintenance	4 days	
	3) PHAST (Health/sanitary Improvement)	3 days	
	Opening of the bank account of the WUG/WUA	10 days	
	Registration of the WUG/WUA to District Water Department	5 days	
	Quarterly reporting (facility status, repair records, financial record) on to District Water Department	Every 3 months	
	Monitoring of WUG/WUA in the village	Every 3 months	
	Application for legal entity of the WUG/WUA to Basin Water Office	3 months	

5.9 Evaluation of Water Supply Plan

5.9.1 Economic Evaluation

a. Economic Analysis

a.1 Basic Assumptions

The economic analysis has been undertaken on the basis of the following assumptions:

(1) The official exchange rate as of May 2006 has been applied:
USD 1.00 = Tsh 1,181 = 114.58 Yen
(2) Project life has been assumed as 30 years. Economic life of water supply facilities range from 10 years for pumps and engines to 30 to 40 years for pipes, storage tanks, domestic points, etc.
(3) Only direct and tangible benefits have been quantified for the calculation of the economic indicators.
(4) Opportunity cost of capital (or discount rate) is assumed to be 10 %.
(5) Transfer payments such as interest and taxes, and price escalation are not included in the calculation.

a.2 Economic Project Cost

Economic Project costs are composed of the investment costs and recurrent costs as mentioned below.

a.2.1 Investment Costs for the Project

Economic investment costs comprise the costs for construction of water supply facilities, administration, engineering services and physical contingency. Taxes and price contingency are not included in the economic costs. Conversion factors to convert the financial prices into economic prices have not been applied in this analysis due to lower percentage of local currency portion. The economic project costs thus estimated amount to USD 230,615,000 at the price level of April 2006.

a.2.2 Recurrent Costs

Recurrent costs consist of annual operation, maintenance and replacement costs for the equipment and facilities.

b. Economic Benefits

Out of the several economic benefits of the Project, only saved time benefits for water fetching and health improvement benefits have been included in the calculation of economic benefits, as other benefits are considered to be difficult to quantify.

b.1 Saved Time Benefits of Water Fetching

Saved time value is measured by multiplying average saved time by economic labor cost for water fetching. The distance to water sources, therefore, is the major factor in determining the saved time benefits. Data on water fetching time are estimated from the results of the interview survey conducted in the selected villages.[1] The saved time value per year is estimated at Tsh 59,495 (USD 50.37) per household.

b.2 Health Improvement Benefits

Health improvement benefits are derived as a result of an improvement in water quality and increased supply of water. The benefits can be measured from the difference of medical

[1] Socio-economic Survey in 2005 and Socio-economic Supplementary Survey in 2006.

expenses between “with” and “without” installation of improved water supply systems. It is assumed that provision of clean water supply will lead to a 40% reduction in medical expenses every year in the target communities. Health improvement benefits are estimated at Tsh 42,598 (USD 36.07) per household per year.

c. Cost and Benefit Analysis

Economic analysis has been conducted on the basis of annual costs and benefits stream as estimated in the preceding sections. The result of economic analysis of the proposed Project in terms of EIRR, Net Present Value (NPV) and Benefit Cost Ratio (B/C) is presented below.

The results of the economic analysis are as follows:

- EIRR: 13.8 %
- NPV: 27,756,193 USD
- B/C: 1.22

The economic indicators mentioned above signify the economic viability of the Project as the EIRR exceeds the opportunity cost of capital (10%), the NPV is positive and the B/C exceeds 1.0.

5.9.2 Financial Aspects

a. Financial Sources for the Project

The total capital costs are allocated in the annual disbursement schedule based on the expected financing of ESAs and NGO and the investment requirement plan by NRWSSP (refer to Table 5.7-6). The allocation for funding by ESAs, NGO and GoT is planned in consideration with the past tendency of funding. About 12% of the entire investment in Tanzania is occupied in that of the Mwanza and Mara regions depending on the investment requirement of the Tanzanian government by NRWSSP. The annual capital cost allocated is relevant in comparison with the expected funding of investment in the Mwanza and Mara regions.

Relevant district councils in the Mwanza and Mara regions and village governments in the water supply plan target villages will be responsible for the operation and maintenance costs of water supply facilities including water intake, reservoirs, borehole wells, pipelines and pumps.

Relevant district councils will give technical as well as financial assistance to the target villages through DWE and CD (community development) officers. Each village government of the target villages will establish a water tariff system and water supply organizations (e.g. water committee) at village as well as sub-village level in order to recover the costs for operation and maintenance of the relevant water supply system.

b. Recovery of Operation and Maintenance and Replacement Costs

The beneficiaries in the target communities are expected to organize their water supply organizations to conduct periodical operation and maintenance works and to collect water fees for the recovery of the operation and maintenance expenses. The water fee to be collected in each community is estimated at Tsh 0.50 or Tsh 1.00 per liter depending on the kind of the facilities.

The following table shows the results of the computation of the expected water fee to be collected from the water users and the amount of operation, maintenance and replacement

(OMR) cost required each year. It could be concluded from the table that in most cases, a water rate of Tsh 0.50 per liter or Tsh 10 per bucket will be sufficient to cover the required OMR costs.

Table 5.9-1: Recovery of Operation, Maintenance and Replacement Costs

Year	No. of households (beneficiaries)	Water demand per year (liter) 1/	Water fee to be collected		Annual OMR costs (USD)
			Tsh 0.50 per liter (Tsh 10 per bucket)	USD equivalent	
2007	7,071	363,263,786	181,631,893	153,764	93,470
2008	28,763	1,477,658,292	738,829,146	625,469	413,333
2009	46,645	2,396,316,996	1,198,158,498	1,014,323	652,245
2010	61,438	3,156,292,700	1,578,146,350	1,336,008	835,360
2011	77,839	3,998,856,536	1,999,428,268	1,692,652	1,698,704
2012	95,350	4,898,502,292	2,449,251,146	2,073,458	2,024,034
2013	114,064	5,859,870,037	2,929,935,019	2,480,389	2,354,996
2014	133,761	6,871,826,757	3,435,913,379	2,908,734	2,685,957
2015	155,081	7,967,090,995	3,983,545,497	3,372,342	3,026,858
2016	184,725	9,490,025,426	4,745,012,713	4,016,976	3,506,238
2017	215,933	11,093,308,774	5,546,654,387	4,695,620	3,985,619
2018	248,774	12,780,458,989	6,390,229,495	5,409,764	4,465,000
2019	283,319	14,555,138,420	7,277,569,210	6,160,957	4,944,381
2020	319,733	16,425,870,373	8,212,935,187	6,952,808	5,423,762
2021	355,372	18,256,809,085	9,128,404,543	7,727,815	5,861,068
2022	392,803	20,179,753,444	10,089,876,722	8,541,767	6,298,375
2023	432,101	22,198,663,891	11,099,331,946	9,396,339	6,735,682
2024	473,348	24,317,667,517	12,158,833,758	10,293,280	7,172,988
2025	516,627	26,541,059,721	13,270,529,860	11,234,406	7,610,295

Note: 1/ about 140 liters per household per day

5.9.3 Organization/Institution Evaluation

Current organizational problems are summarized in the following below.

(1) Inadequate coordination and undefined demarcation between government offices led to weak planning and performance in such areas as budget based planning and activities.
(2) Lack of coordination roles to standardize the water supply activities and human resources deployment among districts deteriorated to keep balanced development of water supply status in the region.
(3) Low priority for monitoring and supervision of community based facility management led to deterioration of water facility
(4) Shortage of skilled technicians in DWE offices led to ineffective and untimely management of water supply.
(5) Lack or deterioration of VWCs and user groups for facility management led to poor maintenance of water facility.
(6) Poor knowledge of technical maintenance and financial management led to weak sustainability of water facility.

Those issues are suggested in the National Water Policy (2002) regarding the organizational/institutional evaluation. To resolve those issues, it is necessary to clear the role of organizations, such as region, district, and community in villages. It is suggested to solve the issues in Study area shown in the following ways set out below.

(1) To establish a coordination body for water and sanitation promotion at the regional level.
(2) This coordination body also serves as the coordinator at a regional level to provide support and guidance for water and as sanitation promotion.

(3) The District Water and Sanitation Team (DWST) provide technical and financial support to communities in the villages and operating and maintaining water facilities.
(4) To clarify the responsibilities of DWST.
(5) To strengthen the capacity of District Water Department /District Water Engineer Office
(6) To establish the responsible bodies of community water organizations, which are shown in the NRWSSP

From those suggestions, above the institutional/organizational plan is judged to be relevant and can be evaluated for the adequate and feasible plan.

5.9.4 Natural/Social Environment Evaluation

An IEE study was conducted in order to consider the impact of project implementation on the natural and social environment. As the primary objective of the water supply plan is to improve water problems, it in essence should not have any negative environmental or social impact. Granted that, several possible impacts due to implementation of the project are assessed in Chapter 8.

The water sources to be used for the supply of water generally consist of surface water and groundwater. The surface water source is to be Lake Victoria and for groundwater, medium, and deep groundwater is targeted. The use of river water is not considered in this water supply plan. Regarding the use of water from Lake Victoria, the plan is to use a total volume of 36,000m^3/day based on the existing piped schemes and newly planned schemes. This water use is to be planned gradually in line with the project until 2015 and the facilities are to be scattered along the lakeside, so it is not likely to have an impact on lake water use. As for the impact of the facilities, no problems are anticipated since they are to be laid underground. If there is any impact at all, it will be the noise from the engine at the pump station during use. However, as most of the village dwellings are far from the pump stations, this is not expected to be a real problem. As for groundwater development, as mentioned before, the study area consists of basement rock, belonging to the old geological age. Therefore the overall development potential is low. In the water use plan, the volume of groundwater use by hand pump is to be approximately 20,000m^3/day to meet the design water demand in the two regions in 2015. However, since the actual yield by hand pump use in view of the groundwater potential is very little and the area targeted for groundwater development is in a basement rock area, it should not trigger land subsidence. Also, there is no soft layer distributed in the surface layer that would cause land subsidence. In the use of wells, it is necessary to consider the effect on neighboring wells. However, there are few existing wells in the study area and the aquifers in basement rock are not continuous so no problems are anticipated.

Although there are water venders in cities and towns near Lake Victoria, there are few such venders in villages. Therefore, the construction of facilities in the water supply plan is not likely to have a big impact on water venders. Nevertheless, it is necessary to consider measures to mitigate the possible impacts of facilities constructed in villages located near towns.

It is also necessary to consider the impact of the project on the Serengeti National Park, which is located in the study area. However, there are too few target villages in the Serengeti District to have an impact on the National Park, and of the three piped schemes, only one small-scale facility is located adjacent to the park. Therefore, in view of the conditions of facility construction and the volume of groundwater use, there is no cause for concern.

There are also many benefits due to the development of water supply facilities, particularly in

regard to the gender issue of water fetching, which is the responsibility of women and children. The construction of water facilities within villages will reduce the amount of time required for fetching water, and the time saved can be devoted to other activities. In addition, the use of safe water can greatly reduce the occurrence of waterborne diseases, resulting in a reduction in time and money spent on travel to and from the hospital and medical fees. The time and money saved will increase the opportunity to use such resources for other social activities, and so on.

Although further considerations are made in Supporting Report, the facility construction by this water supply plan is not likely to have any negative impact in terms of the natural and social environment.

5.9.5 Technical Aspects

In assessing the practicability of the water supply plan from a technical point of view, it is necessary to consider not only "hard" factors, such as facility construction and equipment, but also "soft" factors, such as operation and maintenance. The planned water supply facilities are primarily wells with hand pumps and piped schemes. The water source of the piped schemes is the Lake Victoria water and deep groundwater. In particular, the piped schemes using lake water require filtration devices such as filters, and the technical monitoring and supervision of such devices will be an important technical issue. The repair of hand pumps, with the exception of breakdowns requiring major repairs, is generally easy and inexpensive (i.e. change of spare parts, etc.) and it is not a technical or financial concern. The operation and maintenance of hand pumps is also simple and as they have been used in the past, the implementation of hand pumps is appropriate. The appropriateness of the piped schemes in terms of facility construction, equipment procurement and operation and maintenance is summarized in the table below. Regarding the piped schemes, it is necessary that the project works for the piped scheme are conducted with the technical support for the operation and maintenance of facility.

Table 5.9-2: Appropriateness of Piped Schemes from Technical Aspect

Item	Facilities/Equipment and Materials	Appropriateness
Intake & Intake pump	Lake water intake facility	• Construction: OK • Operation and maintenance: OK(Need to take a records of activity regularly) • Procurement of Screened Pipe: OK
	Groundwater intake facility (Well and Pump)	• Construction: OK • Operation and maintenance: OK
Filtration	Sedimentation basin	• Construction: OK • Operation and maintenance: OK(Cleaning)
	Filter	• Construction: OK • Operation and maintenance: OK (Need to take record of

		water quality monitoring regularly & cleaning)
Transmission	Rising pipe (Galvanized(GS) pipe) (Poly, Vinyl(PVC) pipe)	• Construction: OK • Procurement: OK (Domestic material is available)
Service Reservoir	Type: On- or Semi-ground or raiser Material: Stone masonry, Concrete, steel	• Construction: OK • Procurement: OK (Domestic material is available)
Distribution	Pipes and break pressure tank (Galvanized(GS) pipe) (Poly, Vinyl(PVC) pipe)	• Construction: OK • Procurement: OK (Domestic material is available)

Chapter 6

Priority Project

6 Priority Project

6.1 General

The 428 villages and 57 existing piped schemes were selected for the water supply plan by using selection criteria. The 205 villages were ranked from 428 villages for the socio-economic survey. 100 villages are ranked for the supplementary survey from 205 villages in order to determine the priority project. The process for the selection was discriminated into the selection of villages and that of existing piped schemes. In regard to the existing piped schemes, 15 existing piped schemes were ranked for the supplementary survey from the 57 existing piped schemes. Finally 43 villages and 1 existing piped scheme including 2 villages were selected for the priority project. Therefore the final number of villages for the priority project is 45.

6.2 Selection and Criteria for Priority Project

6.2.1 Selection Process and Criteria

The process of the selection of villages and existing piped schemes for the priority project is executed separately, as shown in Figure 6.2-1.

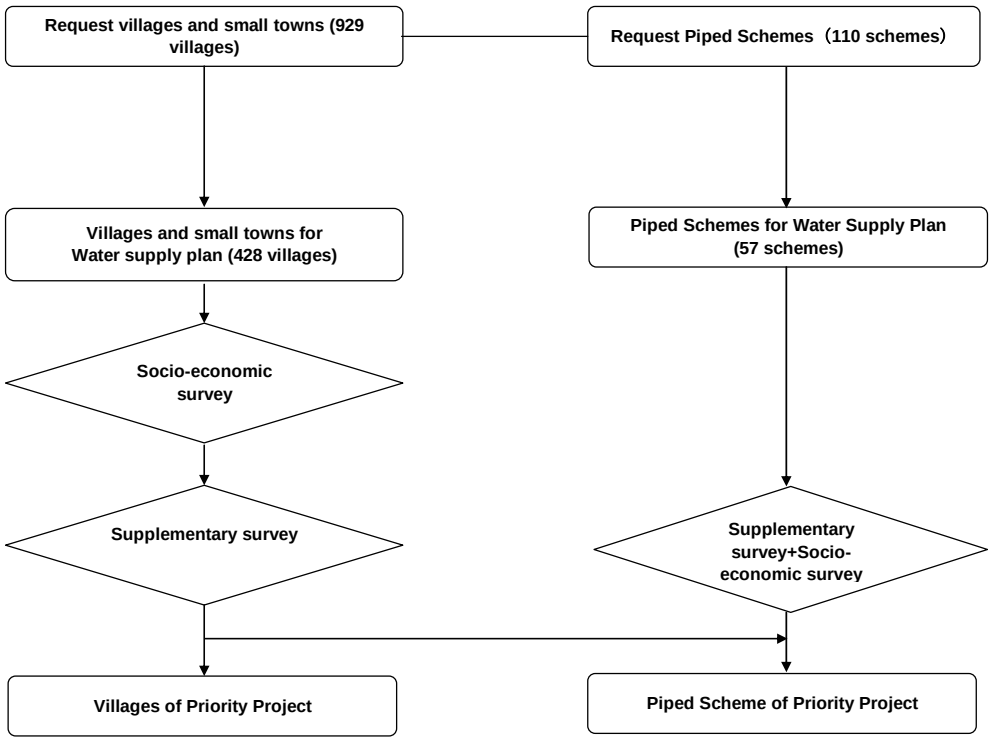


Figure 6.2-1: Schematic Selection Flow of Priority Project for Village and Piped Scheme

a. Village Selection

The first step was to select the villages for formulation of the water supply plan out of the 929 requested villages by the Tanzania side. The seven criteria, such as the advantage of support for water supply, better access to safe water, and existence of unknown factors were applied

to narrow down the villages. The seven criteria are as follows; 1) Supported by donors and NGOs, 2) Located in an urban area, 3) Covered by a piped water scheme 4) More than 50% of the village population is covered by a safe source, 5) More than 50% will be covered by one additional well, 6) Within 1km from Lake Victoria, 7) Inaccurate, incorrect or unknown data descriptions in the list.

The second step was to rank the villages for project implementation and to limit the villages for the socio-economic survey using the criteria, such as lower access to safe water, effectiveness of project implementation, and willingness and /or availability to participate in the water supply project. The third step was to rank the candidate villages for the priority project based on the results of the socio-economic survey. The ranking criteria were the following items, such as demand for an improved supply of water, capability of communities for facility maintenance, and financial capability and willingness to pay a water charge. The fourth step (final step) was to rank the villages for the priority project based on the results of the supplementary survey, for example O&M system of existing water supply system and traditional water sources, willingness and capacity to pay, project experiences of HESAWA or other community based development projects and the capacity of the district water department in consideration with the sustainability of the utilization of a water supply system in the village.

b. Piped Scheme Selection

The first step was to select the existing piped schemes for formulation of the water supply plan out of the 110 requested existing piped schemes of the Tanzania side. The five selection criteria were as follows;

1) Particular existing piped schemes, which cover at least one village out of the requested 929 villages
2) In the serviced villages, an existing piped scheme that covers at least one village classified as being in the rural area
3) Existing piped schemes that are not included in on-going or proposed projects
4) In villages where the population supplied by water using shallow and deep wells is less than 50% of the administrative population, the piped schemes should cover at least one village
5) Existing piped schemes that have been excluded by recent mid-to-large scale rehabilitation projects

The second step was to rank the candidate existing piped schemes for the priority project by using the following six criteria, such as functioning, partially functioning, changing pump after the year 2000, replacement of pipe after completion, served population (more than 50%), and the existence of inaccurate data. The third step (final step of piped scheme) was to rank the existing piped scheme for the priority project based on the results of the supplementary survey, for example demand for improved supply water, O&M capability of community, financial capability, and willing to pay.

The 100 candidate villages and 17 candidate existing piped schemes ranked for priority project in accordance with the criteria of supplementary survey are shown in Table 6.2-1 and Table 6.2-2.

Table 6.2-1: 100 Candidate Villages for Supplementary Survey (1/2) (Mwanza)

Region	District	No. by District	Village	Population in 2025	Water Sources type					served coverage rate(%) in 2005	served coverage rate(%) in 2025	Served Population in 2025	Final Evaluation
					HP=Hand pump MP=Motor pump	Number of HP or MP	Additional Medium BH	Total (HP)	Water Sources				
MWANZA	MISUNGWI	25	Busongo	6,361	Newly Piped Scheme MP	2		2	BH	5	93	5,916	O
	MISUNGWI	28	Ngaya	4,974	Newly Piped Scheme			0	Lake V.	13	100	4,974	O
	SENGEREMA	13	Sogoso	8,174	HP	6	3	9	Deep BH	0	28	2,250	O
	SENGEREMA	18	Nyampande	7,307	Newly Piped Scheme			0	Lake V.	9.2	62	4,520	J
	SENGEREMA	24	Nyitundu	4,323	Newly Piped Scheme			0	Lake V.	0	53	2,276	J
	SENGEREMA	26	Lubanda	5,085	Newly Piped Scheme			0	Lake V.	0	53	2,678	J
	SENGEREMA	30	Juma kisiwani	6,035	Newly Piped Scheme			0	Lake V.	0	53	3,178	J
	SENGEREMA	37	Mwaliga	3,066	Newly Piped Scheme			0	Lake V.	0	53	1,615	J
	SENGEREMA	44	Nyakahako	10,517	Newly Piped Scheme			0	Lake V.	0	53	5,538	O
	SENGEREMA	67	Sotta	6,271	HP	5	2	7	Deep BH	0	28	1,750	O
	SENGEREMA	69	Isole	7,151	HP	5	2	7	Deep BH	17.8	42	3,023	O
	SENGEREMA	73	Mlaga	4,046	Newly Piped Scheme			0	Lake V.	0	53	2,131	J
	SENGEREMA	75	Buswelu	5,384	Newly Piped Scheme MP	2		2	Deep BH	12.4	82	4,415	O
	SENGEREMA	83	Busekeseke	4,872	HP	4	3	7	Deep BH	0	36	1,750	O
	SENGEREMA	84	Katoma	5,763	HP	5	3	8	Deep BH	0	35	2,000	O
	SENGEREMA	86	Magulukenda	7,253	HP	6	2	8	Deep BH	0	28	2,000	O
	SENGEREMA	93	Bukokwa	15,561	Newly Piped Scheme			0	Lake V.	0	53	8,194	J
	SENGEREMA	96	Nyanchecheche	10,934	HP	5	4	9	Deep BH	0	21	2,250	O
	SENGEREMA	99	Nyamiswi	4,649	Newly Piped Scheme			0	Lake V.	0	70	3,255	O
	SENGEREMA	100	Nyakasasa	8,131	Newly Piped Scheme			0	Lake V.	0	70	5,692	O
	SENGEREMA	104	Lugata	24,841	Newly Piped Scheme			0	Lake V.	0	53	13,081	J
	SENGEREMA	106	Lushamba	21,537	Newly Piped Scheme			0	Lake V.	0	53	11,341	J
	SENGEREMA	108	Bulyaheke	10,496	Newly Piped Scheme			0	Lake V.	0	53	5,527	J
	SENGEREMA	110	Ilyamchele	3,461	Newly Piped Scheme			0	Lake V.	0	53	1,822	R
	SENGEREMA	114	Luharanyonga	7,035	Newly Piped Scheme			0	Lake V.	17.9	71	4,964	J
	SENGEREMA	115	Isengeng'he	6,237	Newly Piped Scheme			0	Lake V.	0	53	3,284	J
	KWIMBA	22	Hungumalwa	9,376	Newly Piped Scheme MP	2		2	BH	35	100	9,376	O
	KWIMBA	71	Mhulya	4,042	HP	4	4	8	Deep BH	0	49	2,000	O
	MAGU	75	Kijereshi	9,110	HP	8	2	10	Deep BH	8.4	36	3,265	O
	GEITA	3	Idosero	8,154	HP	6	4	10	Deep BH	0	31	2,500	A
	GEITA	4	Lwenzera	23,775	Newly Piped Scheme			0	Lake V.	0	53	12,641	J
	GEITA	6	Buligi	15,325	Newly Piped Scheme			0	Lake V.	0	53	8,148	J
	GEITA	8	Kakubilo	29,459	Newly Piped Scheme			0	Lake V.	0	53	15,663	J
	GEITA	9	Nyabalasana	11,248	Newly Piped Scheme			0	Lake V.	0	53	5,980	J
	GEITA	10	Kaseni	6,422	Newly Piped Scheme			0	Lake V.	0	53	3,414	J
	GEITA	17	Bugulala	12,737	HP	5	6	11	Deep BH	0	22	2,750	O
	GEITA	18	Kasota	14,410	HP,Spring	5	4	9	Deep BH、S	0	16	2,250	O
	GEITA	19	Nyamilongo	12,017	HP	6	2	8	Deep BH	0	17	2,000	R, A
	GEITA	22	Kamera	12,209	HP	5	3	8	Deep BH	0	16	2,000	O
	GEITA	23	Bushishi	6,970	HP	4	5	9	Deep BH	0	32	2,250	R
	GEITA	24	Ndelema	6,165	HP	3	7	10	Deep BH	0	41	2,500	O
	GEITA	25	Nyashishima	2,913	HP	2	3	5	Deep BH	0	43	1,250	O
	GEITA	26	Bogogo	14,642	HP	6	2	8	Deep BH	13	27	3,903	O
	GEITA	27	Ikina	3,518	HP	2	5	7	Deep BH	0	50	1,750	O
	GEITA	29	Ntono	13,743	HP	6	4	10	Deep BH	0	18	2,500	R, A
	GEITA	30	Ihega	5,593	HP	3	8	11	Deep BH	0	49	2,750	R, A
	GEITA	32	Nyaruyeye	8,181	HP	5	3	8	Deep BH	0	24	2,000	R
	GEITA	42	Ibondo	10,815	HP	7	6	13	Deep BH	0	30	3,250	O
	GEITA	53	Kasangwa	13,467	Newly Piped Scheme			0	Lake V.	0	53	7,160	J
	GEITA	54	Isima	5,964	Expanded Piped Scheme			0	Lake V.	0	53	3,171	R, E
	UKEREWE	12	Namasabo	4,099	Newly Piped Scheme			0	Lake V.	0	56	2,288	R
	UKEREWE	38	Masonga	10,300	Expanded Piped Scheme			0	Lake V.	5	61	6,263	E

Legend of Final Evaluation	
O	: Villages adopted for Priority Project
J	: No Justification to receive grant aid
A	: No acceptable access
L	: Low groundwater potential
R	: Low rank depend on O&M survey
E	: Schemes involved existing piped scheme

Table 6.2-1: 100 Candidate Villages for Supplementary Survey (2/2) (Mara)

Region	District	No. by District	Village	Population in 2025	Water Sources type				served coverage rate(%) in 2005	served coverage rate(%) in 2025	Served Population in 2025	Final Evaluation
					HP=Hand pump / MP=Motor pump	Number of HP or MP	Additional Medium BH	Total (HP)	Water Sources				
MARA	BUNDA	33	Mcharo	1,563	HP	4	1	5	Deep BH	11.36	91	1,428	O
	BUNDA	51	Buzimbwe	3,266	Newly Piped Scheme			0	Lake V.	0	62	2,029	J
	BUNDA	88	Namalama	2,259	Newly Piped Scheme			0	Lake V.	0	62	1,404	J
	MUSOMA	6	Sirorisimba	4,920	HP	4	4	8	Deep BH	0	41	2,000	O
	MUSOMA	8	Ryamisanga	5,871	HP	6	2	8	Deep BH	18	52	3,057	O
	MUSOMA	21	Kisamwene	5,449	HP	6	5	11	Deep BH	0	50	2,750	O
	MUSOMA	24	Mmazami	6,155	HP	7	4	11	Deep BH	0	45	2,750	R
	MUSOMA	31	Chirorwe	4,014	HP	5	3	8	Deep BH	0	50	2,000	R
	MUSOMA	33	Bugoji	6,709	HP	7	3	10	Deep BH	22	59	3,976	O
	MUSOMA	35	Saragana	5,713	Newly Piped Scheme MP	2		2	Deep BH	9	70	3,995	O
	MUSOMA	36	Kaburabura	2,768	HP	4	3	7	Deep BH	0	63	1,750	R, L
	MUSOMA	54	Nyabekwabi	6,594	HP	8	3	11	Deep BH	0	42	2,750	R
	MUSOMA	55	Isaba	5,102	HP	3	7	10	Deep BH	20	69	3,520	O
	MUSOMA	56	Songora	9,076	HP	8	6	14	Deep BH	20	59	5,315	R
	MUSOMA	65	Musanja	6,357	Newly Piped Scheme			0	Lake V.	0	61	3,873	R
	MUSOMA	67	Butata	7,973	Newly Piped Scheme			0	Lake V.	0	61	4,858	J
	MUSOMA	69	Rusoli	4,579	Newly Piped Scheme			0	Lake V.	0	61	2,790	J
	MUSOMA	72	Bukumi	3,668	Newly Piped Scheme			0	Lake V.	0	61	2,235	R
	MUSOMA	92	Mkirira	4,240	Newly Piped Scheme			0	Lake V.	0	61	2,583	J
	MUSOMA	97	Kiemba	5,170	Newly Piped Scheme			0	Lake V.	0	61	3,150	J
	MUSOMA	98	Kigera	9,199	Expanded Piped Scheme			0	Lake V.	0	61	5,604	R, E
	MUSOMA	103	Kiriba	4,482	Newly Piped Scheme			0	Lake V.	13	74	3,314	J
	TARIME	8	Magena	4,250	HP	3	6	9	Deep BH	24.7	78	3,300	L
	TARIME	22	Kebweye	3,866	HP	3	9	12	Deep BH	0	78	3,000	R
	TARIME	24	Nyankunguru	7,534	HP	5	4	9	Deep BH	0	30	2,250	O
	TARIME	41	Matongo	5,389	HP	4	2	6	Deep BH	0	28	1,500	R
	TARIME	44	Kiwanja	6,757	HP	4	1	5	Deep BH	24	42	2,872	O
	TARIME	50	Ng'ereng'ere	3,861	HP	5	1	6	Deep BH	0	39	1,500	R
	TARIME	59	Kikomori	3,515	HP	4	2	6	Deep BH	0	43	1,500	R
	TARIME	64	Nkerege	4,559	HP	5	4	9	Deep BH	0	49	2,250	R
	TARIME	69	Sombanyasoko	1,556	HP	1	3	4	Deep BH	14.9	79	1,232	L
	TARIME	71	Bisarwi	4,808	HP	3	5	8	Deep BH	16.6	58	2,798	O
	TARIME	94	Kisumwa	3,512	HP	2	3	5	Deep BH	15.1	51	1,780	O
	TARIME	112	Nyankonge	2,704	HP	2	3	5	Deep BH	0	46	1,250	O
	TARIME	113	Omoche	6,008	HP	5	6	11	Deep BH	0	46	2,750	R
	TARIME	119	Thabache	2,880	HP	2	7	9	Deep BH	0	78	2,250	R
	TARIME	128	Radienya	3,120	Newly Piped Scheme			0	Lake V.	0	57	1,793	R
	TARIME	129	Masike	4,333	HP	5	6	11	Deep BH	0	63	2,750	O
	TARIME	131	Bukama	6,819	HP	4	7	11	Deep BH	0	40	2,750	O
	TARIME	137	Nyarombo	3,479	HP	4	6	10	Deep BH	10.7	83	2,872	R
	TARIME	138	Rwang'enyi	5,457	Expanded Piped Scheme			0	Lake V.	11.7	69	3,774	R, E
	TARIME	144	Oliyo	5,931	HP	5	4	9	Deep BH	0	38	2,250	O
	TARIME	151	Ryagoro	4,926	HP	4	6	10	Deep BH	0	51	2,500	R, L
	TARIME	155	Nyamsi	2,997	HP	2	7	9	Deep BH	0	75	2,250	R
	TARIME	157	Tatwe	6,937	HP	5	6	11	Deep BH	0	40	2,750	O
	SERENGETI	37	Busawe	2,279	HP,Spring	3		3	Deep BH	0	73	1,663	O
	SERENGETI	66	Nyansurura	5,853	HP	3	6	9	Deep BH	4.72	43	2,526	O
	SERENGETI	67	Kebancha	9,454	HP	4	3	7	Deep BH	6.2	25	2,336	O

Legend of Final Evaluation	
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J	: No Justification to receive grant aid
A	: No acceptable access
L	: Low groundwater potential
R	: Low rank depend on O&M survey
E	: Schemes involved existing piped scheme

Table 6.2-2: 17 Candidate Existing Piped Schemes for Supplementary Survey

No.	Reion	District	Name of scheme	Future source[1]	Design population	Population in 2005	% of current Service population[2]	Cost per capita (US$)	Criteria: Service population of least 50% by piped scheme in 2005	Functioning	Partially functioning	Data missing on design population	Pump replaced since 2000	Pipe replaced since construction	Scores
1	Mwanza	Missungi	Usagara	B	600	9,029	7	59	0	0	0	0	0	0	**0**
2		Missungi	Mbarika	L		5,402	0	31	0	1	0	1	0	1	**3**
3		Missungi	Kasololo / Igongwa	L		24,156	0	135	0	1	0	1	0	1	**3**
4		Missungi	Ukiriguru	L	4,000	16,521	24	135	0	0	0	0	0	0	**0**
5		Missungi	Misasi	B		9,163	0	59	0	0	0	1	1	1	**3**
6		Sengerema	Nyamazugo / Sengerema	L	18,000	103,792	17	135	0	1	0	0	1	0	**2**
7		Sengerema	Katunguru	L	5,500	14,148	39	135	0	1	0	0	1	0	**2**
8		Sengerema	Lumeya / Kalebezo	L	4,600	28,341	16	83	0	1	0	0	0	0	**1**
9		Sengerema	Sima	B	750	5,943	13	59	0	0	0	0	0	0	**0**
10		Sengerema	Luchili	L	3,500	19,175	18	83	0	0	0	0	0	0	**0**
11		Sengerema	Busisi	L	14,904	6,089	245	31	1	0	0	0	0	0	**1**
12		Sengerema	Lugasa	L	650	8,796	7	28	0	0	0	0	0	0	**0**
13		Kwimba	Ngudu	B	6,600	17,126	39	59	0	0	1	0	0	0	**1**
14		Kwimba	Mantare(It was a part of Sumve)	B	1,600	4,630	35	59	0	0	0	0	0	0	**0**
15		Kwimba	Ilula	B	720	9,110	8	59	0	0	0	0	0	1	**1**
16		Kwimba	Kadashi	B		19,665	0	59	0	0	0	1	0	0	**1**
17		Kwimba	Mwamashimba	L	41,000	54,550	75	186	1	0	0	0	0	0	**1**
18		Kwimba	Ilumba	B		2,406	0	59	0	0	0	1	0	0	**1**
19		Magu	Kabila-Ndagalu	B	3,150	13,348	24	59	0	0	0	0	0	0	**0**
20		Magu	Magu	L	6,000	21,158	28	83	0	0	1	0	1	1	**3**
21		Magu	Kalemela/Mkula	L	4,500	34,239	13	83	0	0	1	0	1	1	**3**
22		Magu	Kisesa	L	320	8,971	4	98	0	0	0	0	0	1	**1**
23		Magu	Ilumya	L	1,200	9,128	13	28	0	0	0	0	1	1	**2**
24		Magu	Nassa	L	800	11,533	7	83	0	0	0	0	0	1	**1**
25		Magu	Kililoli	L	300	4,351	7	28	0	1	0	0	1	1	**3**
26		Geita	Karumwa / Msalala	L	18,283	40,060	46	135	0	0	0	0	0	0	**0**
27		Geita	Nzera	L	900	18,763	5	83	0	0	0	0	0	0	**0**
28		Geita	Nyang'wale	B	2,624	17,191	15	59	0	0	0	0	0	0	**0**
29		Geita	Nyakagomba	L	18,369	41,283	44	83	0	0	0	0	0	0	**0**
30		Ukerewe	Gallu	L	2,429	21,916	11	83	0	0	0	0	0	0	**0**
31		Ukerewe	Muriti	L	6,853	21,576	32	83	0	0	0	0	0	0	**0**
32		Ukerewe	Kazilankanda	L	26,770	47,769	56	83	1	0	0	0	0	0	**1**
33		Ukerewe	Murutunguru	L	8,168	11,863	69	83	1	0	1	0	0	0	**2**
34		Ukerewe	Nansio	L	2,634	25,462	10	83	0	0	1	0	1	0	**2**
35		Ukerewe	Kagunguli / Bukindo	L	5,470	23,174	24	83	0	0	0	0	0	0	**0**
36		Ukerewe	Bukonyo	L	1,257	6,097	21	28	0	0	0	0	0	0	**0**
37		Ukerewe	Irugwa	L	3,669	6,495	56	28	1	0	0	0	0	0	**1**
38	Mara	Bunda	Bunda	L	30,000	61,324	49	135	0	0	1	0	0	1	**2**
39		Bunda	Kasahunga	L	1,200	13,044	9	83	0	1	0	0	0	1	**2**
40		Bunda	Kibara	L	600	12,493	5	28	0	1	0	0	0	1	**2**
41		Bunda	Iramba	L	7,600	15,148	50	83	1	0	0	0	1	1	**3**
42		Musoma	Masurura	B	3,341	6,417	52	59	1	0	0	0	1	1	**3**
43		Musoma	Itaro	L	8,826	18,005	49	28	0	0	0	0	0	1	**1**
44		Musoma	Murangi	L	4,150	7,888	53	28	1	0	1	0	1	1	**4**
45		Musoma	Kyankoma	B	600	9,099	7	59	0	0	0	0	0	1	**1**
46		Musoma	Mugango / Butiama (TR)	L	16,000	50,958	31	83	0	0	1	0	1	1	**3**
47		Tarime	Komuge (TR. No.2)	L	31,966	17,934	178	31	1	0	1	0	0	0	**2**
48		Tarime	Shirati (TR. No.1)	L	8,000	21,762	37	83	0	0	1	0	1	0	**2**
49		Tarime	Marasibora	B	3,758	4,850	77	59	1	0	0	0	0	0	**1**
50		Tarime	Ochuna	B	1,284	1,395	92	59	1	0	0	0	0	0	**1**
51		Tarime	Nyarwana	B		4,101	0	59	0	0	0	1	0	0	**2**
52		Tarime	Changuge	S	4,353	4,690	93	47	1	0	0	0	0	0	**1**
53		Tarime	Nyamagaro	L	4,000	27,049	15	83	0	0	0	0	0	0	**0**
54		Tarime	Kyangasaga	L	600	4,756	13	28	0	0	0	0	0	0	**0**
55		Tarime	Nyanduga	B	4,600	2,730	168	59	1	1	0	0	0	0	**2**
56		Serengeti	Mugumu	B		18,421	0	59	0	0	1	1	0	0	**2**
57		Serengeti	Musati Gravity	S	7,400	2,649	279	47	1	0	1	0	0	0	**2**

Note.

1. L: Lake, B: Borehole, S: Spring

2. Since it was simply calculated based on the data collected from DWE office, some of schemes have value of over 100%.

Candidate existing piped schemes for supplementary survey

6.2.2 Selection of Priority Project

In the 100 villages and 17 existing piped schemes ranked for the supplementary project the detailed field surveys of hydrogeology and O&M in the supplementary survey were carried out. The main targets which were confirmed in the supplementary survey are as follows;

- Groundwater potential in target villages
- Good accessibility to/in target villages
- O&M activities in target villages

It is important to confirm the justification and appropriateness to be received by the implementation project, because the priority project is assumed to be implemented by the Japanese Grand Aid Project.

In the groundwater potential survey, the investigation was carried out for the selection of priority project in accordance with the hydrogeological conditions. The villages of low groundwater potential were lowered for the ranking of priority project. Many socio-economic surveys were carried out in the villages through the process of ranking for selection of the priority project. The detailed socio-economic survey including O&M was executed in the villages for the supplementary survey in this time and the main criteria were adopted as shown in Table 6.2-3.

Table 6.2-3: Criteria for Ranking of Villages

Criteria			
I	O&M System of Existing Water Supply Facilities and Traditional Water Sources (TWSs)	(1)	Existence of the VWC
		(2)	Activeness of the VWC
		(3)	Existence of the VWC Fund
		(4)	Regular Collection of Water Fee
		(5)	Existence of WUG or Alternative Organization for O&M (e.g., Sub-village)
		(6)	Activeness of WUG or Alternative Organization for O&M (e.g., Sub-village) about Water Supply Facility or TWS
		(7)	Existence of the Water Fund by the WUG or Alternative Organization for O&M (e.g., Sub-village)
		(8)	Regular Collection of Water Fee by the WUG or Alternative Organization for O&M (e.g., Sub-village)
II	Willingness to Pay	(1)	Villagers' Answer on Possible Monthly Payment of Water
		(2)	If the Villagers Accept the Required/Estimated Cost for O&M
III	Capacity to Pay	Capacity to Pay	
IV	Project Experiences of HESAWA or Other Community Based Development Projects	(1)	HESAWA
		(2)	Other Community Based Development Projects
V	Capacity of District Water Department	Number of Water Technicians (Engineer Full Techinitian+Trade Test Technician)	
		(1)	Below 9 (Geita, Ukerewe, Musoma, Tarime)
		(2)	10 to 14 (Kwimba, Bunda)
		(3)	Above 15 (Magu, Misungwi, Sengerema, Serengeti)

In the results of supplementary survey, the ranking of the 100 villages and 17 existing piped schemes were executed by using the criteria and condition of groundwater potential in villages. The results of ranking for the 100 villages and 17 existing piped schemes are shown in the Chapter-7 of supporting report. The villages and existing piped schemes for the priority project are shown in Table 6.2-4 and the served population rate of the priority villages and districts in 2015 is shown in Table 6.2-5.

The Location Map including villages and piped schemes of priority project is shown in Figure 6.2-2.

The priority project of the water supply plan for 428 villages and 57 piped schemes is selected. It is impossible to confirm the next grant aid schedule which is assumed to be implemented by Japanese Government at this point in time. However, if the next priority project is planned, there is a high possibility that the remaining of 100 villages and 17 piped schemes from the supplementary survey may be selected for the next priority project.

Table 6.2-4: List of Piped Schemes and Wells with hand Pump for Priority Project

REGION	DISTRICT	Scheme Name	No. by District	Village	Population in 2015 =Served population	Type of piped scheme (MP=Motor pump)	Number of MP	Water Sources
MWANZA	MISUNGWI	Busongo	25	Busongo	5,590	Newly Piped Scheme MP	2	Deep BH
	MISUNGWI	Ngaya	28	Ngaya	4,371	Newly Piped Scheme		Lake V.
	SENGEREMA	Buswelu	75	Buswelu	3,780	Newly Piped Scheme MP	2	Deep BH
	SENGEREMA	Nyamiswi	99	Nyamiswi	3,264	Newly Piped Scheme		Lake V.
	SENGEREMA		100	Nyakasasa	5,709	Newly Piped Scheme		Lake V.
	SENGEREMA	Nyakahako	44	Nyakahako	7,384	Newly Piped Scheme		Lake V.
	KWIMBA	Hungumalwa	22	Hungumalwa	7,113	Newly Piped Scheme MP	3	Deep BH
	Ukerewe	Bukonyo	45	Bukonyo	2,290	Existing Piped Scheme		Lake V.
	Ukerewe		-	Namilembe	3,793	Existing Piped Scheme		Lake V.
MARA	MUSOMA	Saragana	35	Saragana	4,641	Newly Piped Scheme MP	2	Deep BH

REGION	DISTRICT	No. by District	Village	Population in 2015	Type of well (HP=Hand pump)	No of Deep BH	No of Additional Medium BH	Total BH No	Total Covered Population Rate(%)	Served Population in 2015
MWANZA	SENGEREMA	13	Sogoso	5,739	Deep & Medium HP	6	3	9	39	2,250
	SENGEREMA	67	Sotta	4,403	Deep & Medium HP	5	2	7	40	1,750
	SENGEREMA	69	Isole	5,021	Deep & Medium HP	5	2	7	53	2,644
	SENGEREMA	83	Busekeseke	3,420	Deep & Medium HP	4	3	7	51	1,750
	SENGEREMA	84	Katoma	4,046	Deep & Medium HP	5	3	8	49	2,000
	SENGEREMA	86	Magulukenda	5,092	Deep & Medium HP	6	2	8	39	2,000
	SENGEREMA	96	Nyancheche	7,677	Deep & Medium HP	5	4	9	29	2,250
	KWIMBA	71	Mhulya	3,067	Deep & Medium HP	4	4	8	65	2,000
	MAGU	75	Kijereshi	7,401	Deep & Medium HP	8	2	10	42	3,122
	GEITA	17	Bugulala	9,030	Deep & Medium HP	5	6	11	30	2,750
	GEITA	18	Kasota	10,216	Deep & Medium HP,Spring	5	4	9	39	3,984
	GEITA	22	Kamena	8,655	Deep & Medium HP	5	3	8	23	2,000
	GEITA	24	Ndelema	4,371	Deep & Medium HP	3	7	10	57	2,500
	GEITA	25	Nyashishima	2,065	Deep & Medium HP	2	3	5	61	1,250
	GEITA	26	Bogogo	10,380	Deep & Medium HP	6	2	8	32	3,349
	GEITA	27	Ikina	2,494	Deep & Medium HP	2	5	7	70	1,750
	GEITA	42	Ibondo	7,667	Deep & Medium HP	7	6	13	42	3,250
MARA	BUNDA	33	Mcharo	1,295	Deep & Medium HP	4	1	5	100	1,295
	MUSOMA	6	Sirorisimba	3,997	Deep & Medium HP	4	4	8	50	2,000
	MUSOMA	8	Ryamisanga	4,769	Deep & Medium HP	6	2	8	60	2,858
	MUSOMA	21	Kisamwene	4,427	Deep & Medium HP	6	5	11	62	2,750
	MUSOMA	33	Bugoji	5,450	Deep & Medium HP	7	3	10	68	3,699
	MUSOMA	55	Isaba	4,145	Deep & Medium HP	3	7	10	80	3,329
	TARIME	24	Nyankunguru	5,772	Deep & Medium HP	5	4	9	39	2,250
	TARIME	44	Kiwanja	5,177	Deep & Medium HP	4	1	5	48	2,492
	TARIME	71	Bisarwi	3,684	Deep & Medium HP	3	5	8	71	2,612
	TARIME	94	Kisumwa	2,690	Deep & Medium HP	2	3	5	62	1,656
	TARIME	112	Nyankonge	2,071	Deep & Medium HP	2	3	5	60	1,250
	TARIME	129	Masike	3,319	Deep & Medium HP	5	6	11	83	2,750
	TARIME	131	Bukama	5,225	Deep & Medium HP	4	7	11	53	2,750
	TARIME	144	Oliyo	4,543	Deep & Medium HP	5	4	9	50	2,250
	TARIME	157	Tatwe	5,315	Deep & Medium HP	5	6	11	52	2,750
	SERENGETI	37	Busawe	1,663	Deep HP,Spring	3		3	100	1,663
	SERENGETI	66	Nyansurura	4,124	Deep & Medium HP	3	6	9	59	2,445
	SERENGETI	67	Kebancha	6,899	Deep & Medium HP	4	3	7	32	2,178

Table 6.2-5: Served Population Rate of Priority Project in 2015

Region	District	Hand Pump (HP)	HP +Spring	Piped Schem e (BH)	Piped Scheme (Lake)	Total Number	Served Population in 2015	Administrative Population of Priority Villages in 2015	Covered Population Rate (%) of Priority Village in 2015	Administrativ e Population of District in 2015	Covered Population Rate (%) of District in 2015
MWANZA	MISSUNGWI			1	1	2	9,961	9,961	100.0%	304,874	3.3%
	SENGEREMA	7		1	3	11	34,781	55,535	62.6%	799,082	4.4%
	KWIMBA	1		1		2	9,113	10,180	89.5%	454,104	2.0%
	MAGU	1				1	3,122	7,401	42.2%	545,368	0.6%
	GEITA	7	1			8	20,833	54,878	38.0%	1,115,502	1.9%
	UKEREWE				2	2	6,083	6,083	100.0%	385,198	1.6%
	SUB TOTAL	**16**	**1**	**3**	**6**	**26**	**83,893**	**144,038**	**58.2%**	**3,604,128**	**2.3%**
MARA	BUNDA	1				1	1,295	1,295	100.0%	330,359	0.4%
	MUSOMA	5		1		6	19,277	27,423	70.3%	434,049	4.4%
	TARIME	9				9	20,760	37,796	54.9%	693,313	3.0%
	SERENGETI	2	1			3	6,286	12,686	49.6%	266,693	2.4%
	SUB TOTAL	**17**	**1**	**1**	**0**	**19**	**47,618**	**79,200**	**60.1%**	**1,724,414**	**2.8%**
	GRAND TOTAL	**33**	**2**	**4**	**6**	**45**	**131,511**	**223,238**	**58.9%**	**5,328,542**	**2.5%**

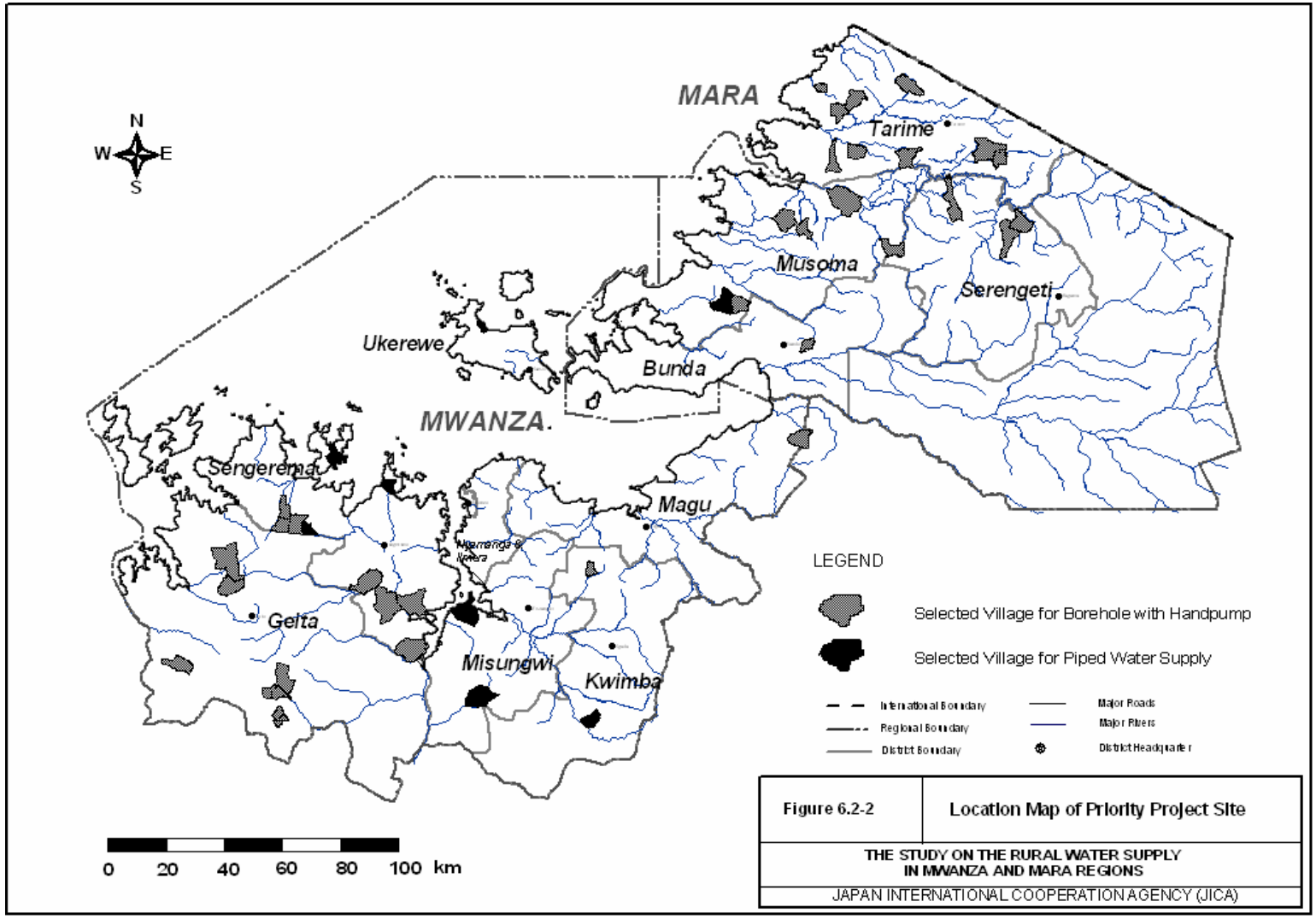


Figure 6.2-2: Location Map of Priority Project Site

6.3 Preliminary Design of Water Supply Facilities

6.3.1 General Notion of Preliminary Design

A preliminary design was prepared for the priority project that consists of 158 boreholes with hand pumps as a “Level 1” system and 8 piped schemes as a “Level 2” system. The water sources of piped schemes are lake water and groundwater. In the case of lake water, simple purification facilities such as slow sand filtration are proposed, and in the case of groundwater, only disinfection using chlorine is proposed. The water to be stored in service reservoirs using rising pumps will be supplied to dwellers by gravity. The preliminary design of the priority project for piped schemes was based on a coverage rate of 100% in 2015.

6.3.2 Water Demand

Future water demand is based on domestic use and institutional use such as school, health center, etc. This is explained in Chapter 5 of the Main report.

6.3.3 Design Manual for Preliminary Design

Since the “DESIGN MANUAL FOR WATER SUPPLY AND WASTE WATER DISPOSAL VOLUME 1 JULY 1997” was applied for conventional water supply projects in Tanzania, this is also applicable for a preliminary design of water supply facilities in principle

6.3.4 Design Criteria

In regards to Level 1, the common conditions, such as service population covered by hand pump, etc. are as follows and the design criteria applied to the preliminary design are shown as follows.

- Service population: 250persons/placet
- Lift capacity of a hand pump: 0.015m3/min (7.2m3/day in pump lifting time of 8 hours a day)

In terms of the piped schemes, the common conditions, such as design flow, etc. for preliminary design are as follows.

- Public tap operation hours: 8hours
- Unaccounted for water: 20% of daily water demand
- Daily average flow: daily water demand + uncounted amount of water
- Daily maximum. flow: 120% of daily average flow
- Hourly maximum. flow: 360% of daily average flow (based on tap operation time of 8 hours a day)

In addition, the design criteria for piped schemes (Level 2) is categorized into intake, purification, transmission and distribution facilities and summarized in Table 6.3-1

Table 6.3-1: Design Criteria of Piped Scheme

Facilities		Specification	Design factor	Design criteria
Intake	Water source	Groundwater or lake water		
	Intake pump	Submersible for groundwater and lake sources	Daily operation hours	12 hours
			Capacity	Daily Max. flow※1 (m3/day)/12 hours
	Power source	Generator with diesel engine		
	Intake chamber	Concrete circular	Capacity	12 hours of Daily Max. flow※1 (m3/day)
	Pipes	Polyethylene	Design flow	Daily Max. flow※1 (m3/day)/12 hours
Purification	Sedimentation basin	Plain sedimentation, Concrete	Capacity	Daily Max. flow (m3/day)
	Filtration	Slow sand filter	Capacity	Daily Max. flow (m3/day)
Transmission	Pump sump	Concrete circular	Capacity	Daily Max. flow (m3/day)/12 hours
	Rising pump	Surface pump	Daily operation hours	12 hours
			Capacity	12 hours Daily Max. flow (m3/day)/
	Booster pump	Surface pump	Daily operation hours	12 hours
			Capacity	Daily Max. flow (m3/day)/12 hours
	Power source	Generator with diesel engine		
	Pipes	GI or DIP	Design flow	Daily Max. flow (m3/day)/12hours
Distribution	Service reservoir	Ground type: Stone masonry or concrete block	Capacity	16 hours of Daily Max. flow (m3/day)
		Riser type: Steel	Capacity	16 hours of Daily Max. flow (m3/day) , Max. 50m3, Height: 15m or less
	Pipes	GI or PVC	Design flow	Hourly Max. flow
	Water point	Mainly double taps (Public taps)	Number of water points	About 580 dwellers per water point

※1: An amount of 10% for washing use is included.

6.3.5 Facility Plan

Each water supply facility is designed based on the following concept. The specification of each water supply facility is summarized in Table 6.3-2. Also, typical structural drawings of the facilities such as spring protection, borehole with hand pump, filtration facilities, service reservoir, etc are shown in the Data Book.

a. Water Sources

Lake Victoria, groundwater, and springs will be adapted to the project. Lake Victoria will be the main water source for the piped scheme, and groundwater will be used for both boreholes with hand pumps and piped schemes. In the case of piped schemes to be supplied from the boreholes, in order to determine the possibilities of the piped schemes, or the number of boreholes required for future demand, a supplementary hydrogeological survey was carried out to verify the capacity of the boreholes at the preliminary design stage. In addition, springs are also one of the water sources for water supply systems equipped with spring protection.

b. Intake Facilities

The type of intake facility depends on the water source, that is, lake, groundwater or spring. The capacity of intake facilities, other than boreholes with hand pumps and spring protection, is planned based on the daily maximum amount of water. The points to note for planning intake facilities for each water source are described in the following.

On the other hand, as a result of the study of the current status of commercial power, power supply facilities are available in about 15% of the target areas. Even if there are power supply facilities or plans to implement them in the near future, the electricity supply is not reliable and actually there are frequent power failures. This will be a problem for pump systems. Therefore, diesel generators are recommended for pump operation in the priority project area.

b.1 Lake Victoria

In order to secure safe raw water from the lake, intake points should be carefully selected so as to avoid contamination by effluent waste water created by human activities or livestock. The specific intake sites were selected by referring to the results of the water quality monitoring of Lake Victoria by the Mwanza regional office and by analyzing the water of the lake at the supplement survey stage.

Furthermore, to avoid not only intake suspension due to reduction of the water level, but also fluctuation of turbidity, algae creation, and bilharzias infection in the raw water, the intake points should be located at least about 80m from the shore line of the lake and at least 3m from the water surface in depth. This condition is from the design manual.

Basically, where topographic conditions allow for laying pipes, it was planned that raw water would be conveyed to the pump sump of the filtration facilities by gravity, because this would reduce operating costs. However, as a result of reconnaissance, it was found that intake candidate places were shoal shores and underwater construction without machinery was very difficult due to inaccessibility. Therefore, raw water that is drawn from the lake flows to an intake chamber using a pump in operation 12 hours per day and then flows from the intake chamber to the filtration facility. In order to avoid cavitations in pumps where the intake point is far from the intake chamber, submersible pumps are used to intake and pump up raw water. Moreover, polyethylene pipes were proposed for suction lines for easy pipe construction under water. The capacity of the intake chamber is proposed to be 12 hours of the daily at maximum flow rate because the pump operates 12 hours per day.

Table 6.3-2: Facility Specifications of the Priority Project

No.	District	Village or Scheme	Water sources		Intake facility			Filtration facility		Transmission facility			Distribution facility		
			Lake water	Groundwater [1] (BH depth)	Conveyance pipes	Pump	Chamber	Sedimentation	Filter	Pump sump	Pump	Pipes	Service[2] reservoir	Pipes	Double Public taps
Borehole with hand pump															
1-35		35 villages	-	225 (100m)	-	-	-	-	-	-	-	-	-	-	-
Newly piped scheme															
36	Misungwi	Ngaya	1	-	Φ50㎜×300m	9.3m3/hr×20m^{H}×1.5kW×1Ls.	V=60m3	Q=4.3m3/hr	Q=4.3m3/hr	V=60m3	8.5m3/hr×60mH×3.7kW	Φ80㎜×1,100m	V=70m3(G)	Φ150㎜×3,300m	15Ls.
37	Sengerema	Nyamiswi	1	-	Φ80㎜×300m	32m3/hr×20m^{H}×3.7kW×1Ls.	V=190m3	-	Q=16m3/hr	V=190m3	29m3/hr×70mH×11kW	Φ150㎜×3,500m	V=150m3(G) V=50m3(R)	Φ40㎜×3,200m Φ80㎜×3,850m Φ100㎜×700m Φ150㎜×2,650m	35Ls.
38	Sengerema	Nyakahako	1	-	Φ80㎜×300m	20m3/hr×20m^{H}×2.2kW×1Ls.	V=90m3	Q=9.2m3/hr	Q=9.2m3/hr	V=190m3	18m3/hr×50mH×5.5kW	Φ150㎜×2,000m	V=150m3(G)	Φ150㎜×3,800m	29Ls.
39	Misungwi	Busongo	-	2 (100m)	Φ50㎜×100m	17m3/hr×60m^{H}×1.5kW×2Ls.	-	-	-	V=100m3	17m3/hr×94mH×1.5kW	Φ150㎜×4,000m	V=140m3(G)	Φ40㎜×2,700m Φ50㎜×6,300m Φ80㎜×500m Φ100㎜×900m Φ150㎜×800m	21Ls.
40	Sengerema	Buswelu	-	2 (100m)	Φ50㎜×100m	11m3/hr×60m^{H}×3.7kW×2Ls.	-	-	-	V=75m3	11m3/hr×93mH×5.5kW	Φ100㎜×2,891m	V=90m3(G)	Φ40㎜×2,100m Φ50㎜×700m Φ80㎜×2,900m Φ100㎜×400m	13Ls.
41	Kwimba	Hungmalwa	-	2 (100m)	Φ50㎜×100m	18m3/hr×60m^{H}×5.5kW×2Ls.	-	-	-	V=110m3	18m3/hr×66mH×5.5kW	Φ150㎜×7,583m	V=90m3(G) V=90m3(R)	Φ80㎜×5,900m Φ100㎜×400m Φ150㎜×1,100m	20Ls.
42	Musoma	Saragana	-	2 (100m)	Φ50㎜×100m	14m3/hr×60m^{H}×5.5kW×2Ls.	-	-	-	V=90m3	14m3/hr×61mH×5.5kW	Φ80㎜×803m	V=120m3(G)	Φ40㎜×1,500m Φ50㎜×700m Φ80㎜×2,600m Φ100㎜×500m	12Ls.
Rehabilitation and Expansion piped scheme															
43	Ukerewe	Bukonyo	1	-	Φ50㎜×300m	16m3/hr×20m^{H}×1.5kW×1Ls.	V=90m3	-	Q=7m3/hr	V=90m3	14m3/hr×64mH×5.5kW	Φ100㎜×3,500m	V=110m3(G)	Φ40㎜×800m Φ50㎜×200m Φ80㎜×2,400m Φ100㎜×1,400m Φ150㎜×1,800m	17Ls.

N.B.
1. See Table on the borehole numbers with hand pump for each village, and this number was accumulated considering drilling success rate.
2. (G):Ground type reservoir,(R):Riser tank

b.2 Groundwater

Groundwater can be used for water supply facilities of boreholes with hand pumps and piped schemes. The number of boreholes required shall be determined based on the associated capacity. The typical structure of each borehole is shown in Table 6.3-3.

Table 6.3-3: Borehole Structure

Item	Borehole with hand pump (Level 1)	Borehole for piped scheme (Level 2)
Borehole depth	100m	100m
Diameter for drilling	8 inches 3/4	10 inches
Casing and screen diameter	5 inch	6 inch
Casing and screen pipe material	PVC	GI
Filling between borehole and casing	Cementing in casing section Gravel packing in screen	Cementing in casing section Gravel packing in screen
Cylinder depth of hand pump	Less than 50m	-
Submersible pump position	-	Varies (Depends on operating water level)

Intake pumps are proposed to be submersible pumps for the piped schemes, considering convertibility with the future commercial power supplies and initial costs of the submersible pumps compared with borehole lift pumps. Since the pumps are operated 12 hours per day, the capacity of the intake chamber is required to be 12 hours of daily maximum flow rate during pump suspension.

b.3 Spring

Spring protection systems are proposed in two villages where springs are available. Springs will be utilized at on-site water points together with boreholes with hand pumps. The spring protection system may complement boreholes with hand pumps for future water demand. Each spring yield was observed to be 20-40 liter per day in the study so far. But spring yield depends on the season. Therefore, to evaluate the feasibility of spring utilization, the spring yield must also be measured at the implementation stage.

In the case of spring utilization, the water aisle must be protected so that an adequate yield from the spring can be secured, and also to avoid contamination by bacteria and waste.

c. Filtration Facilities

Filtration facilities are proposed for the piped schemes using lake water, but only disinfection is proposed for groundwater. According to the water quality data of the Mwanza regional office's laboratory and the JICA study team, raw water taken from Lake Victoria is mostly acceptable for drinking water. However, a closing water body can be easily affected by weather conditions and human activities etc, and turbidity fluctuates. Therefore, in order to remove suspended solids which cause turbidity, filtration facilities such as slow sand filtration will be adapted to the piped schemes for providing lake water. Slow sand filtration is good for removing suspended solids, bacteria, odors, iron, manganese, phenols, anions, ammonical nitrogen and surfactants. However, any increase in chlorophyll "a" should be noted to prevent clogging of the sand filter by checking the filtration losses. Therefore, an

over-flow pipe will be equipped in the filtration to appropriately discharge algae, and the filtration facilities must be maintained properly. Furthermore, if the turbidity of the raw water fluctuates between NTU10 and 30, filtration combined with a sedimentation basin is basically included in the project. In this preliminary design, a necessity of sedimentation is classified by the standard of NTU10 based on the result of water quality analysis.

After filtration, calcium hypochlorite as chlorination shall be injected at the service reservoirs. The capacity of a filtration facility is planned based on the daily maximum flow. Basically the facility will be operated 24 hours.

d. Transmission Facilities

The optimum type and capacity of transmission pump will be selected, taking into account the pumping head and the volume of water to be transmitted. Centrifugal surface pumps are planned on the rising mains to convey water to service reservoirs. Galvanized pipes shall be the main pipe materials because they are easy to procure locally and not easily damaged compared to PVC pipes. However, ductile cast iron pipes will also be utilized in some areas where static pressure exceeds about 1Mpa in consideration of the water hammer phenomenon. In order to facilitate maintenance of the piped schemes, pipes should be laid along an access route such as a foot path or road.

The respective capacities of the transmission, rising main and rising pump facilities are being planned based on the daily maximum flow. Basically, the facility will be operated 12 hours per day. Therefore, the capacity of the pump sump is required to store water for 12 hours of daily maximum flow. Pipe diameters are calculated as shown in the Data Book using the “Hazen-Williams Formula” based on the route survey results.

e. Service Reservoirs

Service reservoirs should be planned in appropriate locations by exploiting topographical features to cover as many villages as possible by gravity flow, as long as it reduces operating costs. Lands to be acquired for service reservoirs were verified with chairpersons of the villages concerned with the priority project for the preliminary design. Service reservoirs are classified into ground and riser types. These types are proposed based on the topographic conditions of the service area. The reservoir structure is planned to be stone masonry for the ground type, and concrete tank for the riser type. In addition, in order to operate and maintain the water supply system, float valves, flow meters, etc. will be equipped in service reservoir facilities. The capacity of each service reservoir is fixed, since the water point operation time is 8 hours a day, based on consumption during water point operation time. Furthermore, in rural water supply systems with multiple service reservoirs connected in series, the primary service reservoir should have the largest capacity affordable in order to provide a stable flow of water that is conveyed by gravity from the primary service reservoir to the secondary service reservoir. Therefore, an amount equal to one hour of maximum daily flow as well as the hourly peak fluctuation of water to be distributed will determine the required capacity for the primary reservoir. Common service reservoirs are stone masonry as a ground type in Tanzania.

f. Distribution Facilities

Pipe length shall be finalized based on the route survey. It is planned that galvanized pipes and PVC (Poly-vinyl-chloride) will be the main pipe materials used, because they are easy to procure locally. However, if PVC is exposed to various activities, it deteriorates easily in sunlight and is often damaged by people stealing water illegally. Therefore, galvanized pipes are most appropriate for this project. Pipe diameter is determined using the “Hazen-Williams

Formula". Residual pressure is determined to be 0.1Mpa or less. The results of hydraulic calculation are denoted in the Data Book.

On the other hand, the location of water points such as public taps will be selected taking into account not only the density of households, but also convenience to dwellers. The main facilities, such as hand pimp, and layouts of piped scheme are shown in Figure 6.3-1 to Figure 6.3-10.

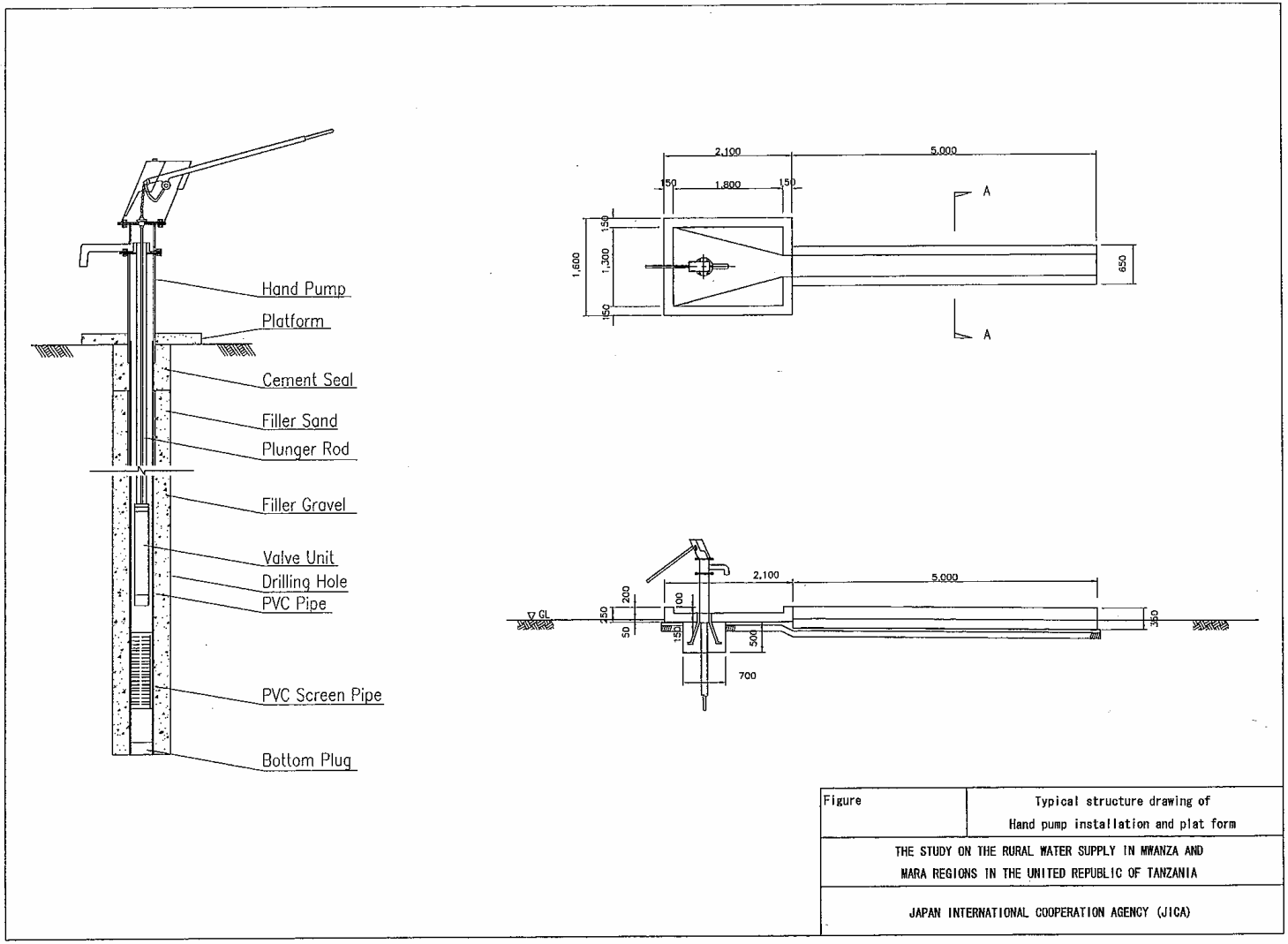


Figure 6.3-1: Typical Structure Drawing of Hand Pump and Installed Plat Form

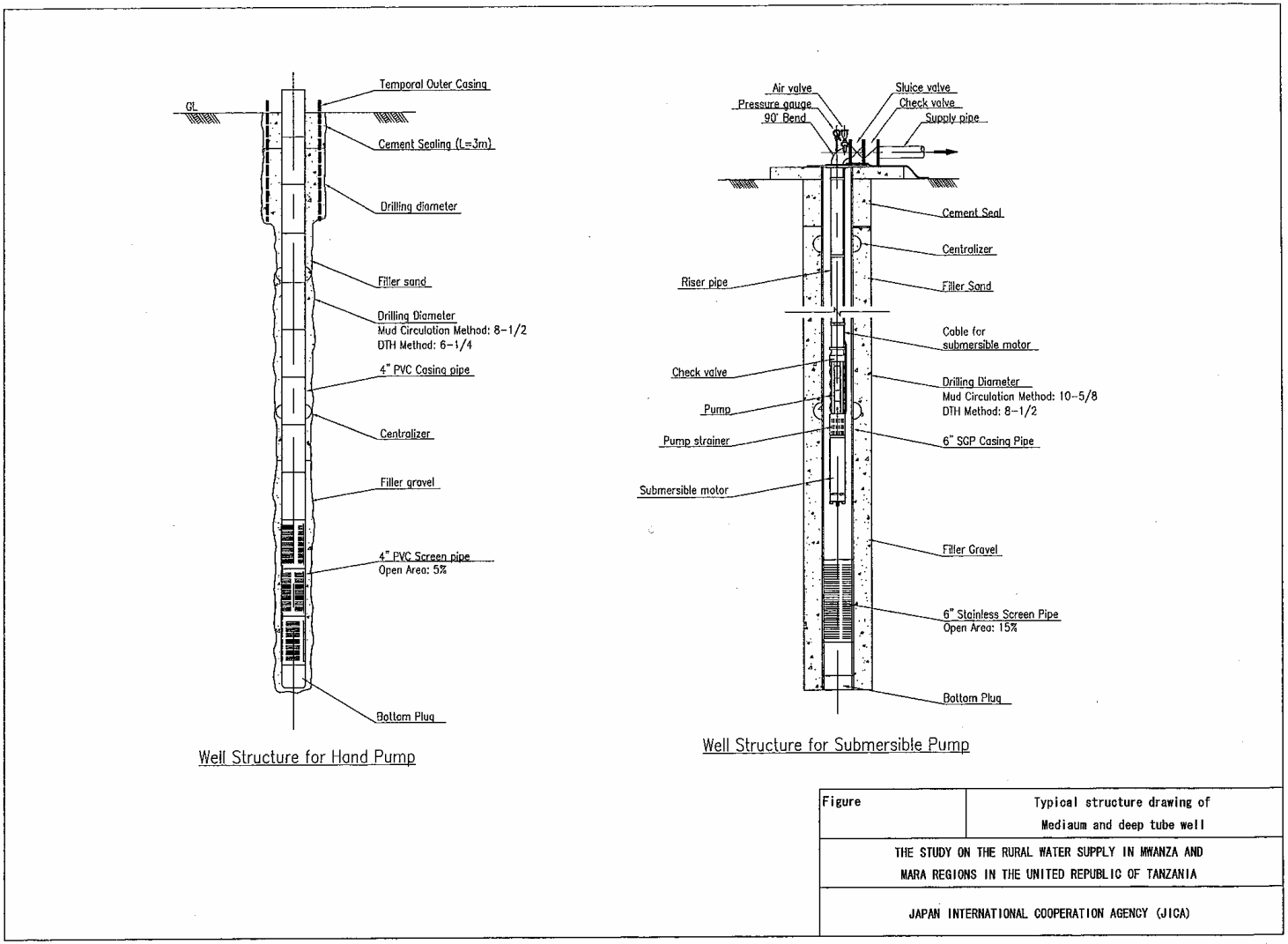


Figure 6.3-2: Typical Structure Drawing of Deep Tube Well

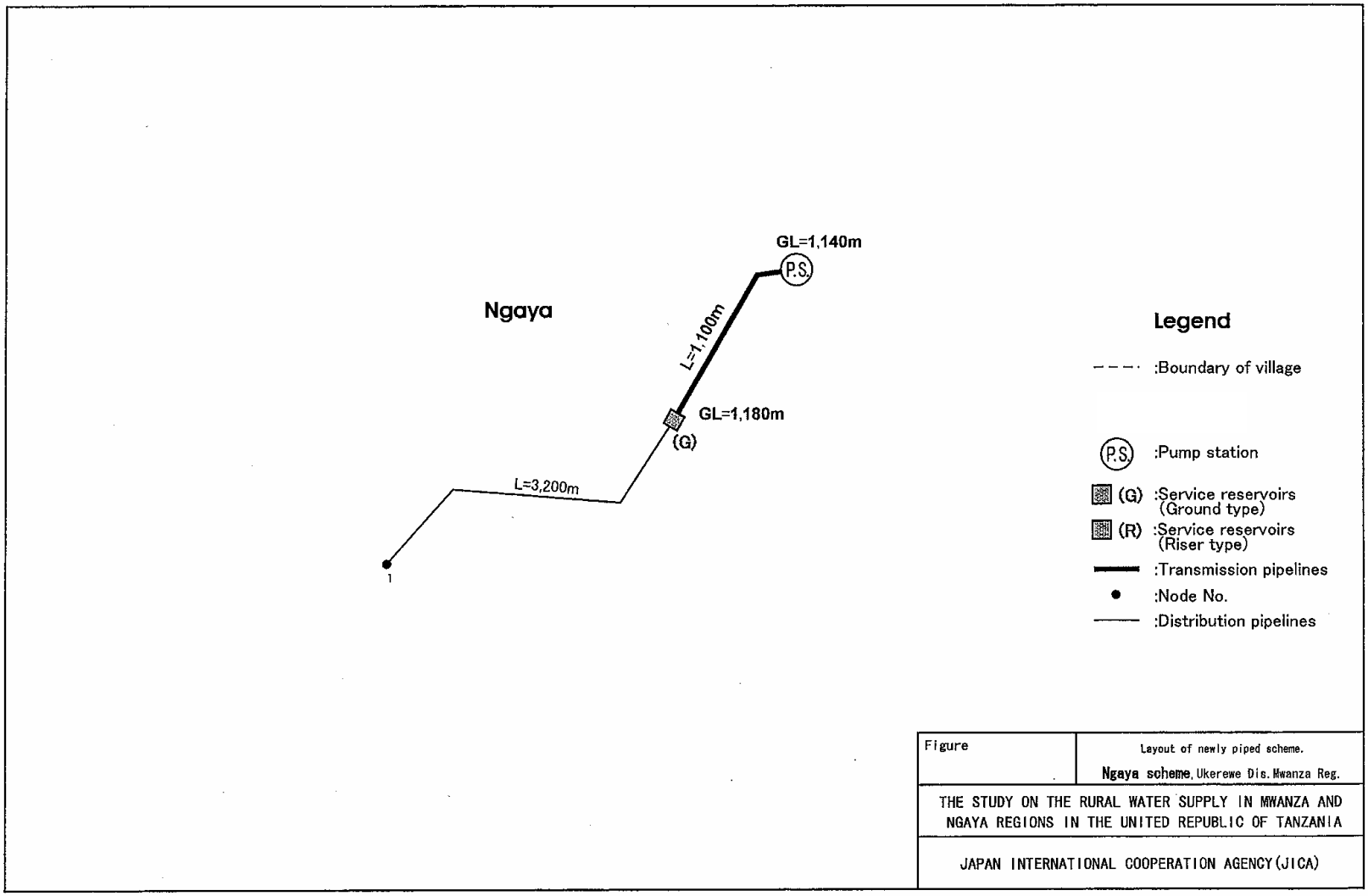


Figure 6.3-3: Layout of Newly Installed Piped Scheme (Ngaya Scheme)

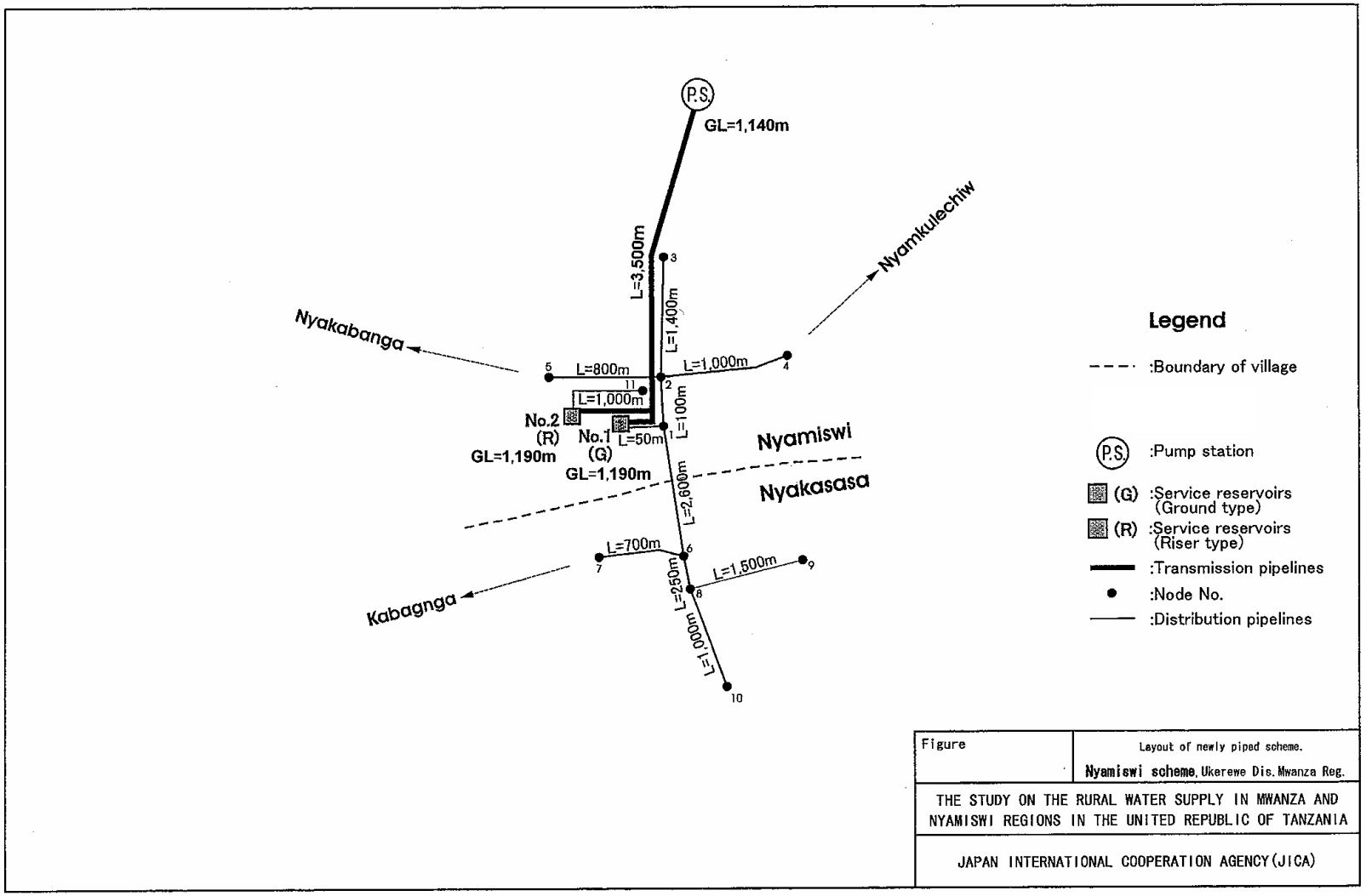


Figure 6.3-4: Layout of Newly Installed Piped Scheme (Nyamiswi Scheme)

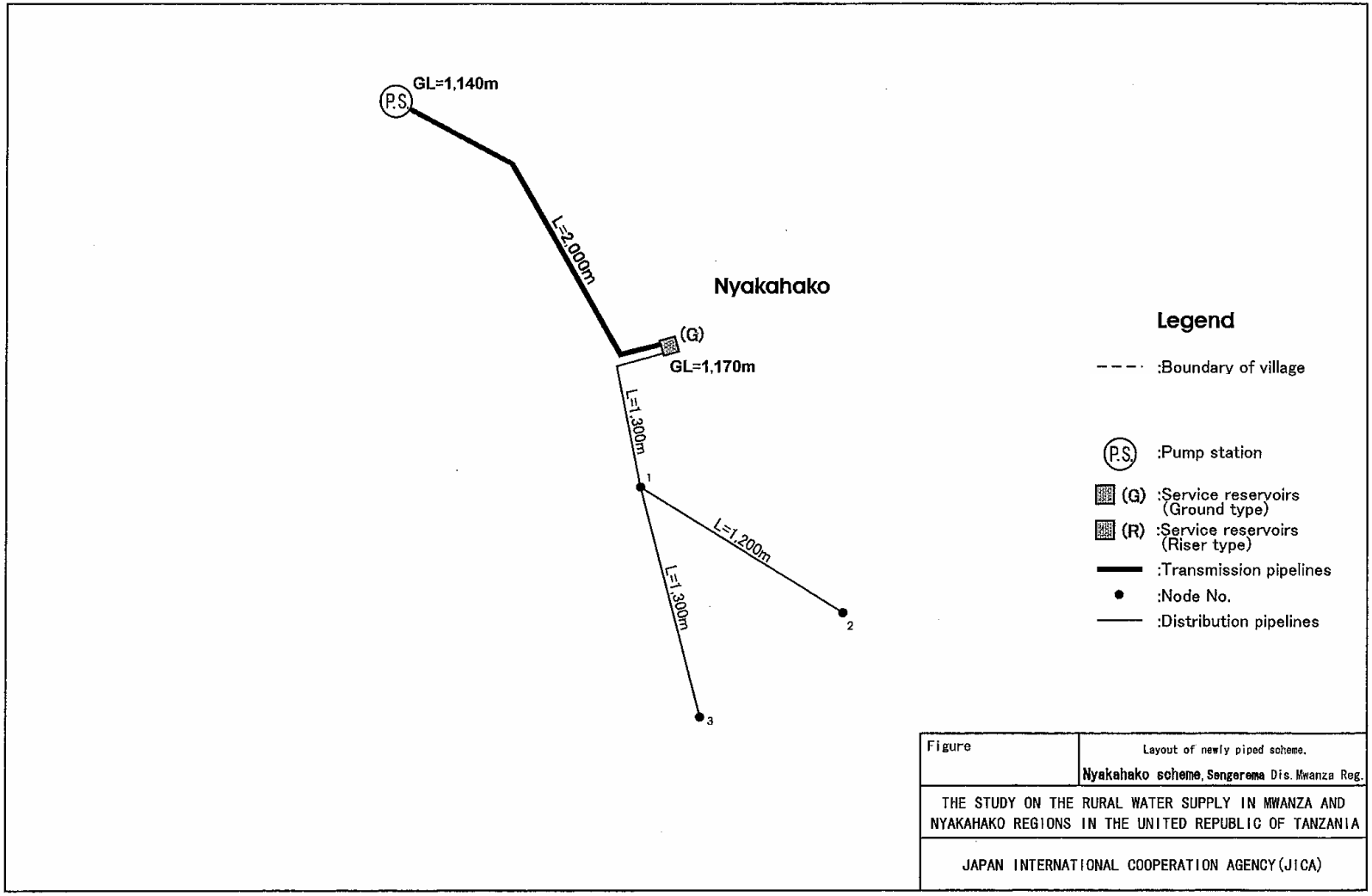


Figure 6.3-5: Layout of Newly Installed Piped Scheme (Nyakahako Scheme)

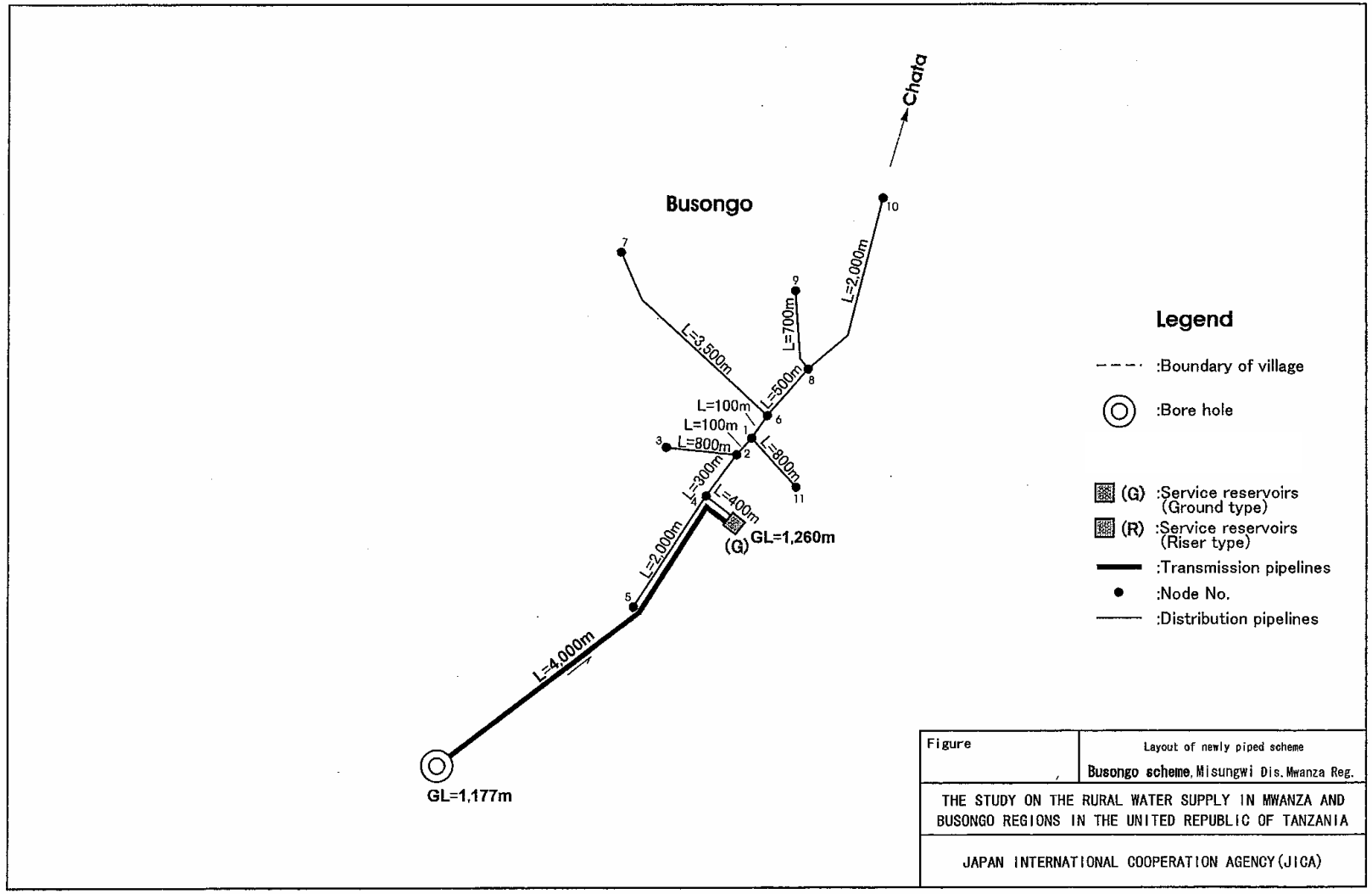


Figure 6.3-6: Layout of Newly Installed Piped Scheme (Busongo Scheme)

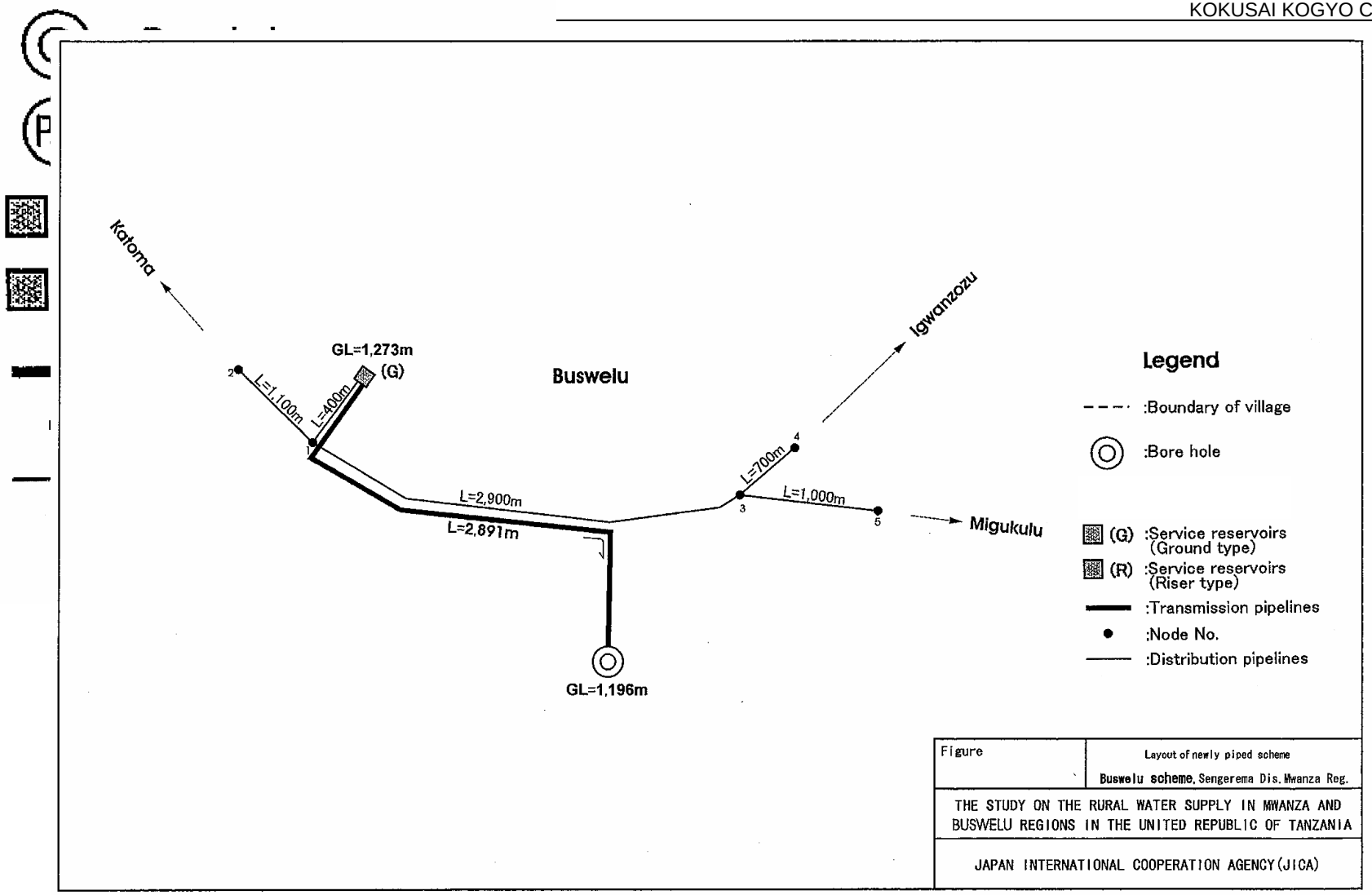


Figure 6.3-7: Layout of Newly Installed Piped Scheme (Buswelu Scheme)

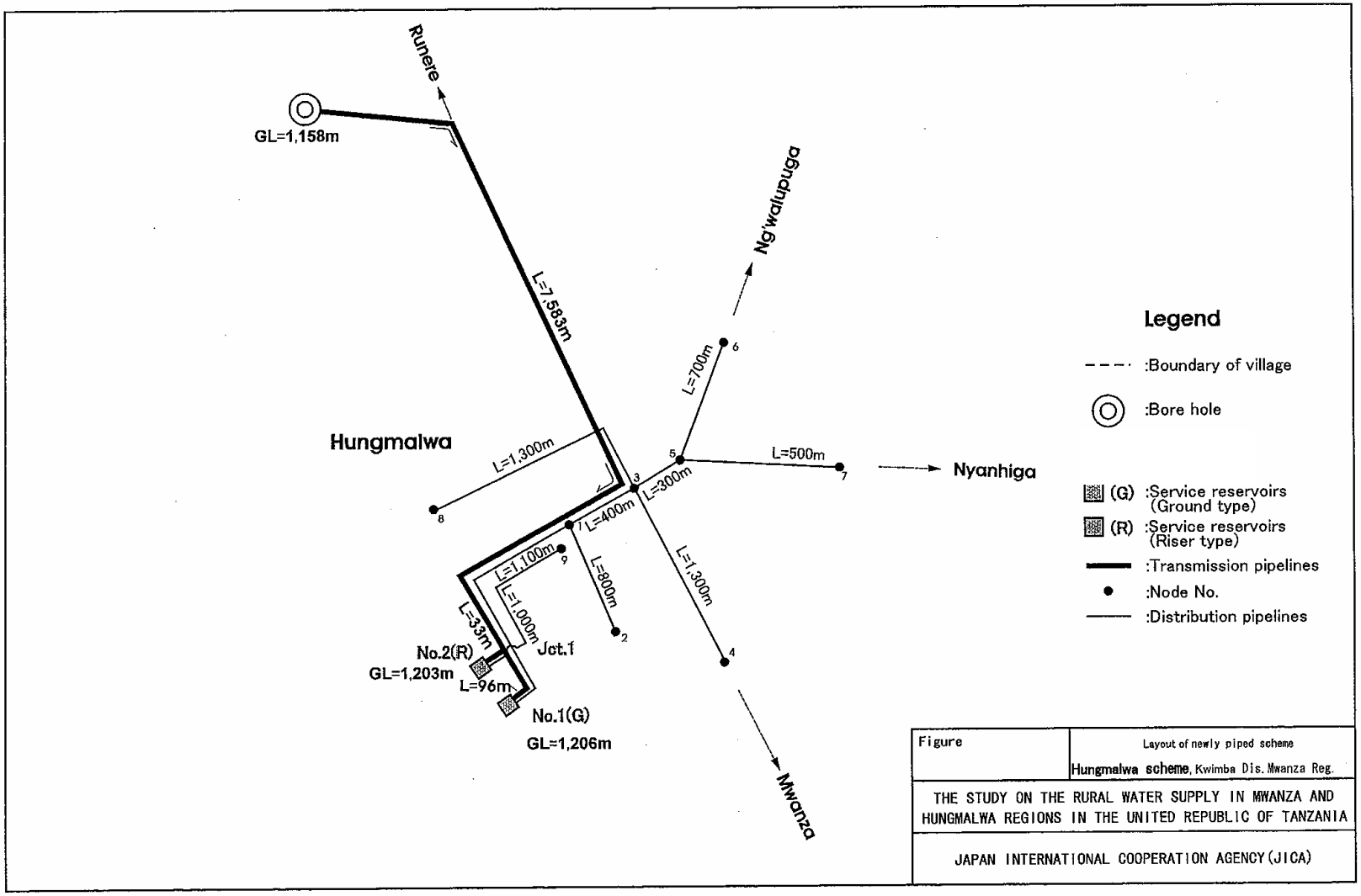


Figure 6.3-8: Layout of Newly Installed Piped Scheme (Hungumalwa Scheme)

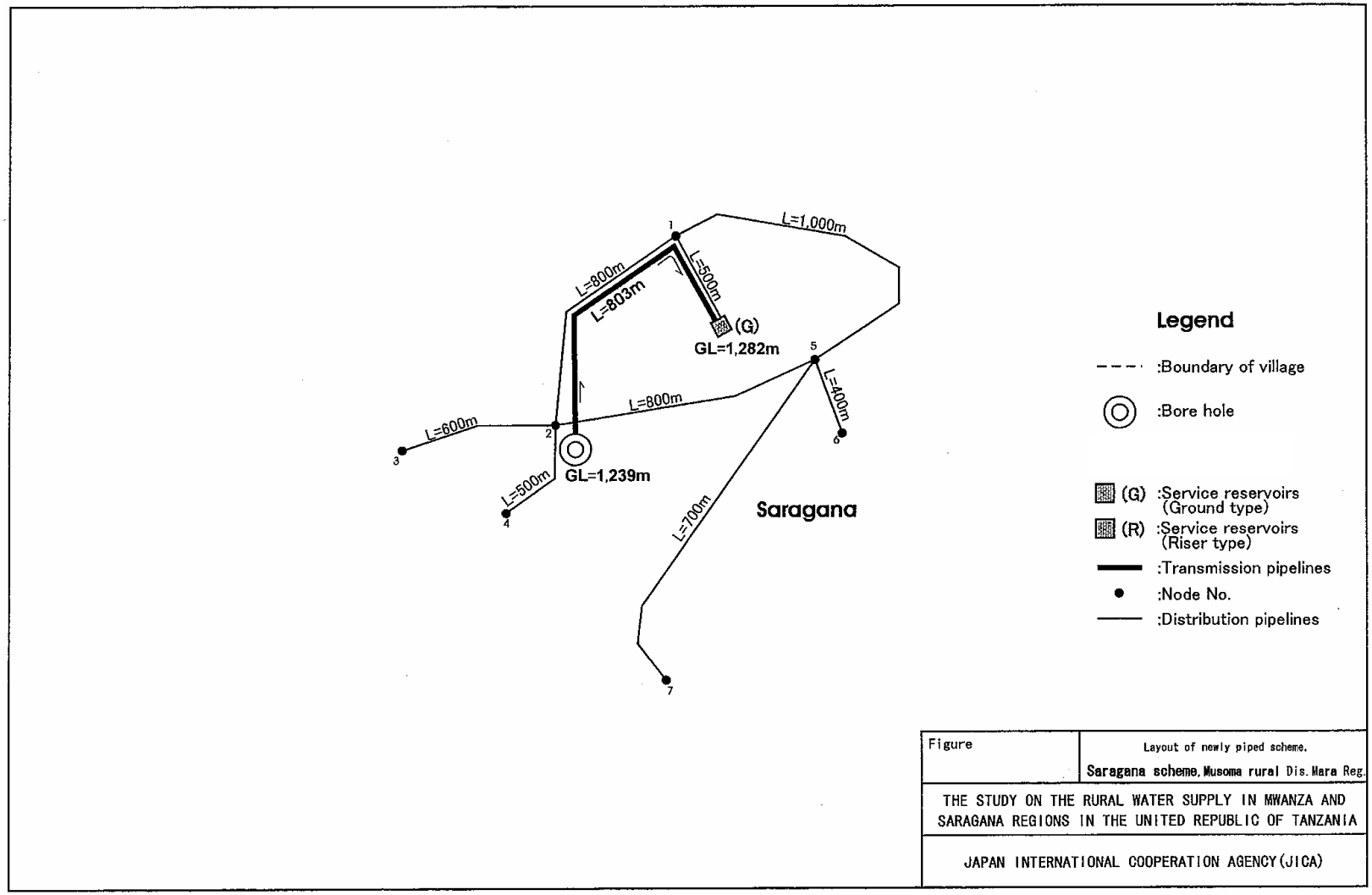


Figure 6.3-9: Layout of Newly Installed Piped Scheme (Saragana Scheme)

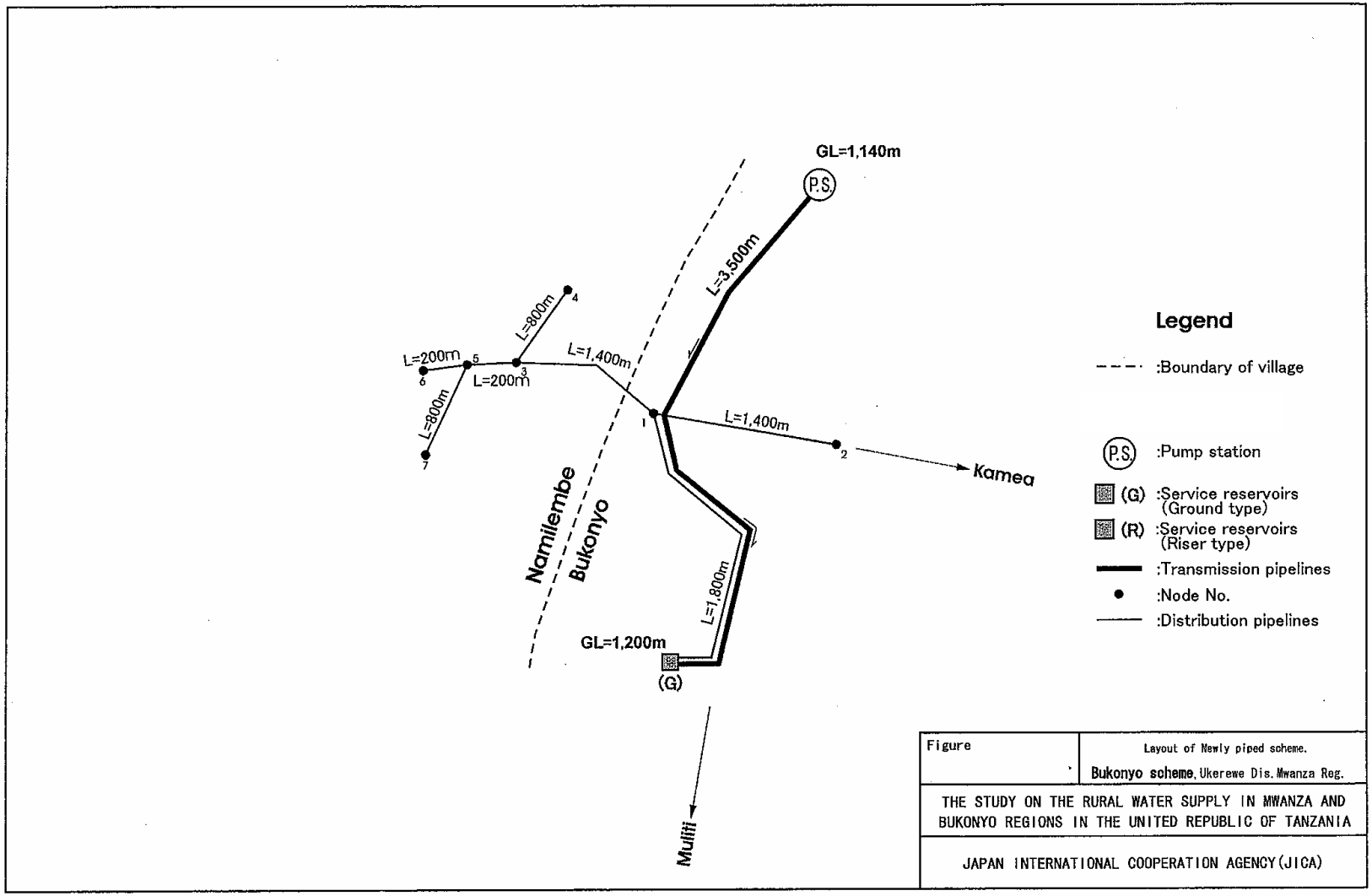


Figure 6.3-10: Layout of Newly Installed Piped Scheme (Bukonyo Scheme)

6.4 Cost Estimation for Priority Project

The construction cost was briefly estimated in consideration of the possibility of Japanese government assistance. The total project cost including the engineering expenses of the priority project is estimated at approximately USD17.6 million. The engineering expenses are taken as 15% of the construction cost. The project costs are summarized in Table 6.4-1. Furthermore, in regards to well drilling, the success rate is assumed to be 70%.

Table 6.4-1: Cost Estimation of Priority Project

Unit: USD

Water supply system	Construction cost	Engineering expenses (15%)+others	Project cost	Remarks
Borehole with hand pump	5,116,000	818,000	5,934,000	35villages, two spring protections are included
Newly piped scheme	8,788,000	1,406,000	10,194,000	7 schemes (8 villages)
Rehabilitation and expansion piped scheme	1,252,000	200,000	1,452,000	1 scheme (2 villages)
Total	**15,156,000**	**2,424,000**	**17,580,000**	

Chapter 7

Project Plan

7 Project Plan

7.1 General

The project plan, including the construction and implementation plan is formulated for the priority project in this Chapter. The natural and social conditions in the Study area are considered in the construction plan. For the formulation of the preliminary design of facilities and cost estimation, the information regarding machinery, material plan and construction conditions are arranged in Study term. In addition, the financial plan of the priority project is discussed in consideration with the internal and external budget plans of MoW.

7.2 Construction Plan

7.2.1 Natural Conditions

As the rocks composing of Granite are widely distributed and exposed in the Mwanza and Mara regions, it is delicate to lay the pipes going though the rock area. In the case of piped schemes using lake water, a submersible pump is proposed to be installed horizontally at least 1m from the bottom of the lake water. The pump must be fixed in the lake rigidly so that it does not collapse.

In the Study area, aquifers with deep wells are the target. In the case of deep wells using deep aquifers, considering the geological features of the Mwanza and Mara regions, water is abstracted from fractures in the basement rock area. The fractures water belongs to the Fissure Aquifer Type. Therefore, accurate surveys of fracture systems are necessary and based on the results of electric exploration and lineament analysis, drilling focused on fracture systems is being conducted.

Deep wells are not so much affected by bacteria but they contain a series of metal ions such as Fe, Pb, Cr, Se, Ba and F. Granite fissure type aquifers in Kwimba and Magu indicated a high concentration of Fluoride. Shallow Wells have a large variation by area. Some Neocene deposits, have an extremely high concentration of Cl^-, SO_4^{2-}, Cd, Na^+, and K^+, and the EC value exceeds 40,000 μS/m. Shallow wells also have a high concentration of coliform and bacteria, and also indicate a high EC value. Lake Victoria water is safe in general. BOD is generally high and turbidity is high in some areas. Most of the locations are influenced by bacteriological contamination, such as general bacteria and coliform.

7.2.2 Socio-economic Conditions

The villagers in the Study area work in cooperation with our staff to construct the roads for drilling sites in the rainy season and to conduct the electric sounding in the villages. In regard to the formulation of village organizations, they will quickly establish the village water committees after the interview of socio-economic survey. The villagers show the activities for the collecting O&M cost for facilities in accordance with their income of agriculture and fishery and etc. In the results of survey, the villagers of priority project sites gave their cooperation to construct the facilities in the villages. Therefore social problems probably never occurred in term of construction for facility.

7.2.3 Machinery and Material

The priority project is the common scope of rural water supply in Tanzania. Also, regarding maintenance sustainability, it is most important to use materials with locally procurable spare parts. Therefore, for conventional machinery, construction materials are utilized for its

construction. Since the construction machinery is property from construction companies in Tanzania, they are responsible for construction.

Some water pipes can be produced in Tanzania and material types and maximum size of those pipes are the galvanized pipes of 150mm, polyethylene of 400mm and PVC of 315mm. Even if most of the materials such as hand pumps, pipes, motorized pumps, generators, etc. are imported, it is easy to procure them through agents of manufacturing companies in Tanzania.

7.2.4 Local Contractor

There are five types of contractors; Civil Works, Building, Mechanical, Electrical, and Specialist Contractor, registered in the "Contractor Registration Board (CRB)" in Tanzania. Those contractors are also distinguished into local and foreign contractors. Local contracting firms are those whose majority shares are owned by citizens of the United Republic of Tanzania. Firms not meeting these criteria will be registered as foreign. Moreover, there are seven classes for civil works, building, mechanical, and electrical contractors. For specialist contractors, there are only three classes. Foreign contractors are restricted to classes one and two in the civil works, building, mechanical, electrical contractors and one to three in the specialist contractors. Thus, these local contracting firms are also expected to be appointed for implementation of the project.

7.3 Implementation Plan

7.3.1 Implementation Schedule

Assuming that the prioritized project is carried out for three years, the following time schedule is proposed. This was determined considering the project cost, location of the target area etc.

Table 7.3-1: Implementation Schedule of Priority Project

Facility	Region	District	Name of Scheme	2007	2008	2009
Borehole with hand pumps	Mwanza	Sengerema	-	■		
		Kwimba	-	■		
		Magu	-	■		
		Geita	-		■	
	Mara	Bunda	-		■	
		Musoma (R)	-			■
		Tarime	-			■
		Serengeti	-		■	
Piped schemes	Mwanza	Misungwi	Ngaya		■	
		Misungwi	Busongo		■	
		Sengerema	Nyamiswi	■		
		Sengerema	Nyakahako	■		
		Sengerema	Buswelu	■		
		Kwimba	Hungumalwa		■	
		Ukerewe	Bukonyo			■
	Mara	Musoma (R)	Saragana			■

7.3.2 Financial Plan for the Priority Project

The total project cost for the priority project is calculated as 16.7 million USD in the three year term as shown in the following table which is supposed to be implemented by the Japanese Grant Aid Project.

Table 7.3-2: Annual Disbursement for Priority Project (Unit: USD)

Facility	District	Amount			
		Total	2007 1st	2008 2nd	2009 3rd
Borehole with hand pumps	Sengerema	1,273,000	1,273,000		
	Kwimba	162,000	162,000		
	Magu	261,000	261,000		
	Geita	1,364,000		1,364,000	
	Bunda	142,000		142,000	
	Musoma (R)	972,000			972,000
	Tarime	1,385,000			1,385,000
	Serengeti	375,000		375,000	
	Sub Total	**5,934,000**	**1,696,000**	**1,881,000**	**2,357,000**
Piped scheme	Missungi	2,687,000		2,687,000	
	Sengerema	4,681,000	4,681,000		
	Kwimba	2,165,000		2,165,000	
	Ukerewe	1,452,000			1,452,000
	Musoma (R)	661,000			661,000
	Sub total	**11,646,000**	**4,681,000**	**4,852,000**	**2,113,000**
Total		**17,580,000**	**6,377,000**	**6,733,000**	**4,470,000**

The entire project which was formulated in the Study as the Water Supply Plan other than the priority project shall be executed by the fund prepared by the MoW and concerned donors and NGOs. The expected budget allocation to the Mwanza and Mara Water Supply Plan was formulated in reference with the budget of NRWSSP as shown in Table 7.3-3.

Table 7.3-3: Planed Budget for Rural Water Supply

Type of Scheme	2007	2008	2009
Priority Project	■	■	■
Medium & Deep Well with HP		■	■
Newly Installed Piped Scheme from Lake			■
Newly Installed Piped Scheme from BH			■
Expanded & Rehabilitated Piped Scheme		■	■
Expected Financing of External Support Agencies & NGO (**USD million**) by NRWSSP	2007	2008	2009
Assumed to be implemented as JGA	17.6		
WB & IDA	20	20	20
AfDB	20	20	20
AFD, EU, UNICEF, GEF, SIDA, IFAD & Others	18	19	20
Plan International & Others	3	3	3
GOT	6.2	6.7	7
Total	67	69	70
Expected Financing of External Support Agencies & NGO in Mwanza and Mara Regions (**USD million**)	7	8	8

Chapter 8

Organization and Institutional Plan

8 Organization and Institutional Plan

8.1 General

Overall institutional framework for the water supply plan in the Study is suggested in Chapter 5 (Water Supply Plan), considering future institutional frameworks proposed by the NAWAPO and NRWSSP, and current organizational issues in the Study area, and along the institutional frame work, the expected roles of responsible bodies for operation and maintenance at regional, district and community level are also clarified. In this chapter, Organization and Institutional Plan is discussed as organizational and institutional improvement plans for the implementation of the priority project in the 45 priority villages selected in Chapter 6.

8.1.1 Objectives

The objectives of the study on the organization and institutional plan are as follows:

- To formulate organizational and institutional arrangement in order to conduct operation and maintenance activities adopted to the water supply facilities of the 45 priority villages
- To formulate organizational and institutional improvement plan in order to implement the priority project in the 45 priority villages in effective and sustainable manner

8.1.2 Methodology

To achieve the above objectives, both qualitative and quantitative methods are applied during the 1st year survey in 2005 and the supplementary survey in 2006. Several qualitative methodologies, such as village profiles, household interviews, focus group discussions and rural rapid appraisal, are deliberately mixed in the quantitative socio-economic surveys, in order to avoid the bias emphasizing only qualitative results.

The currency exchange rate applied in this chapter is based on the official exchange rate of May 2006 (USD 1.00 = Tsh 1,181, 1USD = JY 114.58).

8.2 Current Activities for Water Supply in Villages

Current activities of community water organizations for water supply in the targeted villages of the priority project vary from community to community. To formulate the organization and institutional plan for the community managed water supply in the 45 priority villages, availability, activities and activeness of the current community water organizations in the 45 priority villages, and their advantages and issues in the villages are analyzed.

a. Current Community Water Organizations in the Targeted Villages

As a result of the supplementary survey, all 45 priority villages have established either a VWC or a WUG for water related activities. Although some of the VWC in Sengerema, Geita, Tarime and Serengeti have been established after the socio-economic survey was conducted by the Study in 2005, the VWCs have been established in 91% of the targeted villages, and it is confirmed that the most common community water organization in the targeted villages, followed by the WUG. The concept and formation of the WUG vary from the conventional water committees or tap committees for water facilities under the VWC to the user groups for community facility management facilitated by HESAWA, depending on the villages.

Table 8.2-1: Current Activities for Water Supply in the 45 Priority Villages

DISTRICT	No. by District	Village	Type of Technology HP: Hand Pump Spring: Spring protection PS: Piped Scheme	Availability & Activities of VWC			Availability & Activities of WUG, SV-WUG, or relavant organizations			HESAWA Experience
				Availability of VWC	Water Fee Collection by VWC	Water Fund Collection by VWC	Aviailability of WUG/SV-WUG or relavant org	Water Fee Collection by WUG, SV-WUG or relavant org	Water Fund Collected by WUG,SV-WUG or relavant org	
MISUNGWI	25	Busongo	PS	✔		✔	✔			✔
MISUNGWI	28	Ngaya	PS	✔			✔			✔
SENGEREMA	13	Sogoso	HP	✔		✔	✔			
SENGEREMA	44	Nyakahako	PS	✔		✔	✔			✔
SENGEREMA	67	Sotta	HP	✔	✔	✔	✔			✔
SENGEREMA	69	Isole	HP	✔			✔			✔
SENGEREMA	75	Buswelu	PS	✔						
SENGEREMA	83	Busekeseke	HP	✔			✔	✔	✔	✔
SENGEREMA	84	Katoma	HP				✔			✔
SENGEREMA	86	Magulukenda	HP				✔	✔		✔
SENGEREMA	96	Nyancheche	HP	✔			✔	✔	✔	✔
SENGEREMA	99	Nyamiswi	PS	✔			✔		✔	✔
SENGEREMA	100	Nyakasasa	PS	✔	✔	✔	✔	✔		✔
KWIMBA	22	Hungumalwa	PS	✔			✔		✔	✔
KWIMBA	71	Mhulya	HP	✔			✔		✔	✔
MAGU	75	Kijereshi	HP	✔						
GEITA	17	Bugulala	HP	✔						
GEITA	18	Kasota	HP, Spring	✔						
GEITA	22	Kamena	HP	✔					✔	
GEITA	24	Ndelema	HP	✔					✔	
GEITA	25	Nyashishima	HP	✔						
GEITA	26	Bogogo	HP	✔						
GEITA	27	Ikina	HP	✔						
GEITA	42	Ibondo	HP	✔			✔		✔	
UKEREWE	44	Bukonyo	PS (rehabilitation)	✔		✔	✔			✔
UKEREWE	-	Namilembe	PS (rehabilitation)	✔		✔	✔			✔
BUNDA	33	Mcharo	HP	✔	✔	✔	✔			✔
MUSOMA (R)	6	Sirorisimba	HP				✔	✔		✔
MUSOMA (R)	8	Ryamisanga	HP				✔			✔
MUSOMA (R)	21	Kisamwene	HP	✔						
MUSOMA (R)	33	Bugoji	HP	✔	✔					✔
MUSOMA (R)	35	Saragana	PS	✔		✔	✔			
MUSOMA (R)	55	Isaba	HP	✔			✔			✔
TARIME	24	Nyankunguru	HP	✔		✔		✔		
TARIME	44	Kiwanja	HP	✔			✔			
TARIME	71	Bisarwi	HP	✔	✔	✔	✔			✔
TARIME	94	Kisumwa	HP	✔	✔	✔	✔		✔	
TARIME	112	Nyankonge	HP	✔		✔			✔	✔
TARIME	129	Masike	HP	✔		✔				✔
TARIME	131	Bukama	HP	✔		✔	✔			✔
TARIME	144	Oliyo	HP	✔				✔		✔
TARIME	157	Tatwe	HP	✔		✔	✔			
SERENGETI	37	Busawe	HP, Spring	✔			✔			
SERENGETI	66	Nyansurura	HP	✔			✔		✔	✔
SERENGETI	67	Kebancha	HP	✔			✔			✔

a.1 Activities of VWCs in the 45 Priority Villages

From the results of the supplementary survey, VWCs are found inactive in the targeted villages of the priority projects, in terms of water fee collection. However, 40% of the VWCs in the targeted villages have collected the water fund for water supply activities, and with the exception of newly established VWC in 2005, almost all VWCs have collected water funds. Activities such as the minor repair of hand pumps and concreting the domestic water points are seen in the active VWCs; however, it is observed from the supplementary survey that the activities seem to largely depend on the leadership of the VWC leaders and existence and status of water facilities in the targeted villages.

a.2 Activities of WUGs in the 45 Priority Villages

As shown in Table 8.2-1, all targeted villages where the HESAWA programmes were implemented, WUGs have been established. However, some active villagers have established WUGs for traditional water sources without HESAWA intervention. It is indicated that the WUG is a familiar concept in the targeted villages, and theoretically supposed to be formed for any water installation, even for non-HESAWA facilities. The supplementary survey also revealed that the regular collection of water fees has been carried out by some of the WUGs, though it is fading out along with the completion of the HESAWA programme. Not only HESAWA, but also other donor agencies promote WUGs and provide basic training on operation and maintenance for the WUG leaders. Owing to these training experiences, some of the WUGs are responsible for the minor repair of water facilities.

b. Advantages and Issues on the Current Activities of VWCs and WUGs

One of the significant advantages in terms of the institutional arrangement for water supply in the targeted villages is the extensive existence of VWCs. Since the VWC is structured within the village government, the support related to water and sanitation from the relevant government offices such as not only the District Water Department, but also the community development and health department can be easily delivered through the VWC as a focal point. In this sense, the VWC has the potential to act as a bridge between the government offices and water users. As a matter of the fact, some of the District Water Departments are promoting the VWC as a focal point of their support.

Other significant advantages regarding WUGs based on the HESAWA programme are identified as follows:

(1) Assurance of easy access to adequate and safe water for users

(2) WUG as a manageable unit in which every member can participate in fulfilling their responsibility

(3) Creation of a sense of ownership and control of water facilities

(4) Binding WUG members legally to manage the improved facilities

(5) Ensuring long-term sustainability by creating social cohesion among members

Furthermore, the most significant concept promoted by the HESAWA is the sense of ownership and community based management of water facilities, which also fits into the basic understanding on operation and maintenance of the priority projects.

On the other hand, both the VWC and the WUG also have issues and challenges in carrying out water supply activities in the manner of community facility management. As for the VWC, it is often pointed out that the village government has strong control over the VWC especially regarding the water fund collected by the VWC. In the villages where HESAWA constructed shallow wells, a number of the VWCs lacked the water fund for repair and maintenance due to misuse of the fund. Moreover, it is observed that level of leadership and skills for community mobilization are influential the water supply activities in the villages. As for the WUGs, although some of the WUG members participated in awareness programmes for community facility management along with trainings on operation and management, the supplementary survey revealed that the concept of community owned water supply management has not yet materialized in the targeted villages, due to various obstacles including the insufficient demarcation of tasks between the VWC and the WUG, and the lack of managerial capacity to operate and maintain the water supply facilities financially and technically. As a result of the supplementary survey, the villages pointed out that inactiveness

of both the VWC and WUG attribute to “poor leadership”, “poor support from the district”, “lack of water supply facilities” and so forth.

These advantages and issues of the current activities for water supply in the targeted villages have been taken into consideration to formulate the organizational and institutional arrangement particularly for operation and maintenance of the priority projects, in the next section.

8.3 Organizational and Institutional Arrangement of Responsible Bodies for Priority Villages

8.3.1 Overview of Suggested Organizational and Institutional Arrangment

As for water supply issues within the districts, there are two major groups of stakeholders as depicted below. One is "**Public Offices**" to provide support for O&M to communities; the other is "**Users**" to ensure sustainability of operation and maintenance of water supply facilities.

"**Public Offices**" to provide support for O&M to communities are divided into

- Regional Water and Sanitation Team (RWST) within Regional Administrative Secretariat (RAS)
- District Administration (Council)

  District Water Sanitation Team (DWST)

  District Water Department
- Village Water Committee (VWC)

"**Users**" to sustain facilities (O&M) include two levels of community based groups:

- Water User Group (WUG) for hand pump
- Water User Association (WUA) or Board for piped scheme

Considering the future and current institutional framework, and the current issues on activities for water supply at community level, the following approaches to the both groups need to be taken in the organization and institutional plan:

(1) The self-help capacity for management, operation and maintenance by **Users** at the community level shall be the basis for the sustainability of the water facility.

(2) Support systems to communities on community mobilization and technical maintenance by the **Public Offices** shall be strengthened.

Based on the above understanding, the overall institutional framework and expected roles of responsible bodies proposed in Chapter 5, advantages and issues on current community water organizations, and practical tasks for operating and maintaining the proposed water supply facilities, responsible bodies and institutional framework for the 45 priority villages are outlined by type of the water facility in the following tables and figures.

Table 8.3-1: Tasks of Responsible Bodies for O&M of the Hand Pump in the Priority Village

			Public Offices				User Groups
			Regional Water and Sanitation Team (RWST) within Administrative Secretariat (RAS)	District Administration (Council)		Village Water Committee (VWC)	WUA for Piped Scheme WUG for Hand pump
				District Water Sanitation Team (DWST)	District Water (DWE) Department		
Boreholes with Hand Pump							
Operation & Maintenance	1	Water Fund Collection & Management		○ (training, regular monitoring)	○ (training, regular monitoring)	○ (supervision)	◎ (pump/tap caretaker)
	2	Water Fee Collection & Management		○ (training, regular monitoring)	○ (training, regular monitoring)	○ (supervision)	◎ (Group leaders)
	3	Repair and Maintenance			○ (training, regular monitoring)		◎ (primary/preventive maintenance)
	4	Hand Pump Management, Control and Protection (e.g., Opening of water supply facility)			○ (regular monitoring)	○	◎ (pump/tap caretaker)
Supervision of Training	5	Capacity Building (through Training of Public Office Staff)	○ (coordination of HRD & institution building)	◎	◎	◎	◎ (primary/preventive maintenance)
	6	Community Empowerment (through Training to Communities)	○ (coordination of support for community mobilization)	◎	○	◎	◎

Note: ◎=Primary Responsibility; ○=Secondary Responsibility

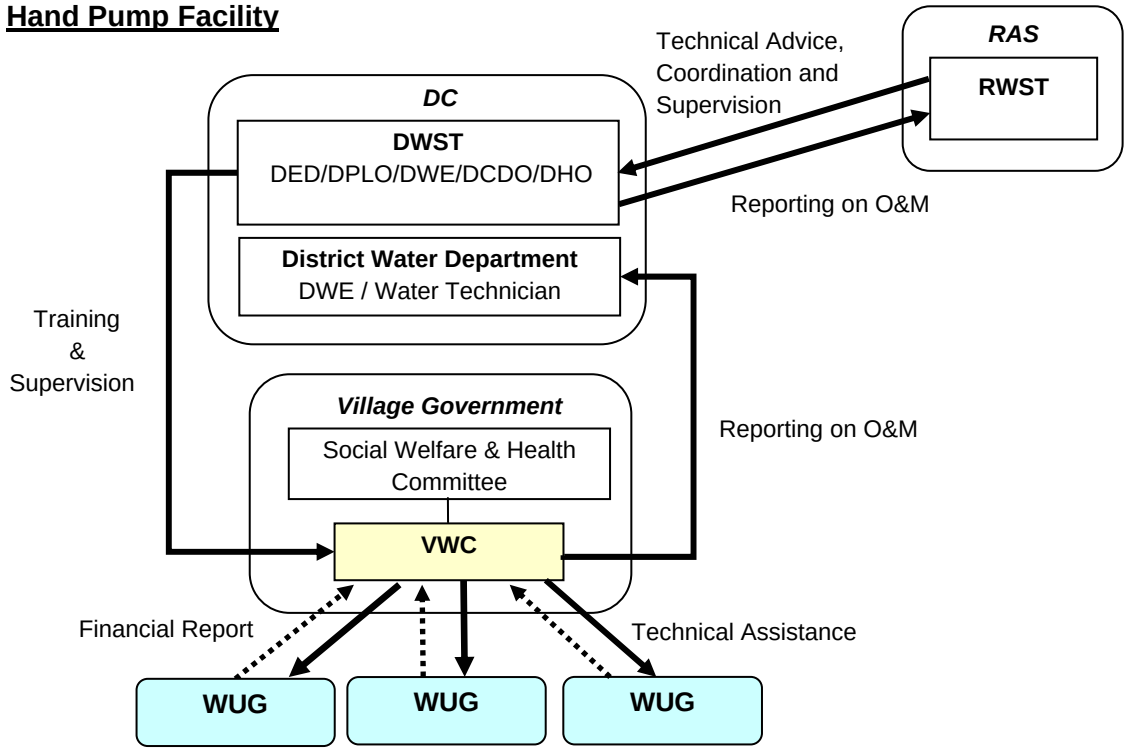


Figure 8.3-1: Institutional Arrangement for O&M of the Hand Pump Facility in the Priority Village

As for the hand pump facilities, a WUG shall be established at each hand pump facility and become the responsible body for operation and maintenance. A respective VWC, District Water Department and DWST in the targeted area will support the WUG based facility

management as shown in Table 8.3-1. After the newly established WUG receive training on community mobilization, management and technical repair and maintenance from the public offices, the WUG take the responsibilities of the collection of water fees and water funds, repair and maintenance of the facility and other activities as shown in Table 8.3-1. To overcome the issue of the misuse of water funds within the Village government, the financial management is independent from the VWC, but the WUG will report the financial status to the VWC for financial accountability. The District Water Department provides mainly technical support with the WUG and monitors the activities.

Table 8.3-2: Tasks of Responsible Bodies for O&M of the Piped Scheme in the Priority Village

			Public Offices				User Groups
			Regional Water and Sanitation Team (RWST) within Administrative Secretariat (RAS)	District Administration (Council)		Village Water Committee (VWC)	WUA for Piped Scheme WUG for Hand pump
				District Water Sanitation Team (DWST)	District Water (DWE) Department		
Piped Scheme							
Operation & Maintenance	1	Water Quality Management			◎ (administration, coordination, information/data management)		
	2	Management of Filtration Plant			○ (regular supervision)	◎	◎ (filtration plant caretaker)
	3	Water Quality Test (Annual)	◎ (Implementation of test)		○ (administration, coordination, information/data management)	○	○ (water collection for test)
	4	Operation of Pumps/Generator			○ (regular monitoring)	○	◎ (pump/generator operator)
	5	Water Volume Control			○ (regular monitoring)	○	◎ (pump/generator operator)
	6	Water Pressure Control			○ (regular monitoring)	○	◎ (pump/generator operator)
	7	Counting of Consumed Water Volume			◎		○
	8	Recording of Operation, Replacement & Repairs of Facilities			○ (regular monitoring and record keeping)	○	◎ (pump/generator operator, pump/tap caretaker)
	9	Water Tap Management, Control and Protection (e.g., Opening of water supply facility)			○ (regular monitoring)	○	◎ (pump/tap caretaker)
	10	Water Fund Collection & Management		○(training, regular monitoring)	○ (training, regular monitoring)	○ (supervision)	◎ (pump/tap caretaker)
	11	Water Fee Collection & Management		○(training, regular monitoring)	○ (training, regular monitoring)	○ (supervision)	◎ (Group leaders)
Supervision of Training	12	Capacity Building (through Training of Public Office Staff)	○ (coordination of HRD & institution building)	◎	◎	◎	◎ (primary/preventive maintenance)
	13	Community Empowerment (through Training to Communities)	○ (coordination of support for community mobilization)	◎	○	◎	◎

Note: ◎=Primary Responsibility; ○=Secondary Responsibility

As for the piped scheme facilities, a tap committee shall be established at each domestic water point, and compose a WUA at each piped scheme (refer to Figure 8.3-2). The WUA

will become a responsible body for operation and maintenance, and a respective VWC, the District Water Department and DWST will support the WUA based facility management.

Figure 8.3-2 shows an institutional arrangement for a piped scheme covering more than one village. The details of organizational arrangement within the VWC is devolved on the next section (refer to 8.3.2). After the responsibilities are transferred from the VWC to the WUA, the WUA will submit financial reports to the VWC ensuring accountability. In the case of operation and maintenance of the piped scheme, the DWE and the water technician of the respective District Water Department especially provide training on technical aspects of the O&M, periodical monitoring of the facilities including pump, generator, and filtration, and data management of the facility conditions.

As for both types of the water supply facility, the regional coordination body shall support the community based facility management indirectly, by providing technical advice and support to the District Water Department, and coordinating trainings at the district level efficiently.

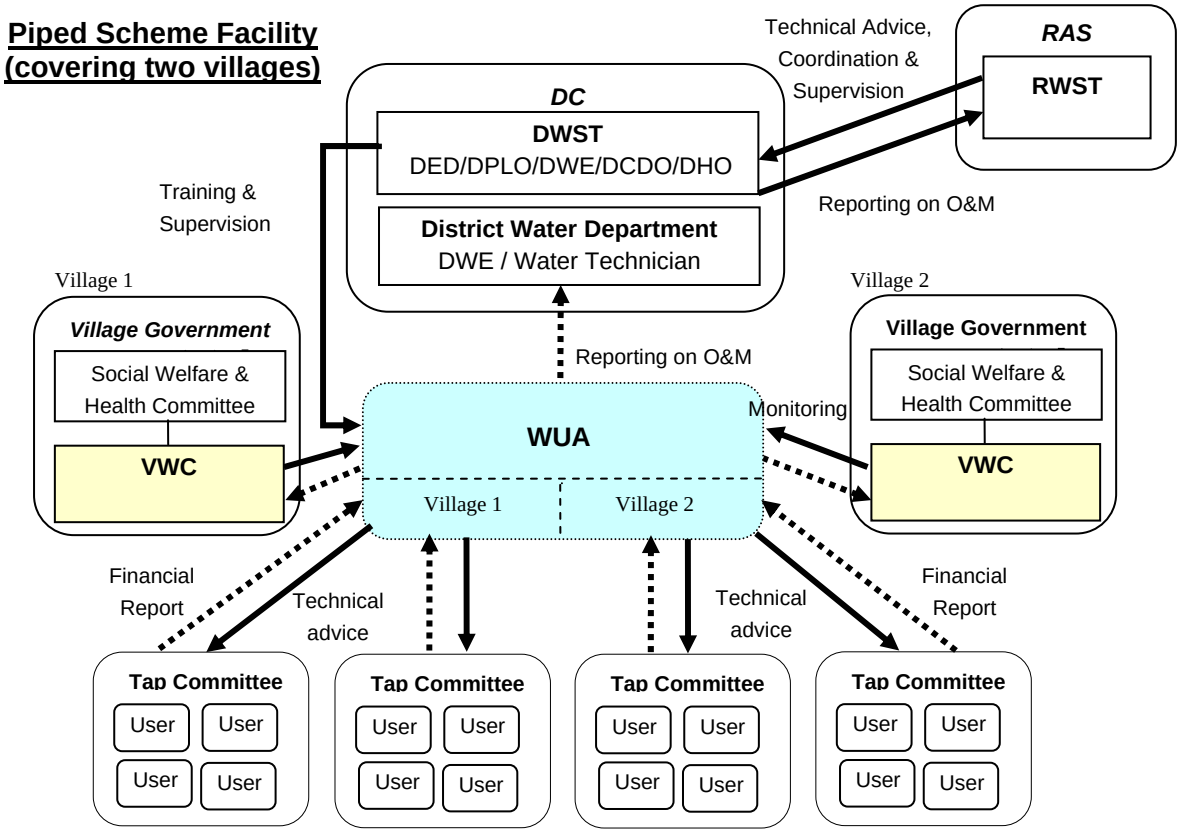


Figure 8.3-2: Suggested Institutional Arrangement for O&M on Piped Scheme in the Priority Villages

8.3.2 Village Level

As suggested in Figure 8.3-1 and Figure 8.3-2, there are three types of community water organizations at the village level: the Water User Association (WUA) or Board [1] for the piped scheme facility; the Water User Group (WUG) for the hand pump facility; and the Village Water Committee (VWC).

a. Water User Group (WUG) for Hand Pump

Institutional arrangement of WUG has been familiarized extensively in the 45 priority villages because of guidance under the HESAWA programme for user based facility management. The suggested structure of the WUG is depicted in Figure 8.3-3, based on the experience of the HESAWA programme and the detailed tasks of WUG members in the priority projects are presented in Table 8.3-3. Along with the recent guidance of NRWSSP, all users of the hand pumps shall be registered at each domestic water point to gain the legal status of the WUG.

A major challenge from an institutional aspect experienced during the HESAWA Project was the difficulty to cope with the existence of both the VWC and user group concurrently within one village. This is because the function of the VWC as supervisor and coordinator for water supply activities within the village was weakened when the WUG was created as the core group of DRA. Therefore, it is suggested that the demarcation of functions between VWCs (coordinator of water supply and heath/sanitation activities) and user based groups (immediate management of respective water facilities) be made clear for better and more efficient O&M within one village. Moreover, the financial management of the WUG shall be independent from the VWC to avoid misuse of the collected fund or water fee.

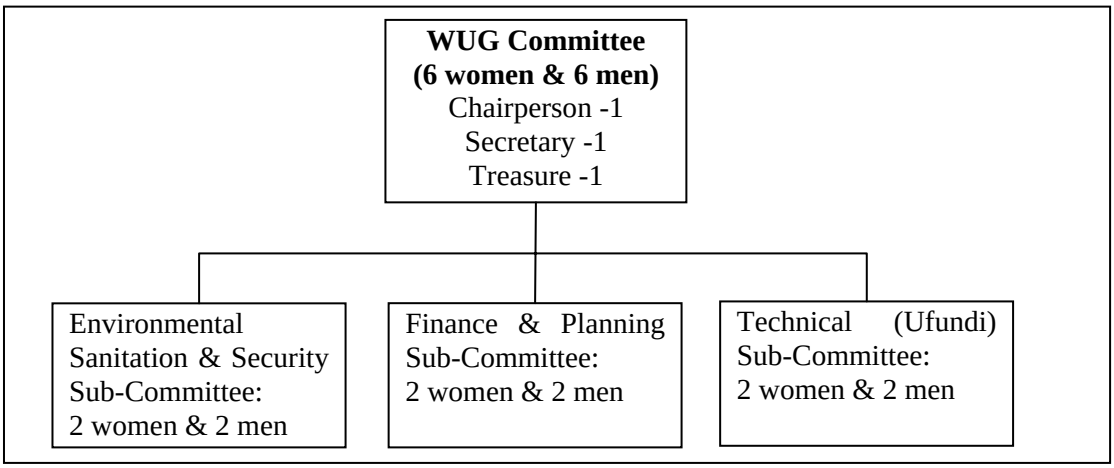


Figure 8.3-3: Suggested Structure of Water User Group (WUG)

[1] 'Board' is mostly formed in town setting and in the rural water supply improvement plan, it is not applicable this time.

Table 8.3-3: Detailed Tasks of WUG Members

	Personnel	Detailed Tasks
Water User Group (WUG)	① Committee (leaders)	i) Mobilization of users/members through Village Water Committees ii) Organization of regular user meeting and reporting of financial and technical records to members iii) Collection of the Water Fund/Fee and financial management (mainly by Treasurer) iv) Technical maintenance of water supply facilities (through technical sub-committee) v) Hiring necessary care takers for facility (Domestic point caretaker/collector) vi) Promotion of Sanitary/health improvement
	② General member (Users)	i) Selection of leaders and sub-committee members ii) Participation to WUG assembly meeting iii) Water fee payment for O&M iv) Participation to necessary labor works and daily up-keeping of facility v) Participation to sanitary/health activities
	③ Domestic point caretaker/water fee collector	i) Operation and daily maintenance of domestic point ii) Recording of the operation and maintenance activities iii) Collection of water fee at domestic point (for per bucket collection)

b. Water User Association (WUA) or Board for Piped Scheme

In the case of piped scheme facilities in the 45 priority villages, it is suggested that a Water User Association (WUA) shall be established at each piped scheme. Moreover, a tap committee at each domestic water point shall be established, and compose the WUA at each piped scheme. A WUA is supposed to take the responsibilities for the detailed tasks as below.

Table 8.3-4: Detailed Tasks of WUA/Board Members (Piped Scheme Facility)

Institution	Personnel	Detailed Tasks
Water User Association (WUA)	① Committee (leaders)	i) Mobilization of users/members through Village Water Committees ii) Organization of regular general assembly and reporting of financial and technical records to iii) Collection of the Water Fund/Fee through Village Water Committees and financial management iv) Technical maintenance of water supply facilities (through technical sub-committee) v) Hiring necessary care takers for facility (Pump operator, Filtration plant caretaker, Domestic point caretaker/collector) vi) Promotion of Sanitary/health improvement
	② General member (Users)	i) Selection of leaders and sub-committee members ii) Participation to WUA assembly meeting iii) Water fee payment for O&M iv) Participation to necessary labor works and daily up-keeping of facility v) Participation to sanitary/health activities
	③ Pump operator	i) Operation and daily maintenance of pump/generator ii) Recording of the operation and maintenance iii) Protection of pump/generator at the site as watchman
	④ Filtration plant caretaker	i) Operation and daily maintenance of filtration plant ii) Recording of the operation and maintenance iii) Protection of filtration plant at the site as watchman
	⑤ Domestic point caretaker/water fee collector	i) Operation and daily maintenance of domestic point ii) Recording of the operation and maintenance iii) Collection of water fee at domestic point (in case collection per bucket)

There shall be various operators to be hired by the WUA such as the pump operator, the filtration plant operator and the domestic point caretaker as listed in Table 8.3-4. Task management tools for the employees such as check sheets for daily operation and preventive maintenance need to be newly developed by the District Water Office to monitor the community based facility management activities.

However, if the newly established WUA has difficulty to manage water supply services, it is suggested that the current respective VWC in the priority village takes responsibilities of operation and maintenance activities, until the WUA effectively functions.

c. Village Water Committee (VWC)

VWC shall be established at all villages. The VWC supervises water funds and fees collection activities conducted by WUG for hand pump, and WUA for piped scheme through checking each financial report. As for the WUA for piped scheme facilities in the priority village, a respective VWC may take responsibilities of operation and maintenance if the WUA has any difficulty to function the facility substantially.

As for the priority villages, the VWC shall become a focal point between the public offices such as District Water Department and user groups such as WUG and WUA in order to receive technical supports from the public offices efficiently.

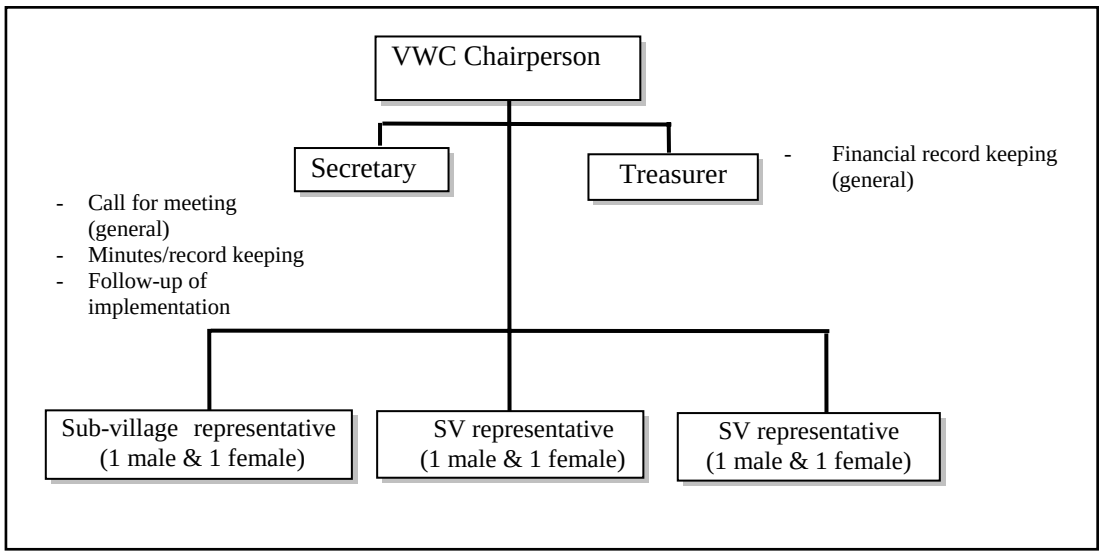


Figure 8.3-4: Village Water Committee

In order to avoid the misuse of the village water fund, the VWC shall be re-organized as an institution independent from the direct control of the village government. As presented in Figure 8.3-1 and Figure 8.3-2, the Welfare and Social sub-Committee of the village government supervises and coordinates the activities of the VWC, but the village water fund needs to be purely protected for water supply development and sanitation improvement purposes. The independent status of the VWC and uses of the village water fund need to be re-defined and acknowledged through the process of training on community mobilization.

The detailed tasks of the key persons of the VWC are presented in Table 8.3-5:.

Table 8.3-5: Detailed Tasks of the VWC

Institutions	Personnel	Detailed Tasks
Village Water Committee (VWC)	① Chairperson	i) Clarification of needs and request of support to the district administration ii) Collection of the Village Water Fund and financial management of it iii) Technical maintenance of water supply facilities (through technical sub-committee) iv) Promotion of Sanitary/health improvement v) Coordination with/report to Social or welfare committee in the village government
	② Secretary	i) Call for general meeting ii) Record of minutes of meeting iii) Follow-up and monitoring of implementation of daily operation and maintenance
	③ Treasurer	i) Collection of the Village Water Fund from general villagers and management of it ii) Monitoring the financial status of Sub-committee for Piped Scheme Management and WUGs

d. Institutional Arrangement for the 45 Priority Villages

As for the community based management organization, the needs for institutional arrangement by each type of the facility is shown in Table 8.3-6 and Table 8.3-7.

Table 8.3-6: Arrangement for Protected Springs & Borehole with Hand Pump in the Priority Village

	No of Priority Villages	Types of Source	No of Total Villages	Targeted Community Water Organizations		Challenges of Community Water Organizations	Institutional Arrangement Concerns	Training Needs
				VWC	WUG			
Hand Pump	35 Villages	Borehole	33	○(29)	○(20)	①Re-promotion of VWCs(29) ②Formation of WUG(13) ③Establishment of VWC (4)	①Community mobilization and WUG organizational set-up ② Technical maintenance of well with borehole	①VWC Training ②WUG Training
		Borehole +Spring	2	○(2)	○(1)			①VWC Training ②WUG Training

Note: ( ) shows number of villages applied to the developmentpatterns for the priority villages

Table 8.3-7: Arrangement for Piped Schemes in the Priority Village

	No of Priority Villages	Types of Source	No of Villages	Targeted Community Water Organizations			Challenges of Community Water Organizations	Institutional Arrangement Concerns	Training Needs
				VWC	WUA				
					Single Village	Multiple Villages			
Piped Scheme	10 Villages (8 scheme)	Borehole	4	○(4)	○(4)	–	①Re-promotion of VWCs ②Formation of WUA	①WUA organizational set-up within a village ②Finance for running costs of piped scheme ③Technical maintenance of piped schemes	①VWC Training ②WUA Training
		Lake Victoria	6	○(6)	○(2)	○(4)		①WUA organizational set-up across multiple villages ②Finance for running costs of piped scheme ③Technical maintenance of piped schemes ④Participation of villagers near the Lake area	①VWC Training ②WUA Training

Note: ( ) shows number of villages applied to the development patterns for the priority villages

e. Organizational Development Plan for the 45 Priority Villages

As shown in Table 8.3-8 and Table 8.3-9, there is different organizational development patterns of the community based water supply facility management observed in the targeted villages of the priority project by types of water supply facilities. The following tables show the completed steps for organizing two types of community based water facility management; one is WUG for 'bore holes with the hand pump water facilities and the other is WUA for the piped scheme facilities.

Table 8.3-8: Development Patterns and Institutional Arrangement of the VWC and WUG

Organization Patterns			A		B		C	
			1	2	3	4	5	6
			No Village Water Committee		Village Water Committee Exists		Village Water Committee and Village Water Fund Exist	
Steps			No Water User Group	Water User Group Exists	No VWC Fund	VWC Fund Exists	No WUG	WUG Exists
1	VWC	Establishment of VWC						
2		Making by-laws and regulations of VWC			Depending on the progress		Depending on the progress	
3		Collection/establishment of VWC fund						
4		Bank Account of VWC Fund				Depending on the progress		Depending on the progress
5		Registration to District Water Office on by-laws and the bank account						
6	WUG	Establishment of WUG		Depending the progress of the WUG				
7		Making by-laws and regulations of WUG						
8		Collection/establishment of WUG fund						Depending on the progress
9		Bank Account of WUG Fund						
10		Water Right Application by WUG						
11		Entitlement of Water Right to WUG						

Steps need to be forwarded.

Table 8.3-9: Development Patterns and Institutional Arrangement of the VWC and WUA

Organization Patterns			A		B		C	
			1	2	3	4	5	6
			No Village Water Committee		Village Water Committee Exists		Village Water Committee and Village Water Fund Exist	
Steps			No Water User Association	Water User Association Exists	No VWC Fund	VWC Fund Exists	No WUA	WUA Exists
1	VWC	Establishment of VWC						
2		Making by-laws and regulations of VWC			Depending on the progress		Depending on the progress	
3		Collection/establishment of VWC fund						
4		Bank Account of VWC Fund				Depending on the progress		Depending on the progress
5		Registration to District Water Office on by-laws and the bank account						
6	WUA	Establishment of WUA		Depending the progress of the WUA				
7		Making by-laws and regulations of WUA						
8		Collection/establishment of WUA Fund						Depending on the progress
9		Bank Account of WUAFund						
10		Water Right Application by WUA						
11		Entitlement of Water Right to WUA						

Steps need to be forwarded.

As presented in the tables there are patterns of the necessary steps of development from establishment to having entitlement of water right legal status. When the intervention for the organizational set-up takes place, first, planning stage assessment of the village progress and

status for organizational arrangement shall be carried out, and then it is recommended to forward the following steps along with the training for institutional arrangement and capacity building on community mobilization skills and financial and technical skills for facility management.

In the case of the piped schemes, most villages have not established WUAs yet, according to the result of the supplementary survey. The organizational development patterns depend on the existence of a VWC and water fund in the village.

8.3.3 District Level

The District Water Department is the primary agent within the district administration for water supply management in the priority villages. However, according to the expected institutional arrangement (refer to Table 8.3-1 and Table 8.3-2), the duties of coordinating the rural water supply rests on the DWSTs, and the functions of the district water department will focus more on prompt technical support to community based water supply services. For the priority villages of the JICA Study, capacity building shall emphasize technical skills for operation and maintenance, which need to be fulfilled mainly by the District Water Technicians in the following preventive maintenance manner.

The organization and institutional plan at the district level consists of the re-organization of the District Water Department and capacity building of the District Water Department staff, such as DWEs and water technicians.

a. Emphasis on Functions to Supervise Preventive Maintenance

It was observed that there is no substantial preventive maintenance activity being implemented by the District Water Department at present. For example, in most districts, the District Water Department hires pump attendants or operators for the piped scheme facilities in order to operate and monitor the condition of the water supply facilities properly at the respective sites. However, it was revealed that a daily recording system on the status or damage of water supply facilities has not been established, and the duty of pump attendants is only security of the facilities. To ensure sustainable operation and maintenance of the constructed water supply facilities, the key principle is to prepare and prevent problems with the facility or machinery before it breaks down. Especially for the piped scheme, periodical monitoring and maintenance by the District Water Department in cooperation with community water organizations is the key to sustainable water supply service delivery. All measures for maintaining the water supply service shall be based on preventive maintenance, as follow:

1) Establishment of a monitoring system for preventive maintenance that shall be linked with the database and information management system
2) Capacity building of water technicians both in terms of technique and community skills to ensure the preventive maintenance system in order to support community based facility management

The details of the above plans are described in the following sections accordingly.

Considering the expected roles and tasks of the responsible bodies for O&M in the 45 priority villages, the technical and human resources capacity of Public Offices to facilitate technical support is observed to be inadequate. Because maintenance for boreholes and piped schemes is new in the Study area, adoption of the regular preventive maintenance system and related capacity building for both technical support and community mobilization are indispensable.

b. Monitoring system for Preventive Maintenance in the Priority Villages

There has been no regular activity of visiting communities for ensuring community based management for water supply facilities by either District Water Departments or Community Development Offices of the district councils in the Study area. As suggested earlier, the organization and activities of the District Water Department need to focus on O&M more in future since construction and hydro-geological tasks conventionally done in the past shall be carried out by private service providers in the near future. In other words, regular visits to villages for technical support and preventive maintenance of water supply facilities and community awareness activities shall be one of the key tasks of the DWST and the District Water Department. As for one village, at least quarterly visits need to be carried out in order to provide technical guidance and monitor the progress of the VWC and group activities, in particular during the 1st year of any intervention. The required cost for re-promotion of village water committees and any type of existing Water User Group for 45 villages of the priority project are estimated below. This re-promotion of the VWC, WUG or WUA shall be linked with database and information management system in the District Water Department. For the purpose of the computation, expenses to visit one village are made in Table 8.3-10.

Table 8.3-10: Annual Cost Estimation for Technical guidance, Facilitation and Follow-up

	Activities	Item	Time	Allowance
DWST	Guidance and Facilitation of community water supply organizations (VWC, WUGs , etc.) As for 1st and 3rd visit 5 hours @ village As for 2nd and 4th visit Half a day @ village	Personnel @village 1 Water Technician 1 Community Development Officer 1 Community Development Assistant (Ward) Driver Transportation @village Vehicle with Fuel	4 times a year	(Tsh) 25,000 25,000 10,000 20,000 30,000
	Total			440,000

c. Capacity Building of Water Technicians at District Water Department

At present, it is observed that the most urgent and critical issue at the District Water Office is a shortage of skilled staff. In order to fulfill the tasks of the Water Department for the proposed improvement as presented in Table 8.3-1 and Table 8.3-2, and at least several water technicians who have good skills and knowledge of operation and maintenance, in particular for the boreholes and piped schemes constructed as the priority projects, are required.

As a result of the supplementary survey, it is found that training opportunities depend on the availability of funds and vacancies in training institutes, and there is no regular follow-up training. Most of the training courses are one year long and on civil engineering, and are implemented at the Water Resource Institute in Dar es Salaam. It is also found that the technicians of the District Water Department have not undergone training in community mobilization skills, such as participatory planning and gender issues.

Table 8.3-11: Human Resource Deployment of District Water Departments (As of November, 2005)

District	Egineer with University / College Degree	Full Technician **	Trade Test Technician ***		Assistant Technician (Untrained Technial Auxiliary)	Clerical Staff	Scheme Pump/Water Installation attendant ****	Total
			I	II				
Mwanza								
Magu	1	1	23		0	4	5	34
Misungwi	1 (Advanced diploma)*	2	10	3	0	8	n.a.	24
Kwimba	0	2	3	5	2	2	9 (some are trained	23
Sengerema	1	2	5	10	1	0	3	22
Geita	1	1	2	0	14 (Trade Test III)	0	n.a.	18
Ukerewe	0	1	2	3	0	3	2	11
Magu								
Musoma	1	3	0	2	0	3	8	17
Bunda	0	4	6	1	8	1	10	30
Serengeti	0	4	5	6	6	2	8	31
Tarime	0	2	3	1	0	0	21	27

Source: Interview with the District Water Department (DWEs or Acting DWEs)

* With Advance Diploma, which is equivalent to University Degree

** Full Technician: 7+4+3 Years Training at Water Resource Institute of MoW

*** Trade Test Techinician: generally devided into I & II category. 7+4+2 years for I, '+3+1 years for II

**** Pump Attendant: some are permanently contracted

Table 8.3-12: Human Resource Arrangement and Skills Development at the District Water Department

Number of Steps	Technicians 0－9	Technicians 10－15	More than Technicians 16
STEP1	At least 10 skilled technicians are necessary	At least 5 skilled technicians who could manage both piped schemes and boreholes	At least 5 skilled technicians who could manage both piped schemes and boreholes
STEP2	At least 5 skilled technicians who could manage both piped schemes and boreholes	At least 5 skilled technicians who knows PHAST approach	At least 5 skilled technicians who knows PHAST approach
STEP3	At least 5 skilled technicians who knows PHAST approach		

d. Training for Personnel of the District Water Department for Priority Villages

The training for strengthening planning capacity and the data organization system shall be carried out for the DWE, the Acting DWE and senior water technicians (2 persons each from respective districts, and 20 DWEs/water technicians in total from 10 target districts need to be trained) as suggested in the previous section. The estimated cost for the training for strengthening planning capacity and the data organization system shall be 16,350,000Tsh (=USD13,856) for the three years. Table 8.3-13 summarizes the needs for capacity building on planning and technical capacity in order to support the community based facility management.

On the other hand, all water technicians shall be also provided as a basis of the preventive maintenance system. The training plan and required inputs are suggested in Table 8.3-13. In order to train 117 water technicians in 10 target districts[2] for 3 years, Tsh 30,275,000 (=USD25,657) shall be required excluding the cost of the Japanese short term expert.

As suggested in Table 8.3-14, capacity building on awareness creation for both health/sanitation and gender issues for water technicians and community development officers shall be recommended in order to promote the use of safe water and hygiene practices in communities. At present, there are a few water technicians and community development officers who have proper knowledge of PHAST (Participation Hygiene and Sanitation Transformation: See the Supporting Report, Chapter 7) and gender issues in development since training opportunities and availability of education materials are limited. According to the plan, two water technicians and two community development officers shall be trained and the trainer personnel shall be peer-educators to transfer the knowledge and skills in their offices as well as to facilitate villagers at the village level. The estimated required cost for training 40 personnel shall be Tsh 6,816,000(=USD 5,776) as presented.

[2] Numbers of DWE and Water Technicians in the 10 target districts who have experienced professional training: Mwanza: Magu(25), Misungwi(16), Kwimba(10), Sengerema(18), Geita(4), Ukerewe(6), Mara: Musoma(6), Bunda(11), Serengeti(15), Tarime(6)

Table 8.3-13: Capacity Training Needs for Organization Improvement at District Level

	Capacity Building for Planning and Data Managament	**Capacity Building for Technical Skills**
Training	Capacity Building for Planning and Data Managament	Awareness for Health/Sanitation and Gender
Objectives	Formualtion of monitoring indicators for water supply facility design & construction and O&M management, collection of inventory data/information, capacity building for supervision of facility construction	Training of Water Technicians and Community Development Officer to implementation of PHAST approach and Gender and development at villages, and monitoring of the approaches as facilitators
Issues to be Improved	①Inadequate knowledge and skills for water supply services and facility management ②Inadequate skills for data/information collection and management	①Inadequate knowledge and skills for Health/sanitation improvement
Contents of Training	①Planning methologies ②Information/data management ③Procedures for Supervision of water supply facility construction ④Monitoring for O&M of facilities	①PHAST（Issues identification and problem solving by participatory manners） ②Gender concerns in community mobilization
Targets	Water Advisor to RAS, DWE and Senior Water Technicians (At least 2 from each District Water Dept. =In total 24 persons	Water Technicians and Community Development Officer in the Study Area (4 persons from 10 target districts)
Modes of Training	Lectures (and OJT for follow-up)	Workshop
Duration of Training	Lectures: 5 days/a year (1st year + 2 years follow-up taining)	①PHAST Approach：3 days ②Gender：2 days
Instructor/Facilitators	①Japanese short term expert ②Engineers of Mwanza City Water Supply Enterprise ③Tanzanian private consultant	①Japanese short term expert ②Tanzanian private consultant
Teaching Material/Manual	Review of the existing teaching materials	Review of the existing teaching materials
Required Budget	①Japanese short term expert ②Allowance to Engineers of Mwanza City Water Supply Enterprise(@Tsh25,000/dayX 1 trainersX 10 days） ③Tanzanian private consultant(@ USD100/dayX 1 consultantX 10 days) ④Allowance to Training Participants（@ Tsh25,000/dayX 22 traineersX 6 days） ⑤Transportation (@Tsh 60,000/day: 1 round avarage: 10 distiricts + 2 regions)	①Japanese short term expert ②Tanzanian private consultant(@ USD100/dayX 1 consultant X 10 days) ③Allowance to Training Participants （@ Tsh20,000/dayX 40 trainees X 6 days） ④Transportation (@Tsh 60,000/day: 1 round average: 10 districts) ⑤Stationeries ramp sum: USD 200
Total Budget Estimate	For 22 trainees for 3 years: Tsh 16,350,000 (=USD13,856) excepting for the cost of the Japanese short term experts	For 22 trainees for 3 years: Tsh 6,816,000(=USD5,776) excepting for the cost of the Japanese short term experts

Table 8.3-14: Capacity Training Needs for PHAST and Gender at District

	Capacity Training Needs for PHAST and Gender at District
Training	Awareness for Health/Sanitation and Gender
Objectives	Training of Water Technicians and Community Development Officer to implementation of PHAST approach and Gender and development at villages, and monitoring of the approaches as facilitators
Issues to be Improved	①Inadequate knowledge and skills for Health/sanitation improvement
Contents of Training	①PHAST（Issues identification and problem solving by participatory manners） ②Gender concerns in community mobilization
Targets	Water Technicians and Community Development Officer in the Study Area (4 persons from 10 target districts)
Modes of Training	Workshop
Duration of Training	①PHAST Approach：3 days ②Gender：2 days
Instructor/Facilitators	①Japanese short term expert ②Tanzanian private consultant
Teaching Material/Manual	Review of the existing teaching materials
Required Budget	①Japanese short term expert ②Tanzanian private consultant(@USD100/dayX 1 consultant X 10 days) ③Allowance to Training Participants （@Tsh20,000/dayX 40 trainees X 6 days） ④Transportation (@Tsh 60,000/day: 1 round average: 10 districts) ⑤Stationeries ramp sum: USD 200
Total Budget Estimate	For 22 trainees for 3 years: Tsh 6,816,000(=USD5,776) excepting for the cost of the Japanese short term experts

Along with the NRWSSP guideline, District Councils are also responsible for water supply and sanitation activities through the District Water Sanitation Team (DWST). It is suggested that District Councils also take active actions and support the DWEs on the following matters:

1） Formation of the DWSTs and clarification of the responsibilities of members and activities to be taken

2） Preparation and implementation of water and sanitation re-promotion plans should be carried out through the DWSTs/DATs and budget allocation for the activities.

8.3.4 Regional Level

a. Establishment of a Coordination Body for Water and Sanitation Promotion at the Regional Level

There is no coordination body at the regional level to follow up the priority projects. However, it is critically necessary to have a regional level mechanism, with which activities for promotion of water and sanitation are coordinated, monitored and integrated to maximize the efforts across all districts within a region. Under Regional Administrative Secretariats (RAS), the regional level coordination unit is also expected to plan capacity building of human resources on water supply issues.

As mentioned above, Mwanza region has a mechanism to supervise and monitor the HESAWA activities while Mara region does not. It is observed that maintaining the HESAWA impacts seems to be more difficult in communities of Mara region than that of Mwanza region, and naturally the HESAWA concepts and the self-help of users for ensuring sustainability of water supply facilities have been fading in Mara region. Besides monitoring, coordination and integration by supervising district activities, it is expected that the unit also be responsible especially for the following matters:

1) Clarification of DWSTs' specific objectives and detailed task identification of each member and schedule for detailed actions by the DWSTs
2) Plans for training of Water Technicians of District Water Engineer Offices, in particular community skills such as participatory planning
3) Guideline for collection of baseline data and record keeping and reporting systems on water facilities and water user groups such as VWCs and WUGs/WUAs

For establishing the coordination body for water and sanitation promotion at the regional level, the annual budget/cost for the unit is Tsh 15,000,000 (=USD12,712) with two coordinators and two assisting staff according to the HESAWA RPISC currently existing in Mwanza region.

b. Capacity Building of the Regional Coordination Body

Although the progress of decentralization is on-going in the Mwanza and Mara regions, the efforts on awareness for hygiene and sanitation shall be made in cooperation by several relevant government offices. To promote community awareness and training such as PHAST at the district and community level, the leaders of the regional coordination body shall be also trained as promoters and facilitators. The estimation of the cost for the PHAST training is made for further computation in each region.

Table 8.3-15: Estimation for PHAST training at a Regional Level

Target	Training	Item	Time	Allowance
RWST	PHAST	Allowance @training 1 Facilitators 8 Participants Stationary for 8 participants Manuals	2 days	(Tsh) 120,000 440,000 16,000 12,000
	Total			840,000

Chapter 9

Operation and Maintenance and Community Awareness Plan

9 Operation and Maintenance and Community Awareness Plan

In accordance with the selection criteria explained in Chapter 6, the 45 priority villages were selected. This chapter covers the O&M plan and the community awareness plan for the 45 priority villages. To implement the priority project effectively, the O&M Plan is discussed followed by the Community Awareness Plan. The questions of who shall be responsible for the operation and maintenance, who shall collect water fees, what kind of steps each district shall pass, etc. are answered in this chapter.

9.1 General

9.1.1 Objectives

The objectives of formulating and proposing the O&M plan and community awareness plan are:

i) To ensure the sustainability of water supply facility improvement proposed in the Water Supply Plan and priority project

ii) To improve access to safe water for rural populations in the Study area

iii) To improve health and sanitation conditions of rural populations in the Study area

9.1.2 Methodology

In order to understand problems and issues regarding the O&M of water supply facilities and to formulate the O&M plan and the community awareness plan, various survey methodologies and tools were deployed from the 1st year study to the 2nd year study as follows:

i) RRA exercises implemented by members of both the counterparts and the JICA Study Team in the five selected villages during June to July 2005

ii) Sub-contracted socio-economic surveys carried out by the Tanzanian consultants during July to August 2005

iii) Supplementary surveys by the JICA Study Team members and the counterparts by visiting 100 priority villages and 17 priority piped schemes during February to April 2006

Besides the aforementioned surveys, a series of discussions with the counterparts and the collection of supplemental information were conducted from time to time when the needs arose.

9.2 Operation and Maintenance Plan

The following examines in detail the O&M cost by water facility type for 45 villages, water fee collection, methods of facility repairs, and spare parts procurement. The exchange rate applied in this chapter is based on the rate of May 2006 (1USD= Tsh 1,181, 1USD=JY 114.58).

9.2.1 Setting Operation and Maintenance Cost

a. Operation and Maintenance Cost for Priority Project

The water fee to recover the O&M costs was calculated on the basis of the construction cost of the water facilities. The O&M costs of the piped scheme include 1) the facility running

cost such as fuel for generators, 2) the recurrent costs for fee collectors, caretakers, and securities, 3) minor spare parts and tools for hand pumps, and various supplies for periodical operation and maintenance, and 4) the future replacement cost of the water facility in accordance with the design manual of Tanzania. All items to be included for the recovery of operation and maintenance cost in the priority project are summarized in Table 9.2-1 and Table 9.2-2.

Table 9.2-1: Basis of O&M Cost (Borehole with hand pump)

Types of Cost	Item
Operation Cost	Wages for collector/caretaker, Supplies (rubber, etc.), Tools
Maintenance Cost	Repair of Hand Pump, Spare Parts
Management Cost	Stationary (ex. Cash Box, Receipt book, Note book)
Replacement Cost	Hand Pump, etc.

Table 9.2-2: Basis of O&M Cost (Piped Scheme)

Types of Cost	Item
Operation Cost	Wages for pump attendant, caretaker, and collector, Fuel
Maintenance Cost	Spare Parts, Supplies (oil, filters, chemical, etc.)
Management Cost	Stationary (ex. Cash Box, Receipt book, Note book)
Replacement Cost	Pump, Pipes, Generator, etc.

The modes and levels of community contribution are matters to be discussed and decided by the users (WUG/WUA) themselves or the Village Water Committees in principle, so that the users/community can decide on an appropriate means and range for fee collection in addition to making rules, setting penalties for rule breakers, and fee waiving for disadvantaged households in the community.

9.2.2 Fee Collection

a. Village Consensus in Decision Making on Mode of Payment

In principle, the water fee amount and the collection method shall be decided and chosen through the process of consultative meetings with the beneficiaries/communities, as the HESAWA projects left it to be determined by community members.

b. Timing of Cash Income

The timing of cash income availability shall be a major factor in deciding the method of water fee collection/payment since constraints of cash income availability will be one of the direct reasons limiting use of the water supply facility, albeit the water supply facilities with safe water are available in the village or nearby villagers' houses. Considering the socio-economic conditions of the Study area, there are two characteristics of 'cash' income availability: one is villages with cash income all year round (such as from fishing of Tilapia from Lake Victoria or pineapple cultivation) and the other is villages with cash income only from seasonal agricultural crops once or twice a year (such as from the sale of maize or cassava). In the case of villagers with the chance to get cash incomes throughout the year from fishing, all year round agricultural products or extra-farming activities, it could be assumed that it is not very difficult to pay per bucket. On the other hand, most of the villagers who depend on the sale of annual or semi-annual crops have difficulty paying per bucket since they do not always have cash income at hand.

c. Types of Facilities

c.1 Well with Hand Pump

In case of hand pumps, the required cost for maintenance is in general smaller than that of piped schemes. The cost for O&M of the spring water sources is rather small approximately 6000 Tsh/year/HP while there is the need to maintain the water sources regularly. There are two villages which include spring protection in the priority project.

c.2 Piped Scheme

As for the piped scheme, not only formulating a management institution such as forming WUA but financing for operation and maintenance of piped scheme itself shall be a new challenge because there is not much experience of maintaining the pipe schemes in the Study area. Again there are 2 types of villages covered in the Study area: villages with cash incomes all year round and villages with cash income only from seasonal agricultural crops. Similar to the hand pump water facility, controlling collection is easier for per bucket payment, but for the payer, per bucket or monthly payment is suitable for villages with recurrent cash incomes while annual or semi-annual payment shall be more pragmatic at villages without recurrent cash income sources as shown in Table 9.2-3.

Table 9.2-3: Suggested Modes of Payment/Water Fee Collection Method for Priority Project

Types of Facilities	Hand Pump		Piped Scheme	
Timing of Cash Income	all year around	seasonal	all year around	seasonal
Easiness to payment	Per Bucket or Monthly	Annual or Semi-Annual	Per Bucket or Monthly	Annual or Semi-Annual
Easiness to Collection	Per Bucket	Per Bucket	Per Bucket	Per Bucket

d. Suggested Collection Methods for Water Fee

The following table illustrates options for methods of collection/payment and timing of cash income for the hand pumps and piped scheme of the priority project. Collection per bucket is the simplest to control for the collector side while the degree of easiness to pay differs according to the socio-economic conditions of the villages.

The timing of payment and the methods of collection to recover the minimum amount for the O&M costs needs to be decided based on the timing of cash income in the communities. The following table shows modes of payment/collection methods for the 45 priority villages.

Table 9.2-4: Suggested Water Fee for the Priority Project

Type of facility	No. of villages classified by timing of cash income		Minimum amount for recovery of O&M costs		Suggested water fee		Mode of payment
	all year round	seasonal (e.g. tree crops)	Tsh per month per HH	Tsh per bucket	Tsh per month per HH	Tsh per bucket	
1. Hand pump		32 villages	924	4.4	1,000	5	Monthly, annual or semi-annual
2. Hand pump	3 villages		924	4.4	1,000	5	Payment per bucket or per month
3. Piped scheme		7 villages	1,775 to 2,503	8.4 to 11.9	1,800 to 2,500	10 or 15	Monthly, annual or

							semi-annual
4. Piped scheme	3 villages		1,019 to 1,887	4.8 to 8.9	1,000 to 2,000	5 or 10	Payment per bucket or per month

The summary of modes of payment/ water fee collection methods are suggested in Table 9.2-5 for the 45 priority villages.

Table 9.2-5: Summary of Modes of Payment/Water Fee Collection for the 45 Priority Villages

DISTRICT	No. by District	Village	Type of Technology HP: Hand Pump Spring: Spring protection PS: Piped Scheme	Timing of Cash Income		Fee Collection		
				All Year Round	From Seasonal Agri Crops	Mode of Collection/ Payment Suggested	Minimum Amount for Recovery of O&M Cost (Tsh/M/HH)	Minimum Amount for Recovery of O&M Cost (Tsh per bucket 20L)
MISUNGWI	25	Busongo	PS		✔	Monthly, Annual or semi-Annual	1,887	8.9
MISUNGWI	28	Ngaya	PS	✔		Per Bucket or Monthly	1,880	8.9
SENGEREMA	13	Sogoso	HP		✔	Monthly, Annual or semi-Annual	924	4.4
SENGEREMA	44	Nyakahako	PS	✔		Per Bucket or Monthly	1,019	4.8
SENGEREMA	67	Sotta	HP	✔		Per Bucket or Monthly	924	4.4
SENGEREMA	69	Isole	HP	✔		Per Bucket or Monthly	924	4.4
SENGEREMA	75	Buswelu	PS		✔	Monthly, Annual or semi-Annual	2,503	11.9
SENGEREMA	83	Busekeseke	HP		✔	Monthly, Annual or semi-Annual	924	4.4
SENGEREMA	84	Katoma	HP		✔	Monthly, Annual or semi-Annual	924	4.4
SENGEREMA	86	Magulukenda	HP		✔	Monthly, Annual or semi-Annual	924	4.4
SENGEREMA	96	Nyancheche	HP		✔	Annual or semi-Annual	924	4.4
SENGEREMA	99	Nyamiswi	PS	✔		Per Bucket or Monthly	1,775	8.4
SENGEREMA	100	Nyakasasa	PS		✔	Annual or semi-Annual	1,775	8.4
KWIMBA	22	Hungumalwa	PS		✔	Monthly, Annual or semi-Annual	2,406	11.4
KWIMBA	71	Mhulya	HP		✔	Monthly, Annual or semi-Annual	924	4.4
MAGU	75	Kijereshi	HP		✔	Monthly, Annual or semi-Annual	924	4.4
GEITA	17	Bugulala	HP	✔		Per Bucket or Monthly	924	4.4
GEITA	18	Kasota	HP, Spring		✔	Monthly, Annual or semi-Annual	924	4.4
GEITA	22	Kamena	HP		✔	Monthly, Annual or semi-Annual	924	4.4
GEITA	24	Ndelema	HP		✔	Monthly, Annual or semi-Annual	924	4.4
GEITA	25	Nyashishima	HP		✔	Monthly, Annual or semi-Annual	924	4.4
GEITA	26	Bogogo	HP		✔	Monthly, Annual or semi-Annual	924	4.4
GEITA	27	Ikina	HP		✔	Monthly, Annual or semi-Annual	924	4.4
GEITA	42	Ibondo	HP		✔	Monthly, Annual or semi-Annual	924	4.4
UKEREWE	44	Bukonyo	PS (rehabilitation)		✔	Monthly, Annual or semi-Annual	1,775	8.4
UKEREWE	-	Namilembe	PS (rehabilitation)		✔	Monthly, Annual or semi-Annual	1,775	8.4
BUNDA	33	Mcharo	HP		✔	Monthly, Annual or semi-Annual	924	4.4
MUSOMA (R)	6	Sirorisimba	HP		✔	Monthly, Annual or semi-Annual	924	4.4
MUSOMA (R)	8	Ryamisanga	HP		✔	Monthly, Annual or semi-Annual	924	4.4
MUSOMA (R)	21	Kisamwene	HP		✔	Monthly, Annual or semi-Annual	924	4.4
MUSOMA (R)	33	Bugoji	HP		✔	Monthly, Annual or semi-Annual	924	4.4
MUSOMA (R)	35	Saragana	PS		✔	Monthly, Annual or semi-Annual	1,991	9.4
MUSOMA (R)	55	Isaba	HP		✔	Monthly, Annual or semi-Annual	924	4.4
TARIME	24	Nyankunguru	HP		✔	Monthly, Annual or semi-Annual	924	4.4
TARIME	44	Kiwanja	HP		✔	Monthly, Annual or semi-Annual	924	4.4
TARIME	71	Bisarwi	HP		✔	Monthly, Annual or semi-Annual	924	4.4
TARIME	94	Kisumwa	HP		✔	Monthly, Annual or semi-Annual	924	4.4
TARIME	112	Nyankonge	HP		✔	Monthly, Annual or semi-Annual	924	4.4
TARIME	129	Masike	HP		✔	Monthly, Annual or semi-Annual	924	4.4
TARIME	131	Bukama	HP		✔	Monthly, Annual or semi-Annual	924	4.4
TARIME	144	Oliyo	HP		✔	Monthly, Annual or semi-Annual	924	4.4
TARIME	157	Tatwe	HP		✔	Monthly, Annual or semi-Annual	924	4.4
SERENGETI	37	Busawe	HP, Spring		✔	Monthly, Annual or semi-Annual	924	4.4
SERENGETI	66	Nyansurura	HP		✔	Monthly, Annual or semi-Annual	924	4.4
SERENGETI	67	Kebancha	HP		✔	Monthly, Annual or semi-Annual	924	4.4

e. Suggested Structure of Water Fee Collection

As shown in Figure 9.2-1 and Figure 9.2-2 below, the suggested structure of water fee collection differs by the type of technology of the water supply facility. The difference in structure is interrelated with the community based management institutions proposed in Chapter 8.3.2, Organization, Institutional Framework of Responsible Bodies at Village Level (refer to Figures 8.3-2 and 8.3-3) and 9.2.3 Method of Repairing Facilities (refer to Figure 9.2-3) in the following.

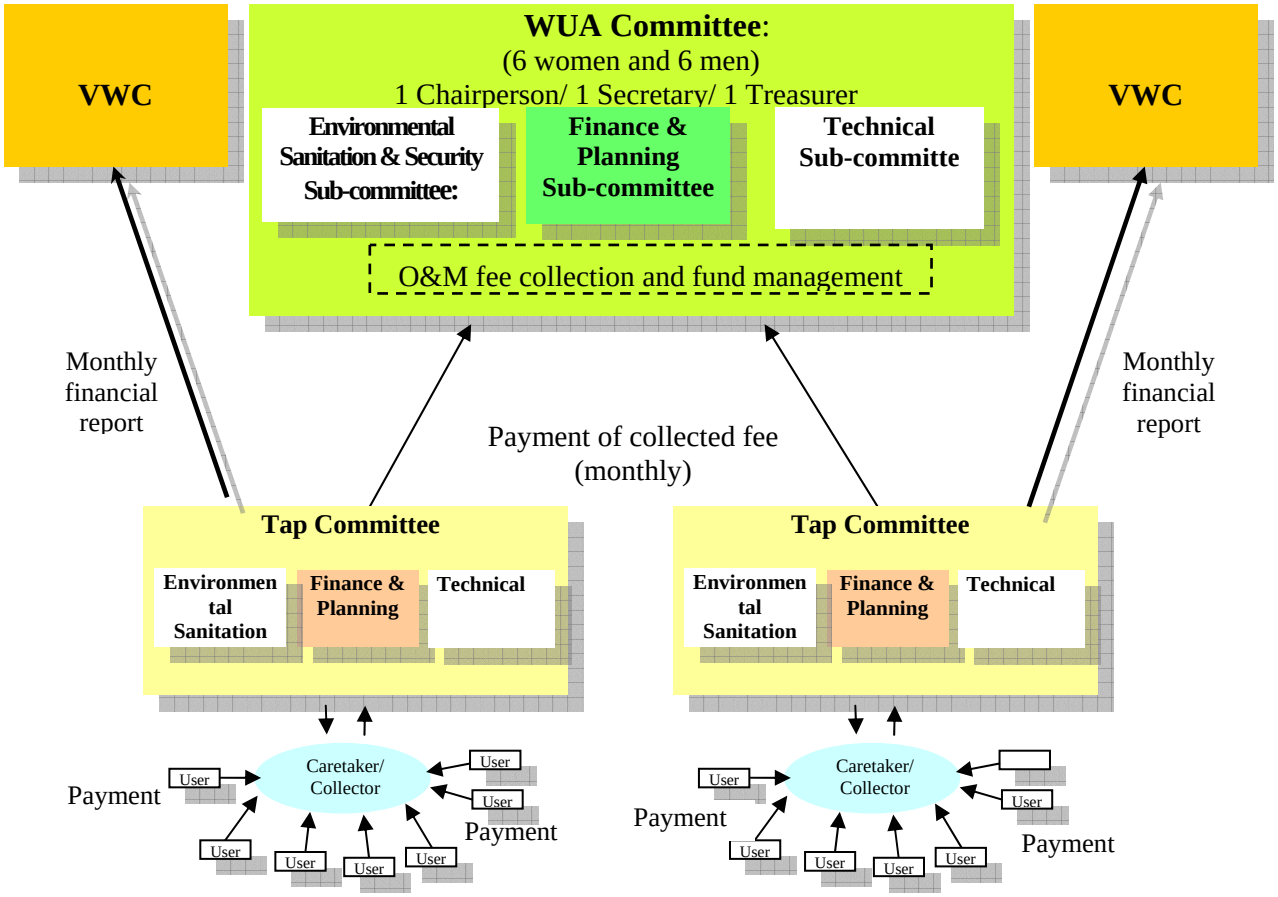


Figure 9.2-1: Suggested Structure of Water Fee Collection for O&M of Piped Scheme Facility (Multiple Villages)

For the piped scheme facilities, in the case of payment per bucket, water users will pay the water fee to the water fee collector of the tap committee at the domestic point, and the treasurer of the WUA will manage the water fees and make monthly reports to the relevant VWC on the WUA's status. In the case of flat rate such as monthly, semi-annual and annual payments, water fees will be collected by treasurers of respective tap committees, and the treasurer of the WUA will manage the water fees and make reports to the relevant VWC on the WUA's status.

The collector, the treasurer of the Tap Committee and the treasurer of Finance & Planning Sub-committee of the WUA shall issue receipts for all payments, and also records of the water fee collection shall be kept in order to secure transparency of the flow of collected money. The following figure suggests the structure of collecting water fee for hand pump.

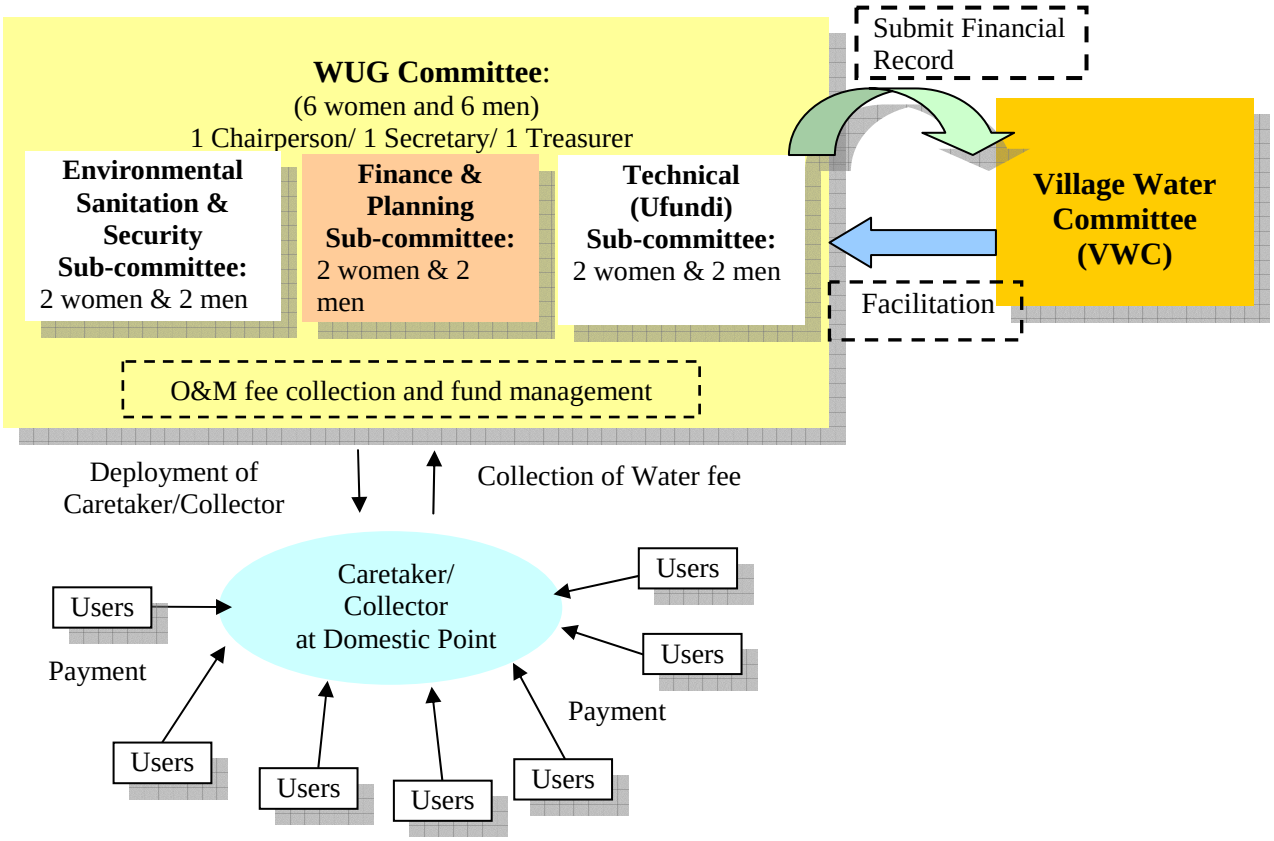


Figure 9.2-2: Suggested Structure of Water Fee Collection for O&M of Hand Pump Facility

In the case of the hand pump facility (Figure 9.2-2), users pay the water fee to the collector who is deployed by the Water User Group (WUG) or the treasurer of the WUG, and the WUG treasurer shall report to the VWC monthly concerning the WUG's financial status. As evidence of payment by the users, receipts shall be issued and recorded by the WUG treasurer.

9.2.3 Method of Repairing Facilities

a. Current Practices for Repairing Facilities

Major repairs for communal water supply facilities, regardless of the type of technology or type of water supply facility, are currently assisted by the Water Technician of the district water engineer office in response to a request from the community[1]. On the other hand, minor repairs are supposed to be taken care of by the users themselves. To do so, in villages where the HESAWA Programme had intervened, four members in the 'technical' sub-committee of the respective Water User Group (WUG) Committee were trained for three days for repairing and up-keeping their water supply facilities. A tool kit for the work was distributed to ensure the sustainability of the water installations (refer to Section 7.3 in the Supporting Report).

[1] For the service of Water Technicians of the District Water Department, community is not requested to pay, but costs of spare parts need to be covered by community in principle, and in general, community prepares food for the Technician.

b. Technical training for Technical (Ufundi) VWC, WUG, and WUA

At first, along with other two types of sub-committees (Finance & Planning and Environmental Sanitation & Security), the Ufundi system shall be strengthened in communities for both boreholes with hand pumps and piped scheme systems as depicted in Figure 9.2-3. Then, members of the Ufundi sub-committee (two men and two women) shall be trained for three days (See Table 9.3-5 in the later section). In case any member of Technical sub-committee moves out the village or can not continue supporting water facility, the chairperson of WUG/ Tap Committee shall appoint the relevant person to substitute for him/her.

Four members in the sub-committee shall be trained for the minor repair and daily maintenance of water supply facilities. Technicians of the district water department shall be facilitated for the 3-day training for the Technical (Ufundi) Sub-committee members. In order to make the technical training effective and efficient, training shall be implemented at the ward level by gathering all Technical (Ufundi) Sub-committees in the same village jointly.

c. Technical manuals

Technical manuals shall also be made for water supply facility repair and technical maintenance, in particular for piped schemes. In the manuals, clear instructions shall be provided explaining what to do and what not to do for maintenance. For example, it may have a reverse effect if the Technical sub-Committee does not recognize the magnitude of maintenance problems, and it leads to significant damage to water facility. It is indispensable to prepare a detailed manual for technical maintenance which can be understood by community members.

The estimated training cost for technical maintenance for 45 villages shall be approximately Tsh 25,456,000 (=USD 21,555) based on the following assumptions.

- One water technician, one community development officer, and one driver shall form one team for implementing technical training in the respective village. The allowance for the district officers is @Tsh 25,000/day on average.
- Forty-five villages shall be visited respectively for three days (piped scheme training can be done jointly per scheme)
- Fuel per vehicle is Tsh 70,000/day on average.
- There are 289 hand pump facilities (158 deep boreholes and 131 medium boreholes in 35 villages) and 8 piped schemes (10 villages) in the priority project.

9.2.4 Method of Spare Parts Delivery and Procurement System

The spare parts delivery and procurement system are fundamental and shall have a direct and vital impact on the sustainability of the water supply facilities. The results of surveys identified several issues such as limited access to spare parts, the slow movement of stock (less profitable), a shortage of funds to purchase spare parts, and leadership problems of key members trained by HESAWA.

a. Spare Parts Centre in Each District

It is recommended to establish a ‘Spare Parts Centre for O&M’ by using the O&M funds collected from the WUGs in each district, which shall be operated by the joint funds contributed by communities. The funds shall be collected from WUGs (hand pumps)/WUAs (piped schemes) to DWEOs as shown in Figure 9.2-3. In fact, in the case of the existing spare parts shop in Kwimba district (see Chapter 7.8 of the Supporting Report), the running cost is

not much since an available container has been used for the space, and water technicians take care of the spare parts shop as part of their routine work. The initial cost to procure the spare parts will be covered by the mutual fund collected from the VWCs for purchasing fast moving spare parts.

a.1 Joint funds for Spare parts Centre

It is suggested that about 5% of the collected water funds shall be saved and contributed to the fund to establish the spare parts centre. The spare parts centre shall in fact be started by using the empty container which is readily available in the district water department; therefore, the initial cost for establishment is only for the spare parts.

a.2 Tax Waivers on Spare Parts

For private businesses, it is recommended to prepare tax waivers for carrying spare parts in their stores. This measure supported by the RWST is strongly anticipated. With a tax exemption for parts, small private business persons such as the owners of bicycle shops and hardware shops in rural areas are encouraged to keep stocks of fast moving spare parts. As the water facilities increase in each district, the more the needs will arise; therefore this measure for tax exemption shall be implemented at an earlier arrangement to facilitate the accessibility to the spare parts of the rural population.

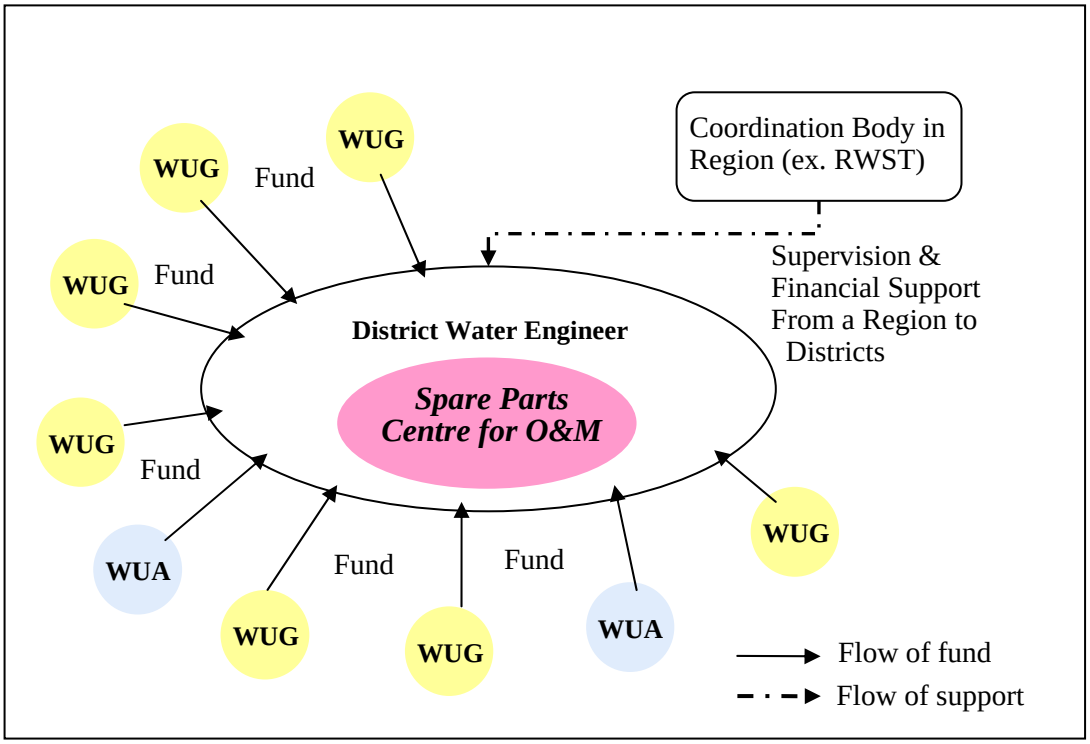


Figure 9.2-3: Recommendation of Spare Parts Centre for O&M

b. Delivery System of Spare Parts Using EMS/ Private Transport Company

It would be possible for villagers to place an order for spare parts by phone or letter to the DWEO (district spare parts centre), and the items can be sent to them by the DWEO. A private bus company such as Mohamed Trans which widely covers Mwanza and Mara regions can be used for a delivery option. Advance payment should be made by cheque since it is safer to post. All the WUGs are supposed to open bank accounts; therefore, payment by cheque would be possible for them.

c. Mobile Spare Parts "One-stop-shop"

When regular maintenance is conducted by the water technicians in each village after facility construction, the relevant spare parts should be brought to the village and sold upon their request. In this case, the water department must have a facility list and update it quarterly according to the quarterly report which shall be submitted by the WUGs. Inventory management and monitoring activities are essential in line with the regular maintenance. This can be done as an exemplar of spare parts procurement for the 428 villages.

9.3 Community Awareness Plan

9.3.1 Current Sanitary/Hygiene Practices and Sense of Ownership

It is observed that low awareness of the importance of safe water and hygiene/sanitary practices shall affect water fee collection directly. Also, both the limited capacity for O&M of the water facility and little sense of ownership for the facility in the community shall reduce motivation for management of the water supply facility by the community. It is anticipated that awareness-raising on safe water and hygiene practices shall be the leading factor for the success of community based water facility management and sustainability of the success.

9.3.2 Objectives of Community Awareness Plan

Following the aforementioned, the community awareness plan is divided into two components as follows 'Capacity Development for Water Supply Facility Management' and Awareness Raising on Use of Safe Water and Sanitary/Hygiene Practices'.

The objectives shall be achieved through implementation of the Community Awareness Plan with the two components emphasized above as shown below.

Table 9.3-1: Objectives of Community Awareness Plan

Components		Objectives
1	Capacity Development for Water Supply Facility Management	• To strengthen O&M capacity at district and community levels • To strengthen a sense of ownership by community for water supply facility • To operate and maintain water supply facility appropriately • To increase villagers' access to safe water is increased.
2	Awareness Raising on Use of Safe Water and Sanitary/Hygiene Practices	• To raise awareness on importance and benefit of using safe water at community • To increase use of safe water from water supply facility • To collect water fee as designed and planned • To improve hygiene and sanitary practices among villagers • To decrease in water-borne diseases • To improve health standard among villagers

9.3.3 Outputs of Community Awareness Plan

The direct outputs to be produced through implementation of the Community Awareness Plan are summarized in the following table.

Table 9.3-2: Direct Outputs to Be Achieved

Components	Outputs
Capacity Development for Water Supply Facility Management	• VWC, WUA and WUG, are organized and activated • Their articles and by- laws are defined • Demarcation of roles/tasks among all the stakeholders are identified and fulfilled (VWC, WUG, WUA, DWST, RWST) • Daily check-up, maintenance and repair of water supply facility shall be implemented in appropriate manner • Fee collection, financial record keeping and cash management shall be implemented by Water Committees in an appropriate and timely manner • Procurement of necessary fuels and spare parts shall be implemented in an appropriate and timely manner
Awareness Raising on Use of Safe Water and Sanitary/ Hygiene Practices	• Use of safe water among villagers is increased, so the number of villagers using unprotected water is decreased. • User of water supply facility is increased. • Water fee is collected as planned. • Knowledge of hygiene/sanitation is increased among villagers.

The above outputs seriously depend on the strong and continuous commitment by the DWST to carry out monitoring activities regularly so that the villages get used to the new activities.

9.3.4 Manuals for Community Awareness

a. Existing Manuals for Community Awareness

In Tanzania and the Study area, there are various manuals and guidelines related to capacity development and community empowerment for rural water supply and sanitation/hygiene, as shown in the table below.

Table 9.3-3: Existing Manuals on Capacity Development and Community Empowerment for Rural Water Supply by NRWSSP, HESAWA and Environmental Sanitation

Related area	Title	year
NRWSSP related	Project Operational Manual	2001
	District Operational Manual (DOP)	2002
	Trainer's Guide for DWST (District Water Sanitation Team) Training	2002
	Trainer's Guide for Training Facilitators	2002
	Facilitators Manual	2002
	Guidelines for Facilitating Communities in Establishing Water User Entities	2006
HESAWA Related	A Guide to Village HESAWA Committee (in Swahili)	1998
	A Guide for the Users of A Water Well (in Swahili)	1998
	A Guide to Participatory Monitoring of Water Sources at User Group and Village Level in Ensuring Sustainability of the Water Sources	2001
Environmental Sanitation related	PHAST Training Guideline	2003

Source: Information collected and compiled by the JICA Study Team.
Note: The list shows what identified by the JICA Study Team relating to rural water supply and does not include all the manuals issued in Tanzania and the regions.

As seen in the list, most of the important issues are in fact already covered by them. However, most of the existing manuals are rather long, and are not convenient to use as a reference according to every practice. There is therefore room to re-consider ways to encourage villagers to use the manuals in a more practical and effective way. For example, the following points are missing in the existing manuals, and these points need to be covered for considering the new manual:

1) An explanation on support from the District Water Engineer Office and contacts to the department
2) Drawings on step-by-step planning and implementation procedures, formats on accounting, meeting records and check lists
3) Emphasis on planning
4) Information on the procurement of spare parts and repair issues
5) List of Contacts of water technicians and spare parts shops

b. Needs of New Manuals for Capacity Building and Training of Priority Project

For community mobilization and technical capacity building of VWC and WUG, there are the existing guidelines and manuals as listed in Table 9.3-3. Based on the existing manuals, revised manuals shall be prepared for the respective training needs as shown in Table 9.3-7. It is necessary to create a new manual for mobilizing the community and sustaining the piped scheme facilities as there is no manual for the technical maintenance of piped scheme water facilities. In January 2006, 'Guidelines for Facilitating Communities in Establishing Water User Entities' was introduced, however it has not been widely known in either Mwanza or Mara regions. It shall also be followed up during the manual preparation.

The necessary procedures and periods for making and revising the manual are presented in Table 9.3-4. It shall take about one month to formulate the manual, from the review of the existing literature to the distribution of it. In the Study area, there are personnel who have participated in making manuals and training for the HESAWA projects. It is therefore encouraged to employ the expertise of these experienced personnel in order to maximize the synergies of the water supply project experiences and to make the preparation process for manual making and the training more efficient.

Table 9.3-4: Necessary Procedures and Terms for the Manual Preparation

Procedures	Necessary Days	
	Revision of the Existing Manual (Hand Pump)	New Manual (Piped Scheme)
1. Planning Workshop (1) Review of the existing manuals/literatures (2) Discussion of contents of new manual	3 days	3 days
2. Making draft manual (1) Description (2) Graphic (3) Typing	7 days	10 days
3. Pre-test of draft final manual (1) Pre-test (2) Revision & finalization	3 days	3 days
4. Mass production: printing and binding	5 days	5 days
5. Distribution of the manual	5 days	5 days
Total Days Required	**23 days**	**26 days**

9.3.5 Capacity Development at Community Level

The following activities and training are discussed in line with the capacity development for managing water facilities and awareness-raising on the use of safe water.

a. Capacity Development for Water Supply Facility Management

- Instruction and establishment of O&M methods and system for villagers: key members of VWC, WUA and WUG.
- The benefit of the new water supply facility shall be informed to and acknowledged by the villagers through organizing guidance and training activities.
- Awareness raising of the importance of the O&M activities for water supply facility management in order to sustain the benefit of the water supply facility

b. Awareness Raising on Use of Safe Water and Sanitary/Hygiene Practices

Once the awareness is raised and the benefit of the water supply facility is acknowledged among the villagers, it is anticipated that the villagers will see the importance of managing the water supply facility through appropriate O&M. For example, the major activities of this component are:

- Delivery of information and training on the benefit of safe water, appropriate water use and hygiene/sanitary practices
- The benefit of the new water supply facility shall be acknowledged by villagers through organizing training.
- Awareness raising of the importance of the O&M activities for water supply facility management in order to sustain the benefits of the water supply facility, use of safe water and hygiene/sanitary practices

The detailed activities/procedures and persons in charge for these activities are summarized by type of community based water supply facility management group in Table 9.3-5 and Table 9.3-6.

Table 9.3-5: Steps and Persons in Charge for the VWC Establishment and Revitalization

Steps	VWC		
	Group Mobilization/Training Steps	Persons in Charge	
		Village	District Administration
1	Information delivery and consultation to village leaders	VC and VEO	DCDO and WT
2	Holding of the Village Assembly	VC and VEO	DCDO and WT
3	Selection of VWC leaders	Village assembly	DCDO and WT
4	1) Management training (Community mobilization and finance)	VWC leaders (Chairperson, Secretary and Treasurer)	DCDO and WT
	2) PHAST training (Health/sanitary Improvement)	VWC leaders (Chairperson, Secretary and Treasurer), VC, VEO and VHO	DCDO, WT and DHO
5	Making by-laws of the VWC	VWC leaders (Chairperson, Secretary and Treasurer)	DCDO and WT
6	Collection of the VWC fund	VWC Secretary, Treasure and Sub-village leaders chairpersons	DCDO and WT
7	Opening of the bank account of the VWC	VWC leaders (Chairperson, Secretary and Treasurer)	DCDO and WT
8	Registration of the VWC to District Water Department	VWC leaders (Chairperson, Secretary and Treasurer)	District Water Department
9	Quarterly reporting (facility status, repair records, financial record) to District Water Department	VWC leaders (Chairperson)	DCDO and WT
10	Sanitary/hygiene promotion	VWC leaders (Chairperson, Secretary and Treasurer), VC and VEO	DCDO, WT and DHO
11	(For piped scheme) Establishment of WUA	VWC leaders (Chairperson, Secretary and Treasurer)	DCDO and WT

VC: Village Chairperson VEO: Village Exective Officer DCDO: District Community Development Officer WT: Water Technician
DHO: District Health Officer

Before starting construction, information delivery and a consultation meeting shall be organized with village leaders. In particular, if there was no pre-existing water committee, the formation of the VWC (Village Water Committee) as the focal institution at the village level shall be the first step. On the other hand, if the VWC is already formed, 1) revitalization of activities, 2) re-selection of key members, and 3) review of articles and by-laws of the VWC shall be priority agenda as urgent activities of this component.

Through these processes, linkages between water related administration officers and staff of the district (i.e., DWE, Water Technician, Community Development Officer and Health Officer) shall be strengthened.

Table 9.3-6: Steps and Person in Charge for the WUG/WUA Establishment and Revitalization

Steps	WUG/WUA		
	Group Mobilization/Training Steps	Persons in Charge	
		Village	District Administration
1	Information delivery and consultation to village leaders	VC and VEO	DCDO and WT
2	Holding of the WUG/WUA Assembly Meeting	VC and VEO	DCDO and WT
3	Selection of WUG/WUA leaders	Water Users	DCDO and WT
4	1) Management training (Community mobilization and finance)	WUG/WUA leaders (Chairperson, Secretary and Treasurer), VWC leaders	DCDO and WT
	2) Technical Repair & Maintenance training	ditto	DCDO and WT
	3) PHAST training (Environmental Health)	ditto	DCDO, WT and DHO
5	Making by-laws of the WUG/WUA	ditto	DCDO and WT
6	Collection of the WUG/WUA fund	ditto	DCDO and WT
7	Opening of the bank account of the WUG/WUA	ditto	DCDO and WT
8	Registration of the WUG/WUA to District Water Department	ditto	District Water Department
9	Quarterly reporting (facility status, repair records, financial record) on to District Water Department	ditto	DCDO and WT
10	Monitoring of WUG/WUA in the village	ditto	DCDO and WT
11	Application for legal entity of the WUG/WUA to Basin Water Office	ditto	District Water Department

VC: Village Chairperson VEO: Village Exective Officer DCDO: District Community Development Officer WT: Water Technician
DHO: District Health Officer

For the piped scheme facility, the WUA shall be set up beyond the village boundary. For the hand pump facility, the VWC shall be re-organized first as a focal organization at the village level, and then WUGs shall be organized at respective water points. After the institutional set-up is done, training shall be provided to each community based organization in order to re-educate them on the following issues: 1) management, 2) technical repair and maintenance and 3) PHAST, as presented later in suggested contents of the training.

In order to organize and facilitate the training to villagers, water technicians and community development officers shall be re-trained on technical and management skills, the PHAST (Participation Hygiene and Sanitation Transformation) method, gender concepts and skills for mobilization as presented in suggested details in Section 8.3.3 of Chapter 8.

9.3.6 Suggested Training

Repeatedly the two components are necessary for the training for villagers and the target of the training, required days, training content and the responsible bodies for implementation of this training are presented in Table 9.3-7. In particular, if there was no pre-existing water committee, formation of the water committee shall be the starting point. On the other hand, if

the village water committee is already formed, 1) revitalization of activities, setting articles and by-laws of the water committee, 2) review of the water fee system, 3) means for effective use of water and 4)hygiene and sanitation education shall be the main agenda for activities of this component. Through these activities, a system for the O&M shall be constructed with good linkage among the district administration, ward and water committee.

There are three categories of training as shown in Table 9.3-7.

a. Management Training

For training on management, different levels and types of community based organizations shall be trained separately using different educational manuals (stated later). There are two parts of training: one is for the village assembly to provide general guidance for half a day and the other is more detailed training on skills for community mobilization and financial management for three days. Similarly, general assembly members (all adult users) and key members of WUGs for hand pump facilities and WUAs for piped scheme facilities (12 each) shall be trained. The training shall be organized by the District Water Department but facilitated by the Community Development Officer.

Table 9.3-7: Needs for Training and Target of the Training at Village Level

Types of Training		Target	Required Duration	Training Content	Responsible Bodies forCapacity Development/Training	
Management	1) VWC	a Village Assembly	0.5 Day	● General guidance	DWST	
		b VWC members	2 Days	● Community Mobilization intra-village □ Finance		
	2) WUG for hand pump	a WUG Assembly	0.5 Day	● General guidance		●･･･ Community Development Dep. □･･･ Water Dep.
		b WUG Committee (12)	3 Days	● Community Mobilization □ Finance		
	3) WUA for piped scheme	a WUA Assembly	0.5 Day	● General guidance		
		b WUA Committee (12)	3 Days	● Community Mobilization intra-village & inter-villages □ Finance		
Technical Repair & Maintenance	1) Boreholes with Hand Pump	a WUG Committee(All)+VWC	1 Day	□ General technical guidance □ O&M of borehole with hand pump		□･･･ Water Dep.
		b WUG Committee (Technical sub-committee)(4)	3 Days			
	2) WUA for Piped Scheme	a WUA Committee(All)+VWC	1 Day	□ General technical guidance □ O&M of piped scheme		
		b WUA Committee (Technical sub-committee)(4)	3 Days			
PHAST	1) Environmental Health	a Village Assembly	0.5 Day	● General guidance		◎･･･ Health Dep. ●･･･ Community Development Dep. □･･･ Water Dep.
		b VWC, Village Government, WUG and WUA committee (9+12)	3 Days	◎ ● PHAST workshop □		

b. Training for Technical Repair & Maintenance

Regarding the technical aspect, there are two types of water supply facility technologies: one is the borehole and the other the piped scheme. Irrespective of the technology type, general technical guidance shall be given to all WUG and WUA committee members (12 each) and VWC members (9-15 members depending on number of sub-villages) for one day. More

detailed technical training in skills for repair and daily maintenance shall be provided to technical sub-committee members of WUG and WUA (4 members each) for three days. This component of training shall primarily be facilitated by water technicians with assistance from the community development officer. As stated previously, the respective village shall be visited every quarter by the water technician and community development officer in order to supervise the technical maintenance activities as well as to monitor the financial management status of the WUG and WUA.

c. PHAST Training

The last category of training is PHAST for the improvement of environmental health. The PHAST approach intends to change villagers' behavior regarding the use of water and health/hygiene practices for better standard of health. In the Study area, the use of unprotected water is very common in the rainy season because the unsafe water is available nearby and free of charge. Thus, low awareness on sanitary practices and hygiene is observed and this shall be a possible risk for the sustainability of water supply facilities in terms of fee collection and community participation.

In order to promote the use of safe water through water supply facilities, the dissemination of PHAST at the village level is critical as a part of the capacity building training before the construction of the water facility is completed. For the village assembly (all adult villagers), half day guidance shall be provided. Furthermore, a three-day PHAST training workshop shall be held for key members of VWC, village government, WUG and WUA committees together at the respective village. The community development officers and water technicians shall be the organizers and facilitators of the training in coordination with the health officers.

9.3.7 Role of Responsible Bodies for Community Awareness Plan

The District Water and Sanitation Team (DWST) holds the key to implementing the community awareness plan in the villages successfully. It shall be a primary responsible and supervising body to plan and carry out the capacity building including the implementation of actual training and to monitor the progress of the activities, and is composed of interdisciplinary sector representatives under the leadership of the District Executive Director (DED). A series of capacity building plans for organization improvement at district level are proposed in Section 8.3.3 of Chapter 8.

As shown in Table 9.3-5, under the DWST, the district community development officers (CDOs) shall be the main implementing agents and facilitators of the 'community mobilization' activities in coordination with the District Water Department. For the 'technical repair and maintenance training', water technicians of the water department shall be the primary organizers and facilitators of the training. For the PHAST training as sanitary/hygiene education, district health officers (DHOs) shall be the planning agents while actual implementation and facilitation need to be carried out by both the water department and community development department (see Section 9.3.2).

Table 9.3-8: Roles and Responsible Bodies for Activities and Training of the Community Awareness Plan

Roles	Responsible Bodies	
	Primary	Secondary
Overall Supervision	DWST (DED, DWE, DPLO)	DWE, DCDO
Manual Formulation	DWST (DED, DWE, DPLO)	Water Dep. and Community Development Dep.
Community Mobilization	Community Development Dep.	Water Dep.
Organization Management Training	Community Development Dep.	Community Development Dep.
Technical Training	Water Dep.	Community Development Dep.
Health/ PHAST	Health Dep.	Water Dep. and Community Development Dep.

Extension workers and the HESAWA trained workers/volunteers shall be used for capacity building and the monitoring activities after the training is implemented. Both the community development department and health department deploy the stationed extension workers (community development assistants and health officers) at the ward level, and the HESAWA projects also deployed and trained the field workers at both the ward and village levels (called village health volunteers). Some HESAWA field workers are still active and relevant to monitor the daily activities at the community level, particularly in Mwanza region.

9.3.8 Community Awareness Plan: Organization, Term, Injection and Budget

The organization and responsible bodies for carrying out respective activities and training in the Community Awareness Plan are presented prior in Table 9.3-8. Details of the term, necessary injection and budget for the Community Awareness Plan are presented as follows.

According to the current estimates, the total required budget for capacity building for sustaining water supply facility management at the community levels is Tsh 218,184,000 (=USD 184,745) for one year as shown in Table 9.3-9.

a. Required Term/duration for Activities and Training of the Community Awareness Plan

The ‘required terms/duration to complete one cycle of activities’ and ‘training for the two components of the Community Awareness Plan’ are described in Table 9.3-10. For formulation of the manual, as explained prior in Section 9.3.3, it shall take about one month. For the establishment and revitalization of VWC activities, one cycle of mobilization needs about 1.5 months while a series of guidance for mobilization and activation of WUG/WUA shall also take 1.5 months plus another three months for proceeding with application for legal entity. The process to be taken for water user entities is available in ‘Guidelines for Facilitating Communities in Establishing Water User Entities’ in NRWSSP (2006).

Training activities for VWC and WUG/WUA include:

- Information delivery and consultation to village leaders
- Holding of the village assembly
- Selection of leaders of VWC and WUG/WUA (WUA is for piped scheme)
- Managerial training to the VWC and WUG/WUA members (community mobilization and finance)

- PHAST training for health and sanitary education
- Making by-laws
- Collection of fund for each WUG
- Opening of bank account of each WUG
- Registration of the VWC and WUG to the District Water Department
- Quarterly reporting (facility status, repair records, financial record etc) to the District Water Department through the VWC and WUA
- Application for legal entity of the WUG/WUA to the Basin Water Office

It is recommended to implement the community awareness plan after the type of water facility is fixed in each village since the timing of training is important in terms of sustainability and the reality of the set of trainings.

Table 9.3-9: Summary of Training Needs and Budget related to Community Awareness Plan at Community Level

Types of Training		Target	Required Duration	Injection	Breakdown	Tsh	Budget for Priority Villages	Total (Tsh)
Management	1) VWC	a Village Assembly	0.5 Day	① Allowance :WT and CDO	25,000 Tsh/day x 2 p x 3 day =	150,000	①+②+③+④+⑤= 516,000	
				② Allowance: Driver	20,000 Tsh/day x 1 p x 3 day =	60,000		
		b VWC members (12)	2 Days	③ Allowance: Participants	2,000 Tsh/day x 12 p x 3 day =	72,000	516,000 x **45 Villages**=	23,220,000
				④ Manuals/guides	2,000 Tsh/ person x 12 p x 1 set =	24,000		
				⑤ Transportation	70,000 Tsh/day x 3 day =	210,000		
	2) WUG for Hand Pump	a WUG Assembly	0.5 Day	① Allowance :WT and CDO	25,000 Tsh/day x 2 p x 4 day =	200,000		
				② Allowance: Driver	20,000 Tsh/day x 1 p x 4 day =	80,000	①+②+③+④+⑤= 656,000	
		b WUG Committee (12)	3 Days	③ Allowance: Participants	2,000 Tsh/day x 12 p x 3 day =	72,000	656,000 x **35 Villages**=	22,960,000
				④ Manuals/guides	2,000 Tsh/ person x 12 p x 1 set =	24,000		
				⑤ Transportation	70,000 Tsh/day x 4 day =	280,000		
	3) WUA for Piped Scheme	a WUA Assembly	0.5 Day	① Allowance :WT and CDO	25,000 Tsh/day x 2 p x 4 day =	200,000		
				② Allowance: Driver	20,000 Tsh/day x 1 p x 4 day =	80,000	①+②+③+④+⑤= 656,000	
		b WUA Committee (12)	3 Days	③ Allowance: Participants	2,000 Tsh/day x 12 p x 3 day =	72,000	656,000 x **8 Schemes**=	5,248,000
				④ Manuals/guides	2,000 Tsh/ person x 12 p x 1 set =	24,000		
				⑤ Transportation	70,000 Tsh/day x 4 day =	280,000		
Technical Repair & Maintenance	1) WUG for Hand Pump	a WUG Committee (all) +VWC	1 Day	① Allowance :WT and CDO	25,000 Tsh/day x 2 p x 4 day =	200,000		
				② Allowance: Driver	20,000 Tsh/day x 1 p x 4 day =	80,000	①+②+③+④+⑤= 592,000	
		b WUG Committee (Technical sub-committee)(4)	3 Days	③ Allowance: Participants	2,000 Tsh/day x 4 p x 3 day =	24,000	592,000 x **35 Villages**=	20,720,000
				④ Manuals/guides	2,000 Tsh/ person x 4 p x 1 set =	8,000		
				⑤ Transportation	70,000 Tsh/day x 4 day =	280,000		
	2) WUA for Piped Scheme	a WUA Committee(All)+VWC	1 Day	① Allowance :WT and CDO	25,000 Tsh/day x 2 p x 4 day =	200,000		
				② Allowance: Driver	20,000 Tsh/day x 1 p x 4 day =	80,000	①+②+③+④+⑤= 592,000	
		b WUA Committee (Technical sub-committee)(4)	3 Days	③ Allowance: Participants	2,000 Tsh/day x 4 p x 3 day =	24,000	656,000 x **8 Schemes**=	4,736,000
				④ Manuals/guides	2,000 Tsh/ person x 4 p x 1 set =	8,000		
				⑤ Transportation	70,000 Tsh/day x 4 day =	280,000		
PHAST	1) Environmental Health and sanitary practices	a Village Assembly	0.5 Day	① Allowance: WT, CDO, DHO	25,000 Tsh/day x 3 p x 4 day =	300,000		
		b VWC, WUG Committee (Environmental sanitation/ security sub-committee) (15)	3 Days	② Allowance: Facilitators	25,000 Tsh/day x 2 p x 4 day x 4 session =	800,000	①+②+③+④+⑤= 3,140,000	
				③ Latrine construction materials (Cement, Weldmesh, Vent pipe)	220,000 Tsh/ latrine x 6 unit =	1,320,000	3,140,000 x **45 Villages**=	141,300,000
		c Community Owned Resource Persons (CORPS) (10)		④ PHAST tools	15,000 Tsh/day x 25 p =	375,000		
				⑤ Stationaries	1,000 Tsh/day x 25 p =	25,000		
				⑥ Transportation	80,000 Tsh/day x 4 day =	320,000		
							Total (Tsh)	**218,184,000**

Table 9.3-10: Required Term for activities and Training for Community Awareness Plan at Community Level

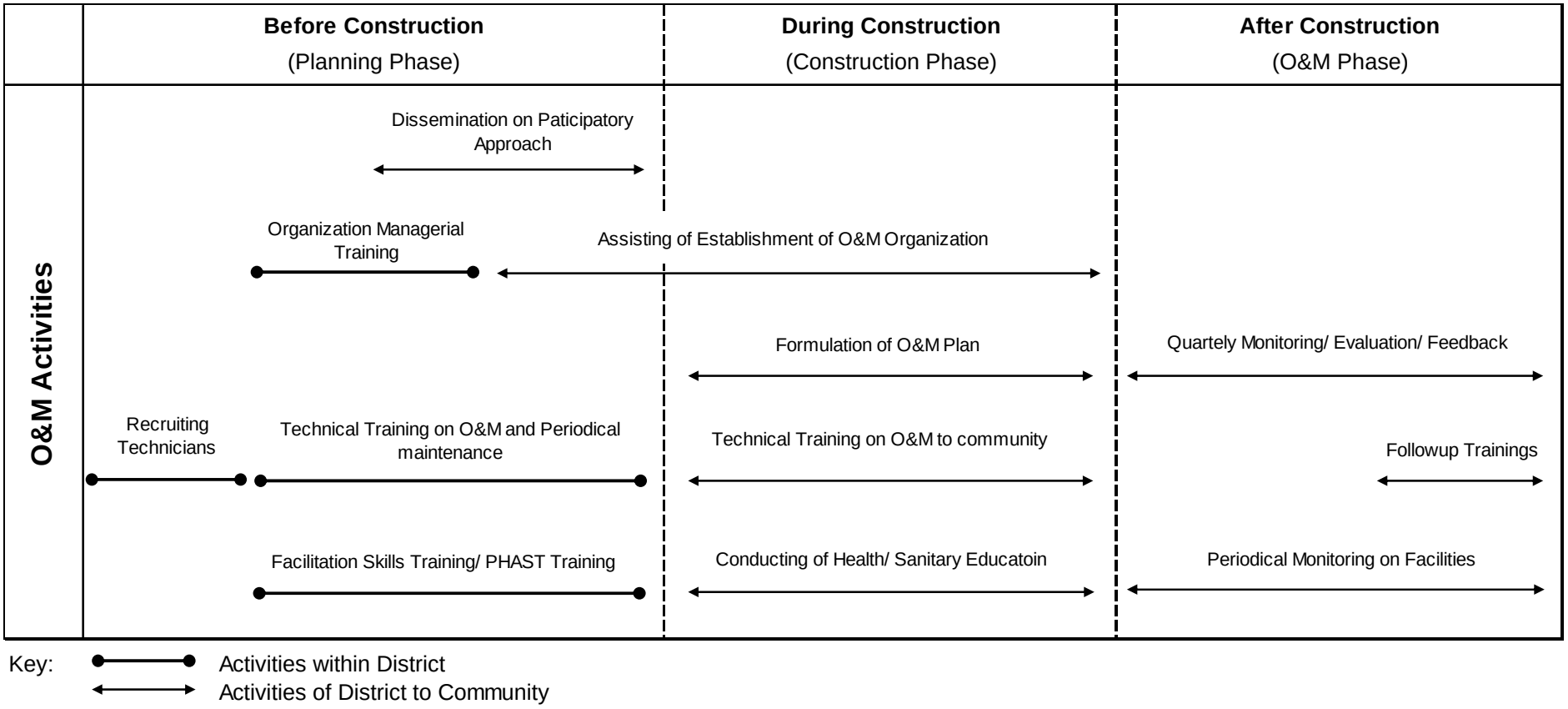
	Mobilization and Training Activities	Days/Terms Required	Required Terms for a cycle of activities
Prep	Preparation of manual for Trainings	1 month	1 month
VWC	Information delivery and consultation to village leaders	1 days	44 days + Quarterly Monitoring
	Holding of the Village Assembly	0.5 day	
	Selection of VWC leaders	0.5 day	
	Training to the VWC members and Assembly		
	1) Management (Community mobilization and finance)	2.5 days	
	2) PHAST (Health/sanitary Improvement)	3.5 days	
	Making by-laws of the VWC	1 day	
	Collection of the VWC fund	15 days	
	Opening of the bank account of the VWC	10 days	
	Registration of the VWC to District Water Department	10 days	
	Quarterly reporting (facility status, repair records, financial record) to District Water Department	Every 3 months	
	Monitoring of Sanitary/hygiene promotion	Every 3 months	
WUG/ WUA	Information delivery and consultation to village leaders	1 days	44 days + Quarterly Monitoring + 3 months legal entity process
	Holding of the WUG/WUA Assembly Meeting	0.5 day	
	Selection of WUG/WUA leaders	0.5 day	
	Training to the WUG/WUA members and Assembly		
	1) Management (Community mobilization and finance)	3.5 days	
	Making by-laws of the WUG/WUA	1 days	
	Collection of the WUG/WUA fund	15 days	
	2) Technical Repair & Maintenance	4 days	
	3) PHAST (Health/sanitary Improvement)	3.5 days	
	Opening of the bank account of the WUG/WUA	10 days	
	Registration of the WUG/WUA to District Water Department	5 days	
	Quarterly reporting (facility status, repair records, financial record) on to District Water Department	Every 3 months	
	Monitoring of WUG/WUA in the village	Every 3 months	
	Application for legal entity of the WUG/WUA to Basin Water Office	3 months	

Other types of capacity building for water technicians and CDOs on the facilitation of community mobilization and the increase in technical skills are suggested in Section 8.3.3.

b. Timing of Training, Monitoring, Follow up and Evaluation

The timing of a series of trainings is summarized in the following table according to the O&M activities plan of the district water department under the DWST. Emphasis should be placed on the significance of the activities of monitoring how VWC and WUG, Tap committee, and WUA are functioning after the facility construction. Initial follow-up and quick supports by the district to the beneficiaries shall be fundamental and essential. It shall then be necessary to discuss and analyze the impacts of the activities through quarterly reports and periodical maintenance of the facilities, and to evaluate the effectiveness of the trainings in order to reflect the result to the next year's activities.

Table 9.3-11: Summary of O&M Activities Plan



Chapter 10

Evaluation of Priority Project

10 Evaluation of Priority Project

10.1 General

The priority project is evaluated based on the economical conditions, financial aspects, organization /institutional situations, natural/social conditions, and technical aspects of Tanzania.

10.2 Economic Evaluation

10.2.1 Target Villages and Beneficiaries in the Priority Project

The priority project has been designed to satisfy the basic human needs of the community people in the selected 45 villages located in the Mwanza and Mara regions. The project aims to provide and distribute sufficient and safe water to meet the needs of domestic water users in the target villages by the year 2015. The total population of the target villages will reach 223,493 persons in 2015, of which the number of beneficiaries is estimated at 131,489 persons as presented in the following table.

Table 10.2-1: Number of Beneficiaries and Households in the Priority Project

Region	District	No. of Target Villages	Projected Population (2015)	Population served (2015)	No. of Households (2015)
Mwanza	Misungwi	2	9,961	9,961	1,769
	Sengerema	11	55,535	34,781	6,178
	Kwimba	2	10,180	9,113	1,618
	Magu	1	7,401	3,122	555
	Geita	8	54,878	20,833	3,700
	Ukerewe	2	6,083	6,083	1,080
Mara	Bunda	1	1,295	1,295	230
	Musoma	6	27,423	19,277	3,424
	Tarime	9	37,796	20,760	3,687
	Serengeti	3	12,686	6,286	1,117
Total		45	223,238	131,511	23,358

Note: Number of households is estimated on the basis of average household size recorded in the 2002 population census.

10.2.2 Economic Analysis

a. Basic Assumptions

The economic analysis has been undertaken on the basis of the following assumptions:

(1) The official exchange rate as of May 2006 has been applied:
US$ 1.00 = Tsh 1,181 = 114.58 Yen
(2) Project life has been assumed as 20 years. Economic life of water supply facilities ranges from 10 years for pumps and engines to 30 to 40 years for water intake, storage tank, etc.
(3) Only direct and tangible benefits have been quantified for the calculation of the economic indicators.
(4) Opportunity cost of capital (or discount rate) is assumed to be 10 %.
(5) Transfer payments such as interest and taxes, and price escalation are not included in the calculation.

b. Economic Project Cost

The Economic Project costs are composed of the investment costs and recurrent costs as mentioned below.

b.1 Investment Costs for the Project

The economic investment costs comprise of the costs for the construction of water supply facilities and engineering services. Taxes and price contingency are not included in the economic costs. Conversion factors to convert the financial prices into economic prices have not been applied in this analysis due to lower percentage of local currency portion. The economic project costs thus estimated amount to US$ 17,580,000 (refer to Section 6.4 of Chapter 6).

b.2 Recurrent Costs

Recurrent costs consist of annual operation, maintenance and replacement costs for the equipment and other facilities.

1) Economic life of water supply facilities ranges from 10 years for pumps and engines to 30 to 40 years for water intake, storage tank, etc. Replacement costs for them are included in the annual operation and maintenance costs.
2) The annual operation, maintenance and replacement costs are estimated at about 1.5 % of the investment cost.

c. Economic Benefits

Out of several economic benefits of the Project, only saved time benefits for water fetching and health improvement benefits have been included in the calculation of economic benefits, as other benefits are considered to be difficult to quantify. Saved time benefits for water fetching will arise immediately at the start of the operation of the Project facilities. Health improvement benefits will arise from the second year after commencement of the Project. Annual benefits have been calculated as the total of saved time benefits and health improvement benefits.

c.1 Saved Time Benefits of Water Fetching

Saved time benefits are derived as a result of shorter distance to water sources after implementation of the Project. Saved time is the difference between water fetching time without installation of water supply systems (“without the Project”) and water fetching time with installation of the same (“with the Project”). Water fetching time consists of travel time, queuing time and filling time. Saved time value is measured by multiplying the average saved time by economic labor cost for water fetching. Distance to water source, therefore, is the major factor in determining the saved time benefits. Data on water fetching time are estimated from the results of the interview survey conducted in the selected villages.[1]

Saved time benefits will arise immediately at the start of operation of the Project facilities and will increase year by year, reaching its maximum amount in 2015.

[1] Socio-economic Survey in 2005 and Socio-economic Supplementary Survey in 2006.

Table 10.2-2: Estimated Economic Benefits by Saved Time for Water Fetching

Items	Indicators
(a) Average time spent for water fetching "without the Project"	3.7 hours per day
(b) Average time spent for water fetching "with the Project"	2.1 hours per day
(c) Saved time	1.6 hours per day
(d) Unskilled labor cost at market prices	Tsh 2,000 per day
(e) Economic labor cost	Tsh 1,000 per day
(f) Saved time value in terms of economic labor cost (Tsh 1,000 ÷ 8 hours x 1.6 hours)	Tsh 200 per day
(g) Saved time value per year per household (Tsh 200 x 365 days)	Tsh 73,000 (USD61.80)

Note: (1) Economic labor cost is assumed to be 50 % of unskilled labor cost at market prices.
(2) Some of family members are assumed to fetch water everyday.

c.2 Health Improvement Benefits

Health improvement benefits are derived as a result of an improvement in water quality and increased supply of water. The benefits can be measured by the reduced amount of medical expenses between "with" and "without" installation of improved water supply systems.

Provision of a clean water supply will lead to the reduction in the incidence of water related diseases by about 40%. As a result, the rural population in the target villages will be able to reduce their medical expenses at that ratio. It is estimated that reduction in the medical expenses for water-related diseases including diarrhea, dysentery, typhoid, cholera and other diseases would be 40 % every year in the target communities.

Table 10.2-3: Estimated Health Improvement Benefits

Items	Indicators
Medical expenses under "without the Project" situation	Tsh 106,494
Reduction rate of water-related diseases per year under "with the Project" situation	40 %
Medical expenses under "with the Project" situation	Tsh 63,896
Saved amount of medical expenses per household per year	Tsh 42,596 (USD36.07)

Source: Socio-economic Survey, 2005 and 2006 conducted by JICA Study team

Health improvement benefits will arise from the second year after commencement of the Project and will reach its maximum amount in 2015.

d. Cost and Benefit Analysis

Economic analysis has been conducted on the basis of the annual costs and benefits stream as estimated in the preceding sections. The result of economic analysis of the proposed Project in terms of Economic Internal Rate of Return (EIRR), Net Present Value (NPV) and Benefit Cost Ratio (B/C) is presented below. Cash flow for the calculation of economic indicators is presented in Table 10.2-4.

The results of the economic analysis are as follows:

- EIRR: 10.5 %
- NPV: USD 467,416
- B/C: 1.03

The economic indicators mentioned above signify the economic viability of the Project as the EIRR exceeds the opportunity cost of capital (10%), the NPV is positive and the B/C exceeds 1.0.

Table 10.2-4: Cash Flow for Calculation of Economic Indicators

Unit: USD

Project Year	Incremental Net Benefit			Incremental Costs			Net Cash Flow	Discount Factor at 10%	Present Value at 10%
	Health Improvement	Saved Time	Total	Investment Cost	O & M Cost	Total Cost			
1	0	436,988	436,988	6,377,000	47,828	6,424,828	-5,987,840	0.909	-5,443,491
2	546,641	936,579	1,483,220	6,733,000	146,153	6,879,153	-5,395,933	0.826	-4,459,448
3	842,307	1,443,154	2,285,460	4,470,000	230,175	4,700,175	-2,414,715	0.751	-1,814,211
4	842,307	1,443,154	2,285,460	0	263,700	263,700	2,021,760	0.683	1,380,889
5	842,307	1,443,154	2,285,460	0	263,700	263,700	2,021,760	0.621	1,255,354
6	842,307	1,443,154	2,285,460	0	263,700	263,700	2,021,760	0.564	1,141,231
7	842,307	1,443,154	2,285,460	0	263,700	263,700	2,021,760	0.513	1,037,483
8	842,307	1,443,154	2,285,460	0	263,700	263,700	2,021,760	0.467	943,166
9	842,307	1,443,154	2,285,460	0	263,700	263,700	2,021,760	0.424	857,424
10	842,307	1,443,154	2,285,460	0	263,700	263,700	2,021,760	0.386	779,476
11	842,307	1,443,154	2,285,460	0	263,700	263,700	2,021,760	0.350	708,615
12	842,307	1,443,154	2,285,460	0	263,700	263,700	2,021,760	0.319	644,195
13	842,307	1,443,154	2,285,460	0	263,700	263,700	2,021,760	0.290	585,632
14	842,307	1,443,154	2,285,460	0	263,700	263,700	2,021,760	0.263	532,393
15	842,307	1,443,154	2,285,460	0	263,700	263,700	2,021,760	0.239	483,993
16	842,307	1,443,154	2,285,460	0	263,700	263,700	2,021,760	0.218	439,994
17	842,307	1,443,154	2,285,460	0	263,700	263,700	2,021,760	0.198	399,994
18	842,307	1,443,154	2,285,460	0	263,700	263,700	2,021,760	0.180	363,631
19	842,307	1,443,154	2,285,460	0	263,700	263,700	2,021,760	0.164	330,574
20	842,307	1,443,154	2,285,460	0	263,700	263,700	2,021,760	0.149	300,522
	13,181,240	23,020,871	36,202,111	17,580,000	4,115,955	21,695,955	0.105		467,416

EIRR	10.5 %
NPV	USD 467,416
B/C	1.03

10.3 Financial Aspects

10.3.1 Financial Evaluation

a. Financial Project Costs

The total capital costs of the Project amounts to 17,580,000 U.S. dollars (USD) including engineering services. It is the policy of the Government of Tanzania that the Government shall finance the capital costs of water supply projects under the condition that each local community will be responsible for operation and maintenance costs of the water supply facilities.

b. Financial Analysis

Financial evaluation in terms of Financial Internal Rate of Return (FIRR) has not been applied in this analysis as no financial revenues are generated from the project to cover the whole project cost.

10.3.2 Recovery of Operation, Maintenance and Replacement Cost

One of the most important issues mentioned in the National Water Policy 2002 is the full cost recovery for operation and maintenance by the water users. The beneficiaries in the target

communities are expected to organize their water supply organizations to conduct periodical operation and maintenance works and to collect a water fee for the recovery of the operation and maintenance expenses.

The results of the Socio-economic Survey in 2005 indicated that 41 villages out of the 45 target villages in the Priority Project showed a willingness to pay a water fee of Tsh 10 or more per bucket of 20 liters. The comparison of the expected water fee to be collected from the water users at Tsh 10 per bucket and the amount of operation, maintenance and replacement (OMR) costs required each year has indicated that the former exceeds the latter every year. The computation also indicates that even if the water fee recovery rate is 55 %, the collected water fee will be sufficient to cover the annual OMR costs.

It is concluded that the proposed Project is financially feasible in terms of recovery of OMR costs.

Table 10.3-1: Recovery of Operation, Maintenance and Replacement Costs

Year	No. of households (beneficiaries)	Water demand per year (liter) 1/	Water fee collection with recovery rate of 100 % (USD) 2/	Water fee collection with recovery rate of 55 % (USD)	Annual OMR costs (USD)
2007	7,071	363,263,786	153,764	84,570	47,828
2008	15,155	778,569,181	329,556	181,256	146,153
2009	23,352	1,199,679,810	507,805	279,293	230,175
2010	23,352	1,199,679,810	507,805	279,293	263,700
2011	23,352	1,199,679,810	507,805	279,293	263,700
2012	23,352	1,199,679,810	507,805	279,293	263,700
2013	23,352	1,199,679,810	507,805	279,293	263,700
2014	23,352	1,199,679,810	507,805	279,293	263,700
2015	23,352	1,199,679,810	507,805	279,293	263,700

Note: 1/ about 140 liters per household per day; 2/ water fee at Tsh 500 (USD 0.423) per 1,000 liters

10.4 Organization /Institutional Evaluation

As a result of the survey, the current organizational issues related to community managed operation and maintenance are summarized below.

(1) Inadequate coordination and undefined demarcation between government offices led to weak planning and performance in such areas as budget based planning and activities.
(2) Lack of coordination roles to standardize the water supply activities and human resources deployment among districts deteriorated to keep balanced development of water supply status in the region.
(3) Low priority for monitoring and supervision of community based facility management led to deterioration of water facility.
(4) Shortage of skilled technicians in DWE offices led to ineffective and untimely management of water supply.
(5) Lack or deterioration of VWCs and user groups for facility management led to poor maintenance of water facility.
(6) Poor knowledge of technical maintenance and financial management led to weak sustainability of water facility.

It is suggested in the plan of priority project that the organization/institutional conditions among the region, district and community of village are improved in the Study in order to proceed with the priority project effectively.

For the solution of the above issues, the expected roles of relevant stakeholders in the Study

are suggested as follows.

First of all, the role of coordination body for water and sanitation promotion at the regional level is to establish the Regional Water and Sanitation Team (RWST) within the Regional Secretariats (RS) under the initiative of NRWSSP. It is suggested that a regional coordination body such as RWST should be urgently established and functioned in the Mwanza and Mara regions. In the organization/institutional plan of priority project, it is discussed that such a coordination body is expected 1) to oversee and coordinate rural water supply, sanitation, hygiene promotion within the region, 2) to provide technical advise and quality assurance in strengthening the District Water and Sanitation Team (DWST), 3) to coordinate training programs and lesson plans for the training of DWST personnel, and other related personnel, 4) to maintain and operate the regional level management of information.

The responsibilities of DWST and the role of District Water Engineer (DWE) office are clarified in the organization/institutional plan of priority project. DWST is principally expected to facilitate communities to establish an appropriate management system for water supply, to coordinate water and sanitation activities in the district, to plan training programs for the training of DWST personnel, and to maintain and operate the district management of information. In order to meet the expected responsibilities of the DWST, the DWE office should lead the DWST to coordinate water and sanitation development at community level. The DWE office is expected to lead the coordination of water sanitation development as a focal point in the district, to provide technical support to communities on O&M activities on water and sanitation issues, to facilitate communities to establish appropriate management system for water supply, and to collect and keep baseline data and an inventory of water facilities.

The role of the community in the village is suggested in the organization/institutional plan of the priority project. For instance, the community level has the responsibilities to execute the water and sanitation activities as well as the operation and maintenance of water supply facilities under the community owned water supply organizations such as Village Water Committees (VWCs), Water User Associations (WUAs) and Water User Groups (WUGs) under the supporting of the region and district.

As mentioned in the above framework of the plan, the organizational/ institutional conditions in the Study are strengthened by the organizational/institutional plan of the priority project, and this plan has led to the national policy of Tanzania. Therefore, the organizational/institutional plan is adequate and sustainable for the priority project.

10.5 Natural /Social Environment Evaluation

The result of the preparatory study conducted by the delegation of JICA experts has indicated the potential environmental and social impacts whose extent of impact was uncertain. Therefore, this study was recognized as Category C.

The key issues indicated in the preparatory study are shown below.

- Groundwater
- Lake / River
- Sea / Coastal zone
- Water rights and rights of common
- Water vender’s job opportunity

The result of the first screening submitted by preparatory JICA experts is shown in .Table 10.5-1

Table 10.5-1: The Results of the First Screening

No.	Environmental item	Evaluation	Reasons
Social environment			
1	Resettlement	D	The water supply plan does not include any resettlement plan
2	Economic activity	C	Although water venders in the study area do not seem to sell water actively throughout regions accordingly to the information collected in the environmental and social baseline study, the extent of negative impact derived from the implementation of the project is uncertain.
3	Traffic and public facilities	D	The water supply plan does not include any activities which may disturb traffic and public facility.
4	Split of community	D	There is no design of facility big enough to split local communities.
5	Cultural property	D	No cultural property is recognized in the study area.
6	Water right and rights of common	C	Domestic regulation of utilization of water from Lake Victoria is completely legal and adjustment of water right is not necessary at present. It, however, is anticipated that the water right of Lake Victoria would become diplomatic conflict among Nile River Basin countries. The water right regarding groundwater needs to be adjusted with respect to the Tanzanian national water policy. The water supply plan does not include the utilization of river or pond water for water supply. Therefore, the adjustment of water right along respective basin is not necessary.
7	Public health condition	D	Access to safe and clean water guarantees improvement of public health and sanitary condition.
8	Waste	C	Sludge generated from construction is properly treated. Sludge from treatment facilities might disturb surrounding environment either physically or sanitarily.
9	Hazard (risk)	D	Large scale construction is not included in the water supply plan.
Natural Environment			
10	Topography and geology	D	Large scale construction is not included in the water supply plan.
11	Soil erosion	D	Large scale construction is not included in the water supply plan.
12	Groundwater	C	It is well know that the withdrawal of groundwater could give significant negative impacts such as decline of groundwater level and land subsidence if the amount of the withdrawal exceeds more than potential. Therefore, the specification of pumping facilities has to be selected carefully with hydrogeological and geological approaches.
13	Hydrological situation	C	The utilization of Lake Victoria water might affect its water level to decline.
14	Coastal zone	C	The intake of water pump will be installed along the coast of Lake Victoria. This may affect physical and scenic status of the coast.
15	Fauna and flora	D	National parks and wild conservation areas are not included in the study area. Moreover, facilities will be constructed in resident areas, not in forests or savanna where precious flora and fauna are settled.
16	Meteorology	D	Not relevant
17	Landscape	D	Not relevant
18	Air pollution	D	Not relevant
19	Water pollution	D	Not relevant
20	Soil contamination	D	Not relevant
21	Noise and vibration	D	Not relevant
22	Land subsidence	D	Not relevant
23	Offensive odor	D	Not relevant

No.	Environmental item	Evaluation	Reasons
Note: Evaluation categories A: Serious impact is expected B: Some impact is expected C: Extent of impact is unknown (Examination is needed. Impact may become clear as study progresses.) D: No impact is expected. EIA is not necessary.			

As acknowledgement of application submitted to NEMC, they concluded that this applied project did not have any major adverse impact on targeted areas and communities and the study team was not required to conduct any further EIA studies. It, however, requested the study team to prepare a checklist of social and environmental criteria concerning the listed environmental factors.

According to the Tanzanian EIA process, NEMC finalized their screening on the water supply plan project including the priority project that there was no major adverse impact. Therefore, the next step of EIA approval was the submission of requested checklists for EIS (Environmental Impact Statement) revision. For the time being, it was accepted by NEMC and they issued the evidential letter of the acceptance, which could be substituted as the environmental permit authorizing this water supply plan to be implemented.

Eventually the water supply plan including priority project passed all required procedures of Tanzanian EIA approval and is ready for the further stage of project realization.

Based on the environmental and social assessment, it is concluded that a full scale EIA for further stages is not necessary. It, however, is required by NEMC that close monitoring of ambient environmental conditions in the project area be securely conducted regularly with the focus of environmental items by implementing agent / organization and findings be reflected on the revision of implementation plan to be more technically and environmentally sound.

The water supply plan for the priority project will contribute, in all aspects, to the improvement of the water situation in the study area by implementation of the proposed follow-up activities.

10.6 Technical Aspects

The proposed water supply facilities in this priority project consist of boreholes with hand pumps and piped schemes using spring water, ground water, and lake water. Technical appropriateness is essential when considering not only the “hard components” but also the “soft components”. Namely, technical appropriateness was evaluated by components such as construction, operation & maintenance, and material procurement. For building both boreholes with hand pumps and piped schemes, there are no special issues such as construction, etc., because such systems, with the exception of filtration facilities, have already been used in the target area. However it is necessary to conduct the technical support for the operation and maintenance of facility. The following table below summarizes the technical appropriateness and some technical notes of the components for boreholes with hand pumps, and piped schemes.

Table 10.6-1: Appropriateness of Piped Schemes from Technical Aspect

Facility		Facilities/Equipment and Materials	Appropriateness	
Boreholes with hand pumps (Level 1)	Boreholes with hand pump	Casing pipes and screen pipes	Con.	OK
			O&M	OK
			Proc.	OK (Domestic materials are available)
		Hand pumps	Con.	OK
			O&M	OK
			Proc.	OK (Some pumps are available locally)
Piped schemes (Level 2)	Intake	Pumps for lake water and ground water	Con.	Required to be rigid submersible pump at the lake bottom
			O&M	OK (Regularly required to take a records of activity such as valve control, etc.)
			Proc.	Procurement is possible locally but items are imported.
		Pipes for lake water and ground water	Con.	OK
			O&M	Regularly required to check leakage
			Proc.	OK (Some pipe materials are available locally)
		Chamber	Con.	OK
			O&M	Regularly required to remove sludge
			Proc.	OK (Domestic materials are available)
	Filtration	Sedimentation basin	Con.	OK
			O&M	Regularly required to remove sludge
			Proc.	OK (Domestic material is available)
		Filter	Con.	OK
			O&M	Regularly required to take a record of water quality and filtration loss, and cleaning. scraping filter and valve control
			Proc.	OK (Domestic materials are available)
	Transmission	Pump sump	Con.	OK
			O&M	Required to make clean
			Proc.	OK
		Rising and booster pumps	Con.	OK
			O&M	Regularly required to take a records of activity such as valve control, etc.
			Proc.	Procurement is possible locally but items are imported.
		Rising pipe (Ductile cast iron, and galvanized pipes)	Con.	OK
			O&M	Required to check leakage and steal water
			Proc.	OK (Some pipe materials are available locally)
	Distribution	Service Reservoir (Stone masonry and steel)	Con.	OK
			O&M	Required to make clean and check leakage
			Proc.	OK (Domestic materials are available)
		Pipes (Galvanized pipes)	Con.	OK
			O&M	Required to check leakage and steal water
			Proc.	OK (Some pipe materials are available locally)

Note
Con.: Construction, O&M: Operation and maintenance, Proc.: Procurement

Chapter 11

Conclusion and Recommendation

11 Conclusion and Recommendation

11.1 Conclusion

(1) The 2002 population census indicated that the biggest region by population size was Mwanza with a population of about 3 million including 712 villages, Mara was ranked 13th among the 21 regions in the country with a population of about 1.4 million including 414 villages.

(2) Economic activities were mainly conducted in the agricultural sector including crop farming, livestock, forestry and fishery and the Mwanza region ranks in the top 5 in Tanzania (2003, Mara ranks 12th).

(3) The water sources to be used for water supply consist of groundwater with medium and deep wells, lake water from Lake Victoria, and springs from three points of view, for example 1) Sustainability for water use, 2) Availability throughout the year and 3) Safety of water quality. The water quality is safe in general; however lake water shall be simply treated and filtered for potable purposes.

(4) The water supply plan was executed for the 428 villages and 57 existing piped schemes were selected from the requesting villages and the existing piped schemes in accordance with the selection criteria. The spring protection, medium and deep wells with hand pumps, and new and existing piped schemes were planned as scheme types.

(5) The total number of the medium and deep wells with hand pumps including two springs is 1,869 wells of which the served population will be 581,100 people with 247 villages in 2025.

(6) In regard to the piped scheme, a total of 64 newly installed piped schemes are planned in 98 villages, and a total of 57 expanded and rehabilitated piped schemes will be installed in 270 villages. The served population by piped schemes will be 1,265,900 in total in 2025.

(7) In regard to the target year of the Tanzanian side for the water supply plan, the increase of the coverage of water supply has three time-specific goals: 65% coverage by 2010, 74% coverage by 2015, and 90% coverage by 2025 (NRWSSP, 2006). The initial plan was formulated for the water supply plan with 2015 as the year of completion. However, it is impossible to complete the implementation of the water supply plan by 2015 due to the high expenses for the implementation of the initial plan within the planned time frame (2015). Therefore progressive payment is needed of the necessary funds into the payment schedule until 2025. If the water supply plan is implemented completely, it will improve the served ratio for water supply which will contribute the target strategy of Tanzanian side in 2025.

(8) Out of 428 villages and 57 existing piped schemes, 45 villages including 289 wells with hand pumps and 8 piped schemes were selected by using the ranking criteria for the priority project which is assumed to be implemented by the Japan Grant Aid project. The total project cost including the engineering expenses of the priority project is estimated at approximately USD17.6 million.

(9) Financial sources for the project costs of the water supply plan shall be derived from not only the government budget, but financial assistance from foreign countries and/or international lending institutions. According to the donor and Investment Requirement Plan on NRWSSP 2006, it is probably possible to be realized with the annual

disbursement schedule of the project costs. In any event, the final completed year of water supply plan is the year of 2025.

(10) The frameworks of organization/institutional conditions in each facility were clarified and the O&M plan was formulated by the clarification of the role of each level, such as region, district, and community, in particular, VWC, WUA, and WUG.

(11) The water fee, composing of the operation and maintenance cost and replacement cost, was calculated for piped schemes facilities, which were equivalent to about 1.5% of the project cost. An economic evaluation was carried out based on this idea, and the NPV was positive and the B/C exceeds 1.0. Therefore, the priority project is economically feasible.

(12) The water fee to be collected within the range of the willingness to pay and the affordability in the villages exceeds the recovering of O&M and replacement costs in priority project villages. Thus the priority project is financially feasible

(13) Based on the application submitted to NEMC, it was concluded that the applied project would not have any major adverse impact on targeted areas and the study team was not required to conduct any further EIA study. However the water supply plan for the priority project will contribute, in all aspects, to the improvement of the water situation in the study area by implementation of the proposed follow-up activities.

11.2 Recommendation

(1) Institutional Development and Supervising Structure

In the implementation of rural water supply works, among the Local Government Authorities （LGAs）, the District Council (DC) in particular will have an important role in the provision of technical support to villages. The NRWSSP strongly urges the establishment of a District Water Supply and Sanitation Team (DWST) as a subordinate organ of the DC, and the establishment of such teams will be a key institutional issue. The DWST will serve as the direct contact with villages and play an important role in community development, education, health (hygiene), rural planning and rural water supply, and its establishment will put in place a supervising structure for villages. Among the members of the DWST, the District Water Engineer (DWE) will play a leading technical role in terms of water supply and management of water supply works. The DWE should also play a central role in strengthening the link with village communities through coordinating with education and hygiene officers within the DWST and establishing a comprehensive system for the operation and maintenance of rural water supply works. Here, therefore, the recommendation for institutional structure is indicated that the DWE should be strengthened through injecting manpower into the DWE. Also, it is important that the DWST has power through legal, institutional and budgetary support.

(2) Establishment of Basic System for Water Sources Management

The National Water Policy (2002) mentions data and information as one of the policy issues of water sources management. For an effective integrated Water Sources Management System, accurate and timely information on water volume, water quality and water source use must be provided. To achieve the goals of the water supply coverage, formation of a Water Supply Plan is essential. However, if accurate information on the critical issue of water supply coverage cannot be obtained, the formation of a plan is unlikely. Therefore, it is recommended that the well inventory information, etc. of each village be managed on a

database, with new data updated one by one as it is obtained. LGAs do not have the capacity to input the information onto a computer quickly enough under the present system. Therefore, initially a system for preparing handwritten documents should be established in the DWE's Office, etc. That data should then be periodically collected and input into a database by computer in the DWE gradually. The input data should be stored in files at the MoW. The files should be updated every half year or annually. The first step to implement this should be the creation of a Database Management Team in the MoW. In any case, a conscious effort needs to be made to strengthen organization at the central level.

(3) For Formation of Yearly Plan for Water Supply

The district level will play a leading role in implementation. The role of the DWE is particularly important and it is necessary to raise the level of DWE personnel. In the implementation of the water supply plan, it is necessary for the DWE to obtain technical support from the Water Engineer of RAS. Guidance at the central level and the securing of personnel capable of providing guidance is also strongly recommended. Fundamental tasks also need to be implemented. In the implementation of water supply plans, such fundamental works will be necessary. Although the formation of programs and strategies is important, measures to implement such programs and strategies also need to be examined. The DWE' role here is also vital. It is not too much to say that the securing of DWE personnel will determine the feasibility of the water supply plans. Therefore, DWE personnel should be immediately secured.

(4) At the time of water supply plan implementation

The Initial Plan was formulated for the Water Supply Plan as the final year of 2015. However, it was found that expenses to complete the Initial Plan were too high referring to the expected internal and external budget plan mentioned in the NRWSSP in 2006. Therefore, the Team suggests the implementation schedule of the Water Supply Plan to achieve the final year of 2025 in accordance with the annual disbursement for the project cost in the Mwanza and Mara regions. However, the following alternative items will be considered and suggested in consideration with the condition of Tanzanian side.

1) Increase the budget by double or 2.5 times the size for the two regions from 2007 to 2015, so that the achievement of the coverage rate in 2015 shall be about 72% (428 villages and 57 piped schemes).

2) Start with the water supply plan, and review the achievement of the coverage rate in 2015 and implementation schedule. Take necessary measures by the NRWSSP and make necessary discussions (amendment) to achieve the National Millennium Target.

3) After formulating the Water Supply Plan, the study team investigated three water supply concepts. The three concepts are (1) Sustainability for water use, (2) Availability throughout the year, and (3) Safety of water quality. These concepts conform to Tanzania's National Water Policy. However, in practice, the Tanzanian side is also in support of the protected shallow well and Charcos Dam which, from the previously mentioned concepts, is discouraged as water sources by the Japanese side. These water sources will not be used in this Water Supply Plan, however the Tanzanian side is not prohibited from using these sources in addition to the potential sources in this plan.