WATER RESOURCES ENGINEERING DEPARTMENT
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ARUSHA MUNICIPAL COUNCIL
ARUSHA

RESOURCE ORIENTED SANITATION CONCEPTS FOR PERI URBAN AREAS IN AFRICA:
ARUSHA CITY PROJECT (WP6)

ASSESSMENT AND BASELINE STUDY FOR SANITATION DEVELOPMENT OF STRATEGIC AND SANITATION WASTE PLAN (SSWP) IN ARUSHA MUNICIPALITY

SUBMITTED TO ROSA PROJECT COORDINATOR IN BOKU, VIENNA,

BY

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Executive summary

This report covers a assessment and baseline study carried in Arusha Municipality to document baseline condition and provide inputs to the development of strategic and sanitation waste master plan. The study involved rapid assessment of all 17 wards in Arusha and detailed house hold survey in three target wards Lemara, Sokon I and Daraja Mbili. The rapid assessment of the situation of water supply, wastewater and solid waste management and resource oriented sanitation practices was conducted.

It was found out that the main sources of water in Arusha are deep boreholes, springs and river. The proportions of water supplied from boreholes, rivers and springs in the municipality are 27%, 13% and 60% respectively. Currently, the AUWSA meets about 90% of municipality water demand. In general the population of Arusha municipality with clean and safe water lies between 30 and 70 % of the municipality population which yet is not enough and further steps are needed to at least half those without water supply.

The situation of wastewater management is not good in Arusha where only 12% of the city is covered by the sewer system. The cost of connection is not affordable for most of the residents and sewerage system seems to be a far fetched solution. Majority of people use pit latrines (94%). There is problem with emptying filled latrines and local people are ready to cooperate in introducing new approaches to ease the problem. In some wards pit latrines are very inconvenient due to frequent filling or flooding as a result of higher water table. In some wards the neighbourhoods are so congested that emptying services can not be done except by using buckets a practice which is unhygienic. Poor sanitation is frequently characterised by cholera.

Solid waste management in Arusha Municipality is unsatisfactory this is because collection and disposal of the waste generated is less than 50 %. From the baseline survey, the following are concluded:

- Large fraction of solid waste from households is organic (75%).
- The collection capacity is estimated to be 178 tons per day, which is 47 % of the generated solid wastes.
- From the 812 household interviews, 68% of respondent don't segregate solid waste before disposing.
- There are poor solid waste services at household's levels as such 57.8% of the respondents said that the service was not available at all.
- Those who had service they have to pay between 500 and 1000 TZS per month but the willingness to pay for this service is very low.

- Only few households practicing recycling and reuse of materials such as metals scrapes, plastic bottles, old tyres and papers

- Improper solid waste disposal methods include burying, burning and dumping at unofficial sites is a common practice within the municipality. Even infectious and hazardous waste from different places is all crudely dumped to the municipal dump site located at Murriet area in Sokon I ward at a distance of about 8 km from the town centre through Unga Limited road.

One of the objectives of the baseline study was to investigate the existence of resource oriented sanitation practices in Arusha in order to guide the project into selection of options which are more likely to succeed. The study sought to document existing options such that they may be perfected and problems facing their use be addressed. The main conclusion of the study is that the issues of reusing sanitation products such as waste water and faeces is not totally new in Arusha and there is high potential to promote and up scale the use. In Arusha the re-use of wastewater for irrigation is acceptable although there is still some objection to use it for some crops such as vegetables. There is a genuine health concern among users of vegetables grown using waste water which needs

to be addressed by ensuring that wastewater is properly treated before being used for irrigation. Proper irrigation technology also needs to be used in this case to ensure water does not contaminate such vegetables. There is also a need to educate the public on the safety of the products.

The focus group discussion revealed that there is acute problem of sanitation especially in high density areas and local authority and the public are ready to cooperate in adopting any new approaches which will help solve the problem including the ROSA approaches. However care must be taken here since the overriding problem seems to be that of collection and removal of the excreta from the house holds without concern for its re-use. There is a need to plan well how products of ecosan toilets will be utilized to complete the nutrient cycle by linking users and producers. Pilot cases should also demonstrate the re-use and link producers of excreta derived fertilizers and users.

The waster water used for irrigation does not meet standards and may be a potential health risk. Moreover it is informal and it may be banned by the authorities any time. There is therefore a need to study the best way of utilizing this resource and educating the public and decision makers on the potential benefits of this practice.

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List of Abbreviations

AMC	Arusha Municipality Council
AUWSA	Arusha Urban Water Supply and Sewerage Authority
CBOs	Community Based Organizations
CWS	Cities without Slums
FDGs	Focus Group Discussions
MDGs	Millennium Development Goals
NGOs	Non – Governmental Organizations
NHC	National Housing Coorporation
PPP	Public Private Partnership
ROSA	Resources Oriented Sanitation Concepts
RPC	Recycling and Process Centre
SAP	Sustainable Arusha Programme
SCP	Sustainable Cities program
SSWPs	Strategic Sanitation & Waste Plans
TANESCO	Tanzania Electric Supply Company Limited
TCA	Technical College of Arusha
TZS	Tanzanian Shillings
UN	United Nations
UNEP	United Nations Environmental Programme
UNIDO	United Nations Industrial Development Organization
WSPs	Waste Stabilization Ponds
YEP	Young Environmental People

Chapter 1: Introduction

1.0 General Background

At the Millennium Summit in September 2000 the largest gathering of world leaders in history adopted the UN Millennium declaration, committing their nations to a new global partnership to reduce extreme poverty and setting out a series of time-bound targets, with a deadline of 2015, which have become known as the Millennium Development Goals (MDGs). Eight (8) MDGs were set which have eighteen (18) targets. The 7th goal of these MDGs is to Ensure Environmental Sustainability. In this Goal two targets were set in which one target (MDGs target 10) requires the reduction by half the proportion of people without sustainable sanitation and access to safe drinking water (http://www.un.org/millenium goals/). So sanitation is considered to be one of the most important global agenda to deal with.

In both developed and developing countries, basically two options are available to handle sanitation problems, which can be described as on-site and off-site sanitation (Esrey *et al*., 1998). These conventional forms of wastewater management and sanitation systems are based on the perception of faecal material, which is considered as repulsive and not to be touched. The design of the technologies is furthermore based on the premise that excreta are waste and that waste is only suitable for disposal (Esrey *et al*., 1998). Off-site or Water-borne sanitation as used in conventional sanitation systems is based on the collection and transport of wastewater via a sewer system. The system mixes comparatively small quantities of potentially harmful substances with large amounts of water and the magnitude of the problem is multiplied. In addition, the construction, operation and maintenance of the option are a heavy financial burden. Even in developed countries, these conventional systems are directly cross-subsidized and the chances to ever become financially sustainable are low.

Conventional sanitation systems have even more fundamental shortcomings than their high costs such as over-exploitation of limited renewable water sources, pollution of soil and groundwater, waste of valuable components in wastewater and the difficulty for an effective removal of pollutants (Wilderer, 2001). On conventional on-site option applying the "drop and store" principles the pit latrine in its various forms is still the dominantly used device in developing countries (Esrey et al., 1998). The obvious disadvantages, like soil and groundwater contamination with pathogens, bad odour, fly/mosquito breading, pit collapse or the distance from the house make clear that this cannot be a viable alternative. However, in densely populated areas, the limits such as digging a new pit when the old one is full often leads to the question where to build the new one. Further problems greatly concern the agricultural sector.

The current sanitation paradigm is failing the world with the poor suffering most. The problems with conventional sanitations are fundamental, and a radically different approach is needed. ROSA promotes resources oriented sanitation concepts as a route to sustainable and ecological sound sanitation in order to meet the MDGs.

1.1 Resource Oriented Sanitation Concepts

Resource-oriented sanitation systems are based on collecting and treating the different wastewater flows separately to optimize their potential for reuse. The different fractions include:

- Blackwater (wastewater from the toilets, a mixture of urine and faeces), and
- Greywater (wastewater without excreta respectively from kitchen, bathroom and laundry),
- Separately collected urine (also called yellow water), and
- Separately collected faeces are called faecal sludge or faecal matter, respectively, depending on if flush water is used or not.

The concept relies on recognition of human excreta and water from households as a resource (not as a waste), which should be made available for re-use and it has the advantages of;

- reducing the health risks related to sanitation, contaminated water and waste,
- preventing the pollution of surface and groundwater,
- preventing the degradation of soil fertility, and
- optimising the management of nutrients and water resources

As far as this research is concerned, the overall objectives of the ROSA project in peri-urban areas of Africa are:

- To add to the current efforts for promoting resource-oriented sanitation concepts as route
- to research the gaps for the implementation of resource-oriented sanitation concepts in peri-urban areas,
- to develop a generally applicable adaptable framework for the development of participatory strategic sanitation & waste plans (SSWPs), and
- to implement resource-oriented sanitation concepts in four pilot cities in East Africa (Arbaminch, Ethiopia; Nakuru, Kenya; Arusha, Tanzania; and Kitgum, Uganda).

1.2 Previous programmes in Arusha

1.2.1 Sustainable Cities program (SCP)

This was a joint initiative of the UN-Habitat and UNEP to implement the Local Agenda 21. The overall goal was to achieve sustainable development through improved environmental information and technical expertise, improved environmental strategies and decision-making and improved implementation of environmental strategies. The program started in Dar es Salaam and in 1997 it was officially introduced in Arusha as Sustainable Arusha Programme (SAP). SAP was based on the participatory spirit by involving all key stakeholders in the whole process of planning.

1.2.2 Cities without slums programme (CWS)

In Arusha this program was established in 2003 with the main goal of assisting the Municipality of Arusha to build/strengthen its approach for upgrading unplanned settlements and improves living conditions of population in those settlements. Elerai and Daraja II were pilot wards for the programme.

1.3 ROSA Baseline Study and its Objectives

The baseline study and assessment that was done in Arusha Municipality had the following objectives;

- Gathering basic information on the existing situation on sanitation and related issues,
- As inputs to the development of Strategic Sanitation and Waste Plan and
- Allowing for decision making on the sites for construction of demonstration ecological sanitation toilets

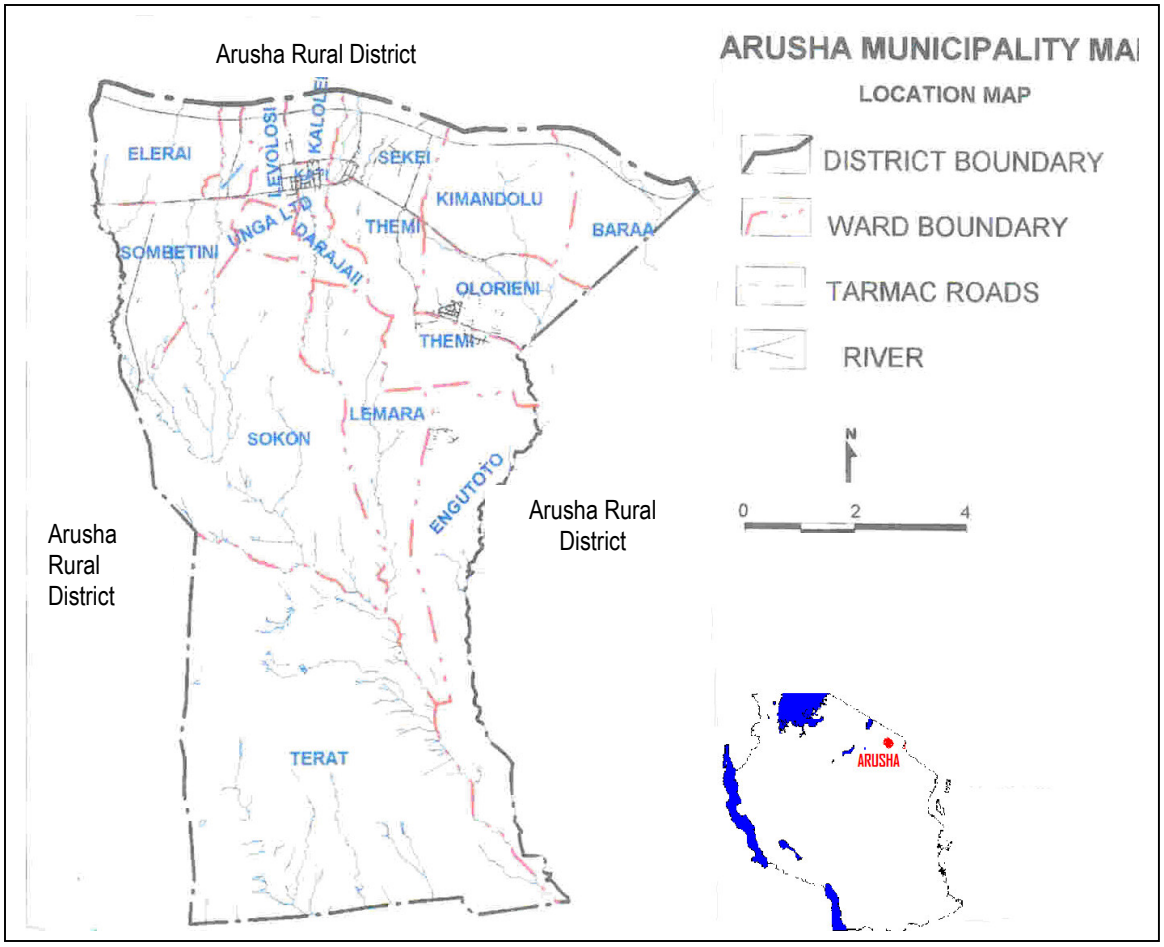
1.4 Introduction for Arusha Municipality

1.4.1 History

The history of Arusha municipality is dated back during German colonialism in 1880, and it started with an area of 1.5 km radius from administrative center (Boma) established by Germans. During the period between 1940 and 1948, Tanzania under British colonialism, Arusha as a small town started to expand and acquired township authority with a population of 5,702. It continued to expand as administrative, commercial and social activities centre for large-scale European settlers. After independence, the Arusha town expanded significantly and in 1967 it became headquarters for East African Community. In 1980 Arusha acquired the title of municipality and from that time the population growth and economic developments have been noticed. Arusha municipality is the center of tourism attraction known all over the world.

1.4.2 Location

Arusha Municipality is one of the seven districts of Arusha Region, with other districts being, Meru, Arusha rural, Monduli, Longido, Ngorongoro and Karatu. It is situated between Latitudes 3.0^0 and 3.4^0 South and longitudes 36^0 and 36.4^0 east (AMC and UN-habitat, 2005). It is surrounded by Arusha rural district in all directions (Figure 1.1) and is seen clearly from the top of Mount Meru. It lies at an elevation ranging between 1160 and 1450 meters above sea level.



Map 1.1: Location map of study area (source: AMC)

1.4.3 Climate

Climatically Arusha Municipality has a mean annual rainfall of 844 mm. It experiences two seasons of rain in the period between October and January as well as in the period of March and May. The temperature is characterized by warm and cold weather ranging from 17^oC to 34^oC.

1.4.4 Soil

The large portion of Arusha municipality soil is of volcanic origin especially in highlands areas while in plain or valley areas the black cotton soil is dominant. Themi, Engarenok, Nduruma Burka, Kijenge, Naura and Goliondoi are rivers which pass in the Arusha municipality. The council has roads of 360 km in total of which only 21% are tarmac, 62% are earth roads and the remaining 17% are gravel roads (AMC, 2002).

1.4.5 Administration Set-Up

Existing information indicates that Arusha Municipality covers an area of about 93 km^2 with the land being allocated according to different activities as shown in Table 1.1.

Table 1.1: Proportion of Land Use in Arusha Municipality

S/No	Land use	Size (km^2)
1	Arable (agriculture) Land	64
2	Pasture or grazing land	1
3	Forest and Hills	0.2
4	Building and playing grounds	26
5	Roads and Rivers	1.8

Administratively, Arusha municipality has three divisions namely, Elerai, Themi and Suye. These Divisions are further sub-divided into seventeen wards (Table 1.2). Each ward has an elected councilor who represents the ward in the municipal council meetings. The administrative set-up is in consistence with Local Government structure stipulated in the Urban Authorities Act, 1982. The act provide for the existence and structure of village within the urban setting. For urban wards with villages (Elerai, Terrat, Sokon I, Oleirien, Lemara, Baraa, Kimandolu, Engutoto and Sombetin), the lowest local government unit is the Kitongoji (hamlet) and for urban wards without villages setting

(Kati, Themi, Unga Ltd, Kaloleni, Levolosi, Daraja II, Sekei, and Ngarenarok), the lowest unit is Mtaa (Street) (AMC and UN-habitat, 2005).

1.4.6 Demography

According to the Tanzania National population census of year 2002, the population of Arusha Municipality was recorded to be 282, 712 people of whom 139,037 (49.2%) and 143,675 (50.8%) people were men and women, respectively. The total households were 72,444 giving an average household size of 4 people. Table 1.2 shows the population in each ward of Arusha Municipality as registered in 2002 census.

Existing data indicate that the population of Arusha Municipality has been almost doubling after every ten years as shown in Table 1.3. The inter-census rates in Arusha were relatively higher as compared to Tanzania growth rates which were 3.2%, 2.8% and 2.9% for 1967/1978, 1978/1988 and 1988/2002 respectively. Figure 1.1 shows the trend of Arusha population since 1947. It is estimated that the current Arusha population (2007) is 464, 294 although some institution have been using 341,000 people as the current population (AUWSA, 2006). This survey estimates that Arusha Municipality population will increase to 670,496 by year 2012 which probably will be the next Tanzania national census.

Table 1.2: Population in Arusha Municipality (National Census, 2002)

Ward	Population
Dararaja II	22,108
Kaloleni	11,651
Kati	4,026
Levolosi	11,287
Ngarenarok	15,773
Sekei	9,968
Themi	8,618
Unga Ltd	18,703

Baraa	5,988
Kimandolu	22,526
Oloirien	13,193
Engutoto	5,067
Sokoni	41,647
Lemara	11,766
Terrat	8,044
Elerai	38,285
Sombetini	34,062
Total	282,712

Table 1.3: Arusha Municipality population dynamic

Year	1947	1957	1967	1978	1988	2002
Population	5,702	9,587	32452	55,240	134,738	282,712
Inter-census growth rate Annual growth rate	-	5.3	13	5	9.3	5.4

(Source: AMC and UN-habitat, 2005)

The high growth rates in Arusha Municipality especially between 1957 and 1988 are probably contributed by rural urban migration and boundary expansion in different periods.

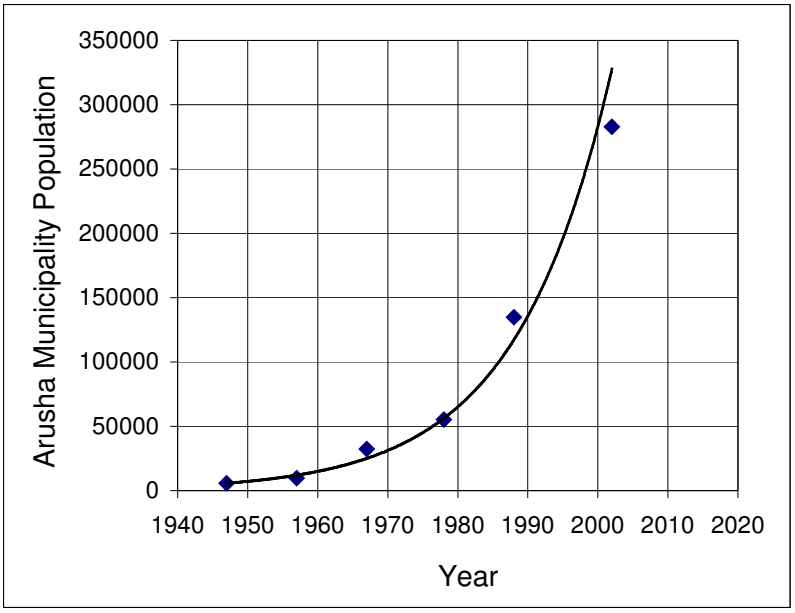


Fig. 1.2: Arusha Municipality population growth trend

1.4.7 Settlements planning and Land Tenure

Existing information indicates that approximately 25-35% of Arusha Municipality has planned settlements with Kati ward having 100% planned settlements. The major reasons for parts of the municipality being unplanned are lack of funds and traditional land tenure/ownership. There are two systems of land tenure used in AMC, namely;

- Customary land ownership practiced mostly in unplanned area
- Long-term ownership granted by AMC-land section

The detailed descriptions on the settlement planning and house characteristics for different wards are given in Appendix I.

Chapter 2: Study Methodology

2.0 Introduction

In order to achieve the objectives of baseline survey on sanitation and other related issues in Arusha Municipality, the following methods/approaches were followed;

- Literature survey and consultation with key stake holders
- Survey design (preparation of survey instruments, questionnaires)
- Focus Group Discussions
- Semi-structured interviews
- Training of fieldwork enumerators
- Fieldwork data collection
- Data Analysis and report writing

2.1 Literature survey and consultation with key stake holders

In this stage, various documents such strategic plans, maps, policies, previous program reports such Sustainable cities and Cities without Slums, demography from municipality and other water and sanitation stakeholders were perused to get basic information for the next stages of the baseline survey. In this stage, the ROSA kick off workshop (in Olasit garden, Arusha) was also useful since a good number of stakeholders were present to discuss their sanitation experiences in Arusha Municipality.

2.2 Survey design and sampling

In survey design, a number of groups were considered. These groups are as shown in Table 2.1

Table 2.1: Various groups (category) involved in baseline survey

S/No	Categories	No of interviews
1	Households	812
2	Water and Sewerage Authority (AUWSA)	1
3	Ward executives officers	3
4	Hospitals/Dispensaries	3

5	Hotels/Restaurants	1
6	Schools (primary/Secondary/college)	3
7	Arusha Municipality Council (health Dept)	1
8	Sludge emptier (private company)	1
9	Solid waste collector (private company)	1
10	CBOs	1
11	Wards development committees	17

The survey instruments for each category are attached in appendix II of this report.

2.2.1 Sample size calculation for household's interview

In calculating the sample size, *n* the following formula was used;

$$n \geq \frac{N\sigma^2}{(N-1)D + \sigma^2)} \quad \text{.....(1)}$$

Where

$$D = \frac{(\text{Margin error})^2}{Z_{\alpha/2}^{\ 2}} \quad \text{.....(2)}$$

N - Represents the population size, which is a current (2007) estimates total households for Lemara, Sokon I and Daraja II wards taken as 30406

σ is the standard deviation - which is estimated to be 4662

If the confidence interval of 90% is used, Z becomes 1.64 and with marginal error of ±265, D in equation (2) becomes 26110

The Sample size was then calculated from equation (1) and found to be:

$$n \geq \frac{30406x4662^2}{\left(30406-1)26110+4662^2\right)}. \geq 810$$

A sample size of 812 households was chosen in this study, this is 812/30406 =2.7% of the population size. Sample size, n $\geq 1\%$ of population size is recommended depending on your resources (Finance, time and human).

2.2.2 Sample distribution within the wards

Each survey enumerator was given exactly the calculated number of questionnaires for the street or hamlet, which bared a recognized number (appendix III). The distribution of households' questionnaires in the wards and streets/hamlets were done as shown in Table 2.2 and within the street/hamlets (mtaa/vitongoji) the survey was done by randomly selection. A total of 26 mtaa/vitongoji were surveyed.

Table 2.2: Distribution of household questionnaires in each ward

S/No	Ward	Street/hamlet	Estimated No of Households	Interviewed Households	Total interviewed Households in the ward
1	Daraja II (8901 HH)	Jamuhuri	1175	31	237
		Ali nyanya	2403	65	
		Sanare	1469	39	
		Ndarvoi	1175	31	
		Darajani	1656	44	
		Kati	1015	27	
2	Sokon I (16768 HH)	Mlimani	151	04	448
		Engosengiu	637	17	
		Olnjavutian	956	26	
		Olmolokea	2146	57	
		Makao mapya	1492	40	
		Lolovono	1023	27	

		Madukani	2566	36	
		Sainevuno	1341	49	
		Kanisani	1844	68	
		Longdong	1325	36	
		Murriet	403	11	
		Migungani	922	25	
		Olovolosi	1962	52	
3	Lemara (4737 HH)	Kikokwani-A	857	23	127
		Kikokwani-B	611	17	
		Korongoni	568	15	
		Lemara kati	976	26	
		Ilkirowa	786	21	
		Olepolos	710	19	
		Sunflag	227	06	
TOTAL			**30406**	**812**	**812**

HH = Households

2.2.3 Training of fieldwork enumerators

ROSA recruited a team of twenty qualified fieldwork enumerators for training to assist in undertaking interviews with the respondents identified in the sample. The survey enumerators were trained on interview skills, objective of the baseline survey, sampling methods within the street/hamlets, approach to the then envisaged data collection and intensively on the instruments of survey. The survey was conducted by ROSA team in collaboration with Municipality Council and Arusha Urban Water and Sewerage Authority experts.

2.2.4 Fieldwork data collection.

Fieldwork interviews in households and other categories as well focus group discussions involved in the baseline survey began on 8th May 2007. The interviews through structured questionnaires were used for all groups in Table 3.1 except for wards development committees. While focus group discussions were conducted in all 17 wards of municipality, household interviews were carried out in all mitaa and vitongoji of

Lemara, Sokon-I and Daraja II wards. In interviews, the data collection process involved a mixed strategy in which in some cases the interviewee field the questionnaires themselves and in some instances the survey enumerators had to fill the questionnaires themselves after probing the intended question. In focus Group the ROSA researchers prepared guidelines (checklist), which they used to manage the discussion. A tap recorder and video shouting were sometimes used to capture the scenarios. In most of the discussions the group consisted of at least 12 discussants in which each discussion took at most one hour effectively.

2.4 Data Analysis

The survey data were processed by Microsoft Excel program and Epidemiological Information program (EPI-Info version 6.04). The analysis of the data, writing and preparation of this report are based on the requirements of the ROSA objectives for the survey.

Chapter 3: Water Supply

3.1 Institutional Setup

Arusha Municipality is among the 18 towns in Tanzania mainland, which were declared autonomous by the Government through the Ministry of Water to have Urban Water Supply and Sewerage Authority (AUWSA) effectively from 1998. The Authority was established by the auspices of the water works ordinance Cap. 281 as amended in February 1997. It is an entity charged with the overall operation and management of water supply and sewerage services in Arusha Municipality. These core functions are carried out by its Technical Services Department, which has five sections namely sewerage, water network production, planning and construction, and maintenance and repair. The Authority has to meet all operation and maintenance cost, personnel emoluments and minor investments. Following the objectives of its establishment, AUWSA has one of its major functions as the production, treatment and distribution of potable water. Currently AUWSA has managed to install a total of 23,689 house connections for supplying safe and clean water in Arusha Municipality. According to AUWSA it is estimated that each connection serves about 10 people which accounts for 236,890 people in the whole Municipality. The population served by AUWSA is about 51% of the current estimated population (464,294). If 361,000 or 341,000 population are used, as some documents have reported (AMC, 2007 and AUWSA, 2006) the level of water supply covers about 65% or 69 respectively, of municipality population. In general the population of Arusha municipality with clean and safe water lies between 50 and 70 % of the municipality population which yet is not enough and further steps are needed to at least half those without water supply.

The low level of water supply in wards is attributed by many factors including:

- Low supply of water sources as compared to water demands,
- People have their own sources or other sources of water,
- Rationing of electricity by electric company (TANESCO) and
- Lack of enough funds by the authority

During this survey, the Authority indicated that it was not possible to account for the demand and supply of water in each ward due to lack of bulk meter in each ward. With regard to quality of the water supply, the authority indicated that it supplies water, which is clean and safe for human consumption. Despite the fact that the water is treated with required dose prior supplied to people, the storage tanks are cleaned twice a year to ensure the safety of water.

3.2 Water Supply Coverage

The number of water supply connections in each ward is shown in Table 3.1.

Table 3.1: Current situation on water supply in each ward

Ward	Number of connections	Population/connection
Dararaja II	501	71
Kaloleni	1710	11
Kati	881	7
Levolosi	1568	12
Ngarenarok	1253	20
Sekei	2007	8
Themi/Engutoto*	3884	7
Unga Ltd	1053	29
Baraa	414	23
Kimandolu	1899	19
Oloirien	1639	13
Sokoni	1492	45
Lemara	778	24
Terrat	13	997
Elerai	1992	31
Sombetini	2605	21
Total	**23689**	

*The data provided covers both wards

From Table 3.1, Terrat has the lowest level of water supply connections with 0.05% of all connections in Arusha Municipality whereby 997 people on average share one connection. Themi, Engutoto, Kati, Sekei, Kaloleni, Levolosi are the wards with very good level of water supply services in Arusha Municipality.

Only about 30% of the population in Daraja II have in-house connection and the remaining percent normally buy water from those with the in-house connection. But on the other hand although Sombetini is an unplanned settlement it is well served with AUWSA water supply system where by 75% of the residents has access to tap water. Generally the water situation in Elerai is not good with about 32 % of the people in this ward getting water from AUWSA.

3.3 Water Quality

Although Unga Limited is not planned, there have no major incidences of epidemic for water related diseases for almost two years now. This is probably due to most of the residents boil their water before drinking. However on the other hand, the health officer of Ngarenarok during the focus group discussion pointed out that water used in unplanned settlement of the municipality even tap water is not safe enough for human consumption because a few years ago, cases of cholera outbreak was reported and this necessitated water tests and the results showed that almost in all unplanned settlements, the water is found to contain Faecal Coliforms. Hence people were advised to boil water before drinking. The presence of pathogens could be due to contamination by sewage from sewerage system to an old water supply network system. Generally to date water supply in Engutoto is safe and sufficient.

Although there is a river passing within the Kaloleni ward no body is using the water for consumption from this river because of health risks. The level of awareness for water related diseases in this ward are high. As regard to the safety of water supplied by AUWSA, some people at Kaloleni boil their drinking water before use but some people believe that the water supplied is safe because it has received treatment at the source.

This seemed to be true because there has been no major incidence of water related dieses in this ward. There are two polluted rivers within Terrat Buruka that marks the northern border of the ward and Themi River that runs on the Eastern side of the ward. The water of these rivers is only used for washing and not for human consumption. Shallow wells are common in Sokon I, but they are not safe due to ground water pollution. In most cases those residents without tap water are buying from their neighbours at 20Tshs per bucket. The majority of Residents of Kimandolu believe that water from AUWSA supply system is of good quality and needs no further treatment before drinking. However, with the water they fetch from springs, they have to boil it before drinking, this is because the springs water source area is not protected and as such there are buildings developed too close to this source and no measures have been taken to control it for the pollution.

Majority of the residents at Oloirien claims that they prefer to use spring water because it is safe as the sources are well protected and they get free of charge they don't have to buy it. But that is not always the case as the result of sample from one of these springs showed that there are fecal matters in that water. Due to this the ward decided to put a notice near the spring so as to alert people to boil water before drinking. Sombetini ward people claims that water from their natural springs is safe because they have been using it for years without any problem. Water from both sources that is from natural spring and from AUWSA water supply system is directly used with people without any treatment. But a few residents are aware of the health risks of drinking water without boiling so they boil their drinking regardless that they get it from AUWSA sources or from springs. On the other hand most people of Sombetini choose to use tap water for drinking, as they believe that it is treated so it is more safe and clean than that from natural springs.

People in Lemara are not sure with the quality of water from the sources within the wards but the majority believes that water, which is supplied by AUWSA, is of good quality. Cholera is the frequent disease facing this ward especially in rain season; this is because the shallow wells are very close to the toilets also in Majengo area the water table is very high. Due to this severe problem there was an operation to demolish these wells in order

to overcome the problem; therefore nowadays the problem is not big compared to previous years.

3.4 Reliability (Water availability)

Shortage of water in Engutoto is experienced during dry season and when there is power failure, which results to water rationing. Generally in Kaloleni water supply is not a major issue compared to other wards like Sokon-I. Almost all residents get safe and clean water either within the house or a short distance from their houses. Shortage of water in Kaloleni occurs only when there is power failure or in some cases during dry season. To the residents of Kati ward, water is available almost everyday unless when there is a power shortage or during long period of drought. Water supply from AUWSA sources within Lemara ward is rationed for the time being it is available only from 4:00 am to 7:00 am. At one of such public kiosk located at Korongoni area in Lemara, water is available all the time except during very dry season when the problem of is acute. The problem with tap water supply system is that in some areas the pipes are already too small or too old to meet the increasing demand of the fast growing population since the line is more than ten years old. As a solution to unreliable water availability people use storage tanks.

In Levolosi ward water is available and reliable except during dry season when it is necessary to apply rationing then it is provided on specific hours. Water table at Sokoni I is very high about 4 ft which adds to contamination of water, especially at Sinovuno hamlet, whereby Water supplied by AUWSA is not very reliable which just available only twice a week. In Themi, generally water is reported to be adequate except during dry season whereby water is provided by rationing (Kiswahili word is Mgao wa Maji). Water Supply at Kimandolu is not very reliable. During dry seasons water in Kimandolu ward is only available three or two times per week. In Kitiangare area in Kimandolu the problem of insufficient water supply is more critical than in other parts of the ward.

There are some areas within the Oloirien ward that experiences water shortages especially during dry season; these areas are R.C., Mbeshere and Mwaivoi. The problem

is more compounded because of lack of natural sources of water such as rivers and springs. The hotspots for water shortage being Urundini, Majengo A and Kware.

3.5 Affordability and willingness to pay (Costs of Getting Water)

The typical price of water in Kiosk in Unga Limited is Five (5) shilling per twenty (20) litres container. The price is very low compared to other private homes where a twenty litres container costs thirty shillings (30Tshs). Payment for water at Ngarenarok per 20 litres is Tshs 25 Shillings. It was learned that most of the people in Daraja 2 can't afford to connect water to their houses. This is due to high connection charges set by AUWSA. During the Focus Group Discussion, in Kiloleni it was learned that, a family with four people is likely to spend around 5,800 Tsh per months for water. At the standpipe in Kaloleni people pay 20 Tsh per 20 litres containers. People think that the cost of water is achievable when compared to the cost of electricity. During dry season June –March Terrat residents buy water from neighbouring wards few kilometres from Terrat costing them about 400/= Tshs per 20liters containers. Economically this is very difficult situation calling for the government and indeed municipality authority to find the sustainable solution to the people in Terrat. People at Kati who are not connected to AUWSA supply system has to buy water from neighbours or public standpipe by paying 20 to 40 Tshs per bucket.

Water connection fee at Lemara from AUWSA supply system is too expensive to the majority of the residents who are low income earners and poor. E.g. the cost of 100-metre connection was 221,000 Tshs in year (2005). People without house water connections have to buy water from their neighbours or from a few AUWSA water points found nearby their homes. The cost of water per bucket is TZS 20 to 50. Residents of Levolosi of such houses are therefore buying water from their neighbours at a cost of 20-50 Tsh per bucket or from water kiosk for about 40-100 Tsh per bucket depending on the area concerned. There are about 2 kiosks and 2 standpipes in Sekei whereby people buy water for 20-30 Tshs per bucket. The price is almost the same if one buys water from neighbour residents who have tap water. In some incidence, some residents provide water freely to those with no tap water in their houses. The connection fee at Sokoni I is very high for

people in that area to afford, considering their low income, as most of them are farmers and small businessmen. To get water at the kiosks the Sombetini residents have to pay 5Tshs per bucket, while if they buy from the neighbour with private connection, they have to pay 20Tshs per bucket. But within the ward it is also said that there are individuals who offer free water to their fellow residents.

Currently, connection of water from AUWSA at Sombetini is no longer a problem as it used to be in the past. Water connection fee from AUWSA supply system is approximately 200,000Tshs per 100 meters; the expenses go on increasing as the distance increases from the main pipe. Sombetini Residents have also another alternative of water connection where by people who are already connected to AUWSA water supply system can invite their neighbours to connect in their line by paying 50,000Tshs as a line connection fee. At Elerai Also AUWSA provide free services to the poor people who they give them coupon in order to fetch water at the kiosk for free and they are allowed to take 3 buckets per day. Cost of water at Elerai in kiosk is 20Tsh per 20-litres bucket.

3.6 O&M (Institutional Set Up for Overseeing Water Systems)

The Baraa ward Development Committee has put a law that requires anybody who wish to buy a land in Baraa and needs to be connected to the ward main pipe he/she must pay 200,000 Tshs to become a member of water supply in the ward. In Kati ward there is neither water committee nor public water kiosk or water vendors found within this ward since water supplied is not a major problem. The natural water sources such as springs at Lemara found within the area are under the control and protection of the ward environmental committee, where by security by-laws are reinforced to prevent the sources from being polluted. One among such by-laws is the one that prevents people encroaching the water sources, where by residents are directed to leave a green area buffer zone of forty meter around the water sources such as natural springs. Despite the reinforcement of the by-law there are a few defaulters who ignore them, for example at Ikororuwa sub-ward there is a big spring used by residents of both Lemara and Unga ltd wards threaten by encroachment of one resident by digging and building a toilet within less than 10 meter away. Something which led to the drying up of that spring, but when

that person was forced to stop what he was doing the water production of the spring went back to normal. On the other hand the responsibility of protection of water sources requires funds to pay for security guard while the income sources of wards are so limited hence this makes the whole venture very expensive for them to carry out. In Lemara ward there is no water committee, the board responsible for water issues as pointed out above is the environmental committee.

In Sokoni I ward only at Kilimani hamlet there are water committees and their main responsibility is to make sure that drains are clean; it is very difficult to prohibit people from digging wells randomly because are doing so due to shortage of water hence they think that is the only solution for their survival. In this ward there are health committees in almost every hamlet and their major role is monitoring toilets and its also difficult for them to deal with other issues like prohibiting people to dig wells near toilets or such kind of things, for instance at Murriet people are pumping water near dump area, but you can not stop them doing so as its their means of living though not good for their health. All these kiosks at Sombetini are operated and maintained with private people who collect money, they remit some of that to AUWSA as water bills and they keep the remaining amount.

3.7 Social cultural aspects

Like many parts of developing world, the community group that was responsible for fetching water in Arusha municipality was women and children. Over 90% of all people involved in fetching water were women and children. This is attributed to social cultural aspects of the area that sees women and children as labour force in the community.

3.8 Findings from Focus Group Discussions (FDGs)

3.8.1 Water Supply Unga limited

The major sources of water supply in Unga Ltd are Natural springs found within the wards. However these springs have been identified to have faecal coliforms (pathogens) making them not suitable for human consumption but only for washing and cleaning floors for houses, toilets and the likes. About 60% of safe water for human consumption in Unga Ltd is

supplied by AUWSA. There are about five Kiosks in the ward constructed by AUWSA and subcontracted to private partners, which serve most of the people especially those who have no water in-house connection and also during water shortage. The typical price of water in Kiosk is Five (5) shilling per twenty (20) litres container. The price is very low compared to other private homes where a twenty litres container costs thirty shillings (30Tshs). Small-scale rainwater harvest is practiced in Unga Ltd especially by those residents with houses, which have appropriate roofs.

Although the area is not planned there have no major incidences of epidemic for water related diseases for almost two years now. This is probably because most of the residents boil their water before use for consumption.

3.8.2 Water Supply Ngarenarok

Water supply for Ngarenarok ward is from AUWSA sources with most of houses being directly connected to this main line. The residents who can not afford to have house connection are get water from public water kiosks or standby pipes located nearby their houses and for a bucket per 20 litres they have to pay 25 Shillings. The health officer during the focus group discussion pointed out that water used in unplanned settlement of the Municipality even tap water is not safe because a few years ago, cholera outbreak necessitated water tests and the results showed that almost all unplanned settlements the water is found to have Faecal Coliforms. Hence People were advised to boil water before use. The Pathogens could be due to leakage of sewerage to old water supply pipes constructed many years ago.

3.8.3 Water Supply Baraa

The major source of water supply in Baraa is Natural springs. The water is supplied to residents through main pipe owned by the ward. This pipe serves about 95% of the wards residents freely. There is another network of water supply by AUWSA, which serves very few people of Baraa. In general water supply in this ward is adequate and the worries are only in future due to population growth and the fact that neighbouring village of Meru district also uses the natural springs within the ward. For those people who cannot afford to have water in their house, they get water from standpipe within the

locality of their premises. The ward developing committee has put a law that for anybody buying a land in Baraa and needs to be connected to the ward main pipe he/she must pay 200,000 Tsh to become a member of water supply in the ward

3.8.4 Water Supply Daraja II

Like other residents in Arusha Municipality, Daraja II residents depend on boreholes, which are owned by AUWSA for safe and reliable water. Only about 30% the population in Daraja II have water from taps in their houses and the remaining percent normally buy water from those with the tap. The ward has few water kiosks (Photo 4.10 Typical Kiosk), which are currently not function. Several springs are found within the wards and are used only for bath and washing. It was learned that most of the people are not affording to connect water to their houses. This is due to high connection cost set by AUWSA.

Plate 3.1: Typical water Kiosk in Daraja II

3.8.5 Water Supply Engutoto

Like most of the area in Arusha Municipality, water supply of the majority of the residents of Engutoto ward is from AUWSA supply system and a few individual has their own shallow

wells and boreholes. Other sources of water found within the ward are river (Kijenge), canals and springs. Shortage of water is experienced during dry season and when there is power failure, which results to water rationing. Within Engutoto ward there is public water kiosks built by AUWSA, but currently are not working. There is also a public standpipe, built by religions organization in Block C2 that is supplies water to the neighbouring community free of charge. Generally to date water supply in Engutoto is safe and sufficient.

3.8.6 Water Supply Kaloleni

Generally in Kalolen water supply is not a major issue compared to other wards like Sokon-I. Almost all residents get safe and clean water either within the house or a short distance from their houses. About 80-87% of residents have water from taps in their houses supplied by AUWSA. The remaining percentage gets water from the four (4) standpipes (kiosks) located within the ward. Shortage of water occurs is only when there is power failure or in some cases during dry season. Although there is a river passing within the ward no body is using the water for consumption from this river because of health risks. The level of awareness for water related diseases in this ward are high.

During the Focus Group Discussion, It was learned that, a family with four people is likely to spend around 5,800 Tsh per months for water. At the standpipe in Kalolen people pay 20 Tsh per 20 litres containers. People think that the cost of water is affordable when it is compared to the cost of electricity. As regard to the safety of water supplied by AUWSA, some people boil their drinking water before use but some people believe that the water supplied is safe because it has received treatment at the source. This seemed to be true because there has been no major incidence of water related dieses in this ward.

3.8.7 Water Supply Terat

Water supply is a major problem in Terrat. Few years ago, water was adequately supplied by AUWSA to the ward. However currently there has been a shortage of water to the people in Terrat and standpipes and empty storage tanks are seen without water. AUWSA claim that, the main pipe to Terrat has been worn as a result of chemical attack of the soil in this area. People are mainly depending on the water harvested during rain season, which serve only few people who have means of water harvest and this is only for short period. There is no

spring source found in Terrat ward, but there are two polluted rivers Buruka that marks the Northern border of the ward and river Themi that runs on the Eastern side of the ward. The water of these rivers can only be used for washing and not for human consumption. During dry season June –March Terrat residents buy water from neighbouring wards few kilometres from Terrat costing them about 400/= Tshs. per 20liters containers. Economically this is very difficult situation calling for the government and indeed municipality authority to find the sustainable solution to the people in Terrat.

3.8.8 Water Supply Kati

Kati ward is well serviced with a good water supply system of AUWSA where by about 95% of the houses are connected to AUWSA distribution network. To the residents of Kati ward, water is available almost everyday unless when there is a power shortage or during long period of drought. People who are not connected to AUWSA supply system has to buy water from neighbors or public standpipe by paying 20 to 40 Tshs per bucket. Also within the area there are a few individually owned shallow wells, used as alternative sources especially during dry season or any time when there is water shortage. In Kati ward there is neither water committee nor Public water kiosk or water vendors found within this ward since water supplied is not a major problem

3.8.9 Water Supply Lemara

Lemara residents are mainly depending on AUWSA water supply and natural springs found within the wards. Most of the houses are connected to AUWSA water supply system. Several springs are distributed within ward as follows:

- 4 are located at Ikororuwa Sub-ward,
- 2 at Levolosi and
- 2 at Lemara-kati Sub-ward

The residents of remaining few houses that are not connected also can access the water supply service within a short walking distance from their homes. The natural water sources such as springs found within the area are under the control and protection of the

ward environmental committee, where by security by-laws are reinforced to prevent the sources from being polluted. One among such by-laws is the one that prevents people from building houses too close to the water sources, where by residents are directed to leave a green area buffer zone of forty meter around the water sources such as natural springs. Despite the reinforcement of the by-law there are a few defaulters who ignore them, for example at Ikororuwa Sub-ward there is a big spring used by residents of both Lemara and Unga ltd wards threaten by encroachment of one resident by digging and building a toilet within less than 10 meter away. Something which led to the drying up of that spring, but when that person was forced to stop what he was doing the water production of the spring went back to normal.

Water supply from AUWSA sources within Lemara ward is allocated on specific hours, for the time being it is available only from 4:00 am to 7:00 am. On the other hand the responsibility of protection of water sources requires funds to pay for security guard while the income sources of wards are so limited hence this makes the whole venture very expensive for them to carry out. In Lemara ward there is no Water committee, the board responsible for water issues as pointed out above is the environmental committee.
Water connection fee to AUWSA supply system is too expensive to the majority of the residents who are low income earners and poor. E.g. the cost of 100-metre connection was 221,000 Tsh in year (2005). People without house water connections have to buy water from their neighbors or from a few AUWSA water points found nearby their homes. The cost of water per bucket is TZS 20 to 50. At one of such public kiosk located at Korongoni area, water is available all the time except during very dry season when the problem of is acquit. The problem with tap water supply system is that in some areas the pipes are already too small or too old to meet the increasing demand of the fast growing population since the line is more than ten years old. As a solution to unreliable water availability people use storage tanks.

3.8.10 Water Supply Levolosi

Levolosi ward is well served with AUWSA water supply network therefore all residents in this ward have access to tap water. In Levolosi ward water is available and reliable

except during dry season when it is necessary to apply rationing then it is provided on specific hours. In this ward, few houses have been disconnected from water supply system due to failure of AUWSA bills payments. Residents of such houses are therefore buying water from their neighbors at a cost of 20-50 Tsh per bucket or from water kiosk for about 40-100 Tsh per bucket depending on the area concerned

3.8.11 Water Supply Sekei

Sekei is well served with AUWSA water supply network therefore most of the residents have an accsess to tap water and also there are natural springs. For some who are not connected to AUWSA network, fetch water from kiosks located at different hamlets within the ward. There are about 2 kiosks and 2 standpipes whereby people buy water for 20-30Tshs per bucket. The price is almost the same if one buys water from neighbor residents who have tap water. In some incidence, some residents provide water freely to those with no tap water in their houses.

3.8.12 Water Supply Sokon 1

In Sokoni I the main source of water supply is natural springs, although there are some of residents who depending on AUWSA water supply system, which is a very old system, dated back in the 1960s. Shallow wells are common in Sokon I, but they are not safe due to ground water pollution. In most cases those residents without tap water are buying from their neighbours at 20Tshs per bucket.

Water table is very high about 4 ft. this also add to unsafe of water, especially at Sinovuno hamlet, whereby Water supplied by AUWSA is not very reliable it is just available only twice a week. The connection fee is also very expensive for people in that area to afford, considering their low income, as most of them are farmers and small businessmen. In this ward only at Kilimani hamlet there are water committees and their main responsibility is to make sure drains are clean, its very difficulty to prohibit people from digging wells randomly because are doing so due to shortage of water hence they think that is the only solution for their survival .In this ward there are health committees in almost every hamlet and their major role is monitoring toilets and its also difficult for

them to deal with other issues like prohibiting people to dig wells near toilets or such kind of things, for instance at Murriet people are pumping water near dump area, but you can not stop them doing so as its their means of living though not good for their health

3.8.13 Water Supply Themi

Most of people in this ward are provided with tap water from AUWSA.There are also three main springs in this ward namely Kambarage, songambele, and kwa wazambia spring, the first two located at Themi mashariki hamlet and the third one is located Corridor area. There are standpipes placed at the ward by AUWSA but all of them are not working due to difficulties on operation and maintenance as the price fixed by AUWSA for selling water from these kiosks is very low compared to running costs. In general water is said not to be a problem except during dry season whereby water is provided by allocation (Kiswahili word is mgao wa maji)

3.8.14 Water Supply Kimandolu

In Kimandolu ward the majority of the residents are using water from AUWSA supply system, but it is not very reliable. During dry seasons water in Kimandolu ward is only available three or two times per week. Other sources of water are a spring located nearby Hotel seventy-seven and a river known as Kijenge that passes across the ward. In Kitiangare area the problem of insufficient water supply is more critical than in other parts of the ward. Within the whole ward there is only one Public water kiosk at present, which is located at Ngulelo area. People wanted to gate water without paying from that public point and this resulted to the closure of that of that service of water kiosks by AUWSA.

A few residents of this ward are practicing rainwater harvesting so as to get free water to meet their domestic needs. This practice of rainwater harvesting started very recently with only few people but currently most of people seem to be interested and have started to join this venture since it a low cost solution. The majority of Residents of Kimandolu believe that water from AUWSA supply system is of good quality and needs no further treatment prior consumption. However, with the water they fetch from springs, they have

to boil it before drinking, this is because the springs water source area is not protected as such there are buildings developed too close to this source and no measures taken to control it for the pollution

3.8.15 Water Supply Oloirien

The majority of Oloirien residents more especially those of Suye and Meiroti areas are fetching water from springs located in their areas. These springs are well protected. Apart from serving Oloirien citizen, the sources also serve people from Meru district. Majority of the residents claims that they prefer using spring water because it is safe as the sources are well protected and they get free of charge they don't have to buy it. But that is not always the case as the result of sample from one of these springs showed that there are fecal matters in that water. Due to this the ward decided to put a notice near the spring so as to alert people to boil water before drinking.

Together with the natural springs Oloirien ward is also served with AUWSA supply system. Most people have direct house connection to AUWSA supply system, the household that are not connected are the ones who fetch water from the pipes that are provided at the above discussed springs. The ward has no public water points provided by AUWSA. There are some areas within the ward that experiences water shortages especially during dry season; these areas are R.C., Mbeshere and Mwaivoi the problem is more critical because in these areas there no natural sources of water such as rivers and springs.

3.8.16 Water Supply Sombetini

Within Sombetini ward there are five natural springs where people get water to meet their daily need. But on the other hand although this is an unplanned settlement it is well served with AUWSA water supply system where by 75% of the residents has access to tap water. Some people are directly connected to the AUWSA system while the rest of the residents fetch water from 5 AUWSA kiosk distributed within their ward. All these kiosks are operated and maintained with private people who collect money, they remit some of that to AUWSA as water bills and they keep the remaining amount. To get water

at the kiosks the residents have to pay 5Tshs per bucket, while if they buy from the neighbor with private connection, they have to pay 20Tshs per bucket. But within the ward it is also said that there are individuals who offer free water to their fellow residents.

Sombetini ward people claims that water from their natural springs is safe because they have been using it for years without any problem. Water from both sources that is from natural spring and from AUWSA water supply system is directly used with people without any treatment. But a few residents are aware of the health risks of drinking water without boiling so they boil their drinking regardless that they get it from AUWSA sources or from springs. On the other hand most people of Sombetini choose to use tap water for drinking, as they believe that it is treated so it is more safe and clean than that from natural springs.

Currently, connection of water from AUWSA is not a problem as it uses to be in the past. Water connection fee from AUWSA supply system is approximately 200,000Tshs per 100 meters; the expenses go on increasing as the distance increases from the main pipe. Sombetini Residents have also another alternative of water connection where by people who are already connected to AUWSA water supply system can invite their neighbors to connect in their line by paying 50,000Tshs as a line connection fee.

3.8.17 Water Supply Elerai

Generally the water situation in Elerai is not good. Only about 32 % of the people in this ward get water from AUWSA. There are four springs and they are well built and protected. People have also deep and shallow wells which they use their source of water. There are also water Kiosks and stand pipes, for example in Majengo there is one stand pipe and one water kiosk which helps to provide water for the people who are living near that service. Cost of water in kiosk is 20Tsh per 20-litres bucket.

People in Lemara are not sure with the quality of water from the sources within the wards but the majority believes that water, which is supplied by AUWSA, is of good quality. Cholera is the frequent disease facing this ward especially in rain season; this is because the shallow wells are very close to the toilets also in Majengo area the water table is very high. Due to this severe problem there was an operation to demolish these wells in order to overcome the problem; therefore nowadays the problem is not big compared to previous years. Also AUWSA provide free services to the poor people who they give them coupon in order to fetch water at the kiosk for free and they are allowed to take 3 buckets per day. Places which suffer a big problem on water supply is mainly Urundini, Majengo A and Kware.

Chapter 4: Wastewater Management

4.1 Institutional setup

Arusha Urban Water and Sewerage Authority (AUWSA) is entity charged with the overall operation and management of water supply and sewerage services in Arusha Municipality. These core functions are carried out by its Technical Services Department, which has five sections namely sewerage, water network production, planning and construction, and maintenance and repair. AUWSA is not responsible for on-site sanitation system within the municipality. However, it has one sludge pond receiving wastewater from cesspit/septic emptier. It receives about 170 emptier/month and each emptier has to pay 2,000 Tshs on emptying its contents to the sludge pond.

Arusha Municipality Council (AMC) through its health department is responsible for coordinating sanitation activities within the municipality. It has a total of two trucks (emptiers) for pit latrines and cesspit emptying and discharging them to the sludge pond located in Lemara owned by AUWSA. There are also two private companies in the municipality namely Monjes and City Sanitation which provide a service with charges being negotiable depending on the distance from the sludge pond. The private companies have in total five cesspit/pit latrines emptier.

4.2 Coverage

Despite the fact that AUWSA meets 98% of municipality water demand, most residents in Arusha Municipality are not connected to sewerage systems and they use on-site sanitation. Existing reports indicate that only 12% of the population (2002 population) in Municipality is connected to the sewerage systems and most of them are in the central parts of Municipality.

4.3 Technologies

Wastewater management technologies used in Arusha Municipality include; sewerage system with sewage being treated by using waste stabilization ponds and on-site sanitation system, which mainly includes traditional pit latrine and water closet connected to septic tanks.

4.3.1 Sewerage system

The existing sewerage system was designed for population of 41,000 people and currently it serves 33,497 people, which is 81.7% of its full design capacity (41,000). The wastewater treatment plant in Arusha Municipality which is waste stabilization ponds (WSPs) is located in Lemara ward and it receives 5460m^3/d. Table 4.1 shows the design and served sewered population in various categories in the Municipality.

Table 4.1: Design against sewered population

Category	Domestic	Commercial	Industrial	Institution	Total
Design population	24,160	5,400	5,040	6,400	41,000
Served population	19,600	5,861	3996	4,040	33,497
Existing connections	2,450	486	111	101	3,148

The billing of wastewater by AUWSA is dependent on water consumed and category of connection. The cost of wastewater is calculated as a product of 76W, 96W, and 120W and unit cost for Domestic and Institution, Commercial, and Industrial respectively, where W is the amount of water consumed in m^3 as recorded in the water meter.

Only few wards have sewerage system and even in those wards with this system, they are not fully covered. The wards with public sewer line are Levolosi, Ngarenarok, Sekei, Themi, Daraja II, Kaloleni, and Kati, which is the ward with 100% coverage of sewerage system. In total the public sewer line covers a total length of 36.5 km. The sewer line needs upgrading in most areas to 500 mm from 100-200 mm diameter to coupe with the

current population. WSPs are the current technology, which is used for wastewater treatment. It comprises of one anaerobic pond which discharges its effluent to two parallel secondary facultative ponds. The two facultative ponds effluent is further polished in two series maturation ponds discharging waster treated effluent to Themi River. Plate 4.1 shows a view of one of facultative pond.

Plate 4.1:Secondary facultative stabilization pond-Lemara treatment plant.

4.3.2 On-site sanitation system

Information from AMC and AUWSA shows that 91.8% of AMC population use on-site sanitation and 1% practice open defecation (Fig. 4.1). However, based on the household survey, it was found out that a high proportion (94.4%) of respondents use on-site sanitation as their means of disposing excreta. Only 5.2% of respondents in the three wards use flush toilets, which were connected to the sewerage system. It was observed that in the three wards 0.4% of respondents practices open defecation. Table 4.2 shows the proportion of respondents who used traditional pit latrines in each ward.

Table 4.2: Traditional Pit Latrines In Three Wards

S/No	Ward	No. Households with pit latrines	% Households with pit latrines
1	Daraja II	190	81.2
2	Sokon I	234	67.0
3	Lemara	91	75.8

From the interview it was observed that about 61.1% share their toilets with other households. At most 59.3% indicated that they do not empty their pit latrines when they get full, but they either dig another pit (66.8%) or close the toilet and use the room for other purpose (11.5%). About 73%) of the interviewed households showed that emptying of pit latrines is usually done by private companies and Municipality The survey established that the cost of empting a pit latrine/septic tank varies between 20,000 and 50,000 Tshs with the total construction cost of pit latrines varying between 10,000 Tshs and 1,500,000Tshs with an average of 250,00 Tshs depending on the sophistication of the pit latrine toilet. Plate 4.2 indicates typical sanitation systems used by majority of people in Arusha.

Plate 4.2: Typical on site-sanitation systems

Of the visited households, 33.8% households had their toilet in bad shape and needed repair. Most pit latrines in all the wards were poorly maintained and according to 70% of the respondents it was a responsibility of landlords. Bad construction, lack of cover, weather, lack of cleaning, used by many people, lack of maintenances, and lack of use of disinfectants were pointed out to be the reasons of smell in traditional pit latrines. Of the interviewed households in the three wards it was mentioned that their grey water goes to latrines (45% of respondents) others disposing areas mentioned were septic tanks, roadsides, in the pits at the back yard of their houses.

Interviews carried out in three schools from Lemara, Sokon I and Daraja II showed that one stance of pit latrine was shared between 88 to 260 students with the worse condition being in Daraja II School (Table 4.3).

Table 4.3: ratio of students to number of pits for the toilet

School in	Number of students	Number of stances	Students/stance
Lemara	884	10	88
Sokon I	1408	8	176
Daraja II	2599	10	260

In these schools boys and girls have separate pits. Teachers have their own toilets. In all three interviewed schools, their toilets smelled badly due to absence of vent pipe.

Plate 4.3 shows typical latrines for schools.

Plate 4.3: A primary school in Sokoni I and the toilets for students

Fig. 4.1 Give a summary of sanitation system in Arusha Municipality.

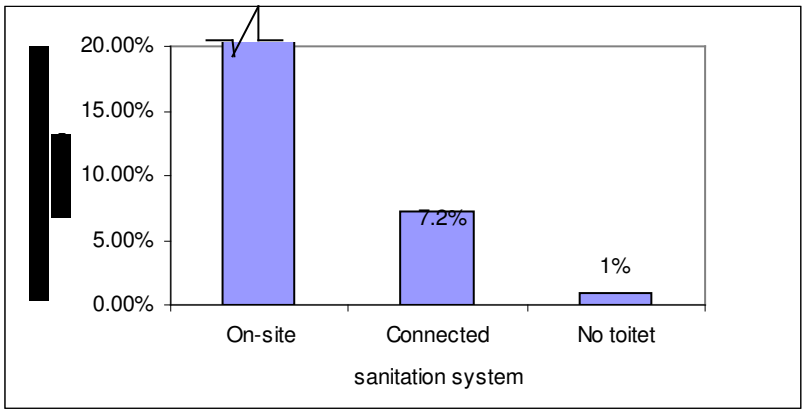


Fig. 4.1: Proportion of sanitation system in Arusha Municipality

4.4 Health aspects

The problem of sanitation in Arusha Municipality is reflected by the high frequency of diarrhoea, typhoid, dysentery, cholera and intestinal worms among the residents. Three health centres were involved in this survey, which were from Lemara, Sokon I and Daraja II. They all agreed that most of the cases reported in their centres have the relation with water borne diseases. In Daraja II and Sokon I health centres 80% and 90% respectively of the cases reported are related to sanitation while in Lemara only 35% of the cases reported are related to sanitation issues. Malaria, cholera, dysentery, typhoid and

intestinal worms being the cases frequently reported in these wards with malaria and typhoid leading. According to results from the household survey, Malaria was highly ranked by 89% of respondents as the most frequently disease in the three wards followed by typhoid by 44.4%.

4.5 Socio-cultural aspects

Arusha municipality is made up of multi cultural and multi religious heterogeneity. In spite of the Islamic region that emphasises use of water for anal cleansing, other non-Moslems do use water for anal cleansing due to limited funds to buy toilet paper. The household survey indicated that most of respondents (95.3%) use water as their means of anal cleansing. Anal cleansing is a very important factor in Ecosan as it influences design and usage aspects.

4.6 Findings from Focus Group Discussions (FDGs)

4.6.1 Wastewater (Unga limited)

In Unga Ltd ward the sewerage system covers only a small portion of Viwandani sub-village say 10% of the ward and majority of residents use on-site sanitation like most of the wards in Arusha. Most of pit latrines found in Unga Ltd are not VIP and are made of marginal materials which make them looking very unattractive (Plate. 4.7). The type of soil in Unga Ltd varies from place to place. In some areas like Viwandani, the clay soil is dominating making very difficult for pit latrine option due to high water table. In Makaburi ya Baniani the situation is a little bit better and it is not surprisingly to go deeper like 20 ft without finding a water table.

Empting of septic tanks in some areas of Unga Ltd is sometimes very difficult due to inaccessibility. Like any other unplanned areas of Arusha, this has force some of the residents to shift from one room to another providing a room for pit latrine. To avoid frequently empting of On-site sanitation systems, the residents of Unga Ltd allow Grey water to flow in the street making the place unpleasant and vulnerable to heath risks.

Plate 4.4: Typical Pit latrine found in residential areas of Unga Ltd

4.6.2 Wastewater Ngarenarok

In unplanned area of Ngarenarok, due to congestion of houses it is difficult to introduce sewerage system as results almost all residents in this area use on-site sanitation, the common type being pit latrines. Shifting the toilet from one room to another once the one in use is full is a common practice especially in Olmatejo area. In planned areas of TCA and NHC most of the houses are connected to sewer line and do not have a problem of emptying. The biggest problem in planned area is blockage of the system, which leads to floating and spilling over of wastewater in inspection chambers along the sewer line. Most of PVC pipes for sewerage system are above the ground, which is not professional because they susceptible to damage and above all causing health risks to the residential areas.

4.6.3 Wastewater Baraa

As with water supply, people in Baraa do not have major problem of discharging wastewater. Wastewater from kitchen and bath (grey water) are allowed to flow to the small farm/garden around the residential areas. This is not causing any hazards because Baraa ward has very low population density (26 people/ha). The majority of people in Baraa use on-site sanitation with pit latrines as their prime option. In this ward there is no sewerage systems service at all. Almost all hamlets are accessible to earth roads making it easy to empty the septic tanks/cesspits.

4.6.4 Wastewater Daraja II

Daraja II is not fully covered by sewerage system and as such the majority of residents (about 90%) are using pit latrines for discharging their excreta. The toilets are made up of reject timber floor or few logs with old iron sheet as walling materials. Permanent toilet structures are very few in this area. The houses are built so close to each other that make it very difficult to access; hence emptying toilets once they are full is quite impossible except for a few houses that are built along the road. This has resulted to some people to wait until rain season and discharging their wastes from toilet to the resident area. Others are forced to shift the toilet to one of the room in the house. All these practices are pausing health related risks to the residents. The cost of digging toilet in Daraja II is 5,000 Tshs per feet. For those areas, which are accessible for disludging toilets, the typical emptying cost is 30,000 Tsh per trip and this is done by private or municipal owned trucks. The typical cost for connecting the house to sewerage system is 150,000 Tshs, which is very difficult for many people in this area.

4.6.5 Wastewater Engutoto

In Engutoto all residents use on-site sanitation with the majority using flush toilets which discharge wastewater to the septic tank. Pit latrines are found in part of Block C which is where by Masai tribe largely concentrated. Water table in Engutoto varies from one block to another depending on the type of soil. Black cotton soil the dominant soil type in Engutoto while soils in Njiro area is loam as well as reddish silt clay gravel soil. Plans by AUWSA are underway to build the treatment plant in Njiro area to serve people of

Engutoto. Septic tank emptying in Engutoto like other wards is done on household's arrangement with responsible companies. The cost is negotiable and ranges from 50,000 Tshs to 70,000 Tshs per trip depending on the distance to the Lemara, AUWSA treatment plant. The ward development committee is worried about the storm drainage system. They advised the Municipality They asked the Municipality Authority to help in constructing the systems to avoid road damage. Most of the roads in Engutoto are either of gravel material or earth roads. The tarmac road is only of small portion of the ward.

4.6.6 Wastewater Kaloleni

In Kaloleni ward more than 50% of the population is connected to sewerage system. However, there has been a major concern that while many people want to be connected to this sewer line, the process is too long and tedious. For the people who use on-site sanitation there has been a problem of frequently emptying their system due to high water table as the soil in this ward is either clay or silt clay. For the unplanned area of Mita-Miambili, on-site sanitation is the only option of discharging their wastewater. The area is having difficulty in emptying because some people have built their houses which block the access. Another problem in this ward is that in planned area some people who were previously connected to sewerage system have misused the land making it difficult to the other people to be connected. They claim compensation for new connection because they think the connection is done in their plots. This is not acceptable as per city plans but the required authority AUWSA and Municipality has not been able to resolve this issue.

4.6.7 Wastewater Terat

All residents of Terrat are using on-site sanitation with pit latrines toilets dominating in the area. Due to the land availability, residents in Terrat do not empty their toilet once they are full; they just abandon them and dig a new pit latrine the cost of which is 2,500 Tshs. Per ft. In one of the day-secondary school with 650 students, it was found out that one toilet, which has seven pits, was the only mean of sanitation. In this school, the number of female students, which was almost the same as male students have 4 pits and the rest 3 pits, were for male students.

4.6.8 Wastewater Kati

Waterborne sanitation system (off-site) is the very common in Kati ward due to well-established water and sewerage networks. The ward has four places of public toilets, two located at central markets and other two are at the bus stand. To use the toilet one has to pay Tshs 100 per call. The buildings of these public toilets belong to Arusha municipal council but the services are provided by individuals through Public Private Partnership (PPP).

Due to good sanitation system, this ward has no water based diseases or other diseases, which are related to poor sanitation system.

4.6.9 Wastewater Lemara

The most commonly used toilet type in unplanned areas of Lemara ward is pit latrine; a few people are connected to the main sewer line that passes though the small portion of ward and the remaining small percentage is using flushing toilets connected to septic tanks. On the other hand, the residents of planned areas that is people of block 'A', 'B', 'E' 'G' and western part of block 'J' Njiro are using flushing toilets. The major part of the ward is characterized by black cotton soil and very high ground water table more especially during the raining season. Due to high levels of underground water disposal of wastewater is very challenging as a result in every three to five months, the toilet have to be empted.

Toilet emptier trucks available are very few, at present there is only one emptier owned by Arusha Municipal Council, which is in a good condition and of a big capacity. Private owned emptiers are of smaller capacity and their charges are the same with the one of the bigger capacity. The minimum empting cost per toilet is Tshs 90,000/= and the frequency of empting per year depends on the number of inhabitants of the house. In densely populated areas, the overflow of wastewater is a common problem of most of itsresidents are poor, they can't afford empting toilets every time when they are required to do so. All houses have toilets although in unplanned areas most of these toilets are not well maintained and they are not in good shape. The environmental committee and the ward

health officer are working closely together to reinforce by-laws so as to ensure the health condition of their ward. The leading disease in this ward is malaria and others that occur occasionally are diarrhoea and cholera.

The Waste Stabilization Ponds (WSPs) of the municipality are found in this ward located at Lemara Kati Sub-ward. The residents living nearby the ponds are using effluent from ponds for irrigation in their vegetable gardens and banana farms as such they are able to produce vegetable throughout the year, though they are not aware of the health risk that might happen to them as a result of using the ponds effluent. This is because the ponds are used for treatment of both domestic and industrial waste. During the focus group discussion it was pointed out that the corrugated iron sheets houses located nearby the pond have to be replaced in less than ten year.

4.6.10 Wastewater Levolosi

Levolosi ward residents is mainly using flushing toilets; a small percentage and those living nearby the sewer line passing though the ward are connected to the system. Few people are using pit latrines within the planned area of Levolosi but in unplanned part of the ward majority of the residents are using pit latrines, while the remaining few are using flushing type toilets. In some cases people have both flushing and pit latrine toilets where by pit latrines are kept at the back yard out of the house erected on top of soak away pits, these pit latrines are for emergence purposes. As such people use them during the water shortages as a way of minimizing the cost of water used by the household. The people who are not connected to the sewerage system once their toilets are full they use the emptier trucks to transport and dispose of the effluent at Lemara Waste Stabilization Ponds (WSPs).

Due to the fact that Levolosi ward is well serviced with water supply and that wastewater management is good, cases of water born diseases are rarely reported. The cholera patients sometime admitted at Levolosi Health Centre are always coming from other parts of the municipality and sometime they even come from outside Arusha municipally, that is, from the neighbouring district of Arumeru.

4.6.11 Wastewater Sekei

Sekei is well covered with Sewerage system except in few areas and especially in unplanned area of Mita Miambili where the majority of residents use pit latrines. In case of emptying pit latrines residents normally use the municipal council's trucks as well as Monjes private company's trucks for the service. One has to pay between 25,000-30,000Tshs for municipality trucks and Private Company's truck respectively. In other hamlets like Sanawari at Mbwa chini, water table is very high leading to frequently emptying the toilets. Illegally and unsafe methods of empting their toilets by connecting their toilets into drains when is fully is practiced. This is normally done during rain season so as to let wastewater and rainwater flow together to water bodies. In this ward about 75% of residents are educated enough on sanitation issues and they know exactly the health risks caused by poor sanitation practice

4.6.12 Wastewater Sokon 1

Most of the people in this ward use pit latrines and very few of them do use flushing toilets connected to septic tanks, but the problem comes to the empting process whereby people empty sludge by using buckets and dispose of in street drains., This practise is normally done during rain season where they let it flow with rain water. The main cause of this is attributed to nature of the settlement structures of the area, because the area is unplanned, its actually a squatter area hence no enough space to dig pits as septic or to dig toilets as result you can find one toilet shared by more than ten households.

Wastewaters from industries are also discharged to street drain during rain season. In this area most of residents are not covered by sewerage system from AUWSA this is due to low income of the people and also the AUWSA networking is not covering the entire ward.

4.6.13 Wastewater Themi

At Themi ward while some of the people are using flushing toilets connected to septic tanks for collection of wastewater, others are connected directly to AUWSA sewerage system at the main sewer line. Most of residents at Themi Mashariki are using pit latrines and when get fully they are emptied either by municipal council emptier or private emptier A large area of Themi ward which is about 70% of households are connected to the AUWSA sewer line, therefore waste water management is not a big issue although there is a problem on waste water management at some parts of the ward especially at old police line hamlet whereby police houses are old enough and the sewerage system is very old leaking wastewater in streets and along the roads. The same problem is said to appear in municipal houses whereby there are about 84 houses with sewer problems this makes the situation even worse during rain season, but still, together with these problems there are no reported cases on water borne diseases.

4.6.14 Wastewater Kimandolu

There is no sewer network within the ward and the majority of the residents use pit latrines as their major option of sanitation. The remaining few are uses flush toilets connected to septic tanks/cesspits. In Tindiga and Kijenge Kaskazini area, there is very high water table therefore the pit latrines get full frequently hence they are forced to dislodge after a very short period of time. The same private company known as Monjes, which is providing the emptying services in other wards, is the one also serving Kimandolu ward. Arusha Municipality Council trucks also provide the service.

In some areas of the ward accessibility is very poor and at the same time the area is over crowded to the extent that there is no more room for a construction of a new pit latrine. Hence for those who are living in this situation, they normally have no enough space to dig another pit hence they use one of the room in the house in order to construct a new pit latrine or they put salt inside the pit and leave for sometime in order to reduce the level. Others disludge their pits by allowing the sludge to flow on the streets, especially during the rain season, or in the river especially for those who are living near the river. Disease, which is normally facing this ward, is cholera occurring almost every dry season.

4.6.15 Wastewater Oloirien

The majority of Oloirien residents are using pit latrines especially in unplanned part of the ward. But in the planned areas the common type is flushing toilets connected to sewerage system are the preferred sanitation option. To control wastewater flowing uncontrolled around the ward the health officer advised people to have pits for grey water collection within their backyards. Within the ward areas with high water table, which require to emptying services frequently are Suye and Meiroti. Like other ward they also use emptying trucks from Arusha municipal council and a private company known as Monjes. Environmental awareness is very high in Oloirien ward; as such the ward has been receiving awards from the municipality council from time to time almost every year. Common diseases in Oloirien ward are typhoid and Malaria.

4.6.16 Wastewater Sombetini

Wastewater management of Sombetini ward is in very poor condition, factors contributing to this situation are impermeable black cotton soil dominating most parts of the ward, high water tables and poor accessibility of the area. Due to this water born diseases such as cholera and typhoid are serious problems of the ward.

The common type of toilets used by the majority of Sombetini residents is pit latrine where by in most cases they have to build and raise them as high as one up to one and a half meter above the ground level. And for the residents who are using septic tanks and soak away pits they have to empty them at least once per month something that makes the whole process very expensive and for low income earners it is very expensive that they can't afford it at all. Therefore in most parts of Sombetini the over flow of waste water is very common around the area, waste water from households washing, toilets and other domestic uses is just flowing along roads, drains, streets and passages more especially during the raining season.

The situation is so critical that at some areas e.g. along river Burka those people living close to it do illegally empty their toilets into the river. They do it either by using buckets

to carry waste water over flowing from their toilet and pour it in to the river, or by connect a pipe to drains their toilet direct in to the river. Construction cost of a pit latrine ranges between 600,000 to 1,000,000Tsh depending on the materials used. Within the ward like other wards there is a private company that provides waste water empting services known as Monjes Company Ltd, the charges per trip is 30,000Tshs which is high for low income people. Plate 4.5 show a pit latrine, which built close to river Burka.

Plate 4.5: A pit latrine constructed close (a bout 2 meter) to River Burka

4.6.17 Wastewater Elerai

Onsite sanitation is 100% used by Elerai residents. The ward has no sewer connection. In Majengo area the pit latrines become full in a short period, which have forced the residents to empty their toilets frequently. The charges are 25,000Tshs per trip of emptier. But others who do not have money, they emptying their pit latrines by using buckets, a method that is health risking. Due to cost embedded in emptying pit latrines the residents do not allow grey water to go to pit latrines so as to prevent pit to get full quickly, but they discharge their grey water to the roadsides. The common soil type of the ward is black cotton type that keeps the water above the soil. There is no drainage system for Storm water in most areas of Elerai, which has made the place unpleasantly during rain seasons.

Chapter 5: Solid Waste Management

5.1 Institutional setup

The role of Solid waste management in Arusha Municipality is the responsibility of the Health Department and direct under the cleansing Section. During 2000, municipal consultation workshop poor solid waste management was identified as one of the pressing environmental issues facing Arusha municipal council. By 2003, Public Private Partnership was adopted as the new approach to Solid waste Management. At present four private organizations have been contracted by council to carry out solid waste management in different wards of the municipality, these includes Kivesi, Kisomboko companies, one NGO known as YEP (Young Environmental's People) and a CBO known as Faraja Engilejileta. The municipality has two skip bucket trucks that collect all skip buckets distributed in various second collection points and empty them at Murriet municipal dumping site. On the other hand it is also the municipality responsibility to provide services to all areas that are not served by the private companies.

5.2 Sources and generation rates

According to the 2002 Comprehensive Solid Waste Management system in Arusha municipality document, solid waste generated in the municipality is estimated to be 378 tons/d with average generation rate of 0.8kg/capita/day. The collection capacity is estimated to be 178 tons per day, which is 47% of the generated solid wastes. On average the status of solid waste management in Arusha Municipality is unsatisfactory due to a number of reasons including:

- Insufficient equipment and trucks (only 5 trucks for the whole municipality). Plate. 5.1 indicates typical truck owned by Municipality council,
- Inefficient of working and safety gears,

- Lack of enough secondary collection points (skip buckets) distributed within the municipality (only 27 skip buckets available to serve the whole municipality) leads to the poor management as shown in Plate. 5.2 Below.
- Limited funds available to address solid waste management activities of the municipality both as contribution of users and budget allocated by Arusha Municipal council.
- Poor acceptance of cost sharing concept of solid waste management among the residents.
- Low level of private sector participation in the solid waste management of the municipality. (Or unwillingness of the private sector to participate in solid waste management

According to the information given by Cleansing section, the solid waste generation of different categories found in Arusha municipality are as indicated in Table 5.1

Table 5.1: Solid generation by different categories

S/No	Category	Solid Waste generated (tons/day)
1	Households	278
2	Institutions	5
3	Commercial	16
4	Streets	2
5	Markets	42
6	Industries	35

5.3 Collection and Transportation

Waste collection is mainly done jointly by the AMC and private companies, NGOs and CBOs. Generally collection services are of two methods which are primary waste collection and secondary waste collection.

Primary solid waste collection within the ward assigned to private contractors, is provided through a door to door service. And for the wards that are not assigned to private contractors, primary collection of waste from households to secondary collection points is either done individually by household members, or through private arrangements that involves informal youth groups using pushcarts to haul waste.

Secondary collection points are normally supplied with skip buckets. For the wards served by the private contractors secondary waste collection is carried out in two ways which are:

- Collection and emptying skip bucket, this is done by AMC skip buckets trucks. But the private contractors have to pay collection fee to the municipal council.
- The contractors have to use their own trucks to collect waste from the secondary collection points which are not provided with skip buckets or the waste which overflows out of the skip buckets.

Plate 5.1: Insufficient equipment and trucks

Plate. 5.2: Pilled uncollected solid waste

Table 5.2: Coverage of solid wastes service in all wards of Arusha

S/No	Ward	Service provider	Current No of skip buckets	Level of service	Remarks
1	Dararaja II	AMC	2	Unsatisfactory	Inaccessible, Unplanned settlement
2	Kaloleni	KISOMBOKO Co.	3	Unsatisfactory	New contractor
3	Kati	KIVESI INVEST.	3	Satisfactory	
4	Levolosi	KIVESI INVEST.	2	Satisfactory	
5	Ngarenarok	AMC	2	Satisfactory	
6	Sekei	AMC	4	Satisfactory	
7	Themi	LEMALI INVEST.	2	Satisfactory	
8	Unga Ltd	AMC	3	Unsatisfactory	Unplanned, poor accessibility
9	Baraa	YEP	0	Satisfactory	
10	Kimandolu	YEP	2	Satisfactory	
11	Oloirien	NONE	0	Unsatisfactory	Unplanned (90%)
12	Engutoto	NONE	0	Unsatisfactory	Not contracted
13	Sokoni	AMC	2	Unsatisfactory	Unplanned, rural, not contracted
14	Lemara	NONE	0	Unsatisfactory	Unplanned, not contracted
15	Terrat	NONE	0	Unsatisfactory	Rural area
16	Elerai	AMC	1	Unsatisfactory	Unplanned
17	Sombetini	FARAJA ENGLEJILEJATA	1	Satisfactory	

AMC = Arusha Municipality Council, YEP = Young Environmental People's

According to the above table the solid waste contractors and the areas they are serving are as follows:- Kivesi company provide service to Levolosi and Kati wards, Kisomboko company is serving Kaloleni ward, while Lemali investiment company is contracted to serve Themi ward, the NGO known as YEP is working in Baraa and Kimandolu wards. The CBO of Faraja Englejilejata is contracted to work in Sombetini ward. AMC takes care of wards that are not yet assigned to private contractors these includes Daraja II, Engarenarok, Sekei, Unga limited, Sokon 1 and Elerai. There are a few wards that are not serviced at all, these are Oloirien, Lemara, Terrat and Engutoto.

5.4 Treatment

Each health facility is supposed to have an incinerator to treat their waste on site. In most cases solid waste disposed is a mixture of all types of wastes. Some hospitals dispose waste openly, few separate medical waste from normal waste, with medical waste usually incinerated onsite or buried and normal waste is disposed to the legal dumpsite.

Industries are supposed to takes care of waste disposal themselves. Since there are no guidelines and follow-up, they employ any method including burying, burning and crudely dumping at official/unofficial sites. That means even infectious and hazardous waste from different places is all crudely dumped to the municipal dump site.

5.5 Disposal

The main dump site of the whole municipality is located at Murriet area in Sokon I ward at a distance of about 8 km from the town centre through Unga Limited road. The dumping site is fenced and occupies an area of 60 acres, the site is planned for the development of a proper sanitary landfill but is not yet realized.in any case the plans will be realized in the near future.

5.6 Re-use, recycle, recovery (sale of resources)

There is no formal recycling being done but according to this study it shows that there are some recycling and reuse of materials such as metals scraps, plastic bottles, old tyres and papers initiatives carried out by groups and individuals.

For recycling to be successful, wastes must be separated at source of generation or at least sorting as much high as possible in the waste stream. A reliable market for recyclable and reusable materials as well as recycled products is prerequisite. On the other hand the formal recycling activities will only be established when there is a clear solid waste collection system and a clear by laws to support the system. According to the 2003 Needs Assessment and Follow up on Solid waste Management activities Report, Tanzania has a big plastic, paper, glass, aluminium and steel industries which will provide a good market for recycling product on the other hand there is UNIDO Recycling and Process Centre (RPC) established in Dar es salaam which uses plastics and paper waste as raw materials.

5.7 Rapid Solid Waste Assessment

Focus group discussion between ROSA team members and Development Committees members of each of the 17 wards was carried out as a rapid way of assessing the existing solid waste generation, collection, transportation, treatment and disposal. According to the data collected during the information for each ward is discussed here below:

5.7.1 Solid Waste Unga Limited

In Unga Ltd, ward health committee supervises the solid waste management from the households. Each household is supposed to bring their solid waste in collection points placed within the ward. For this ward the collection and disposal to the municipal dump site is done by Municipal council skip buckets trucks. The service is free for households but for business entities normally one has to pay 60,000 shillings per annual as collection fee. The solid wastes from households are normally not separated (sorting) in various from fractions but for wastes that have financial value like metals scraps, plastic bottles etc they normally not reach collection point they are taken at source. The major problem at collection point is the attitude of some people throwing wastes outside the skip container and this result to a poor condition around the container (see photo 5.3). Reason for these being:

- Delaying of bringing back the bucket
- low rate of emptying
- Poor condition around the skip bucket site especially during rain season
- Unfavorable design for children (too high for them to reach)

During Focus Group Discussion, it was noted that in Unga Ltd there are women and Youth group working in the area to collect solid wastes for low fee.

Plate 5.3: Misuse of the solid waste collection point in Unga Ltd

5.7.2 Solid Wastes Ngarenarok

Solid waste collection and disposal is not out sourced to any private company and currently the cleansing department of Arusha municipal council is responsible for collection of waste from secondary points of Ngarenarok ward and disposal to the dumping ground of Muriet. All residents have to clean areas and to bring the waste to the secondary collection points (Skip buckets). Within the ward there is an informal waste collection group of women and youth providing the service in the unplanned part of the ward for each visit they charge TZS 200-500/= per household for collection and disposal to the secondary collection points, they do this work three days a week.

5.7.3 Solid Waste Baraa

In this ward people sort solid waste for different purposes. Organic matter, which is the major portion of solid waste from most of households, is composed and used as fertilizers. Banana pills are given to the cattle and metals are sold for 100 Tsh/Kg as scraps for recycling. Plastics in most cases are put in the dustbin and latter are burnt locally.

YEP is a NGO contracted to collect solid waste in Baraa ward although their service is not extended to the whole ward. In the rural parts of ward, people want them to provide the service free of charge. Baraa is one of the Municipality wards that do not have skip buckets at all therefore the secondary waste collection points are just on common dumping points found within the ward. All in all most of the residents of this do dispose waste within their compounds because of its rural characteristic, where by the waste is either burn or burying.

5.7.4 Solid Waste Daraja II

Management of solid waste in daraja II is an issue of interest. Besides the fact that the ward has about four (4) collection points of solid waste, yet some people place their wastes along the road and sometimes in the drainage system (plate.5.4). The solid wastes generated from this area include plastic bags which are found lying almost everywhere in the area. Other solid wastes are plastic bottles, papers, and kitchen wastes. Solid waste separation (sorting) prior disposal is not practiced. Daraja II ward people do not pay anything for their solid wastes except those owning business buildings.

Plate 5.4: Solid wastes placed in the drainage system

5.7.5 Solid Waste Engutoto

There is no solid waste service contractor working at Engutoto ward at present. And at the same there are no any services provided by the municipal council cleansing unit in the area. Currently, residents in Engutoto dispose their solid wastes in pits at the backyard of the plots, some thing that is contrary to the regulations and conditions applicable to planned areas. Papers, plastics bags and containers are burned on site to reduce the waste bulk ness. Some people practice illegal open space solid waste disposal while others dispose their solid wastes in skip bucket in Kijenge area, which is located in the neighbor Oloirien ward. Basically the people of Engutoto needs solid waste service in their residents like in some wards where collection from households to skip bucket is done by private companies through certain fee.

5.7.6 Solid Waste Kaloleni

The role of solid waste collection in Kaloleni ward lies within the hands of municipality authority. In each household people collect their waste in dustbins and disposal it at skip bucket/secondary collection points found within the ward. There are three secondary collection point distributed within Kaloleni ward. From the ward collection points waste is collected and transported to the municipal dumping site of Muriet, by the ward solid waste contractor known as Kisomboko company, that been contracted to work in Kaloleni area.

Each household is supposed to pay TZS 1000/= for refuse collection and for commercial activity one has to pay between TZS 5,000 to TZS 15,000/= depending on the type of business Guesthouses being the highest. Sort the solid wastes is not done in Kaloleni, even organic matters are just dumped like any other waste contents. There has been a major problem of accumulation of wastes at collection points for long time, especially during rain season. This is caused by poor condition of the road to damping site, which ends up to the increase of transport costs. As a result this leads to unhealthy condition of the ward due to bad smell and breeding flies and it ends up threatening the health condition of the ward residents.

5.7.7 Solid Wastes Terrat

Terrat is one of the municipality wards that are characterized by rural development. The major activity of the residents is farming and the area is very sparsely populated. Hence solid waste management in Terrat ward is not a critical issue the major method applied is on site waste disposal, whereby residents dig waste disposal pits within their areas nearby the houses. They also practice burning to reduce the bulk ness of inorganic matters such as plastics.

5.7.8 Solid Waste Kati

There is a private company, which is responsible for solid waste collection in this ward. The company is known as Kivesi Investment. This Company is collecting solid waste everyday. The payment for collection per domestic waste per month is TZS 1000/= and TZS 3000/= to TZS 5000/= per months for shops or small business and hotels respectively. Since this ward is the city centre of the municipal, there are a good number of collection points for solid waste collection (Plate 5.5). During this discussion it was learnt that although most of solid wastes produced in Kati ward are of organic nature (Plate 5.6), there is no sorting of solid waste prior disposal, but at the dumping place there is Community Based Organization, which is responsible for sorting.

Plate 5.5: Collection point in Kati Ward

Plate 5.6: Market place in Kati ward

5.7.9 Solid Waste Lemara

In Lemara ward the common type of solid waste produced are domestic waste, dominated with plastic bags, papers and organic matter such as remaining of food. In unplanned part of the ward collection of waste is very difficult due to poor accessibility hence burying and burning in the method people use to treat their solid waste. But on the other hand planned areas are neither supplied with solid waste skip-buckets nor with solid waste collection contractors. Some of the residents more especially of the densely populated areas do empty wastes in river (E.g. in Korongoni Sub-ward). And sometime solid waste is also disposed along roadsides within the ward. Drainage systems of both planned and unplanned areas are very poor and roads are in very bad conditions.

5.7.10 Solid Waste Levolosi

Solid waste management that is collection and disposal of waste in Levolosi ward is contracted to a private company known as Kivesi Investment the same company contracted to clean Kati ward. The residents of Levolosi are quite aware of the importance of solid waste management and they realize that poor management of waste may result to the health risks of the people. Therefore most of them accept and they willingly pay fee for solid waste collection and disposal service within their ward. Refuse collection fee is TZS 1,000/= per household, Business owners are paying TZS between 5000/= and 15,000/= per month, depending on the size of their business.

Before Kivesi was assigned to clean Levolosi the ward health committee and the ward health officer used to take care of solid waste management issues of their ward. In case there was waste dumped haphazardly within the ward they use to do a follow-up of who disposed it. Sometimes they where even forced to sort that waste so as to identify it's origin and after that the person responsible have to pay a penalty of TZS 50,000/= as

punishment of polluting the environment. This is just a ward by-law set to re-enforce cleanness, and to ensure proper solid waste and environmental management in the ward. On the other hand due to good road network of more than ¾ of Levolosi, which is the planned part of this ward, solid waste management that is collection and disposal can easily be carried out. To clean roads and drainage system there is a women group paid by Arusha Municipal council who were recently engaged to take care of all roads and storm water drainages for the whole ward.

5.7.11 Solid Waste Sekei

Like most of the wards in Arusha Municpality, in Sekei ward secondary solid waste collection point are provided with skip buckets, from this points waste transported and disposed at Murriet damp site by Arusha Municipal Council skip busket trucks. The collection of solid wastes from households to the skip buckets is the responsible household members. One has to pay a monthly solid waste collection fee, which varies depending on category set by municipality. For household the fee is TZS 1000/=, restaurants TZS 5000/=, guesthouses TZS 5000/=, dispensaries TZS 3000, Hospitals TZS 5000/=, garages TZS 10,000/=, wholesales TZS 10,000/=, Boutique TZS 15,000/= and butchers TZS 5,000/=.

According to Street Government Law, No 8, of 1982 and Environmental council bylaws of 2005 any one failing to handle his/her solid wastes properly, and failure to pay collection and disposal of solid waste is given a fine of 40,000Tshs.

With only four skip buckets in the wards it is not surprising to see solid waste laying around the skip bucket, as buckets get full within a short period. Some people in the

Arumeru district who are living close to Sekei ward make the situation worse as they also use the same skip buckets for disposing their wastes. Some few people who are located near rivers just empty their solid wastes along rivers or even in rivers, this is mainly because the municipal skip basket is a bit far from their residents and hence to avoid walking distance they think this is the solution. For some people who are aware of health risks resulted from mishandling of wastes, they burry wastes especially those which are organic and later use it as fertilizers, and sometimes sell to those who are in need of it, this is mostly practices at mahakamani hamlet. There is neither NGO nor CBO practicing solid waste management in this ward, before there was an NGO called Red Cross but failed to deliver the expected services which residents wishes to archive..

4.7.12 Solid Waste Sokon 1

Sokon I is provided with only one skip/secondary collection point for solid waste which is located at Levolosi sub-ward. At present there is no contractor assigned to carry out solid waste management at this ward as such all residents are suppose to take waste produced in their house holds and deposited at the secondary collection point. But once the waste is produce the community members feels it is no longer their responsibility they don't want to incur any cost to handle it or to pay for its management. As a result some people do dump waste along roadsides, or into roads drainages. And for the residents who have enough space at their homes they dig pits and use them for waste dumping and to prevent pits from getting full easily they burn waste to reduce the load. The reinforcement of the municipal bylaws which states that every individual must pay for waste collection is not yet applicable to this ward; this is because the ward is not yet assigned the waste management contractor. Of recent there is unofficial waste collection and disposal of waste done by an informal youth group, where by on Saturdays they move from door to door collecting waste and people have to pay TZS 100/= per housed hold. This group is formed by 10 members including women and men, it is known as "Mwamko Group".

5.7.13 Solid Waste Themi

Themi ward is well organized on solid waste management, as there are private companies and CBO dealing on collection and disposal of solid waste. A company known as "Lemali Investments" where by the truck is passing from house to house to collect waste, and carry to the skip basket sited within the ward by the municipal council, and the council is responsible for final disposal at the municipal dump, which is located at Murriet in Sokon I ward. Customers are required to pay for these services and the amount ranges between TZS 1000 and 15,000 depending the area one is working according to the rates fixed by municipal, for instance households are supposed to pay TZS1000, salon TZS 3000, restaurants TZS 5000, guest houses TZS 5000 etc. In unplanned area of Themi Southern East this company does not operate, but there is an informal youth group providing this service known as "Mtarakwa". There is no fixed price for waste collection by the group it is negotiable depending on the load of waste to be collected and the distance to the secondary waste collection points where they normaly take the waste.

5.7.14 Solid Waste Kimandolu

There is a private company, which is responsible for solid waste collection in this ward. The company is known as Young Environmental People's (YEP). The company has one car, which carries a load of 10 tons, and it has 10 pushcarts. Their head quarter is at Kijenge kaskazini. The cost for collection of solid waste is TZS 500 per household.

There is also an NGO known as Help Age International that is creating awareness about AIDS among Kimandolu residents and also educating old people in all matters related to HIV/AIDS, aware on ways of how aids disease can be controlled. On the other hand this same organization is also dealing with Environmental issues as well as orphanage.

5.7.15 Solid Waste Oloirien

People have enough space for digging holes to dump waste. Therefore there is no problem of solid waste. Hence there is no collection system from the municipality or private company.

5.7.16 Solid Waste Sombetini

The solid waste produced at sombetini is mainly domestic solid waste that includes leftovers, plastics bags, papers, tins and plastic bottles. Material such as old pieces of iron and metal scrappers are now regarded as valuable waste, people scramble to get them, so that they can sell to recycling industries that takes them as their production raw materials.

Most of the low income earners among the residents of Sombetini ward have negative attitude on who is responsible for sanitation issues, most of them are taking it for granted that waste management issues are total the responsibility of the Municipal council or of the contracted private sectors working in their ward. But with time and a lot of sensitization and mobilization activities carried out they are now starting to realize that they have to take care of collection and disposal of their own waste.

Solid waste collection of Sombetini ward is contracted to a CBO formed by a group of women residents of the same ward known as 'Faraja Engilejileta'. The women group decided to take lead in cleaning their ward because most contractors are not interested or rather they are unwilling to work in unplanned settlements, as it is very difficulty to move within the area, during collection and disposal of waste. Charges for collection and disposal of waste are TZS 500/= per month for households and TZS 5000/= for business premises/owners per month. Collection of solid waste from houses is carried out using push carts by the contracted CBO where by they take it to the secondary collection points; from there the CBO responsible for cleaning the area have to hire Municipal trucks to pick up the collected waste and transport to the Municipal dumping grounds of Muriet. Despite the efforts of collecting solid waste from the wards, some residents like other place of the ward throw their wards in water channels as shown in plate 5.7

Plate 5.7: Solid waste thrown in water channel close to residencial areas

5.7.17 Solid Waste Elerai

In Elerai like other wards most of solid wastes generated are mainly plastics bags, food left over, metals etc. The ward has skip buckets where residents are supposed put their solid wastes for the collection to the damping site. Even though there are skip buckets but you may find luggage of solid waste along the road. Apart from that there are only two collection points in this ward, which are not enough hence it is common to find solid waste haphazardly dumped within the ward.

Back in 2003, there was an NGO known as UEDA, which was contracted to work in Elerai ward it used to collect solid wastes from houses to the collection points and then transport it to the dumping site of Muriet. But due to unwillingness of residents to pay the required fees they failed to perform as such they decided to terminate the contract since 2006.

Chapter 6: Rosa issues

6.0 Introduction:

During the study the main issues covered were the acceptance of the ROSA philosophy, existing practice of ROSA concepts, opportunities and constraints on introduction of resource oriented sanitation practices. The information presented in this chapter was obtained from questionnaire survey of house holds, focus group discussions, observations and literature review. The results of the survey are provided in the following sections

6.1 Existing practices

General situation of sanitation is that most of the people use pit latrines (94%) of respondents. There are no people using excreta (feaces and urine) for agriculture such as derived from ecosan-toilets. Waster water is not treated before using for irrigation. All respondents indicated that they do not use treated waste water for irrigation. Moreover the focus group discussion with AUWSA experts revealed that even effluents from the waste stabilization ponds used by Lemara ward peasants does not meet effluent standards.

6.2 Re-use of WSP Effluents

A number of people use wastewater for irrigation. Irrigation using waste water is mainly practiced in Lemara ward which is located downstream of the waste stabilization ponds. About 70% of all respondents in the survey who indicated that they use waste water for irrigation came from this ward. There seems to be no objection on re-use of wastewater for irrigation and although it is practiced informally and for a small scale, there is high potential for up scaling if more water is available and the use is formalized and health implications addressed.

6.3 Crops grown using waste water

Crops which are grown using waste water are (% of respondents who said they grow these crops in brackets), maize (66.5%), Beans (54%), Vegetables (50.5%), Banana (39.7%) and others like fruits, potatoes, etc (19.7%). Generally people do not like to eat vegetables grown using waste water however these vegetables are sold in markets in

Arusha where customers who do not know the source of the vegetables buy and use them. The situation of acceptability is different for crops such as maize and banana. For these crops people have no problem using them even when they know that they are grown using waste water.

6.4 Fish farming

There is no fish farming using wastewater in Arusha, however it is a common practice to fish in the waste stabilization ponds where mud fish thrive. Fish from these ponds are generally un acceptable but like vegetables, these fish are sold in the market and people are accepting without knowing the source.

6.5 Re-use of abandoned pit latrines

The use of abandoned pit latrines for planting trees was introduced in Terrat Ward in 2000. A "plant a tree project" advocated construction of shallow pit latrines which were used for planting trees when they became full. This approach for solving sanitation problems was proposed because of water shortage in the ward and of course the availability of land for constructing toilet when one is full. It was accepted but there is no further information on the success of the project. This approach would be possible only for areas with ample land space such as Baraa, Engutoto and Terat. The lesson learnt however is that people at least were introduced to beneficial uses of excreta in solving sanitation problems

6.6 Re-use of solids waste

In addition to re-use of waste water there is re-use of other resources such as metals, organic waste and plastics. This facilitates cleanliness in the residential areas and helps to generate self employment and income. The most commonly recycled wastes are plastic and metals. These wastes are sold to the industries in Arusha. The business is carried by individual's especially young men who employ themselves in the business. Waste from kitchen is used for animal feeding and in the farms as fertilizer. About 10% of respondents in the house hold survey indicated that they use waste from kitchen for feeding animals and 2.2% said they use it for fertilizer.

6.7 Challenges to introduction of ecological sanitation

During the baseline study the potential constraints to introduction of resource oriented sanitation approaches in the study were investigated. Information was collected through focus group discussions in all seventeen wards of the Municipality. The focus group discussion involved political and religious leaders of major religious groups Christians and Muslims in some wards.

6.7.1 Religion

It was originally thought that introduction of some of resource oriented practices such as use of dry toilets and re-use of waste water would be objectionable to some religious groups which have restrictions for touching human waste such as Muslims. Muslims strictly use water for ablution. It was however found out during the study that there is no major objection to re use of faeces obtained from ecosan toilets. The only aspect of religion which featured in the discussion is the use of water for anal cleansing. This is required for practising Muslims and generally for hygiene. The acceptable ecosan toilets therefore will have to be designed to allow for use of water for anal cleansing. During the house hold survey 95.3% of respondents indicated that they use water for anal cleansing.

6.7.2 Social and cultural issues

During the focus group discussions it was found that most people find it difficulty to accept the idea of using urine and faeces as fertilizer. This is a cultural issue because of the normal practice in the society which abhors handling of excreta. During the focused group discussion it was evident that most people do not readily accept the use of faeces and urine for fertilizer because of lack of education. When researchers showed the members of the focused group discussion the use of urine and faeces in other parts of the world they showed interest and indicated that they may accept the idea. During house hold survey the question of re-use of faeces and excrete for fertilizer was asked as open ended questions which drew various answers. The largest group of respondent 28% indicated that the use human excreta for fertilizer is good. Various numbers of respondents indicated that they may accept the idea if properly educated on the beneficial

use of the excreta. The most overriding issues however is not re-use of excreta but solution of sanitation problems. Areas where there is acute problem of land for pit latrines people handle untreated excreta when disposing it in water ways because of lack of connection to sewers. These people are therefore ready to use ecological sanitation to solve their sanitation problems. If ecosan toilets are introduced they are ready to accept and use them but the products of toilets (faeces and urine) will have to be handled in separate arrangement involving a third party.

6.7.3 Health

Health implications of introduction of ROSA sanitation approaches were investigated through house hold questionnaire and structured questionnaire to hospital staff in Lemara, Sokon 1 and Daraja mbili wards. There is relatively high percentage of people in Sokon 1 (90% of out patients) and Daraja II (80% out patients) suffering water related diseases (malaria, typhoid, worms). In Lemara only 30% of out patients suffers from these diseases. The focus group discussion with AUWSA revealed that water used for irrigation from their ponds contains 7000 faecal colliforms per 100 ml. this water posses potential health risk to consumers especially because of lack of controlled use of the water.

6.8. Recommended Sanitation Options

The recommendation on the sanitation options to be implemented depends on the existing situation including factors such as groundwater table, settlement structure and issues of ownership of both the land and the buildings. Issues of acceptance of a given option must also be considered. In addition future plans of the city and bylaws on sanitation must be taken into account. The sanitation options available in Arusha have been described in chapter 4. Mostly people in Arusha use traditional pit latrines and only a few are connected to the sewer line. The project aims at promoting resource oriented sanitation approach which advocates the use of some form of improved on site sanitation where urine and faeces are collected and used as fertilizer. The results of the baselines study indicate although reuse of faeces and urine is not readily acceptable the whole idea of ecological sanitation which results in convenient disposal of feacal matter is readily

acceptable as an option for solving sanitation problem in wards with critical problems. Example of such wards includes the Daraja mbili ward where there is huge problem of getting a land to construct a new pit latrine once one is full. In such wards ecological sanitation concepts are welcome as means of disposing the feacal matter which is the major problem in the area. The pit latrine option have problem for emptying of which there is no sustainable service. It is thought that introduction of toilets which allows one to empty the pit and continue using the toilet will bring a great relief to the people. The ecological toilets will also help to reduce the problem of handling raw excrement as the case is now with traditional pits. This is a typical example of a case where intervention with ecosan toilets is recommended based on problems of the existing sanitation system. Some of the problems found during the baseline study which necessitate the use of ecological sanitation include; unplanned settlements, lack of water supply, lack of emptying service, low income to afford connection to water supply and sewerage system, high water table. Wards which have these problems according to the baseline study are; Unga limited, unplanned part of Ngarenarok, Daraja mbili and Sokon I. In Lemara ward some form of ecological sanitation is primarily recommended because of high ground water table which necessitates frequent emptying of the pits due to flooding. This situation is also observed in parts of Sekei ward (Sanawari and Mbwa chini), Kimandolu (Tindiga and Kijenge), Oloirien (Suye and Meiroti), Sombeting and Elerai. Summary of the findings of the baseline study in 17 wards of Arusha showing typical problems which necessitates use of ecological sanitation options is provided in Table 6.1

Table 6.1 Summary sanitation problems by wards as found out in the baseline study

s/no	ward	Typical problems	Remarks
1	Baraa	Low density accessible area, mostly use pit latrine but can shift the toilet because land is available	The ward can be used to the demonstrate use of toilets where faeces and urine can be used as fertilizer because of plenty of land available for house holds.
2	Daraja mbili	Congested unplanned area.	People have no means to empty pit latrines and they discharge raw sewage on the streets during rainfall endangering public health.

			Introduction of better ways of handling excreta very welcome, but re-use of excreta not possible.
3	Elerai	100% onsite sanitation. Pit latrines get filled up too frequently. There are commercial pit latrine emptying services but the cost is largely un affordable (Majengo area). Emptying by "Frog men" is practiced and it endangers the health.	Introduction of an ecosan option that helps proper handling of collection and disposal of excreta is highly welcome.
4	Engutoto	Mostly people use flush toilets connected to septic tank systems. Pits latrines are used in block C only	Relatively rich and possibly earmarked for sewer line expansion. More advanced ECOSAN toilets for in house installation may be considered.
5	Kaloleni	50% connected to sewer	Probably earmarked for sewer expansion. No compelling reasons to introduce ECOSAN
6	Kati	Fully planned, well served(water supply and sanitation) central business district area of Arusha	May not meet criteria for peri urban however a collaborator may be sought to promote ecosan by introducing urine harvesting in public toilets if re-use in another place is practiced.
7	Kimandolu	Not covered by sewer line, mainly uses pit latrines. The area is congested and new pits have to be dug by converting a room to toilet. Water table is very high in Tindigani and Kijenge North. Frequently plagued by cholera. Commercial service for pit emptying exists.	Introduction of an ecosan option that helps proper handling of collection and disposal of excreta is highly welcome. It is impossible to re-use excreta in the area due to congestion. Think of converting pit emptying service into Handling of sanitized excreta from ecosan toilets.
8	Lemara	Partially planned ward. Both pit latrine and flush toilets connected to septic tanks are used. Groundwater table is very high and pits get flooded during rainy season. Waste stabilization ponds	Ecosan toilets may be introduced as convenient means of solving the problem of frequent emptying of the pits. Health concerns for polluting ground water are

		are located in this area and farmers nearby use the effluents for irrigating crops.	also an argument for proposing ecological sanitation. The wards can also be used to demonstrate re-use of urine and faeces as well as reclaimed waste water for irrigation.
9			
10	Ngarenarok	Unplanned congested area, not serviced by sewer.	People move toilet from one room to another when one is full
11	Oloirien	This ward is partly planned and served by sewer system. Major problem is handling of waste water which flows in the streets especially in un-connected areas.	The ward can be considered for study of re-use of grey water, if utilized it may solve malaria problem by reducing breeding ground for mosquitoes.
12	Sekei	This is a highly developed area of Arusha with many business establishments.	Does not qualify criteria for peri-urban
13	Sokoni	Unplanned area. Pit latrine is the mostly used sanitation option. Emptying of pits is by buckets and is done haphazardly during rainfall causing wide spread pollution and endangering health. No space for new pits. There are industried which discharge waste water to street drains	Ecosan options responding to need for proper handling of excreta and avoidance of environmental pollution is desirable.
14	Sombetini	Poorly accessible, high water table, improperly managed wastewater, commonly affected by Typhoid and cholera. Pit latrines are built on raised ground because of high water table. In addition River Burka which flows across the ward is polluted by people emptying toilets in the river.	Target for solution of sanitation problems by use if ecosan toilets.
15	Terrat	This a relatively rural ward, where pit latrine is the major option. There is ample land however and when pits are full a place to dig another one can be found.	With land for farming available options linking re-use of excreta can be considered.
16	Themi	The ward is served by AUWSA about 70%. The existing sewer line is leaking and there is	The ward may provide a study area for grey water management.

		problems of waster water in the streets.	
17	Unga limited	Unplanned congested area, no accessibility for emptying tracks, high water table, acute sanitation problem, mostly uses pit latrines because of lack of sewer connection but there is no place to dig new pits. Emptying of filled pits is un regulated and poses health danger.	Ecosan option that helps in proper handling and disposal of the excreta is needed. The area is in critical sanitation problem.

Chapter 7: Conclusions and Recommendations

7.1 Water Supply

The main sources of water in Arusha are deep boreholes, springs and river. The proportions being for water from boreholes, rivers and springs to the municipality of Arusha are 27%, 13% and 60% respectively. Currently, the AUWSA meets about 90% of municipality water demand. In general the population of Arusha municipality with access to clean and safe water lies between 30 and 70 % of the municipality population which yet is not yet enough and further steps are needed to at least halve of those without water supply. The low level of water supply in wards is attributed to many factors including:

- Lower yield in water sources as compared to water demands,
- People have their own sources,
- Rationing of electricity by electric company (TANESCO) and
- The Authority has no enough funds

The quality of water for sources other than those of AUWSA is not good enough for human consumption. This is indicated by the reported number of water related diseases. The problem is more pronounced in Lemara ward where cholera is the frequent disease facing this ward especially in rain season, because of shallow wells which are very close to the toilets. The same is also experienced in Majengo area where the water table is very high. As for water availability, great part of Arusha municipality doest have reliable water supply. The hotspot for this is at Kimandolu. During dry seasons water in Kimandolu ward is only available three or two times per week. In Kitiangare area in Kimandolu the problem of insufficient water supply is more critical than in other parts of the ward. The cost for getting water per bucket varies from one place to another in the municipality. It ranges from 5 Tsh to 400 Tshs. It is lowest at Sombetini and highest at Terrat.

The study therefore concludes that for implementation of ROSA concepts, water availability has to be a very important factor for the selection of sanitation options. In area where water is available and reliable, the wet will be a good option whereas in water scarce area, the dry will be an appropriate option.

7.2 Wastewater

Based on the findings of this entire baseline survey, the followings conclusions have been made concerning wastewater in Arusha Municipality;

- The sewerage system covers only a small part of the Municipality. In addition the connection fee is unaffordable to most of the residents and the connection process is bureaucratic.
- Majority of the people in Arusha use on-site sanitation mainly traditional pit latrines and to a small extent flush toilets connected to septic tanks.
- Emptying of traditional pit latrine and sludge removal from septic tanks is messy, unhygienic, expensive and technically difficult.
- New approach on sanitation is needed
- Need for Strategic Sanitation Plan for wastewater in Municipality

7.3 Solid Waste

Solid waste management in Arusha Municipality is unsatisfactory. This is because collection and disposal of the waste generated is less than 50 %. From the baseline survey, the following are concluded:

- Large fraction of solid waste from households is organic (More than 75%).
- The collection capacity is estimated to be 178 tons per day, which is 47 % of the generated solid wastes.
- From the 812 household interviews, 68% of respondents don't segregate solid waste before disposing.

- There are poor solid waste services at household's levels as such 57.8% of the respondents said that the service was not available at all.
- Those who had service have to pay between 500 and 1000 TZS per month but the willingness to pay for this service is low.
- Only few households practicing recycling and reuse of materials such as metals scraps, plastic bottles, old tyres and papers
- Improper solid waste disposal methods such as burying, burning and dumping at unofficial sites are common practice within the municipality. Even infectious and hazardous waste from different places is crudely dumped to the municipal dump site located at Murriet area in Sokon I ward at a distance of about 8 km from the town centre through Unga Limited road.

7.4 ROSA Issues

One of the objectives of the baseline study was to investigate the existence of resource oriented sanitation practices in Arusha in order to guide the project into selection of options which are more likely to succeed. The study sought to document existing options such that they may be perfected and problems facing their use can be addressed during the project. The main conclusion of the study is that the issues of treating sanitation products such as waste water and faeces is not totally new in Arusha and there is high potential to promote and up scale its use. In Arusha the re-use of wastewater for irrigation is acceptable although there is still some objection to the use of some crops such as vegetables grown using waste water. There is a genuine health concern among users of vegetables grown using waste water which needs to be addressed by ensuring that wastewater is properly treated before being used for irrigation. Proper irrigation technology also needs to be used in this case to ensure water does not contaminate such vegetables. There is also a need to educate the public on the safety of the products.

The focus group discussion revealed that there is an acute problem of sanitation especially in high density areas and the local authority and the public are ready to cooperate in adopting any new approaches which will help solve the problem including the ROSA approaches. However care must be taken here since the overriding problem seems to be that of collection and removal of the excreta from the house holds without concern for its re-use. There is a need to plan well how products of ecosan toilets will be utilized to complete the nutrient cycle by linking users and producers.

The waste water used for irrigation does not meet standards and may be a potential health risk. Moreover it is informal and it may be banned by the authorities any time. There is therefore a need to study the best way of utilizing this resource and educating the public and decision makers on the potential benefits of this practice.

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Appendinces

Appendix I. Description of wards

1. The Unga Ltd Ward

Unga Ltd ward is located North West of Arusha Municipality. It is one of the highly populated wards with an average population of 0.031/m^2 (310/ha). The municipality density is 0.0047/m^2 (47/ha). The number of men and women are almost the same, which are respectively 9,266 and 9,437 based on 2002 census. This survey, estimates that by 2007 the population of Unga Ltd has been increased to 30, 121. Unga Ltd is characterized by unplanned settlements (70% of the area is unplanned), which are packed very closely without proper roads with wastewater and storm water flowing all directions without proper drainage system. Most of the houses in Unga Ltd are built of wood and mud walling with very old Aluminium sheets roof covers (Photo. 4.6). Unga Ltd is surrounded by Levolosi and Ngarenarok in the North and Sokon-I in the south. While in the West there is a Sombetin and Elerai wards, in the East there is Daraja Mbili Ward (Plate 1).

Administratively Unga Ltd has six sub-division (mitaa) which are Osterbay, Tindiga, Viwandani, makaburi ya baniani, Darajani and Esso. Viwandani Street bears the real core activity of the place, which means there is good number of industries in the place. Most of the residents in Unga Ltd are employed in these industries making earning for their living. Other activities in the area by residents are small to medium business. Major portion of roads in Unga Ltd are of earth roads. The tarmac portion is within industries area probably made to transport products from these industries.

Plate 1: Typical house and the road in Unga Ltd

2 Ngarenarok Ward

Ngarenarok is the second highly populated ward after Unga Ltd with a population density of 0.028/m^2 (276/Ha). It has six hamlets (mitaa) as shown in the population distribution Table 1.

Table 1. Ngarenarok population (2002 National census)

S/No	Name of Mtaa (Sub-division)	Population		Total	No of Households
		Men	Women		
1	Darajani	2,094	2,180	4274	1053
2	Kambi ya Fisi	2,105	2,225	4330	1254
3	Olmatejo	1,850	1,903	3753	912
4	Mita 200	810	617	1427	485
5	NHC	382	455	837	210
6	TCA	564	588	1152	274
Total		7805	7,968	15773	4188

Out of the six mitaa of the ward, only two that are TCA and NHC are planned, that means the majority of Ngarenarok residents are living in the unplanned part of the ward. The built up area of the ward is dominated by permanent structures of concrete blocks with corrugated iron sheets roofing. To earn living Ngarenarok residents mainly depend on employment in both private and government sectors as well as self-employment in informal sectors.

Ngarenarok has two government primary schools and five privately owned primary school. At the same time there are three secondary schools within the ward in which one is government owned and two are privately owned. Arusha technical college is also an education institution found within Ngarenarok ward. Like other areas of Arusha municipality sanitation issues in Ngarenarok needs attention for sustainable development.

3 Baraa Ward

Baraa ward is located North-East of Arusha Municipality. It occupies 3.8% (3.7 Km^2) of the Municipality area and has 1,299 households and a population of 5,988 with 48.7% of the ward population being female as per 2002 national census. The ward is divided into four sub-divisions, which are Sorenyi, Kwa mrefu, ofisini and Kiroshi. The population distribution in these hamlets is shown in Table 2.

Table 2: Population in hamlets of Baraa ward

S/N	Name of the hamlet	Population (2002 census)	Population (2007 estimate)
1	Sorenyi	1677	2,702
2	Kwa mrefu	1547	2,491
3	Ofisini	1427	2298
4	Kiroshi	1337	2,153
	Total	5,988	9,643

About 75% of Baraa population depends on agriculture and livestock (zero grazing) for their living. The remaining percentage is either employed in various sectors or depends

on formal and informal business activities. While in Baraa the major ethnic group is wamasai, spiritually the majority are Christians. The area has unplanned characteristics (100% unplanned settlements) with large portion of the land used for agricultural activities. There is only one road, which is tarmac and in fact it is highway from Arusha to Moshi (Plate 2).

Plate 2: Highway passing through Baraa ward

4 Daraja II Ward

Daraja II occupies 1.2% of Arusha Municipality and according to 2002 census the ward had a population of 22,108. It is dominated by squatter's characteristic settlements with 100% of the area not planned. In this ward there are only few houses built with cement concrete blocks walls while most of the houses are built with mud walls and covered with very old iron sheets. The ward consists 7.7% of the population in Arusha municipality. It has six hamlets, which are Jamuhuri, Ali nyanya, Sanare, Ndarvoi, Darajani and Kati. People in Daraja II earn their living through self-employment in various informal production activities, petty trading, employment in industries located nearby their ward as casual labour. There are also people who depend entirely on their rental revenue from their houses.

Like other wards, Daraja II is lead by a number of people who constitute to ward Development committee under the chairmanship councilor.

5 Engutoto Ward

Engutoto ward is one of the three largest wards in Arusha Municipality others being Terat and Sokon I. Engutoto was part of Lemara ward until year 2000 when it was sub-divided and declared as an administratively autonomous ward. The majority of the people of Engutoto ward work out side the area for their living. Other activities by residents in Engutoto are agriculture and domestic animal keeping especially in unplanned area. During the national census of 2002, Engutoto had population of 5,067 with a very low population density of about 10 people/ha.

Engutoto ward is mainly planned (60% of the whole ward has planned settlements) and a newly developing part of the municipality. It is sub-divided into six sub wards named after block as follows C1, which is the only unplanned part of the ward and C2, D, F, H, and J. Most of the buildings found in this ward are permanent structures as the area is being developed according to the Land development conditions that guide and controls development of urban areas in the country.

6 Kaloleni Ward

Kaloleni is one of the 17 wards of Arusha Municipality. It is located in the Northern part of Arusha Municipality surrounded by Sekei in the east, Levolosi in the west, Kati in the south and Arusha-Moshi Road in the North. Kalolen occupies 1.1% of Arusha Municipality. It is part of Themi districts and it has three streets namely Kaloleni mashariki, Kalolen magharibi and Mita-miambili.

Based on 2002 Tanzania National Census, Kalolen has a population of 11,651 people and 2851 households. It has an average of 4 people per households, which is the Arusha Municipality average household size. Kaloleni is currently estimated to have a population of 18,764, which is 4% of the municipal population. Economically like all residents in Arusha Municipality, Kaloleni residents are earning their living through working in small to large Business, employment in offices, elementary occupations and other activities. Kalolen has planed settlements except mita-miambili area. It has some tarmac and gravel roads in planned area and earth roads in unplanned area. With the exceptional of

unplanned area, most of the houses in kalolen are of modern type built by cement concrete blocks and covered by aluminium iron sheets or tiles.

7 Terrat Ward

Terrat is the largest ward with an area of 29.1 km^2, which is approximately 30% of the Arusha Municipality area. It borders Arumeru district on the West and Southern sides while in the North there is Sokon-I ward and on the Eastern there is Lemara and Engutoto. According to the census of 2002, Terrat had a population of 8,044 who are mainly depending on agriculture and livestock for their economy.

Terrat is characterized by spicily populated rural settlements with buildings that are mixed, between traditional mud and pole houses and Permanent structures of concrete block with corrugated iron sheet roofing. It is formed by two villages namely Mkonoo and Nadosoito. These villages are further more sub-divided into fourteen administratively hamlets/sub-wards, which are Maskina, Olepolos, Engavunet, Bondeni kati, Ilmeitongwa, Ilaitayok, Erangau and Olkung'u for Mkonoo village. Others are Kati, Embararwai, Mlimani, Ngorienito, Ndosoito kusini and Elianyi for Nadosoito village.

All roads serving Terrat ward are rough or earth roads but the major road that goes to the municipal main dumping place is well maintained and it is passable throughout the year. Transportation to Terrat is a problem because public transport (dala dala) is available only in three days a week and it costs a person 1400/= Tshs round trip Terrat-City centre. The ward has four primary Schools and one Secondary School.

8 Lemara Ward

Lemara ward is part of central area of Arusha municipality and has an area of 7.32km^2. It is estimated to have a population of 18949, which is 4.1% of the municipality population. Lemara ward is divided into two parts; the eastern part, which is a planned area, occupied by blocks A, B, E, G and western part occupied by block J. The western part of the ward is dominated by overcrowded unplanned settlements on the north while the southern west part of the ward is scarcely populated and mainly dominated with farming activities.

9 Levolosi Ward

Levolosi ward is sub-divided into two hamlets (mitaa), which are Majengo and Levolosi. According to 2002 census, population of Levolosi was 11,287; in which 5899 were females and 5387 males. There were about 5512 households, an average of 4 people per household. It consists of 4% of the whole population of Arusha municipality. The a bigger part of Levolosi ward is planned and the area that is not planned and dominated by unplanned settlements is the 200 metre zone, located to the northern side of Arusha-Namanga road.

10 Sekei Ward

Sekei is one of northern wards of Arusha Municipality with a total area of 2.98 km^2. It is sub divided into six hamlets (mitaa), which are Sanawari, Naura, Mahakama, Aicc, Naurei, and Goliondoi. According to 2002 national census, population of Sekei was 9,968 of which, 4,738 were and 5,230 were females. The population of Sekei by 2002 contributed 3.5% of Municipality population. Plate 3, shows part of Ward development committee members during Focus Group Discussion.

Plate. 3: Focus Group Discussion in Sekei

A large part of this ward is of planned settlements structures with a very small part of unplanned settlement structures at 200-meter zone, which is located at the northern side of Moshi Arusha road. The ward consists of five primary schools, three possessed by the government and the rest are privately owned. There are two private secondary school and eight nursery schools. Among them three are government properties and five are private.
The ward is composed of rivers and numerous small springs including Kijenge river, Naura river, and Themi river. Being town-centered ward, sekei is a bustling ward, with a wide variety of medium and small enterprises and manufactures. The Headquarter of the East Africa Union and the UN International Criminal Tribunal for Rwandas are placed in this ward. Moreover many other government offices are in this ward, like Arusha municipal council, Regional commissioner office, Mount Meru Regional Hospital, and Arusha International conference Center are all in this ward.

11 Sokoni I Ward

Sokon I is a ward occupying a large proportion of municipality central area sharing together with Lemara. It has a land of 16.9 km^2, which is 17% of the municipality land area. According to 2002 national census, Sokon I .had a population of 41,611 of which 20,952 were females and 20, 695 were males. This study estimates that, the current sokon I population density is 40 people/Ha. The ward is characterized by unplanned settlement and has 13 hamlets namely, Mlimani, Enosengiu, Olnjavutian, Olmolokea, Makao mapya, Lolovono, Madukani, Sainevuno, Kanisani, Longdong, Murriet, Migungani and Olovolosi. The ward has two villages, which are Sokon and Sinon. In Sokon there are seven hamlets, and Sinon six hamlets.

12 Themi Ward

Themi is one among the 17 ward of Arusha municipality, with the coverage of 5.661 km^2 with the population of 8598, among them 4339 are females and the rest are males. This population was approximately 3.04% of the whole municipal population according to 2002 census. Currently Themi has a population density of 25 people/ha. Themi is divided into four sub-wards (hamlets) including old police line, Corridor, AICC, and

Themi mashariki. The large area of Themi is surveyed except the small part at Themi Mashariki where there are unplanned settlements structures with the congestion of people. Most of the residents in this area are employed especially those living at AICC street area, some are businessmen especially those who stays at old police line, and there are well rich people especially those stays at Corridor hamlet. Corridor hamlet also is where; most of the administrative government officers stay. There are two secondary schools and three primary schools that are government owned there are also three private owned primary schools. The ward is also rich in industries because many industries are located in this ward including, Tanzania Breweries Co Ltd, Fiber Board Co Ltd, Sun Flag Tanzania Ltd, and SBC Pepsi Ltd, just to mention few. There are many other different institutions for social services like restaurants, hotels, supermarket, hospital, and dispensaries. Also the municipal Fire Brigade is located in this ward.

13 Kimandolu Ward

Kimandolu ward is one of the wards of Arusha Municipality that is fully unplanned; it is much of a rural kind of a settlement. According to the last census in 2002 Kimandolu ward had a total population of 22,526 inhabitants and 6019 household as shown in Table 3.

Table 3. Population of Kamandolu in 2002 census

Population	Males	Females	Households	Birth rate	Able	Disabled
22,526	10,930	11,596	6,019	3.7%	14,502	8,024

The ward consists of four sub wards namely Kijenge kaskazini, Kijenge Kusini, Tindigani and Kitiangare. Most of the houses in Kijenge kusini are temporary building of mud and pole while the buildings of Kitiangare are permanent houses built of permanent materials and are of good quality. The soil type is good loam and some areas are also characterized with black cotton soil. Kimandolu has a land of total area of 5.41 km^2, in which 1/3 is used for agricultural purposes and the rest 2/3 is used as building area. It is estimated that the current population density of Kimandolu is 67 people/ha.

There are five secondary schools distributed in Kimandolu ward these are Suye, Kimaseki, Bethel, Biling'a and Kimandolu Lutheran secondary school, while primary schools found in the ward are three Mwl. J. K. Nyerere, Suye and Kimandolu. On the other hand there is no Government health facility found within the ward, but there are four private dispensaries. All roads of the ward are rough/earth roads except the major Arusha-Moshi road that is found on the northern part of the ward.

The main activities of Kimandolu ward residents are self-employment in petty businesses and agricultural or farming activities and of diary farming (zero grazing). There are also residents of this ward who are employed in government sector as well as in private sectors.

14 Oloirien Ward

Oloirien ward is situated in the North East of Arusha Municipality covering an area of 3.727 Km^2. The ward has one village called Oloirien and inside this village there are six sub wards namely Meiroti, R.C., Suye, Mwanama, John Mbeshere and Mwaivoi. Only a small portion of Mwaivoi is planned (PPF area) and the rest of the ward is unplanned.

According to the last national census of 2002, the ward had a population of 13,193 of which 6,556 were males and 6,637 were females. Currently the ward has a population density of 57 people/ha. The ward has two primary schools and one secondary school. The main activities of the people are farming, small grazing and business. The ward has industries like Banana investment (wine), Gaimo Construction Company and Perfect printers.

15 Sombetini Ward

Sombetin ward is the second populated ward after Elerai. During the 2002 census, Sombetini had 34,062 inhabitants. It has a land area of 4.92km^2 and currently it is estimated to have a population density of 112 people/ha. The ward is sub-divided into 5 sub-wards (mitaa) which are Osunyai, Simanjiro, Kirika A, Kirika B, and Olamriak.

The whole of the ward is of informal or unplanned settlements with a mixture of buildings, which are permanent, semi permanent as well as temporary structures/houses roofed with corrugated iron sheets. The main activities of the residents of Sombetini ward are petty trading, vegetable gardening and variety of other informal activities. Such as recycling and reuse of various types of waste, which include iron, steel, pieces of timber, plastic bottles etc. while a few individuals are employed either in the government sectors or private sectors. The soil type of Sombetini ward is mainly Black cotton soil characterized with very high water tables throughout the whole ward.

16 Elerai Ward

Elerai ward has the area of 4.192 km^2. And according to the census of 2002, Elerai ward was one of the densely populated wards with a population of 38,285. Among them, male were 18,686 and female were 19,599. Also there are 9,847 households and the population growth rate of this ward was 3.9%. This study estimates that the current population density in Elerai is 147 people/ha. This ward is also a surveyed area and comprises of one village called Elerai and 14 sub ward namely Kware, Shuma, Urundini, Majengo A, Majengo B, Mama musa, Ngurumo, Remtula, Sakon, Samanga, Azimio, Sakina, Olmatejeo A and Olmatejeo B. The ward has two primary schools and one secondary school, which are government owned. Moreover it has three primary schools and two secondary schools, which are private owned.

Plate 4. Focus Discussion Group Scenario in Elerai Ward with councillors standing

17 Kati Ward

Kati is one of the smallest wards found in Arusha municipality covering 0.6% of the municipality area with population density of 111people/ha. It is located in Themi division and during 2002 national census it had a total population of 4,026, where by 1,945 were male and the remaining 2,081 female. Currently, Kati is estimated to have 6483 people. It is Sub-divided into two Sub-ward Pangani and Bondeni with 235 and respectively. Kati is one of the few wards of Arusha municipality that are fully planned, as a result the area well served with a good water supply and sewerage systems. The ward has education public services that include 2 secondary schools, 2 primary schools and 5 nursery schools. Kati ward is located at the Central Business District (CBD) of the old municipality area. It accommodates a lot of business activities of the municipality. These include; the municipal Central market, pharmacies, guesthouses, bars, hotels, restaurants, butchers, supermarkets, retail and wholesale shops. Hence the major activity of residents of this ward is business and the remaining are civil servants employed by government or

private companies. The ward area is well serviced with electrical distribution network but it is poorly serviced with streetlights. Most of the roads are tar marked and are in good condition with good storm water drains.

Appendix II: The survey instruments for each category

Ward Executives Questionnaire

BASELINE SURVEY FOR SANITATION ISSUES IN ARUSHA MUNICIPALITY

QUESTIONNAIRE FOR CARRYING SANITATION SITUATION ANALYSIS AND OTHER RELATED ISSUES

INTRODUCTION

Beginning from March 2007, Resource Oriented Sanitation (ROSA) Concept Project through Arusha Municipality in collaboration with the University of Dar es Salaam and funds from EU has started to be implemented in view of attempting to promote sustainable concept of ecological sanitation in few selected wards of Arusha Municipality.

As one of the key stakeholders, you are kindly requested to fill in the questionnaire, as frankly as possible, so that the result of the survey will be used to develop Strategic Sanitation Waste Plan (SSWP) and set up a pilot scale for demonstration of ROSA Concepts in Arusha peri-urban areas

1: General Questions

1.1 Full Name of the Interviewee (optional)……

1.2 Ward……

1.3 Your Position in the ward……

1.4 Total Population in your ward……..……..Female……Male

1.5 How many:

[a] Total Primary schools……Private……Government……

[b] Total Secondary school……Private……..Government……

[c] Hospital/Dispensary……Private……Government……

1.6 What are the major activities of your ward?

[a]……

[b]……

[c]……..

[d]……

2: Technical Questions (Sanitation)

2.1 How many house houses with pit latrines in your ward?……

2.2 How many houses with flush toilets……..……

2.3 How many houses without toilet?……..……

2.4 In 2.3, do you know why these houses are without toilet?…….…… ……

2.5 What are major sanitation problem facing your ward?……

2.6 Does your ward frequently experienced water related diseases?

[a] Yes

[b] No

2.7 Rank the following diseases in order of their severity (1, 2, 3 etc..) in your ward?

[a] Diarrhoea

[b] Cholera

[c] Malaria

[d] Intestinal worms

[e] HIV

[f] Others (specify)……..

2.8 How many people in your ward are entirely depending on agricultural activities……..

2.9 Do some people use wastes from their houses or other people wastes as fertilisers?

[a] Yes

[b] No

3: Technical Questions (Water Supply)

3.1 Which one of the following is the source of water for your ward?

[a] Springs

[b] River

[c] Dam

[d] Boreholes

[e] Shallow wells

[f] Others (specify)……

3.2 How many people in you ward with safe and clean water?……

3.3 Reliability of water in your ward

[a] Very reliable

[b] Not reliable at all

[c] Reliable except during dry season

3.4 Who provide water for your ward

[a] AWSA

[b] Others (specify)……

4.Technical Question (Solid wastes)

4.1 Do you have solid waste service in your ward?

[a] Yes

[b] No

4.2 IF yes in 4.1, who collects solid wastes and other garbage in your ward?……

[a] Private companies……Name of the company……

[b] Government

4.3 Who is paying for the service?

[a] Each household is responsible for its garbage

[b] Municipality

4.4 Where is the damping place of your ward's garbage?

[a] Within the ward……..name of the place please……

[b] I don't know

[c] Within the municipality, but not in my ward……..name of the place please……

4.5 In general what is your opinion regarding to the sanitation in our wards……

[a] The situation is excellent

[b] Current practices must be improved……by who?……

4.6 Do you have community based Organisations in your ward?

[a] Yes

[b] No

4.7 If yes in 4.6, list their names and function

[a] Name……..Function……

[b] Name……..Function……

[c] Name……..Function……

4.8. Do you know any NGO (Non government Organisation) which dealing with sanitation and related issues in your ward?

[a] Yes

[b] No

4.9 If Yes in 4.8, list their names

[a] …….

[b]……..

[c]…….

5.0 In your opinion do you think these NGOs are very helpful in your ward?

[a] Yes

[b] No

Schools Questionnaire

BASELINE SURVEY FOR SANITATION ISSUES IN ARUSHA MUNICIPALITY

QUESTIONNAIRE FOR CARRYING SANITATION SITUATION ANALYSIS AND OTHER RELATED ISSUES

INTRODUCTION

Beginning from March 2007, Resource Oriented Sanitation (ROSA) Concept Project through Arusha Municipality in collaboration with the University of Dar es Salaam and funds from EU has started to be implemented in view of attempting to promote sustainable concept of ecological sanitation in few selected wards of Arusha Municipality.

As one of the key stakeholders, you are kindly requested to fill in the questionnaire, as frankly as possible, so that the result of the survey will be used to develop Strategic Sanitation Waste Plan (SSWP) and set up a pilot scale for demonstration of ROSA Concepts in Arusha peri-urban areas

1: General Questions

1.7 Full Name of the Interviewee. ……

1.8 Your Position in the School……

1.9 Ward……

1.10 Village/street……

1.11 Name of the School……

1.12 Type of school

[a] Boarding

[b] Day

[c] Both day and boarding

1.13 IF in 1.6 the answer is [b] what is Number of shifts (give time): From…to…..and from…..to

1.14 IF in 1.6 the answer is [c] how many boarding……..and how many day……

1.15 What are the main function (s) of your School?

(i)……

(ii)……

(iii)……

(iv)……

1.16 Number of students……..Boys……..Number of girls……

1.17 Number of teachers……Male……..Female

1.18 What is the range of ages of your students from……years to……..years

1.19 General observation on schoolyard: (garbage on the ground and class rooms, waste containers, location of solid waste disposal etc)……

2: Technical Questions (Water)

2.10 Is there a functioning water point within the school area?

[a] Yes

[b] No

2.11 During the interview was the water point functioning?

[a] Yes

[b] No

2.12 Reliability of water

[a} Very reliable, always there is water for the whole year

[b] Only during rain season

[c] Only during official visit

[d] Not reliable at all, especially during dry season

2.13 Do you have clean storage tanks

[a] Yes

[b] No

2.14 Is the water of drinking quality

[a] Yes

[b] No

3: Technical Questions (Sanitation)

3.1 Do you have toilet within the school compound?

[a] Yes

[b] No

3.2 If in 3.1 the answer is [a], what type of toilet do you have

[a] Pit latrine

[b] Water closet (WC)

[c] Others (specify)

3.3. Are the toilet clean?

[a] Yes

[b] No

3.4 Do you have boys and girls toilets separately?

[a] Yes

[b] No, they share

3.5 For teachers/staff do you they have their own toilets?

[a] Yes

[b] No

3.6 Who is cleaning your toilet? Students toilet……..Teachers/staff toilet……

3.7 On what days the toilets are cleaned?……

3.8 Do you have training on sanitation in your school?

[a] Yes

[b] No

3.9 Do you have farming activities around the school?

[a] Yes

[b] No

If yes in 3.9, what crops do you cultivate?

[a] Maize

[b] Beans

[c] Vegetable

[d] Banana

[e] Others (specify)…….

3.40 What fertilisers do you use in your farm

[a] Artificial

[b] Manure

[c] No we don't use fertilisers

3.41 Have ever tried to apply urine, faeces or any waste from your school as fertilisers?

[a] Yes

[b] No

3.42 IF yes in 3.41, are there any differences from manure or artificial fertilisers

[a] Yes

[b] No

3.43 IF yes in 3.42, what differences?

[a] More yields

[b] Less costs, cheaper

[c] Both a and b

[d] Others (please specify)……

Households Questionnaire

BASELINE SURVEY FOR SANITATION ISSUES IN ARUSHA MUNICIPALITY

IDENTIFICATION AND ASSESSMENT
OF SANITATION SITUATION ANALYSIS AND OTHER RELATED ISSUES

INTRODUCTION

In many cities of the world today people live and raise their children in highly polluted environments. Urban and peril-urban areas in developing countries are among the worst polluted and disease ridden habitats of the world. Much of this pollution, which leads to high rates of disease, malnutrition and death, is caused by inadequate sanitation services. Over the past hundred years flush and discharge has been regarded as the ideal technology, particularly for urban areas. However, due mainly to a lack of financial resources, these systems cannot be correctly operated in many developing countries. The pit toilet has been remained their principal means of excreta disposal except for their well do classes who are often provided with government subsidised sewerage system. On-site pour flush toilets are to day popular and widely used in South Asia, especially in India.

In achieving UN Millennium Goals, the tendency is now towards ecological sanitation where there are many benefits including resource recovery. Beginning from March 2007, Resource Oriented Sanitation (ROSA) Concept Project through Arusha Municipality in collaboration with the University of Dar es Salaam and funds from EU will attempt to promote this sustainable concept of ecological sanitation selected wards of Arusha Municipality.

As one of the key stakeholders, you are kindly requested to fill in the questionnaire, as frankly as possible, so that the result of the survey are used to develop Strategic Sanitation and waste plan and ecological sanitation pilot in Arusha municipality

1: <u>General questions</u>:

1. Name of interviewee .....
2. Gender……
3. Age ……
4. Ward……
5. Village/Street……
6. Households' situation: (Tick)
[a] Good
[b] Fair
[c} Poor
7.Are you the owner of this house? (Tick)
[a] Yes
[b] No
8. How many people live in your households?……
9. What is your main source of income? (Tick)

[a] Farming
[b] Self-employed in business
[c] Employed
[d] My children
(e) Others (specify)……
If [a], also answer questions in part D

10. What is your income per month in Tsh? (Tick)
[a] 0-20,0000
[b] 30,000 -100,000
[c] 100,000 - 300,000
[d] >300,000

2: Technical questions (Water supply):

11.What is the source of water for your household? (Tick)
[a] Tape water
[b] Hand pump
[c] River
[c] Canal
[d] Boreholes
[E] Shallow wells
[F] Others (specify)……..
12. Where do you get water for your household?
[a] In my house
[b] Neighbour short distance
[c] Long distance from the house
[d] Water kiosk…. specify distance
[e] Water vendor
[f] Others (specify) ……
13. Do you harvest water from rain?…….. [a] Yes [b] No
14. Reliability of water (availability of water)
[a] Everyday
[b] Once to twice a week
[c] Not reliable at all

15. Quality of water
[a] Good
[b] Poor
[c] I don't know
16. On average how much money do you spend for water in a month?
[a] < 1000
[b] 1000- 5000
[c] >5000
[d] None

17. If in 7 the answer is [a], What was the investment cost for the water in your house (Connection, materials, labour etc)? ……

Technical Questions (Sanitation)

18. Where do you defecate?
[a] Pit latrine
[b] Flushing toilets (WC)
[c] I don't have a toilet, I use neighbours toilet
[d] I don't have toilet, I practice open defecation in bush etc
[e] Others (specify)……
19. What methods do you use for anal cleansing after defecation?……..
20. What is the reason for the choice in 18 (Tick)
[a] I don't know, I am not the owner of this house
[b] There is no enough space
[c] This is the only type I know
[d] This is the only choice I have
[e] I don't have money for other types
[f] Shortage of water
[g] Reliability of water
[h] High water Table
[i] Others (Specify)……..
21. IF in 18, the answer is [a], how long does it take for your pit latrine to get Full?……
22. Do you emptying (dislodging) your pit latrine when it is full?
[a] Yes
[b] No
23. IF yes in 22, who is emptying your pit latrine?
[a] Private company
[b] Government
[c] Others (specify) ……..
24. IF No in 22, what do you do?
[a] Closing the pit and dig another one
[b] Wait until the level decrease
[c] Other (specify)
25. What is the total construction cost of your pit latrine toilet? ……
26. What is cost of emptying you pit toilet per emptier?……
27. IF in 18 the choice is [b] where does the toilet waste go?
[a] Open drains
[b] Closed drains
[c] Connected to sewerage system
[d] Septic tank
[e] To the river
[f] To the farm
[g] Others (specify)…….
28. How do you judge the condition of your toilet (not cleanliness)
[a] Good
[b] Bad…need repairing
29. Who conducts maintenance and operation of your toilet? ……
30. What is the advantage of using this toilet?……
31. What problems are you facing by using this type of toilet? …….
……..……

32. Do you reuse wastewater or excreta?
[a] Yes
[b] No
33. IF yes in 32, for what purposes?
[a] Farming (agriculture)
[b] Others (specify)……
34. If yes in 32 where do you get this wastewater or excreta?
[a] From my house
[b] From effluent of treatment plant
[c] Others (specify) ……..
35. IF in 34 the answer is [a] Do you treat before using?
[a] Yes
[b] No, I don't
36. IF yes in 35, how do you treat?…….
37. Are you aware of the health risks associated with faecal matters?
[a] Yes
[b] Not at all
38. Which diseases are your household members frequently suffering from?
[a] Malaria
[b] Typhoid
[c] Cholera
[d] Diarrhoea
[e] Others (specify)……..
39. Are you willing for your plot (farm) to be used in setting up pilot scale for ecological Sanitation? (The interviewee should try to explain the ecological concept and benefits)
[a] Yes
[b] No

3: Technical Question (Farm/agriculture activities)

40. What is the size of your farm/garden?…….
How far is your farm from home?……
Which crops are you growing in your farm/garden?
[a] Maize
[b] Beans
[c] Vegetables
[d] Bananas
[e] Others (specify)……..
What is the average yield (harvest) (kg, tons etc) of crops annually?……
Do you have good soil?
[a] Yes
[b] No
If the answer is [b] do you use artificial fertilizers?……
What type of Fertilizers do you use annually?……
How much do you spend for Fertilizers in your farm/garden annually?……
Do you harvest more crops from your farm by re use wastewater/excreta?……

What is your attitude using human excreta (if adequately treated)?……

4: Technical Question (Solid waste and kitchen waste)

What types of Solid wastes and kitchen wastes is generated from your house? ……
……
……
Do you sort (segregate) your wastes from your households?
[a] Yes
[b] No
52. IF in 44 the answer is yes, why do you segregate
[a] Easy to handle in disposing
[b] Easy to sell
[c] Others (specify)……
53. What do you do with following components?
(i) Kitchen wastes (lest over)……..
(ii) Plastics Bags……
(ii) Plastic bottles…….
(iii) Papers…….
(iv) Glasses……..
(v) Old clothes……
54. Is there any waste (Garbage) service in your place?
[a] Yes
[b] No
55. IF yes in 54, who is doing wastes collection?
[a] Municipality
[b] I don't know
[c] Others (specify)……
56. How much do you pay for waste collection per (month, per trip, per day etc)……

57. IF No in 54. What do you do with your waste?
[a] I bring somewhere else,……...where……
[b] I drop them around my hose
[c] Others (specify)……..

Thank you very much for your cooperation. Your respond will be very useful
Name Interviewer ……
Date of Interview ……

Hotel/Restaurant Questionnaire

BASELINE SURVEY FOR SANITATION ISSUES IN ARUSHA MUNICIPALITY

QUESTIONNAIRE FOR CARRYING SANITATION SITUATION ANALYSIS AND OTHER RELATED ISSUES

INTRODUCTION

Beginning from March 2007, Resource Oriented Sanitation (ROSA) Concept Project through Arusha Municipality in collaboration with the University of Dar es Salaam and funds from EU has started to be implemented in view of attempting to promote sustainable concept of ecological sanitation in few selected wards of Arusha Municipality.

As one of the key stakeholders, you are kindly requested to fill in the questionnaire, as frankly as possible, so that the result of the survey will be used to develop Strategic Sanitation Waste Plan (SSWP) and set up a pilot scale for demonstration of ROSA Concepts in Arusha peri-urban areas

1: General questions

1. Name of the Interviewee……

2. Ownership of the Hotel/restaurant?
[a] Private, Local
[b] Private, foreigner
[c] Government

3. What is your position in the restaurant?……
[a] Director
[b] High level Management
[c] Supervisor
[d] Others (specify)……

4. How do you judge the standard of the restaurant?
[a] Low class
[b] Middle class
[c] High class

5. On average how many customers attend the Hotel/restaurant a day for service? ……

6. Main meal sold in the restaurant
[a] Breakfast
[b] Lunch
[c] Dinner
[d] Others (specify)……

2. Technical Question (Sanitation)

7. How many toilets do you have in the restaurant?

8. What type of toilet system are you using in your restaurant?
[a] Pit latrine
[b] Flushing toilets
[c] Others (specify)……..

9. If answer in 8 is [a], what happens when the pit is full?……

10. If answer in 8 is [b] where does the toilet waste go?
[a] Open drains
[b] Connected to sewer system
[c] Septic tank/Cesspool
[d] Others (specify)……..

11. IF in 10 the answer is [c] what happens when the septic tank is full?……

12. How do you judge the condition of your toilet (not cleanliness)
[a] Good
[b] Bad need repairing

13. Who conducts maintenance and operation?

14. Why have you decided to use this kind of toilet?
[a] I don't know, I am not the owner of this house
[b] There is no enough space
[c] Specify

15. What is the advantage of using this toilet?

16. What problems are you facing by using this type of toilet?

17. Do you reuse wastewater?
[a] Yes
[b] No
If yes, for what purposes?

18. Do you treat before using?
[a] Yes

[b] No
If yes, how

3. Technical Question (Water supply)

19.What is the source of water for daily use?
[a] Tape
[b] River
[c] Boreholes
[d] Shallow wells
[e] Others (specify)……

20.Realiability of water?
[a] Available all the time
[b] Sometimes
[c] Not available

21.how much do you pay for water per month?
[a] Less than 5000
[b] Above 5000

4. Technical Question (Solid waste/kitchen wastes)

22. List all types of solid wastes are generated from your restaurant/Hotel?
[a]……..
[b]……..
[c]…….
[d]……..

23. What do you do with the solid wastes listed above?…….
……...
……

23. Where do you take the leftover from your restaurant/hotel?
[a] People buy for their dogs, pigs etc
[b] Collected by private company for disposal in dumping site
[c] Others (specify)……..

24. Where is you water from the kitchen go?
[a] Open drains
[b In a pit at the yard of the restaurant/hotel
[d] Septic tank/Cesspool
[e] Others (specify)…….

AWSA Questionnaire

BASELINE SURVEY FOR SANITATION ISSUES IN ARUSHA MUNICIPALITY

QUESTIONNAIRE FOR CARRYING SANITATION SITUATION ANALYSIS AND OTHER RELATED ISSUES

INTRODUCTION

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1: General Questions

1.20 Full Name of the Interviewee (optional)……

1.21 Name of the Authority/organization……

1.22 Your Position in the organization……

1.23 What are the main function (s) of your organization?……

2: Technical Questions (Sanitation)

2.15 How many households are connected to your sewerage system?……

2.16 Do you know what is the number population are connected to your system in 2.1 abov

2.17 What is the percentage of this population as compared to the whole population in the municipality?

2.18 What is the design population of your sewerage system? (See table below)

Category	Domestic	Commercial	Industrial	Institution	Others (specify)	Total
Current No. of connection						
Design population						
Served population						

2.19 Which wards are covered by sewerage system? (Tick) [a] Daraja II……[b] Kaloleni……

[c] kati….. [d] Levolosi……[e] Ngarenoro……..[f] Sekei ……..[g] Themi…….[h] Unga Ltd……[I]

Baraa…….[j] Engutoto…….[k] Kimandolu…….[l] Oloirien……[m] Elerai…….[n] Lemara…….[o] Sokoni…..[p] Soombetini…..[q] Terrat……..…

2.20 What is the average connection fee per connection?……

2.21 Is the connection fee including materials costs?

[a] Yes

[b] No

2.22 Is there any relation between monthly wastewater charges and water consumed per house?

[a] Yes, IF Yes go to 2.9

[b] No, IF No go to 2.10

2.23 What is the monthly charge as compared to water consumed per connection based on the following category

[a] Domestic……..……

[b] Commercial……..……

[c] Industrial……

[d] Institutional……

[e] Others (specify)…….

2.24 Is there any other wastewater discharged to your treatment plant other than those in 2.4?

[a] Yes, IF yes go to 2.11

[b] No, IF no go to 2.12

2.25 List those other sources.

……

2.26 Can you account the amount (number of septic emptier) of sludge discharged in sludge pond per day……..

2.27 Do you own this emptier

[a] Yes, IF yes go to 2.14

[b] No, IF No go to 2.15

2.28 What is the cost of disluging from soak away pits or pit latrines? Per tanker……

2.29 What is the cost of empting to your sludge pond per emptier?……

2.30 Is connection fee from households differing from other sources? Yes/No……

2.31 What is approximately inflow flow rate (Q_{in}) to the wastewater treatment (WSP)?……

2.32 What is effluent flow rate (Q_e) of your treatment plant)?……

2.33 Do you know what percentage of municipal population with Pit latrines?……

2.34 What about percentage with flush and discharge (WC) system not connected to your sewerage system?

2.35 Do you have any policy in re-use of effluent from your treatment plant?

[a] Yes

[b] No

2.36 Is your effluent meet any standards?……

2.37 Which standards is your effluent meet?……

2.38 Is your effluent meet effluent standard for agriculture?……..……

2.39 What is the typical concentration of the following parameters discharged from your treatment plants, [a] NH_3……..….(mg/l), [b] NO_3……..(mg/l), [c] PO_4……(mg/l), [d] K …….(mg/l), [e] Na……..(mg/l) and [F] FC……(No/100ml), [g] others (specify)……

2.40 Currently, Do you know if people use your wastewater treatment plants effluent for agriculture Activities?

[a] Yes, IF yes go to 2.27,

[b] No, IF No go to 2.30

2.41 How many people use this effluent? (Approximately) ……

2.42 What percentage of wastewater effluent in 2.18 is used by these agriculture activitie

2.43 Do they pay anything in using your treatment plant effluents?

2.44 Is there any future plan to allow people to use people to use treatment plant effluents in a large scale Farming? [a] Yes, [b] No

2.31 In 2.30 why yes or No……

2.32 Are you aware of ecological sanitation concept? Yes/No……IF yes go to 2.33, If

No go to 2.34

2.33 Are there any plans for your authority to solve sanitation problem in an ecological way? Yes/No

2.34 What are the people perceptions in using Excreta for agriculture purpose?

……

……

……

…….

3: Technical Questions (Water)

3.1 What are the sources of water supplied by Authority for the municipality?

[a] Boreholes

[b] Rivers

[c] Springs

[d] Canal

[e] Lakes

[d]

Others (specify)……

3.2 Currently what proportion of area of the municipality is supplied water by your Authority?……..

3.3 Can you quantify water supply per ward?

[a] Yes, If yes fill table below, 3.34

[b] No

3.4 Level of service per ward

Ward	Current Water supplied	Population supplied with water	Demand
Dararaja II			
Kaloleni			
Kati			
Levolosi			
Ngarenaro			
Sekei			
Themi			
Unga Ltd			
Baraa			
Kimandolu			
Oloirien			
Engutoto			
Sokoni			
Lemara			

Terrat			
Elerai			
Sombetini			
Total			

3.5 Is the proportion of water supplied in 3.4 satisfactorily? Yes/No……..…IF No go 3.6

3.6 What is the reason for the situation in 3.5?

[a] The water demand is higher then the yield from sources

[b] Affordability, people do not afford the connection costs

[b] People have their own or other sources of water

[d] Others (specify)……..……

3.7 What is the connection fee for the water supply?…….

3.8 Is water supply in the covered area by your Authority reliable? Yes/No….IF No, go to 3.9

3.9 What are the major problems for unreliability of water supply in the municipality?

[a] Water losses

[b] rationing of electricity by TANESCO

[c] Frequently breakdown of the pumps

[d] Others