

# Evaluation Report 2.82

Water Supply —  
Kenya

VOLUME TWO  
APPENDICES



BUSINESS AND  
ECONOMIC RESEARCH  
NAIROBI, KENYA

The views and interpretations expressed in this report are those of the authors and should not be attributed to the Norwegian Agency for International Development (NORAD).

**KENYA:**  
**SOCIO - ECONOMIC EVALUATION**  
**OF THE**  
**URBAN WATER SUPPLY PROGRAMME**

**VOLUME TWO**  
**APPENDICES**

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## APPENDICES

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## TERMS OF REFERENCE

### FOR THE SOCIO-ECONOMIC EVALUATION OF

### THE NORAD PROJECT KEN 020- URBAN WATER SUPPLY PROGRAMME

#### I. BACKGROUND AND OBJECTIVE OF THE EVALUATION

NORAD has since 1974 contributed towards the development of water supplies and sewerage schemes termed as the Urban Water Supply Programme in Kenya. It has been agreed to concentrate the Norwegian contribution on 39 water supplies for minor urban centres and 8 sewerage schemes for similar centres. The Programme includes establishment of related service functions. The total Norwegian commitment up to 1983 is NOK 100 million. According to recent project reviews, it will be necessary to continue the Norwegian assistance for a considerable number of years beyond 1983, and with a considerable amount of funds over and above the current commitments, if the Programme as it stands is to be fulfilled. A planning process for a possible future phase of the Programme will consequently have to be carried out and concluded during 1982. In order to obtain information and understanding of the socio-economic characteristics and impact of the Programme to date, it has been decided to carry out an evaluation, or a socio-economic survey. The results of this survey will be applied as an input in the planning process for a next phase of the Programme.

#### II. MODE OF WORK

The socio-economic survey will take place from January through May 1982. It will be carried out on a consultancy basis by Business & Economic Research Bureau Ltd., Nairobi (hereafter: The Consultant), in accordance with a contract with NORAD. Prior to the signing of

the contract, the consultant shall present a work schedule with necessary information concerning the qualifications of the evaluation personnel, a budget etc.

The Consultant will carry out a survey in a selection of project areas, specified in Annex 1.

The survey will comprise of two parts: a household survey and a macro socio-economic survey. The household survey will be based on a random sample (selected in a statistically appropriate manner) of households with and without individual connections and shall include institutions within each project area. The total number of respondents shall be 600. The response shall not be less than 75%. A draft questionnaire is enclosed as Annex 2. In addition to the household survey, the Consultant will collect necessary background data on the socio-economic environment and setting of the selected project areas. This and other relevant information may be collected through public statistics, field observation etc, or in the manner considered by the Consultant to be most adequate.

### III. ISSUES OF THE EVALUATION

The Consultant is requested to provide answers to the following questions through the evaluation:

1. Macro aspects
  - 1.1 Discuss, on the basis of available information, the development effects of the growth centre strategy in Kenya, to which this Programme was supposed to contribute.
  - 1.2 Assess the selection of urban centres included in the programme, also in the light of the latest figures and prognoses of population development, and how the selection of water and sewerage projects have been linked to each other.

1.3 Discuss which problems and irrationalities may have arisen out of the administrative division between urban and rural water supply.

2. Socio-economic aspects of the households

2.1 Describe the socio-economic characteristics of the households selected for the survey, including:

- a) Household size, including a specification of number of dependants not directly related to head of household.
- b) Income (or proxy thereof), and household's main sources of income
- c) Characteristics of head of household, like sex, age, education level, type of employment
- d) Real assets (such as land, buildings, livestock), household equipment, and household's legal relationship to land cultivated and/or dwelling premises
- e) Length of occupancy of the household in the present dwelling
- f) Type, quality and space of dwelling
- g) Geographical origin of household
- h) Basic household expenditures

2.2 Contrast the socio-economic characteristics of the households with and without individual connections, and identify statistically significant differences.

3. Technology and popular participation

3.1 Indicate the local population's general identification- or lack of identification- with the schemes.

- 3.2 Describe the training and education received by the local population for an appropriate use of the schemes.
- 3.3 Indicate the extent and form of the local population's participation in the planning, financing, construction, operation, repair and maintenance of the projects.
- 3.4 Describe the socio-economic differences regarding items 3.1, 3.2, and 3.3.
- 3.5 Evaluate the ability of the responsible personnel for each project to operate and maintain the schemes on a self-reliant basis, concerning recurrent costs, spare parts, human resources etc. Discuss in the light of this:

- a) The technological level and complexity of the schemes.
- b) The structure of authority and decision-making in the operation and maintenance of the schemes.

4. Socio-economic impact

- 4.1 Describe the patterns of water use and sanitation of the households with individual connections- before and after the start of the schemes- including:
- a) The sources used to obtain water before the start of the water scheme.
  - b) The volume of water used for household consumption, distribution to other households (this estimate to be made by recall data from one time enumeration).
  - c) The reliability of the water supply provided.



- d) Distances, number of trips and time spent fetching water before the scheme came into operation and when scheme water fails.
- e) The method by which water is distributed to other households: sale, gift, as part of wage compensations for workers, etc.
- f) The sanitation patterns of the households.

4.2 Describe the patterns of water use and sanitation of the households without individual connection- before and after the start of the water and sewerage schemes- including:

- a) The sources used to obtain water including seasonal variations.
- b) The volume of water used to household consumption.
- c) The distances travelled daily to obtain water and the number of such trips (daily) including any seasonal variations. The time spent (daily) collecting water including any seasonal variations.
- d) The frequency and volume of water obtained from CWP or kiosks.
- e) The reliability of water supplied from CWP or kiosks.
- f) Attitudes on the use of CWPs or kiosks.
- g) The frequency and volume of water obtained from households with individual connections.
- h) The payment made for water obtained from households with individual connections: cash payments, water received as part of wage for work performed, gift etc.

- i) The sanitation patterns of the households.
- 4.3 Contrast the patterns of water use and sanitation of households with and without private connections, before and after the start of the water schemes.
- 4.4 Describe and assess the actual water expenses of households with and without individual connections in relationship to the tariff structure.
- 4.5 Decide and contrast the health conditions of household with and without private connections and on different socio-economic levels, and, if possible, before and after the start of the schemes, including such items as:
- a) General health as estimated by persons interviewed for household members.
  - b) Visits to doctors, hospitals, clinics, health care centres etc.
  - c) Incidence of diseases that may have been caused by insufficient access to and use of clean water. (Indicator: diarrhoeal diseases, cholera).
  - d) Incidence of diseases that may have been caused by inadequate sewerage and sanitation systems. (Indicator of infections diseases: Schistosomiasis; indicator of diseases transferred by insects: Malaria).
- 4.6 Describe the consequences of changed patterns of water supply and sanitation system for the households distribution of tasks, in particular the consequences for women and children. Contrast women from households with and without individual connections and from different socio-economic levels.

- 4.7 Assess, in general terms, the actual and potential industrial and economic growth in the project areas, and to what extent the water and sewerage schemes may have been stimulating such growth.
- 4.8 Discuss the relationship between household, institution and industry needs for water in the project areas, how possible conflicts have been solved, and the effect of these contrasting interests - if any - on the tariff system.
- 4.9 Assess how industrial enterprises served through the water schemes seem to have solved their waste water problem.
- 4.10 Describe the sanitation situation for the various centres supplied with water schemes under the Programme.

#### IV. REPORTING

The Consultant will carry out analysis of the results of the socio-economic survey, containing conclusions to the questions raised in this terms of reference. The Evaluation Report is to be submitted to NORAD by 1 June 1982.

Arne Arnesen  
Director General

ANNEX 1.

PROJECTS AREAS TO BE INCLUDED IN THE SURVEY

Chepkorio

Homa Bay

Kisii

Muranga

Port Victoria

Naiivasha

MEMORANDUM ON INTERPRETATION OF TERMS OF REFERENCE FOR

SOCIO-ECONOMIC EVALUATION OF THE URBAN WATER

SUPPLY KENYA

Submitted to NORAD

by

BUSINESS AND ECONOMIC RESEARCH

February 1982

The Urban Water Supply (UWS) Programme in Kenya was initiated in 1974 with Norwegian assistance and has, therefore, been in existence for about 7 years, a long enough period under normal circumstances to allow for a substantive evaluation of its achievements and impact. Unfortunately, the record of realization of the Programme - in terms of physically completed projects - has been slow: of the original 48 water supplies and sewerage schemes scheduled for completion in 1978, only 14 had been completed by 1981, and, of these, 8 were completed only in 1980. This factor accounts partly for the extension of Norwegian assistance to 1983 and for proposals to extend the aid agreement possibly into the 1990's.

Largely on account of this slow pace in the physical realization of the Programme, past NORAD Review Missions (1978 and 1981) have focussed on the technical aspects of the Programme including finances, manpower assistance and utilization, and the Ministry of Water Development's (MOWD) management of the Programme. Up until now, no evaluation relating to the socio-economic impact of the Programme has been undertaken; a wholly understandable circumstance given the fact that only recently have completed schemes come to fruition. The evaluation now underway shall, no doubt, close this gap, by generating data and analyses on the social and economic impact to date, of the Programme. In the following pages we discuss our interpretation of the Terms of Reference (TOR) submitted to us by NORAD and which form the basis for the consultancy contract arrived between us and NORAD.

## INTERPRETATION OF THE TERMS OF REFERENCE

### 1. GENERAL

- 1.1 Broadly the TOR call for a socio-economic evaluation of the UWS Programme at two levels, viz,
  - (a) at the Programme level and
  - (b) at the project level, a level which consists in turn of two further levels, namely:
    - (i) the water consuming household level, and
    - (ii) the centre/project supply level.
- 1.2 Evaluation at these levels is to be undertaken through an examination of six completed water supply areas assisted by NORAD.

The six supplies selected by NORAD with the participation of the consultant are:-

Muranga in Muranga District  
Naivasha in Nakuru District  
Chepkorio in Elgeyo-Marakwet District (erroneously located in MOWD files as being in Uasin Gishu District)  
Kisii in Kisii District  
Homa Bay in South Nyanza District  
Port Victoria in Busia District

Chepkorio and Port Victoria were new supplies while the others were augmentation projects; Kisii and Port Victoria were completed in 1977 while the other schemes become operational in 1980, considerations which affect the nature of the impact study as discussed in para 4.2 below.

- 1.3 The evaluation is directed to focus on four central areas of concern, namely:-
- (a) certain macro issues affecting the Programme as a whole and relating to Kenya's "growth centre strategy", selection of the centres included in the Programme and the effects of the administrative division between Urban Water Supplies and Rural Water Supplies.
  - (b) to determine the sociological and economic attributes and characteristics of the population living within the Urban Water Supply areas,
  - (c) to assess the sociological, economic, health and sanitation impact of the Schemes on:
    - (i) the population living within the supply areas, and, on
    - (ii) the commercial and industrial growth of the centres,
  - (d) to examine the populations' identification with the Schemes in terms of their participation in its development, operations and maintenance as influenced by the technological complexities, availability of locally generated resources needed to maintain the scheme and the adequacy of the authority structures.

entrusted with the management of the scheme.

We may now treat each of these issues of concern separately.

2. Macro concerns:

2.1 The UWS was initiated not simply for its intrinsic value in the provision of water to Kenyans but also as a key instrument in the Government's growth centre strategy which aimed at setting up localized and geographically spread out nuclei of economic, commercial, industrial and social development around the large cities and their environs. Provision of water was seen as an important input in catalysing the emergence of the nuclei. The evaluation shall seek to determine the extent to which this strategy remains as an aspect of the government's development strategy and assess the concrete steps taken by the government in its realization in terms of provision of other inputs, infrastructures and services at the level of the six water supplies.

2.2 In this regard, the evaluation shall attempt to assess the extent to which the selection of the Urban Centres included in the Programme tallies with,  
(a) the growth centre strategy,  
(b) recent trends in economic and social development, and especially in population growth trends.

Further, an examination shall be conducted to determine the extent to which the selection and provision of sewerage facilities has been related to the selection and provision of water supplies.

2.3 The provision of water supplies to areas outside the large cities in Kenya has been undertaken by a motley of institutions and ministries and through an equally wide array of programmes. Principal among these are the two programmes - Rural Supply Programme, and the Urban Water Supply Programme - programmes which at the project level interact, often not optimally.



The TOR direct the study to examine the problems which arise out of this administrative division and their effects on the provision of water.

3. The Six Schemes: Project settings and their socio-economies:

3.1 The above cited macro concerns shall be analysed in the context of an empirical study on the six schemes listed in para. 1.2 above. This study shall consist primarily of:

- (i) the socio-economic environment and settings of the scheme areas including population trends, structure of economic activities (commerce, agriculture, industry, etc) state of infrastructure, provision of social services and facilities,
- (ii) the state of water, sanitation and sewerage facilities within the scheme areas and its relationship to the socio-economic life of the centres,
- (iii) a description of the health conditions obtaining in the scheme area with specific attention paid to public health, incidence of water related diseases during the recent past, including the pre-project period,
- (iv) the water project histories, operations and management including a specification of the actual NORAD contribution to the scheme and its contribution to the improvement of water supplies in the scheme area,
- (v) an assessment of the availability of resources-human, technical and financial- at the centre level to service the water scheme,
- (vi) an examination of the population's relationship with the scheme in terms of attitudes, identification and participation, and,
- (vii) a determination of the extent of competition between various uses and different categories of consumers for water resources and the resolution, if any, of the competition.

3.2. The environment study shall provide comparative data on the centres and on the schemes and shall provide the critical setting for the household survey on patterns of water use and the impact of the schemes on these patterns, health and sanitation conditions of the populations living within the supply areas.

4. Household Survey: Income of Scheme Supplies on Household Patterns of Water Use, Health and Sanitation

The issues raised the TOR relative to households fall into three broad but related categories. First, is the requirement to establish the socio-economic characteristics of household water users and second is the need to determine the impact of the installed Water Supplies on the lives of the households in terms of (i) water use, (ii) the internal household division of labour, and (iii) health conditions and sanitation habits facilities. Third, is the need to establish the households attitudes toward and identification with the project. Basically, data on these three areas of investigation shall be obtained through the administration of a household questionnaire on a sample of 600 household heads in the six Water Supplies, (the suggested draft questionnaire is enclosed as Annex 1), where the sample shall comprise households with and without individual connections hopefully, providing the survey with a control group (crude as it may be) for contrasting both the socio-economic character of water use and the impact of the Water Supply at the household level. Data generated at this household level shall be analysed in the context of the project settings, histories and socio-economies of the centres served by the Supplies as discussed above in para 3.

4.1. The Socio-Economic Characteristics of Households

Paragraphs 2.1 and 2.2 of the TOR specify the socio-economic attributes of the households to be studied and analysed and suggest that the critical analytical categories in the collection and analysis of the data are households with and households without individual connections.

Within the parameters set by this division, the survey shall collect data on household sizes, incomes, assets, quality of dwellings, basic household expenditures (education, food, housing etc), household migration patterns, ages, sex, education levels and employment of household heads as specified in paras. 2.1 (a) - (h) of the TOR for households with and without individual connections and contrast them suggesting any statistically simple correlations and differences; correlations and differences which are then related to the impact concerns of the study in para 4.2 below.

#### 4.2 Socio-Economic Impact of the Supplies on the Household

Paragraphs 4.1-4.6 of the TOR relate to the socio-economic impact of the Supplies on the patterns of household water use, health and sanitation habits and facilities, and require a pre-scheme and a post-scheme comparative analysis. Three problems immediately suggest themselves in regard to the "before and after" comparative analysis.

First, no comparable base-line data was collected before the initiation of the schemes: the socio-economic data in the design reports is unsuitable and too meagre to afford a comparative base. Second, and as noted in para 1.2 above only two of the selected six schemes were completely new schemes, the other four being augmentation schemes, but it is extremely difficult in such cases to assess the exact impact of NORAD assistance on the households. Thirdly, and equally problematic is the fact, as noted earlier, that only two schemes have been in existence for a comparatively long enough period to afford a reasonable assessment of their impact. The other four were completed in 1980 and have been in existence for less than two years, hardly a sufficient period to allow an indepth impact study. For these reasons the impact issues of this evaluation shall be more indicative rather than conclusive, depending, as they will necessarily have to, on the vagaries of human recollections and memory on the pre-scheme situation. Incidentally, to avoid similar problems in future evaluations we recommend that immediate steps be

taken to start collecting baseline socio-economic data for all the -ncompleted schemes.

#### 4.2.1 Household Patterns of Water Use

4.2.1.1 Paragraphs 4.1, 4.2 and 4.3 of the TOR require that patterns of water use for households with and without individual connections be established. Patterns of usage in this context include sources of water supply and their reliability; effort expended in obtaining water (distances travelled, trips made, time spent etc); costs, payments and transactions relating to water; and volumes of water consumed in various household uses and/or in transactions with other households.

4.2.1.2 The above mentioned data is analysed in regard to:

- (a) the socio-economic characteristics of households discovered under para 4.1 above,
- (b) the division between households with and without individual connections, and
- (c) the pre-project patterns of water use obtaining in the scheme area, thus spelling out both the socio-economic character of household water use and the impact of the Supply on the patterns of household water use.

#### 4.2.2 Household sanitation and health conditions

4.2.2.1. Para 3.2 above has described the broader aspects of the sanitation facilities and disposal of waste at the level of the scheme area. In so far as the household is concerned, the survey shall attempt to establish the facilities and means available and utilized in the disposal of household and human waste, means which are correlated to:

- (a) the socio-economic characteristics of households
- (b) the existence/ or non-existence of private connections and
- (c) as far as possible to the situation obtaining before initiation of the scheme.

4.2.2.2 Similarly para 2.3 above has described the broad health conditions to be investigated at the project level and has emphasized the public health aspect and water-related diseases. As is well known, it has proved extremely difficult to provide error-free scientific correlations between water supplies and specific diseases although the general relationship between water-related diseases and the quality of water supply is generally acknowledged. We feel that in this regard the strategy adopted in para 4.5 of the TOR is the most sensible, where,

- (a) the respondents are allowed to evaluate their own general health conditions and to enumerate their household's visits to medical and health centres in the recent past, defined in the questionnaire as the past six months, and
- (b) the incidence of certain water-related diseases is examined. We would suggest that the incidence of diarrhoeal diseases, cholera, malaria, etc, upon the sample be matched against the incidence of these diseases for the project area as a whole and where possible determine the historical levels of incidence of these diseases, at least for the older projects completed in 1977.

As in the other cases, the analysis on the health conditions of household members shall be examined in the context of:

- (i) the socio-economic characteristics of households established under para 1. above
- (ii) the presence and /or absence of private connections.

#### 4.3 Households attitudes and relations with the Water Scheme

Paragraphs 3.1. - 3.4 of the TOR require that an assessment be made of the local population's participation and identification with the project be made. Participation is examined in relationship to

planning, financing, construction, operation, repair and maintenance of the projects, while identification relates to the attitudes held on and the relations existing between the project and the population. For the larger urban centres - Kisii, Muranga and Naivasha with a relatively large migrant population living in rented houses, it is difficult to ascertain any meaningful levels of participation while for the smaller centres with a strong rural -Homa Bay, Port Victoria and Cheopkorio - participation can be easily measured as indicated in the draft questionnaire. Identification and relations with the scheme shall be examined as specified in the household questionnaire, and in the light of the socio-economic groups discovered under para 4.1. above and in the light of the performance of each of the scheme.

5. Conclusions:

The different types and forms of data collected at the different levels shall then be analysed in the context of the broad Programme goals affording NORAD an opportunity to assess the extent to which the Programme has been realizing its objectives.

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## PRELUDE

THIS REPORT IS BASED ON THE DATA COLLECTED FROM THE FOLLOWING:-

1. REPLIES TO QUESTIONNAIRES FROM THE RELEVANT WATER SEWERAGE AUTHORITIES.
2. PHYSICAL CHECK-UPS ON SUPPLY AND DISTRIBUTION SYSTEMS.
3. DISCUSSIONS WITH RELEVANT DISTRICT WATER/SEWERAGE OFFICERS AND STAFF.
4. DISCUSSIONS WITH CONSUMERS IN THE TOWNS.
5. ANALYSIS REPORTS (As Attached)

THIS REPORT CONSISTS OF THE FOLLOWING:-

	<u>PAGE NOS</u>
1. NAIVASHA WATER SUPPLY.	1 - 14
2. MURANG'A WATER SUPPLY	15 - 23
3. MURANG'A SEWERAGE AND STORM WATER DRAINAGE.	24 - 36
4. GENERAL STUDY OF TRAINING FACILITIES AND ITS IMPACT ON MAINTANANCE AND OPERATIONS.	37
5. WATER ANALYSIS REPORTS	38 - 42

1.0 INTRODUCTION :

A study (hereafter referred to as the study) of the present water supply system at Naivasha town and its surrounds was carried out with a view of comparisons of the prevailing conditions in 1975 and the existing water supply system with improvements made in way of recommendations by VIAK'S "Naivasha Water Supply Project Volume I & II of 1975 (hereafter referred to as the 1975 Report).

For obvious reasons this study is to be read in conjunction with the 1975 Report. An attempt has been made to evaluate the adherence to 1975 Report in its implementation of Phase I (1975) and Phase II (1975 to 1985) and their short coming, if any.

2.0. THE SOURCES OF EXISTING WATER SUPPLY.

The sources of existing water supply system are a combination of the one existing in 1975 and some new works carried out in accordance with the recommendation offered in the 1975 Report for the Phase No.1 (1975) and Phase No.2(1975-1985). Reference should be made to Pages No. 45 to 48 of the 1975 Report. Description of the new works are also given with respective indications of their shortcoming (if any) in their purpose of integration to the system existing in 1975.

2.1. Phase I (1975)

Refer to Page 45 and 46 of 1975 Report Items 9.2 (i) to (iv)

2.1.1. Two new boreholes have already been drilled and installed with pumps and are functioning at the present. The data for these are as follows:-

	BH C 4161	BHC 4168
Depth	52.0 m	52.0 m
Maximum Tested Yield	36 m <sup>3</sup> /hr	36 m <sup>3</sup> /hr
Static Water Level	16.1 m	16.8 m
Casing Left-in	152 mmØ	152 mm Ø
Strainer At	45.6 m	45.4m



In boreholes C4168 and C4177 the water was also struck at varying depths of 17m to 52m.

These boreholes have been installed with submersible Pumps of 9.2.KW with capacity of  $25\text{m}^3/\text{hr}$  at about 2900 RPM for a head of 119 metres.

From the date available the two boreholes are producing  $16\text{m}^3/\text{hr}$  and  $25\text{m}^3/\text{hr}$  total of which if pumping 23 hrs a day would yield  $943\text{m}^3/\text{day}$ .

It therefore appears from the data that the yielding capacity of the boreholes is not being exploited to its full value, perhaps due to the smaller sizes of the pumps, compared to those recommended of  $32\text{m}^3/\text{hr}$  capacity. Also it was noticed that one of the boreholes is connected directly to the rising main, without entering the clear water tank. Here the water does not receive any treatment and is pumped "raw" to the main reservoir in town.

2.1.2. Two new boreholes have been completed the data of which is as follows:-

	BHC 4177	BHC 4178
Depth	52.0m	52.0m
Maximum Tested Yield	$54.5\text{ m}^3/\text{hr}$	$36\text{ m}^3/\text{hr}$
Static Water Level	16.0 m	16.4 m
Casing Left in	1.52 m $\emptyset$	1.52 m $\emptyset$
Strainer At	45.8 m	40 to 50 metres

Another  $90\text{m}^3/\text{hr}$  yield is therefore expected from these boreholes when completed and installed with larger sizes of pumps.

- 2.1.3. A clear water tank of  $90\text{m}^3$  has been built at the site of the boreholes and equipment for disinfection is provided but not yet in use due to lack of electrical power. This tank receives water from only one borehole whilst the other is connected directly to the rising main.
- 2.1.4. Pipelines from boreholes to tank and from tank through booster station to the existing reservoir of  $1135\text{m}^3$  in town are also completed with the recommended sizes. The rising main is 250mm (instead of 200mm  $\emptyset$  as specified and is class 'C' PVC pipe.)
- 2.1.5. A booster station with 2 No.40 H.P. pumps has also been completed.  
However, there is a diversion from the recommendation of 1975 Report which stipulated the pump to be designed to meet the demand for 1990 i.e.  $126\text{m}^3/\text{hr}$  for 90m head. The pumps installed are capable of pumping only  $63\text{m}^3/\text{hr}$ . Also a stand-by pump of capacity  $63\text{m}^3/\text{hr}$  is installed at present.
- 2.1.6. There are already 3 master meters installed at the site of the borehole source.
- 2.1.7. The supply from the existing Treatment works to the existing main reservoir has not been disconnected but is still recharging the main Reservoir.
- 2.1.8. A new reservoir of  $460\text{m}^3$  has been constructed at the existing treatment works. The specified reservoir in 1975 Report was  $1,500\text{m}^3$ .  
However, this reservoir appears to serve no useful purpose as this is connected to the pipe line from the filters to the old clear water tank. Also since the top layer of the filter sand is some 2M below the TWL of the new reservoir, the reservoir rather acts in a form of "black wash" and never gets filled up. Hence due to this the new reservoir is now almost redundant, and does not appear to serve its intended purpose as a storage tank.

- 2.1.9. No new major works at the Treatment Plant have been carried out since 1975 to improve the situation except for a new doser (chlorine) on the new tank.

3.0. PHASE II

Refer to Page 46 of 1975 Report items (i) to (ix).

The supply from the KRM is still being depended upon because the water supplied from the two boreholes is still inadequate as seen from Section 5.0.

3.1. Stage I (1975-1980)

Major diversions from the recommendations of 1975 Report have occurred in the pipelines constructed except for pipelines from the boreholes. Also the main pipeline is of 250mm  $\emptyset$  Class 'B' pipes, instead of the recommended 200 mm  $\emptyset$ .

3.2. Stage II (1980-1985)

Refer to Page 47 of 1975 Report items (i) to (v)

- 3.2.1. The recommendations of 1975 Report are carried out by installation of the 150mm mainline connected to the old 150mm pipeline near the County Council.
- 3.2.2. The 100mm pipeline recommended is not yet installed.
- 3.2.3. The 100mm pipeline recommended to be installed to the one in 3.2.1. is not yet installed.
- 3.2.4. The recommended 100mm pipeline to the 200mm pipe at the reservoir is not yet installed.
- 3.2.5. The recommended tank (350 m<sup>3</sup>) at the Prison is not yet constructed.

However, a masonry tank and a borehole at the prison is constructed individually by the Prison Authorities for irrigation purposes, but this cannot be considered to contribute anything to the system in question.

#### 4.0. EXISTING STORAGE RESERVOIRS

The storage reservoirs as described in the 1975 Report have been enhanced by construction of 2 new reservoirs and the total capacities are as follows:-

1. Main Reservoir in Town -  $1135 \text{ m}^3$
2. Clear Water Tank at Treatment -  $45 \text{ m}^3$
3. Prison Reservoir (old) -  $230 \text{ m}^3$
4. Prison Reservoir (new) - Unknown
5. Clear Water at boreholes (new) -  $90 \text{ m}^3$ .
6. New Reservoir at Treatment -  $450 \text{ m}^3$ .

#### 4.1. Main Reservoir

The main reservoir is connected to the two tanks at the Treatment works by 150mm  $\emptyset$  pipe line receiving a major portion of the available water from the KRM.

This is also connected to the pressure pipes from the boreholes and receives only a portion of the water.

To be able to calculate as to what amount of water this reservoir receives from the borehole it requires very elaborate calculations because this reservoir receives only the residual portion of the borehole water as most of the water goes direct to the consumers without being stored (or treated) by intermediate connections.

The water from the boreholes site has also heavy fluctuations depending on the demand of the branch pipes before the main pipe-line reaches this reservoir. Also the proportion of water from the KRM line recharging the Reservoir depends on what demand there is from the Prison, Kabati Estate and others. Since the total available water from the KRM line as shown by the meter is (during rainy season only) is  $40 \text{ m}^3 / \text{hr}$  it can be assumed that some  $10 \text{ m}^3 / \text{hr}$  flow finds its way into the main reservoir.

However, records also show that during the dry season the flow from KRM is as low as  $25 \text{ m}^3 / \text{hr}$  in which case only  $10 \text{ m}^3 / \text{hr}$  (or only  $240 \text{ m}^3 / \text{day}$ ) finds its way into the main reservoir, whilst  $30 \text{ m}^3 / \text{hr}$  is supplied directly.

Also from the interviews carried out at the Treatment Plant the staffmembers confirm that the main reservoir does not get filled up to its full capacity of  $1.135 \text{ m}^3$ . If a rough calculation is carried out it becomes obvious why this reservoir cannot get filled up.

From the total supply of some  $41\text{m}^3/\text{hr}$  of the borehole water an estimated  $30\text{m}^3/\text{hr}$  is supplied via branch lines to the consumers in town whilst only a residual amount of water of some  $10$  to  $11\text{m}^3/\text{hr}$  finds its way to the reservoir. This is about  $240\text{m}^3/\text{day}$ .

Also as explained earlier only  $10\text{m}^3/\text{hr}$  (or  $240\text{m}^3/\text{day}$ ) enters the reservoir.

Hence the expected water in the reservoir is  $480\text{m}^3/\text{day}$  whilst the capacity of the tank is  $1,135\text{m}^3$ .

This reservoir, is therefore not exploited to its full volume in way of carrying stored water for emergencies.

#### 4.2. Clear Water Tanks at Treatment Plant

As explained earlier the new storage tank is connected to the pipe between the filters and the old clear water tank and is acting as a "back wash" for the filters and never gets filled up due to the (erroneous or planned) unsuitable level difference between the filters and the TWL of the Tank.

This new tank is further connected to the  $150\text{mm } \emptyset$  outlet from the old tank. Therefore only a small portion of the capacity of the new tank is useful as a storage.

The new tank can therefore be considered as redundant and indeed the purpose of building such a tank is absolutely unclear.

#### 4.3. Tanks At prison

The existing tank of  $230\text{m}^3$  at Prison does not get filled even to this date. The 1975 Report recommends a new tank of  $350\text{m}^3$  (which has not been constructed yet, in any case). This again depended on whether the booster station at the main reservoir was available for pumping the required water to the proposed  $350\text{m}^3$  tank and the existing  $240\text{m}^3$  tank.

#### 4.4. Clear Water Tank At the Borehole Site

At present only one borehole is serving the clear water tank at  $25\text{m}^3/\text{hr}$ . The calculations show that if both the boreholes were serving this tank the time for filling it would be  $1\frac{3}{4}$  hr. However, the time for emptying this tank would be  $1\frac{1}{2}$  hr.

Normally a retention time for treatment by chlorine is  $\frac{1}{2}$  hr. (i.e. the water entering the tank should be faster than emptying it).

The reason for one borehole not connected to the tank is obvious, as the design capacity of the tank is too small.

Also when all four boreholes become operational (pumping some  $80\text{m}^3/\text{hr}$ ) either the size of the tank will need increasing or the pumping capacity of the booster pump will need increasing to achieve a correct balance of the flows.

Also this tank does not serve its original purpose as a treatment tank because a major portion of the water is pumped in "raw" condition to the consumers (see water analysis results).

#### 5.0. ADEQUACY OF PRESENT WATER SUPPLY

From the figures available an average daily demand of some  $1530\text{m}^3$  per day for the whole township was arrived at.

Assuming that both the borehole pumps (total capacity of  $41\text{m}^3/\text{hr}$ ) are working 24 hrs a day without any breakdowns, a capacity of some  $986\text{m}^3/\text{day}$  is obtained. Also from the figures available the water from KRM has a maximum capacity to supply  $40 \times 24 = 960 \text{m}^3/\text{day}$ .

Therefore a possible maximum capacity of some  $(980+960) 1940 \text{m}^3/\text{day}$  is obtained provided that the conditions are ideal.

However, during the dry season the recorded figures at the meter for the water from KRM is as low as  $25\text{m}^3/\text{hr}$  giving a maximum capacity of  $600\text{m}^3/\text{day}$ .

Also, for the borehole pumps to operate for 24 hrs day after day without breakdowns is not possible. Therefore a consideration must be given to the case when only one borehole pump is operating ( $25 \text{m}^3/\text{hr}$ ) and the KRM is supplying water in the dry season ( $25\text{m}^3/\text{hr}$ ).

The total supply is then rendered to only  $1200 \text{m}^3/\text{day}$  instead of the required  $1500 \text{m}^3/\text{day}$ .

Also as shown in the next section the inadequacy of the storage capacities can bring about a shortage of water to the consumers.

## 6.0. ADEQUACY OF THE PRESENT STORAGE CAPACITY

In theory the total storage capacity is as follows:-

- (a) Main Reservoir -  $1135 \text{ m}^3$
- (b) Clear Water Tanks (Treatment Plant) -  $495 \text{ m}^3$
- (c) Clear Water Tank at boreholes -  $90 \text{ m}^3$
- (d) Tank at Prison -  $230 \text{ m}^3$

As described in the preceding Sections none of these storages could be utilized to full capacity due to the following reasons:-

(a) Main Reservoir - Does not fill up to its full capacity as records show. Estimated average capacity for this is about  $480 \text{ m}^3$ .

(b) Clear Water Tanks At Treatment Plant

The new tank does not fill up and only about  $150 \text{ m}^3$  storage is expected, bringing the combined total to some  $200 \text{ m}^3$  for both the old and the new tanks.

(c) Clear Water tank at Borehole

This can be considered to store to its full capacity of  $90 \text{ m}^3$  only when the pumping is adjusted.

(d) Tank at Prison

This does not fill up to its full capacity and also this does not serve the town.

Hence it is obvious from the foregoing that the maximum storage capacity expected from the whole system is  $770 \text{ m}^3$ . This constitutes a storage for about  $\frac{1}{2}$  or only 7 hrs supply for a 18 hrs day, considering a negligible demand at night for some 6 hrs.

However, the standards stipulate that the storage should meet the following capacities:-

Balancing	-	8/12 hours supply
Breakdowns	-	9/18 hours supply

It can be seen therefore that the storage is not enough for the system.

### 7.0. ADEQUACY OF WATER SUPPLY FOR THE NEAREST FUTURE

From the data available following are the immediate requirements for the connections to the water supply line for which applications have already been made.

(a)	Pan Food Factory	-	45m <sup>3</sup> /day
(b)	Fisheries	-	135m <sup>3</sup> /day
(c)	Prison	-	90m <sup>3</sup> /day
(d)	Naivasha Girls School-		45m <sup>3</sup> /day
(e)	National Housing Corporations Site and: Service Schemes	-	45m <sup>3</sup> /day
(f)	Hospital	-	45m <sup>3</sup> /day
(g)	Kabati Estate	-	45m <sup>3</sup> /day
	TOTAL		450m <sup>3</sup> /day

It is expected therefore that the total average daily demand will increase to some 2000 m<sup>3</sup>/day in about 6 months. Reference is made to Page 13 of the 1975 Report where the projections were given for the year 1980 - 1475m<sup>3</sup>/day and the year 1990-3090 m<sup>3</sup>/day. If a straight forward linear interpolation is carried out an increase of some 300m<sup>3</sup>/day was stipulated, but the actual figures show that the demand was underestimated for 1982.

### 8.0. ADEQUACY OF CAPACITY OF WATER SUPPLY IN THE NEAR FUTURE

When the two boreholes (which at present are ready but not yet installed with pumps) are functional in the near future, it is estimated that another 980m<sup>3</sup>/day would be added to the water supply.

Hence this should be sufficient to cater for the whole town as the total would then be 980+980+960 = 2920 m<sup>3</sup>/day, as compared with the actual present demand of some 1530 m<sup>3</sup>/day, and some 2000 m<sup>3</sup>/day in the nearest future.



9.0. ADEQUACY OF STORAGE CAPACITY IN THE NEAR FUTURE

Storage capacity of at least 2000m<sup>3</sup> will be required within 6 months, but only 770 m<sup>3</sup> are available, as shown in the previous sections. Also since the storage Tank of 1,500 m<sup>3</sup> as recommended in the 1975 Report has not yet been constructed to its correct capacity this has inadvertently increased the supply of water without providing for an equal storage area.

10.0. QUALITY CONTROL OF WATER AND TREATMENT

10.1. Treatment Plant

Regular water analysis is being carried out at the Treatment Plant and the average dosages of chemicals used are as follows:-

ALLUM - 30 Kg/day  
SODA - 15 Kg/day  
CHLORINE - 3 Kg/day

There does not appear a significant variation of water treatment dosages for the dry season and rainy season with the quality of raw water changes in the KRM which is expected to vary in quality seasonally.

10.2. Borehole Water

No treatment is being carried out as yet but chlorination is expected to take place soon.

No water analysis for the borehole water is carried out regularly.

10.3. Water at Main Reservoir

Neither water treatment nor analysis of water being used by the consumers is carried out at this point regularly to assess the potability.

11.0. PRESSURE TESTS IN PIPES

No equipment for testing the pressures in the pipes exists at the water works.

## MURANG'A WATER SUPPLY

### 1.1. INTRODUCTION:

This section of the report deals with the technical aspects of the water supply and distribution systems, comprising:-

- (a) Intake
- (b) Treatment works
- (c) Pump house and pumping plant
- (d) Rising main
- (e) Storage
- (f) Distribution

Reference has also been made to the Final Design Report by the Consulting Engineers, M/S Howard Humphrey's and Sons (E.A.). Chemical analysis has been carried out on raw water samples taken from the river at intake, and on treated water samples taken from random taps in Town.

### 1.2. INTAKE

As recommended in the Final Design Report, a sump type intake chamber was constructed on river Kayhwe, a tributary of Maragua River, Approx. 5 Km along Murang'a - Mugoiri Road. The river's catchment area, and the catchment areas of the tributaries to Kayahwe river, are largely on the rural areas to the south-eastern slopes of the Aberdare Mountains. The ridges are densely populated by small scale farmers majoring in Tea Plantations on high altitudes and Coffee plantations elsewhere. While the farmers have done little to prevent soil erosion, effluent from road culverts cut through the slopy land eroding large quantities of soil into the rivers. Raw water is therefore characteristically turbid throughout the year with turbidity being excessively during the rainy seasons.

The intake is located approximately 100m below a confluence of two rivers on a relatively flat river valley. During

the rainy seasons, the silt-laden waters break the banks and deposit mud, stones and broken sticks into the intake chamber and clog it. The 200mm dia. bitumen lined steel pipe from the intake structure to the Treatment Works is similarly blocked by mud especially at the section below the overflow chamber, where flow velocities slacken. It was also noted that the intake chamber was constructed at the upper end of a gentle water fall. Excessive turbulence of the water at intake was observed, and this indicated that water entered the intake chamber with maximum silt-loading. It appeared, therefore, inevitable that clogging of intake chamber and the pipe had to occur. This phenomenon was observed about two months after commissioning of the Works and has yet to be resolved.

The District Water Officer has alternatively constructed a sump type intake chamber at the end of the Posho Mill channel, from which water flows by gravity into the coagulation tanks through 2 No. 100mm UPVC pipes. Dosing arrangements have been adjusted to suit. This arrangement was made possible by the Posho Mill owner shutting off flow to one of his two mill turbines alternatively in order to maintain adequate flow to the new intake chamber. He expects compensation for his 'generosity' from the Ministry of Water Development. While the latter construction is temporary, it was observed to be effective. The permanent one was found to be continuously blocked. An opinion was, therefore, formed that the intake chamber and the gravity mains to the treatment works have to be re-designed if a permanent solution to blockage problems is to be realised.

### 1.3 TREATMENT WORKS

The treatment works comprises:

- 4 No. coagulation basins
- 2 No horizontal flow Sedimentation Tanks.
- 3 No. Rapid Sand Filters.

- 1 No. clear water tank.
- 1 No. Washwater tank
- A pump house.
- Administration Building
- Staff quarters.

The works are relatively new, having been commissioned in 1980. Construction was completed to good quality and apart from normal cleaning there are no repairs required to-date.

Construction was carried out closely in accordance with the recommendations contained in the Final Design Report. The operator's office, Laboratory, Toilet Facilities Chemical Storage and dosing facilities are in the administration building Alum, soda ash and tropical chloride of lime are stored in sufficient quantities for one month operating requirements. There are holding Tanks with mechanical stirrers in duplicate (one duty and one standby) for all the three chemicals. Dosing is carried out by electrically operated dosing pumps (one duty and one standby) from the respective holding tanks to the point of application.

The dosing pumps require constant maintenance especially by removing soda ash and alum fine particles which coat the pumps internally and may choke them.

According to the operator, pumping of the dosing chemicals could have been avoided by constructing holding tanks on higher altitude such that flow of the chemicals into the works would have been by gravity. This would have minimised dependance on qualified pump fitters and on electrical energy necessary to get the pumps working.

#### 1.4 SEDIMENTATION

Flocculation process is obtained by use of mechanical paddles electrically operated. This method was preferred to a baffle wall system in order to achieve better flocculation results, having considered the annual variations in raw water quality.

Each sedimentation tanks has a flocculation chamber in two compartments in which the electrically operated paddles are installed. The rotational speed of the paddles is varied to obtain the best flocculating conditions.

As mentioned above, 2No. sedimentation tanks were constructed and a space left for one additional tank in future. The capacity of each tank was designed to be  $330\text{m}^3$ , and, when one tank was being washed, a surface loading of the  $16.0\text{m} \times 7.2\text{m}$  tank was approximated to be  $1.8\text{m/hr}$ . Further to this, allowing for sludge depth of approximately  $750\text{mm}$ , a detention period of 3 hours at maximum flow was obtained.

A record obtained from the water officer indicating the daily monthly average for a period of 12 months gives the quantity of water pumped in 16 hours average pumping period as  $1407\text{m}^3$  per day. The following observation is noted:-

- Design capacity of each tank =  $330\text{m}^3$  -----(i)
- Quantity retained in each tank  
when the other is being washed =  $16.0 \times 7.2 \times 1.8 = 207\text{m}^3$  --(ii)
- Average quantity observed to pass through  
tanks over 12 month period taking 16 hours  
average operation period and 3 hours detention period.  
 $= 1407 \times 3/16 = 263.6\text{m}^3$  .-----(iii)

From (i) & (iii) above it can be observed that the tanks are operating at 40% the design capacity and from (i) and (ii) at 63% design capacity.

#### 1.5. RAPID GRAVITY SAND FILTERS

In the final design, a provision was made for 4 No. filter units; 3 No. units to be constructed in the first phase, and 1 No. unit to be constructed in the next phase. The following observation was noted on the 3 No. filter units already constructed:-

- Design flow on 16 hours operating period for 3 No. filter units each  $12.25\text{m}^2$  at filtration rate of  $4.38\text{m/h} =$   
 $16 \times 3 \times 12.25 \times$

$$4.38 = 2576\text{m}^3/\text{day} \text{ ----(i)}$$

- Ditto but for 2 No. filter units at filtration rate of 657m/hr when one filter is being washed
 

= 16 x 2 x 12.25 x 6.57	
= 2576m <sup>3</sup> /day	----- (ii)
- Average monthly daily quantity for 12 months
 

= 1407m <sup>3</sup> /day	----- (iii)
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Therefore, operating capacity can be observed to be 57% of design capacity.

Backwash of the filters is carried out every three days. While this may sound to be too frequent in view of the amount of treated water used in the exercise, the quality of raw water necessitates this frequency of maintenance to keep the filters at the desirable operating conditions.

#### 1.6 CLEAR WATER TANK

The tank was constructed in reinforced concrete and has a design capacity of 361m<sup>3</sup> estimated to be 1½ hrs storage demand at 1995. Presently the tank's capacity is equivalent to 4 hours storage.

(i.e.  $\frac{361}{1407} \times 16 = 4 \text{ hours}$ )

#### Pump House and Pumping Plant

The high lift pumps for pumping water into supply were housed in a separate pump house at the lower end of the site. Installation was made of 2 No. electrically driven pumps (1 duty and one standby), and 1 No. diesel operated pump to act as standby in case of electrical power failure. A space was left for installation of a further electrically operated pump in the future, all in accordance with the final design. There is also a standby diesel generator of sufficient capacity to operate the chemical dosing equipment, the filter air blowers, the surge vessel compressor and site lighting.

The pumps installed are rated at  $13\text{m}^3$  per hour, and, considering an average pumping period of 16 hours, ahead and pump losses, and a monthly daily average amount of water pumped to be  $1407\text{m}^3$  per day, the pump efficiency is approx. 67%.

#### 1.7 Wash Water Tank

This was constructed with reinforced blockwork walls and a reinforced concrete roof and floor. It was designed to have a capacity of  $120\text{m}^3$  of which approx.  $38\text{m}^3$  is available for site water. The tank is situated at a high point in the site such as to provide the head to backwash the filters. The water officer did not have a record of the amount of water used in washing the filters nor did he record the amount of water used on site. However, from the record of daily water pumped and the daily supply for a period of 12 months from March 1981 to February 1982 a discrepancy of daily monthly average of  $185\text{m}^3/\text{day}$  is observed. This may be accounted for as the quantity used at treatment works for backwashing filters, quantity for site use, and as the residue at storage tanks and in the pipes after supply to the consumers has been made.

#### 1.8 RISING MAIN

The treated water from the clear water tank is pumped to service reservoirs at Maragi and Kiharu. The quantity is measured at the treatment works by a master meter.

1 No. 200mm UPVC main was laid from the treatment works to Maragi and 1 No. 150 UPVC main from Maragi to Kiharu. Ductile iron pipes were laid as per requirements of the head. The pipelines were designed to have maximum flow of  $131\text{m}^3/\text{hr}$  and  $73\text{m}^3/\text{hr}$  respectively at an average velocity of  $1.16\text{m}/\text{sec}$ . for a 16 hour day. Connections to both tanks respectively were made in accordance with the final design.

The pipeline route follows Murang'a - Mugoiri road, close to the road reserve boundary. It was, however, observed that

the pipeline is on the high road embankment and about a metre away from the face of the road cutting. This being a red coffee soil zone, the stability of the bank is questionable during rainy seasons, and in the everyday use of the land by the peasants and their animals.

There is therefore a possible danger of eroding the pipe cover, and, at one section approx 2 km from Maragi, the pipe was observed to span across approx. 1m wide gully. This is undesirable, and while efforts should be made to contain minor land slides and erosion along the pipeline route, it is advisable that the future rising main be laid on the lower bank of the road.

The pipeline was otherwise laid in accordance with the standard specifications recommended by the consultants. Pipe bursts were recorded two times in six months.

#### 1.9 STORAGE RESERVOIRS

Maragi reservoir was constructed next to Maragi Primary School. It has a capacity of  $580\text{m}^3$  capable of meeting the present demand for 6 hrs, full. There is also Kiharu reservoir which had been existing before the new scheme was constructed. This tank was being fed from Mathioya dam but the supply was discontinued when the new works were completed. Mathioya supply can still be operated in case of need but at a much higher operational cost than the new scheme.

As mentioned earlier, on, Maragi and Kiharu tanks are interconnected through 150mm diameter UPVC pipe. At Maragi reservoir, provision was made in the design for a future identical reservoir to be constructed. The pipework was so arranged that the future extension of the reservoir and duplication of the rising mains can be readily accommodated. At Kiharu, there are 2 No. tanks of capacity  $1140\text{m}^3$  and  $270\text{m}^3$  respectively, constructed before the new scheme and fed from Maragua dam. There is a small treatment plant which has already been put out of operation.



## 1.10

DISTRIBUTION

Water distribution was carried out as an improvement to the previously existing system recommended in the Preliminary Design Report. A new 150mm gravity main was laid from Kiharu Service Reservoir to the Centre of the town along the opposite side of the existing 100mm main. It was cross-connected at three points to the existing main so that both mains act as an intergral supply main.

There is a break pressure tank in town which after receiving water from the new mains, in turn, feeds the lower lying area of the town. The higher area of the town is fed by a main by-passing the break pressure tank, and, the distribution system was strengthened by a 75mm ring main as recommended in the Preliminary Design Report.

Another 200mm dia gravity main reducing to 150mm and 100mm starts from Maragi reservoir and feeds the areas in the vicinity of Mukuyu Market including Mjini, Mumbi Estate and all the areas to the South of Nairobi Sagana Road. 100mm main terminates at the further end of Mumbi Estate, where in future a service reservoir shall be built to serve the areas further east.

There are 1139 No. connections in the town. If each connection is estimated to serve 5 No. persons (including Institutions, and the hospital) then a population of approx. 6,000 persons can be considered to be adequately served with water. This leaves approx. 9,000 persons to be served. At a glance it is noted that upper Zone of St. Marys has no supply. There are no technical problems in supplying the area as it can easily be served from a new tanks connected to the 150mm mains from Maragi to Kiharu. Distribution network for this is yet to be designed.

It was further observed that Murang'a Town was recently elevated to Municipal Status. Town boundaries shall be extended to include further rural areas, the population figure of which is not yet available.

The new populations will be required to pay rates to the Municipal Council and will in turn require Council services including Schools, Roads, Water and Dispensaries. There are no planned water distribution schemes to the proposed new areas.

Industrial plots are located to the east of the town next to the existing sewage treatment pond.

The District Water Officer confirms that funds have been requested from the Ministry of Water Development to have water reticulation extended to the new Industrial Area. If the funds are sanctioned, construction shall be expected to be executed by Ministry's direct Labour Unit.

The proposed new sewage treatment works are expected to be built close to the Railway Station. Water distribution to the works has been suggested in the Preliminary Design but a design has not been finalised.

Further observations have revealed that Mjini Estate is undergoing a face lift. Construction of roads, sewers, surface water drainage and water reticulation is underway. When sewer connections are made to individual plots, a higher rate of water usage shall be expected. The water demand is however adequately estimated for in the design and shall not adversely affect the supply.

## 2.0 MAINTENANCE AND OPERATIONS

### 2.1 Murang'a Township Water Supply Personnel

There are 15 No. Maintenance staff attached to the township water supply project. A list of their names, training and experience is on page 5 of the questionnaire. Of these, it can be observed that 33% have had some training in water works, while only one appears to have had adequately long experience. Shortage of adequate number of relevantly trained and experienced staff can probably explain why repair to a pipe burst on the mains takes 7 hours on the average instead of a maximum of 3 hours.

## 2.2 CHEMICALS, TOOLS, SPARES AND FITTINGS

There does not appear to be a shortage of water treatment chemicals, (i.e. Alum sulphate, Soda Ash and Tropical chloride of lime). According to the water officer and the record obtained at the Treatment works, 400kg of Alum, 250kg of Soda Ash and 5kg of Tropical chloride of lime are required daily for the works. All the chemicals are readily available at Thika, Magadi and Nairobi, respectively.

The water officer reports that the necessary tools for all kinds of repairs are available within their stores.

Their biggest problem, is unavailability of spares and fittings. Experience received from water schemes under constructions within Nairobi area confirms that spares and fittings have always been a cause of delay to water contracts.

Some of the spares and fittings are manufactured locally but the demand seems to be higher than supply. As regards to imported fittings and spares, the red tape involved in the importations can, at times be responsible for the shortages.

Looking at the type of pipes used in the project, there are UPVC pipes, asbestos cement pipes galvanised pipes and bitumen lined steel pipes - all of which require different kinds of spares and fittings. It would have been possible to resolve the problem if specific types of pipes were used for specific projects, but considering the developmental rate of new and more economical materials, and until the country is able to meet its demands from local manufacturers, problems in spares and fittings can be foreseen to last much longer.

## 2.3 MAINTENANCE COST

Maintenance cost of the works was reported to be approximately KShs. 100,000.00 per month. Revenue from water sold to consumers averages KShs. 80,000.00 per month, at a cost of KShs. 1.50 per cubic meter. The Ministry, therefore, subsidises the operational cost to the tune of approx. KShs. 240,000.00 per annum.

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It has been noted that the new Municipal Council wants to run the water supply. The Council is newly instituted, and while it is still struggling with its "teething" problems it cannot be easily foreseen how a smooth transition will be effected. Financial and personnel problems shall be the major set-back.

## MURANG'A SEWERAGE AND STORMWATER DRAINAGE

### 1.0 INTRODUCTION

This evaluation (hereafter referred to as "the study") and subsequent impact on future recommendations as laid out for the existing sewerage works for Murang'a and their maintenance are in a form of elaborations on the previous Cowiconsult's "MURANG'A SEWERAGE AND STORM WATER DRAINAGE PROJECT - Preliminary Design and Master Plan - 1976" (hereafter referred to as the "1976 Report").

The 1976 Report offers rather thorough recommendations according to the situation prevailing in 1976 in form of Phase No. 1 and No. 2.

However, a further evaluation carried out in depth, in May 1982 by BER indicates that the current situation is somewhat different as compared to that of 1976 and its projections due to several reasons as set out in the following sections.

For obvious reasons comparisons will be made between conditions prevailing in 1976 (as laid in 1976 Report) and at present. And for future planning and implementation it is found convenient that reference be made to the 1976 Report. Also for the purpose of perusal of this study, it is envisaged that this study should be read in conjunction with 1976 Report for finer details to complete the picture.

### 2.0 CONDITION OF THE EXISTING SEWERAGE SYSTEM:

The condition of the existing system has deteriorated to a stage where a remedy is required in the nearest possible future details of which are as described in the following sections of this study.

Amongst the most important factors for the prevailing deterioration of the system is simply and inadvertently the "Overloading Factor" of the existing Treatment Plant and to a smaller extent the maintenance of the system due to absence of equipment. Following therefore are the observations made during the study.

#### 2.1

Phase No. 1 for the sewerage system as recommended in 1976 Report for implementation and commissioning circa 1979 has not been realized to date. This has created an anticipatory planning and implementation of other reticulations and connections (legal or otherwise) to the existing sewerage works since after the 1976 Report.

#### 2.2

Whilst improvements by way of connections to the existing sewer have been attempted in good faith to bring about improvements for the populace, this has had an opposing effect of clogging and overloading the sewers as evidenced by the data obtained by this study.

#### 2.3.

Another reason is that since 1976 Report the population of the town has increased from 7900 to some 15,000 at present.

#### 2.4.

Further, due to the increase in water consumption brought about by the completion of the water supply project for the town the sewage flows have now increased proportionately.

### 2.5

No remedial measures in improving the flow capacity or treatment capacities have been carried out since 1976.

Foregoing are amongst the most important reasons for the prevailing undesirable conditions for the sewage system.

## 3.0 DESCRIPTION OF EXISTING SEWAGE WORKS

The existing sewage works cover mainly the town centre, Mumbi Estate, Mumbi Girls School and the District Hospital.

The surrounds of the town centre are self catered for by way of individual Septic Tanks, Soakage Pits and Pit Latrines.

As described in the 1976 Report and confirmed by this study the existing sewerage works are at their basic minimum in the form of branches of mainly 150mm and 230mm concrete pipes and a Trunk Sewer of 230mm diameter, culminating in a Waste Stabilization Pond which further has an outlet to percolation trenches in form of "fork type" radial arms.

The study shows that the condition of each individual component of the system is as follows.

### 3.1

#### Connections:

Most of the individual domestic connections are of the correct size. No problems appear to be encountered due to size, but the problem focuses more on the quality of discharge from these connections in way of insoluble materials such as maize cobs, newsprints and even bandages from the District Hospital.

## 3.2

Manholes:

Quality of construction and design of these are of generally acceptable standards but certain manholes create bottle-necks whereby clogging the major system.

Some of the manholes are spaced at longer distances than acceptable (i.e. 60 metres) inconveniencing the rodding when jammed, whilst others have rough beddings preventing free flow of suspended or insoluble matter.

## 3.3

Branch Sewers:

These are generally in good condition as problems of leakages have not been reported (A thorough study of this could not be carried out as the pipes are buried in the ground).

Problem area for this is however due to the fact that some of the branch pipes are of inadequate diameters to accommodate "peak flows" of half capacities as is the acceptable standard. This has an effect of preventing the escape of Hydrogen Sulphide (which is part of the sewage in form of gas) to the atmosphere whereby a chemical action occurs creating Sulphuric Acid as the deteriorating factor for the concrete pipes and also rapidly turning the sewage "septic".

## 3.4

Trunk Sewer:

The Trunk Sewer is 1300 metres long and 230mm diameter concrete pipe leading to the Treatment plant.

It was not possible to inspect the condition of the Trunk Sewer as this would have involved stopping of the whole system for the period of inspection.



However, it is feared that a major blockage may occur in the near future due to "overloading" of the sewer shown by calculations carried out.

### 3.5

#### Treatment Plant:

This comprises of a Waste Stabilization Pond of 60 metre diameter and an average depth of 1.5 metres with screens, an Inlet with a Scum Board and an Outlet to the "percolation trenches".

#### 3.5.1

##### Inlet:

At the Inlet there are Open Inspection chambers with a screen in form of a grille to curtail the advent of objects over 25mm O/A dimensions. This further discharges into the next chamber, the purpose of which is to trap the grit.

These are generally in good condition but a need for provision of covers to the chambers is considered essential.

From the data collected it appears that these are cleaned out at regular intervals.

#### 3.5.2

##### Scum Board

The Scum from the sewage is removed here.

#### 3.5.3

##### Waste Stabilisation Pond:

After removal of the Scum via the Board the raw sewage percolates down into the Pond for required reduction of Biochemical

~~Oxygen demand by a biological process of algal photosynthesis.~~

Normally for this BOD reduction to occur a minimum Retention period of 50 to 70 days is accepted as an empirical value for some 60% reduction of the BOD.

But from this study it appears that neither the process of algal photosynthesis for transfer of oxygen is occurring (as indicated by the absence of algae on the surface of the Pond) nor the minimum Retention Period for the reduction of BOD is being achieved due to the reduction of the retaining capacity of the pond by formation of the sludge depth of some 60cm.

This can be seen from the calculations laid out in section No. . Also from the next section it is apparent that the effluent is nearly in form of raw sewage.

The absence of sludge removal, sludge drying beds and maturation ponds (further process for disinfecting the effluent by destroying pathogenic bacteria and virus) were noted.

Note: Perhaps the Maturation Ponds were omitted in the original design due to the presence of the percolation Trenches which were supposed to disinfect the sewage. However, these are not functioning as seen in the next section).

#### 3.5.4

##### Outlet:

Outlet is via an open Inspection chamber somewhat similar to the Inlet. As far as the flows are concerned this appears to function well except for the quality of the effluent

which appears to be the same as that of the raw sewage entering the Pond.

### 3.5.5

#### Percolation Trenches:

The original purpose of these trenches was to let the effluent from the Outlet flow into the Percolation Trenches for the purposes of soakage to the ground (and perhaps as described earlier for disinfection) and slowly to Morare River in form of acceptably treated sewage.

However, the study shows that this is not taking place and the effluent by-passes the trenches and flows straight into the river due to overloading of the trenches. This introduces considerable health hazards to the populace downstream of the river.

It can be judged from the foregoing that the Treatment Plant while appearing to serve its purpose is failing in its main function of treating the effluent being discharged into the river.

## 4.0 EXISTING MINOR TREATMENT WORKS

The existing minor Treatment Works comprises of septic Tanks, percolating trenches, Soakage Pits and Pit Latrines installed for individual housing estates (e.g. Mukuyu) and other institutions (e.g. prisons).

No major problems have been reportedly encountered with soakage Pits and Septic Tanks except that some means of emptying these must be considered to enable them to function to the desired standards.

With Pit Latrines there appears to be a problem with foul odours and some health hazards. It is envisaged that sooner or later these conditions will have to be improved by way of connections to a better system.

#### 5.0 PRESENT CONSTRUCTION OF NEW RETICULATION SYSTEMS:

At present the construction of the sewer Reticulation system is well advanced at the site and services scheme at Mjini Estate is supposed to be completed in August/September 1982.

This scheme is to cater for some 2300 persons with sewage quantity discharge of some  $104\text{m}^3/\text{day}$ . This constitutes approximately 35% increase in loading of the present Trunk sewer in the near future.

#### 6.0 MAINTENANCE AND OPERATION OF EXISTING WORKS:

The findings of this study show that this is also a problem area as far as equipment and manpower are concerned for proper regular maintenance and operations. The study attributes this to the following:

##### 6.1

There are no means of grit removal, and desludging of the present works.

##### 6.2

Except in the Municipal Offices there appears to be no adequately qualified personnel to execute the field work except where regular roding of the branch sewers is concerned. The number of field workers counted were 2 only, which is considered rather low compared to the demand of the work.

6.3

Chemical and Biological Tests for the Treatment Plant are not taken at regular intervals to enable one to know when remedial measures are to be taken. Absence of the available recent data for this is the point in question when new connections are considered.

7.0 COSTS OF MAINTENANCE:

A provision of maximum of £2,500 per annum is made in the budget for maintenance but the figures for the actual costs were not available. However, it is considered that the figure budgeted is fair or even low considering the conditions of the works.

The figures for revenue for the works were not available.

8.0 CHECK ON THE DESIGN IMPACTS OF THE EXISTING SYSTEM:

An attempt is made to keep the following calculations simple as possible as it is not in the scope of this study to introduce elaborate calculations. For elaborate calculations and their derivations a reference may be made to the 1976 Report.

9.0 PRESENT POPULATION:

Available figures indicate that present population of Murang'a Town to be some 15,000 people.

10.0 PRESENT WATER CONSUMPTION

The present water consumption as indicated in the water supply study for the same town is some  $1400\text{m}^3/\text{day}$ .

### 11.0 PRESENT ESTIMATED SEWAGE FLOWS

This study has shown that there are totally 785 connections to the existing sewage works. Using an average of 4 persons per connection for the sewage flow estimate following is obtained.

$$\text{FLOW} = \frac{785 \times 4 \times 110 \times 0.8}{1000} = 276\text{m}^3/\text{day}.$$

where - 110 is the estimated average water consumption per day per person as an empirical average accepted figure.

0.8 is the accepted average empirical ratio of sewage quantity to the water consumption.

### 12.0 FLOW IN THE TRUNK SEWER

An elaborate calculation carried out separately shows that the Trunk sewer is at present overloaded, the capacity of which is calculated at about  $150\text{m}^3/\text{day}$ .

### 13.0 CONCLUSION

The present sewage works are not adequate to cater for the existing connections due to the following:

#### 13.1

- The raw sewage is not being treated properly due to inadequate retention period because of the size of the waste stabilization pond and due to excessively high flow rate in the Trunk Sewer.

#### 13.2

- Health hazards are being introduced due to raw sewage finding its way into Morare River.

## 13.3

- When a comparison is made between the present average water consumption of  $1400\text{m}^3/\text{day}$  and if 100% of the people were connected then the flow should be some  $1,120\text{m}^3/\text{day}$ . However, only  $276\text{m}^3/\text{day}$  flow is estimated at present, constituting only 25% of the population being served.

## 13.4

- The size of the trunk sewer is inadequate as indicated earlier.

## 13.5

- The new connections from the up and coming housing estates are likely to introduce unsurmountable problems for the near future unless urgent remedies are carried out.

14.0 EXISTING STORM WATER DRAINAGE

No new major improvements have been carried out since the 1976 Report. It can be safely assumed that the details of the existing drainage do not vary much from the condition of the drainage in 1976.

Also since at the time of this study, the long rains (in March and April) were already past, a new study of the drains was not possible so that the data as given in 1976 Report remains without a change.

However, it is felt that a presentation of main points from 1976 Report would suffice as a reminder of the evaluation. These are as follows:-

- (a) Master Plan mainly covers the Town Centre, Murang'a High School, Catholic Mission, Mukuyu Market, Mjini Village (Eatate) and Mumbi Housing Estate together with the future proposed developments.

GENERAL STUDY OF TRAINING FACILITIES AND ITS  
IMPACT ON MAINTENANCE AND OPERATIONS

Construction and maintenance and operations of the Water Schemes in most towns in Kenya has been, and still is, the responsibility of the Ministry of Water Development. The Ministry has been training technical staff to man water projects all over the Country at the training school located in Nairobi Souce 'C'. The demand for the Technical Personnel is much higher than the Ministry can adequately train, especially considering the hundreds of new water projects in the Country.

Harambee Institutes of Technology which were recently developed do also train technicians and craftsmen who are adaptably suitable for maintenance of water projects. The annual turn over from all the Institutes is hardly 100 in number - a drop in the ocean, considering the demand.

Of the established contractors in the Country, there are none who are specifically specialised in the maintenance of water supply and distribution systems.

It is therefore, a pity that while the Government plans to provide all the population in the Country with water by the year 2000, an adequate number of well established and equiped maintenance force is not being proportionately developed.



BUSINESS AND ECONOMIC RESEARCH Ltd.

Job Norad/1

HOUSEHOLD QUESTIONNAIRE - URBAN IC

Name of Water Scheme \_\_\_\_\_ Questionnaire No. \_\_\_\_\_

Zone \_\_\_\_\_

Name of Head of Household\* \_\_\_\_\_ Sex \_\_\_\_\_

A/C NO. \_\_\_\_\_

Name of Respondent \_\_\_\_\_

Date of Interview : \_\_\_\_\_

Name of Interviewer \_\_\_\_\_

\_\_\_\_\_  
Signature of Field Supervisor

\*The respondent must either be the head of Household or the wife.

Socio-Economic Questions

1. (a) How many people live on this homestead? \_\_\_\_\_  
 (b) Give details on them below starting with the eldest/household head

Name	Sex F/M	Age	Relationship to head
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			

2. (a) In which year did you settle on this farm/here? \_\_\_\_\_  
 (b) Which district/country did you move from? \_\_\_\_\_

3. (a) What is the level of education of the head of household?  
 \*(Insert tick in appropriate bracket) None [ ] Primary [ ]  
 Secondary [ ] Post Secondary [ ]  
 (b) What is the occupation of the head of household?  
 Self-Employed: Shop-keeping [ ] market trading [ ] Farming [ ]  
 Wage-Employment: by local council [ ] central govt. [ ]  
 Private sector [ ]  
 Unemployed [ ]

4. (a) Do you own this house [ ] or rent it [ ]?  
 (b) How many rooms do you have in the house? \_\_\_\_\_  
 (c) Which is your most important means of cooking? (Tick one)  
 Charcoal Jiko [ ] Paraffin stove [ ] Firewood [ ]  
 Electric Cooker [ ] Gas cooker [ ] Other specify \_\_\_\_\_  
 (d) What do you use for lighting? (Tick one) Electricity [ ]  
 Paraffin-Lamps [ ] Gas Lamps [ ] Other specify \_\_\_\_\_

\* Interviewer to indicate whether type of dwelling is:  
Permanent [ ] Semi-Permanent [ ] or Temporary [ ]

Water Use Questions

Note if Renter go to question 6; Question 5 to be answered by Owner Occupiers only. (i.e Quest.5-owner occupiers; Q.6-renters)

- 5. (a) In which year did you install the water connection? \_\_\_\_\_
  - (b) How much did it cost you to install the connection?  
Shs Up to 500 [ ] 501-1000 [ ] 1001-1500 [ ] 1501-2000 [ ] Over 2000 Shs [ ]
  - (c) List the main reasons which motivated you to install the connection by order of importance.
    - (i) \_\_\_\_\_
    - (ii) \_\_\_\_\_
    - (iii) \_\_\_\_\_
  - (d) To what extent have you been satisfied? Very satisfied [ ] satisfied [ ] Not very satisfied [ ] Disappointed [ ]
  - (e) Is the water tap connection outside [ ] or inside your house [ ]?
  - (f) If inside: How many water taps do you have? \_\_\_\_\_
- 6. (a) Is the water tap connection inside [ ] or outside [ ] your house?
  - (b) If inside: How many water taps do you have? \_\_\_\_\_
  - (c) If outside: Is it shared with other tenants? Yes [ ] No [ ]
  - (d) If shared: how many other house-holds (other than those in your household) draw water from the connection? \_\_\_\_\_
  - (e) How do you pay for your monthly water consumption?  
Personal/Tenant Account [ ] Through landlord [ ]
  - (f) To what extent are your water needs satisfied? Very satisfied [ ] Satisfied [ ] Not very satisfied [ ] Disappointed [ ]
- 7. (a) List the four most important uses to which you put water in this household.
    - (i) \_\_\_\_\_
    - (ii) \_\_\_\_\_
    - (iii) \_\_\_\_\_
    - (iv) \_\_\_\_\_
  - (b) Among these uses which takes most water?  
(i) [ ] (ii) [ ] (iii) [ ] (iv) [ ]
  - (c) How many debes of water do you think you use per day? \_\_\_\_\_

- (d) How many other households use your connection? (owner-occupiers only) \_\_\_\_\_
- (e) If other households use your connection: do you give them water as gift [ ] or for sale [ ]? other specify \_\_\_\_\_
- (f) If sells water: how much do you sell per debe? \_\_\_\_\_
8. (a) Do you get a regular supply of water during the day?  
Yes [ ] Sometimes [ ] No [ ]
- (b) If No or Sometimes: What time of the day do you usually not get water? Morning [ ] Mid-day [ ] Evenings [ ]
- (c) During the past week how many days did you not receive water? \_\_\_\_\_
- (d) In general how often do you receive water in your taps?  
Always [ ] Most times [ ] 50/50 [ ] Rarely [ ] Never [ ]
- (e) What do you think are the reasons the Scheme fails to deliver water all the time?  
(i) \_\_\_\_\_  
(ii) \_\_\_\_\_
- (f) What is the quality of water in this Scheme? clean [ ]  
Sometimes dirty [ ] Dirty [ ]
9. (a) Do you think the distribution of water to different types of consumers in this Scheme is fair? Yes [ ] No [ ]
- (b) Why? \_\_\_\_\_
10. (a) Which is your most important source of water when your tap runs dry? Kiosk [ ] Stream/River [ ] Well [ ] Private Borehole [ ] Rain tank [ ] Walking Vendor [ ] Other specify \_\_\_\_\_
- (b) Do you have water storage facilities? Yes [ ] No [ ] Storage capacity in debes \_\_\_\_\_
- (c) If not Walking Vendor: Who fetches water? Men [ ] Children [ ] women [ ] Hired labour [ ]
11. (a) What is the price of water per cubic metre in this Scheme?  
\_\_\_\_\_
- (b) On average how much do you pay for water per month? \_\_\_\_\_
- (c) Do you think the cost of water is low [ ] high [ ] or reasonable [ ]?
- (d) Do you have any difficulties in paying for your bills  
Yes [ ] No [ ]  
(ii) Which? \_\_\_\_\_

Attitude questions

12. (a) What is the name of your water supply? \_\_\_\_\_
- (b) Have you ever visited the intake and or the treatment

plant? Yes [ ] No [ ] .

13. (a) Have you ever contributed to the water Scheme? Yes [ ]  
No [ ]  
(b) If yes in what form? Financial (other than payment for water) [ ] Labour [ ] Materials [ ] Attended meetings relating to scheme [ ] Other specify \_\_\_\_\_
14. (a) How much influence do you as a consumer have on the running of the scheme? None [ ] Very little [ ] Little [ ] Some [ ] Significant [ ]  
(b) How much influence does the local community have on the running of the scheme? None [ ] Very little [ ] Little [ ] Some [ ] Significant [ ]  
(c) i. Do you think that local participation would enhance the success of this scheme? Yes [ ] No [ ]  
ii. If YES how? \_\_\_\_\_
15. (a) Have you ever noticed people damaging pipes and/or valves? Yes [ ] No [ ]  
(b) If Yes what did you do? \_\_\_\_\_
16. (a) Have you ever come across a burst pipe or leakage? Yes [ ] No [ ]  
(b) If Yes what did you do? \_\_\_\_\_
17. (a) How well is this Scheme managed? Very well [ ] Well [ ] Poor [ ] Very poor [ ] Don't know [ ]  
(b) If Poor how can it be improved? \_\_\_\_\_
18. (a) Has any officer discussed with or trained you on how to use water? Yes [ ] No [ ]  
(b) If Yes who? \_\_\_\_\_  
(c) What did he discuss/train? \_\_\_\_\_
19. (a) Has any officer discussed with/trained you on how to dispose of waste water?  
(b) If yes Who? \_\_\_\_\_  
(c) What did he discuss/train? \_\_\_\_\_

Sanitation

20. (a) What type of toilets do you use? WC [ ] Pit latrine [ ]  
 bucket toilets [ ] Other specify \_\_\_\_\_
- i. If use WC: is it connected to: Sewer [ ] or Septic tank [ ] ?
- ii. Is your toilet private [ ] or Communal [ ] ?
- (b) i. What type of bathroom do you use? Shower [ ] Bathtub [ ]  
 Enclosure [ ] Other specify [ ] \_\_\_\_\_
- ii. Is it private [ ] or Communal [ ]
- (c) How do you dispose of household waste water? On ground-in plot [ ]  
 On ground off-plot [ ] House drainage system [ ] Other specify \_\_\_\_\_
- (d) How do you dispose of your garbage? Collected by town /urban council [ ]  
 Burnt [ ] Buried [ ] Put in open pit [ ] Put on vacant land [ ] Composted [ ] Other specify \_\_\_\_\_

21. HEALTH - Following the order of the names given in Question 1 give details on health.

General Health Good (G) Fair (F) Poor (P)	No of visit to medical facilities in past 6 months	Cases of KUHARA/DIARRH- EA attacks in past 6 months	Case of MALARIA in past 6 months	Cases of KIPINDUPINDU/ CHOLERA in past 6 months.
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
0.				
1.				
2.				
3.				
4.				
5.				

Household Income and Assets

22. Approximately, what are your family (husband and wife) earnings from occupation or employment per month?  
Up to 500 Shs [ ] 501-1000 [ ] 1001-1500 [ ] 1501-2000 [ ]  
2001-3000 [ ] over 3000 [ ]

23. (a) Do you own any of the following ? Agricultural land [ ]  
how many acres? \_\_\_\_\_ Non-Agricultural land [ ]  
how many acres? \_\_\_\_\_ Building [ ]

NOTE: If own agricultural land ask question (b and c); if own buildings ask question d); and if does not own any of the three go to question (e)

(b) which crops did you grow last year (1981) ?

<u>CROPS</u>	<u>Estimated quantity in No of bags</u>
Maize [ ]	_____
Beans [ ]	_____
Peas [ ]	_____
Vegetable [ ]	_____
Other specify _____	_____

	<u>Estimated quantity in No Kgs</u>
Coffee [ ]	_____
Tea [ ]	_____
Pyrethrum [ ]	_____
Sugar-cane in tons [ ]	_____
Other Specify _____	_____

(ii) Approximately, How much did you get from the total crop sales last year (1981)?  
Up to 500 Shs [ ] 501-1000 [ ] 1001-2000 [ ] 2001-4000 [ ]  
4001-6000 [ ] Over 6000 [ ]

(c) i. Do you have any livestock on your land ? Yes [ ] No [ ]  
ii. If Yes give number by type : Cattle-Grade \_\_\_\_\_ Native \_\_\_\_\_  
Sheep/Goats/Pigs \_\_\_\_\_ Poultry \_\_\_\_\_

iii. What were your livestock sales last year (1981)?  
Up to 500 Shs [ ] 501-1000 [ ] 1001-2000 [ ] 2001-4000 [ ]  
4001-6000 [ ] Over 6000 [ ]

(d) If have buildings: approximately, how much did you earn from your buildings last year (1981) ?  
Up to 500 Shs [ ] 501-1000 [ ] 1001-2000 [ ] 2001-4000 [ ]

- (e) i. Have you invested in any business enterprise? Yes [ ]  
No [ ]
- ii. If Yes Approximately, what were your earnings from business investment (s) last year (1981)?  
Up to 500 Shs [ ] 501-1000 [ ] 1001-1500 [ ] 1501-2000 [ ]  
2001-4000 [ ] 4001-6000 [ ] over 6000 [ ]

24. Household expenditure:

- (a) If you rent this house: How much do you pay per month?  
Up to 200 [ ] 201-500 [ ] 501-1000 [ ] 1001-1500 [ ]  
1501-2000 [ ] Over 2000 [ ]

- (b) i. Do you pay any school fees? Yes [ ] No [ ]
- ii. If Yes: Approximately, how much is the total per term?

Shs. 100- 500 [ ] 501-1000 [ ] 1001-2000 [ ] 2001-3000 [ ]  
3001 - 5000 [ ] Over 5000 [ ]

- (c) Approximately, what are your monthly expenses on things like food, lighting, transport etc.

Up to 200 [ ] 201-500 [ ] 501-1000 [ ] 1001-1500 [ ] 1501-2000 [ ]  
Over 2000 [ ]

- (d) i. What are your other major household expenses not covered above? \_\_\_\_\_

ii. Approximately how much do you spend on them per month?

Up to 200 [ ] 201-500 [ ] 501-1000 [ ] 1001-1500 [ ]  
1501-2000 [ ] Over 2000 [ ]

- 25. Are you able to have a saving from your earnings? Yes [ ]  
No [ ]

- 26. Do you have a pipe and/or tap leakage within your premises  
Yes [ ] No [ ]

27. Instructions to interviewer:

- (a) Please physically check whether there is a pipe and/or a tap leakage at the homestead Yes [ ] No [ ]

(b) Read the meter on the day of the interview    M<sup>3</sup>

\* What is the last meter -reading at water office    M<sup>3</sup>

Date of meter reading \_\_\_\_\_

\* \* \* \* \*

\* Before you leave the respondent check through the questionnaire \*  
and make sure all the questions have been answered. Do not forget  
\* to thank the respondent. \*

\* \* \* \* \*



BUSINESS AND ECONOMIC RESEARCH Ltd.

Job Norad/1

HOUSEHOLD QUESTIONNAIRE - URBAN NC

Name of Water Scheme \_\_\_\_\_ Questionnaire No. \_\_\_\_\_

Zone \_\_\_\_\_

Name of Head of Household\* \_\_\_\_\_ Sex \_\_\_\_\_

A/C NO. \_\_\_\_\_

Name of Respondent \_\_\_\_\_

Date of Interview: \_\_\_\_\_

Name of Interviewer \_\_\_\_\_

\_\_\_\_\_  
Signature of Field Supervisor

\*The respondent must either be the head of Household or the wife.

Socio-Economic Questions

1. (a) How many people stay in this house? \_\_\_\_\_  
 (b) Give details on them below starting with the eldest/househead

Name	Sex F/M	Age	Relationship to head
1.			
2			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			

2. (a) In which year did you settle here? \_\_\_\_\_  
 (b) Which district/country did you move from? \_\_\_\_\_
3. (a) What is the level of education of the head of household?  
 \*(Insert tick in appropriate bracket) None [ ] Primary [ ]  
 Secondary [ ] Post Secondary [ ]  
 (b) What is the occupation of the head of household?  
 Self-Employed: Shop-keeping [ ] market trading [ ] Farming [ ]  
 Wage-Employment: by local council [ ] central govt. [ ]  
 Unemployed [ ] Private Sector [ ]
4. (a) Do you own this house [ ] or rent it [ ]?  
 (b) How many rooms do you have in the house? \_\_\_\_\_  
 (c) Which is your most important means of cooking? (Tick one)  
 Charcoal Jiko [ ] Paraffin stove [ ] Firewood [ ]  
 Electric Cooker [ ] Gas cooker [ ] Other Specify \_\_\_\_\_  
 (d) What do you use for lighting? (Tick one) Electricity [ ]  
 Paraffin-Lamps [ ] Gas Lamps [ ] Other specify \_\_\_\_\_

Interviewer to indicate whether type of dwelling is: Permanent [ ] Semi-Permanent [ ] or Temporary [ ]

Water Use Questions

Note If Renter start with Question 6

5. If owner occupier- why have you not installed a connection at your home-stead? ( Give reasons by order of importance)
- (i) \_\_\_\_\_
- (ii) \_\_\_\_\_
- (iii) \_\_\_\_\_
6. (a) Which is your most important source of water during the dry season? Kiosk [ ] CWP [ ] Walking vendor [ ] Neighbour with IC [ ] River/stream [ ] Well [ ] Other Specify \_\_\_\_\_
- (b) How reliable is this source? Always Available [ ] Usually Available [ ] Rarely Available [ ] Never Available [ ]
- (c) What is the quality of water from this source? clean [ ] Sometimes dirty [ ] dirty [ ]
- (d) If source is Kiosk or Walking Vendor: What is the price paid per debe? \_\_\_\_\_
- (e) (If use walking vendor go to question (f)) Who fetches water? Women [ ] Children [ ] Men [ ] Hired labour [ ]
- (i) What is the distance travelled to fetch water? Kms \_\_\_\_\_
- (ii) How many trips do you make a day to collect water? \_\_\_\_\_
- (iii) How many hours per day do you spend on collecting water? \_\_\_\_\_
- (f) How many debes of water are collected per day? \_\_\_\_\_
7. (a) Is your source of water during the wet season different from that used during the dry season? Yes [ ] No [ ]
- (b) If yes which is your most important source during the wet season? Rain Tank [ ] CWP [ ] Neighbour with IC [ ] Other specify \_\_\_\_\_
- (c) How reliable is this source? Always Available [ ] Usually Available [ ] Rarely Available [ ] Never Available [ ]
8. (a) Which are the four main uses of water at this homestead?
- (i) \_\_\_\_\_
- (ii) \_\_\_\_\_
- (iii) \_\_\_\_\_
- (iv) \_\_\_\_\_

- (b) From the uses given which takes most water? (i) [ ] (ii) [ ]  
(c) Approximately , How much water do you use per day in <sup>(iii) [ ] (iv) [ ]</sup> debes? \_\_\_\_\_
- (d) Do you <sup>what</sup> have water storage facilities? Yes [ ] No [ ]  
(ii) If yes /is your storage capacity in No of debes? \_\_\_\_\_
9. (a) If use water from Kiosks (i.e response from Question 2&3)  
(i) Do you think the cost of water from kiosks is high [ ] reasonable [ ] or low [ ]?  
(ii) Does your kiosk get a regular supply of water during the day? Yes [ ] No [ ]  
(iii) If No which do you think has more reliable water supply Kiosks [ ] or ICs [ ]?
- (b) If use water from CWP (i.e response from Question 2&3)  
(i) Does your CWP get a regular supply of water during the day? Yes [ ] No [ ]  
(ii) If no: Which do you think has more reliable water supply CWP [ ] or ICs [ ]?
10. (a) Have you ever noticed people damaging pipes and/or valves Yes [ ] No [ ]  
(b) If yes, what did you do? \_\_\_\_\_
11. (a) Have you ever come across a burst pipe or leakage? Yes [ ] No [ ]  
(b) If yes: what did you do? \_\_\_\_\_
12. (a) Has any officer discussed with or trained you on how to use water? Yes [ ] No [ ]  
(b) Who ? \_\_\_\_\_  
(c) What did you discuss? \_\_\_\_\_
13. What do you think needs to be done to enable you install a water connection on your homestead?  
(i) \_\_\_\_\_  
(ii) \_\_\_\_\_

Sanitation

- 14 . (a) What type of toilets do you use?  
 bucket toilets [ ] Other specify \_\_\_\_\_
- 
- ii. Is your toilet private [ ] or Communal [ ]?
- (b)i. What type of bathroom do you use?  
 Enclosure [ ] Other specify [ ] \_\_\_\_\_
- ii. Is it private [ ] or Communal [ ]
- (c) How do you dispose of household waste water? On ground-in plot [ ] On ground off-plot [ ] House drainage system [ ] Other specify \_\_\_\_\_
- (d) How do you dispose of your garbage? Collected by town /urban council [ ] Burnt [ ] Buried [ ] Put in open pit [ ] Put on vacant land [ ] Composted [ ] Other specify \_\_\_\_\_

15. HEALTH - Following the order of the names given in Question 1 give details on health.

General Health Good (G) Fair (F) Poor (P)	No of visit to medical facilities in past 6 months	Cases of KUHARA/DIARRH- EA attacks in past 6 months	Case of MALARIA in past 6 months	Cases of KIPINDUPINDU/ CHOLERA in past 6 months.
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
0.				
1.				
2.				
3.				
4.				
5.				

Household Income and Assets

16 . Approximately, what are your family (husband and wife) earnings from occupation or employment per month?  
Up to 500 Shs [ ] 501-1000 [ ] 1001-1500 [ ] 1501-2000 [ ]  
2001-3000 [ ] over 3000 [ ]

17. (a) Do you own any of the following ? Agricultural land [ ]  
how many acres? \_\_\_\_\_ Non-Agricultural land [ ]  
how many acres? \_\_\_\_\_ Building [ ]

NOTE: If own agricultural land ask question (b and c); if own buildings ask question d); and if does not own any of the three go to question (e)

(b) which crops did you grow last year (1981) ?

<u>CROPS</u>	<u>Estimated quantity in No of bags</u>
Maize [ ]	_____
Beans [ ]	_____
Peas [ ]	_____
Vegetable [ ]	_____
Other specify _____	_____

	<u>Estimated quantity in No Kgs</u>
Coffee [ ]	_____
Tea [ ]	_____
Pyrethrum [ ]	_____
Sugar-cane in tons [ ]	_____
Other Specify _____	_____

(ii) Approximately, How much did you get from the total crop sales last year (1981)?

Up to 500 Shs [ ] 501-1000 [ ] 1001-2000 [ ] 2001-4000 [ ]  
4001-6000 [ ] Over 6000 [ ]

(c) i. Do you have any livestock on your land ? Yes [ ] No [ ]

ii. If Yes give number by type : Cattle-Grade \_\_\_\_\_ Native \_\_\_\_\_  
Sheep/Goats/Pigs \_\_\_\_\_ Poultry \_\_\_\_\_

iii. What were your livestock sales last year (1981)?

Up to 500 Shs [ ] 501-1000 [ ] 1001-2000 [ ] 2001-4000 [ ]  
4001-6000 [ ] Over 6000 [ ]

(d) If have buildings: approximately, how much did you earn from your buildings last year (1981) ?

Up to 500 Shs [ ] 501-1000 [ ] 1001-2000 [ ] 2001-4000 [ ]

- (e) i. Have you invested in any business enterprise? Yes [ ]  
No [ ]  
ii. If Yes Approximately, what were your earnings from business investment (s) last year. (1981)?  
Up to 500 Shs [ ] 501-1000 [ ] 1001-1500 [ ] 1501-2000 [ ]  
2001-4000 [ ] 4001-6000 [ ] over 6000 [ ]

18. Household expenditure:

- (a) If you rent this house: How much do you pay per month?  
Up to 200 [ ] 201-500 [ ] 501-1000 [ ] 1001-1500 [ ]  
1501-2000 [ ] Over 2000 [ ]
- (b) i. Do you pay any school fees? Yes [ ] No [ ]  
ii. If Yes: Approximately, how much is the total per term?  
100- 500 [ ] 501-1000 [ ] 1001-2000 [ ] 2001-3000 [ ]  
3001 - 5000 [ ] Over 5000 [ ]
- (c) Approximately, what are your monthly expenses on things like food, lighting, transport etc.  
Up to 200 [ ] 201 -500 [ ] 501-1000 [ ] 1001-1500 [ ] 1501-2000 [ ]  
Over 2000 [ ]
- (d) i. What are your other major household expenses not covered above?  
ii. Approximately how much do you spend on them per month?  
Up to 200 [ ] 201-500 [ ] 501-1000 [ ] 1001-1500 [ ]  
1501-2000 [ ] Over 2000 [ ]
- 19 Are you able to have a saving from your earnings? Yes [ ]  
No [ ]

\* \* \* \* \*  
\* Before you leave the respondent check through the questionnaire \*  
and make sure all the questions have been answered. Do not forget \*  
\* to thank the respondent. \*

\* \* \* \* \*

BUSINESS AND ECONOMIC RESEARCH Ltd.

Job NORAD/1

HOUSEHOLD QUESTIONNAIRE - RURAL NC

Name of Water Scheme \_\_\_\_\_ Questionnaire No. \_\_\_\_\_

Sublocation \_\_\_\_\_

Name of Head of Household \_\_\_\_\_ Sex \_\_\_\_\_

Name of Respondent\* \_\_\_\_\_

Date of Interview : \_\_\_\_\_

Name of Interviewer \_\_\_\_\_

\_\_\_\_\_  
Signature of Field Supervisor

\*The respondent must either be the head of Household or the wife.



Socio-Economic Questions

1. (a) How many people stay in this house? \_\_\_\_\_  
 (b) Give details on them below starting with the eldest/household head

Name	Sex F/M	Age	Relationship to head
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			

2. (a) In which year did you settle here? \_\_\_\_\_  
 (b) Which district/country did you move from? \_\_\_\_\_
3. (a) What is the level of education of the head of household?  
 \*(Insert tick in appropriate bracket) None [ ] Primary [ ]  
 Secondary [ ] Post Secondary [ ]  
 (b) What is the occupation of the head of household?  
 Self-Employed: Shop-keeping [ ] market trading [ ] Farming [ ]  
 Wage-Employment: by local council [ ] central govt. [ ]  
 Private sector [ ]  
 Unemployed [ ]
4. (a) Do you own this house [ ] or rent it [ ]?  
 (b) How many rooms do you have in the house? \_\_\_\_\_  
 (c) Which is your most important means of cooking? (Tick one)  
 Charcoal Jiko [ ] Paraffin stove [ ] Firewood [ ]  
 Electric Cooker [ ] Gas cooker [ ] Other Specify \_\_\_\_\_  
 (d) What do you use for lighting? (Tick one) Electricity [ ]  
 Paraffin-Lamps [ ] Gas Lamps [ ] Other specify \_\_\_\_\_

Interviewer to indicate whether type of dwelling is: Permanent  
[ ] Semi-Permanent [ ] or Temporary [ ]

Water Use Questions

Note If Renter start with Question 6

5. If owner occupier- why have you not installed a connection at your home-stead? ( Give reasons by order of importance)
- (i) \_\_\_\_\_
- (ii) \_\_\_\_\_
- (iii) \_\_\_\_\_
6. (a) Which is your most important source of water during the dry season? Kiosk [ ] CWP [ ] Walking vendor [ ] Neighbour with IC [ ] River/stream [ ] Well [ ] Other Specify \_\_\_\_\_
- (b) How reliable is this source? Always Available [ ] Usually Available [ ] Rarely Available [ ] Never Available [ ]
- (c) What is the quality of water from this source? clean [ ] Sometimes dirty [ ] dirty [ ]
- (d) If source is Kiosk or Walking Vendor: What is the price paid per debe? \_\_\_\_\_
- (e) (If use walking vendor go to question(f)) Who fetches water  
Women [ ] Children [ ] Men [ ] Hired labour [ ]
- (i) What is the distance travelled to fetch water? Kms \_\_\_\_\_
- (ii) How many trips do you make a day to collect water? \_\_\_\_\_
- (iii) How many hours per day do you spend on collecting water  
\_\_\_\_\_
- (f) How many debes of water are collected per day? \_\_\_\_\_
7. (a) Is your source of water during the wet season different from that used during the dry season? Yes [ ] No [ ]
- (b) If yes which is your most important source during the wet season? Rain Tank [ ] CWP [ ] Neighbour with IC [ ] Other specify \_\_\_\_\_
- (c) How reliable is this source? Always Available [ ] Usually Available [ ] Rarely Available [ ] Never Available [ ]
8. (a) Which are the four main uses of water at this homestead?
- (i) \_\_\_\_\_
- (ii) \_\_\_\_\_
- (iii) \_\_\_\_\_
- (iv) \_\_\_\_\_

- (b) From the uses given which takes most water? (i) [ ] (ii) [ ]  
(iii) [ ] (iv) [ ]
- (c) Approximately, How much water do you use per day in  
debes? \_\_\_\_\_
- (d) Do you have water storage facilities? Yes [ ] No [ ]  
<sup>what</sup>
- (ii) If yes, is your storage capacity in No of debes? \_\_\_\_\_
9. (a) If use water from Kiosks (i.e response from Question 2&3)
- (i) Do you think the cost of water from kiosks is high [ ]  
reasonable [ ] or low [ ]?
- (ii) Does your kiosk get a regular supply of water during the  
day? Yes [ ] No [ ]
- (iii) If No which do you think has more reliable water supply  
Kiosks [ ] or ICs [ ]?
- (b) If use water from CWP (i.e response from Question 2&3)
- (i) Does your CWP get a regular supply of water during the  
day? Yes [ ] No [ ]
- (ii) If no: Which do you think has more reliable water supply  
CWP [ ] or ICs [ ]?
10. (a) Have you ever noticed people damaging pipes and/or  
valves Yes [ ] No [ ]
- (b) If yes, what did you do? \_\_\_\_\_
11. (a) Have you ever come across a burst pipe or leakage?  
Yes [ ] No [ ]
- (b) If yes: what did you do? \_\_\_\_\_
12. (a) Has any officer discussed with <sup>or</sup> trained you <sup>on</sup> how to use  
water? Yes [ ] No [ ]
- (b) Who? \_\_\_\_\_
- (c) What did you discuss? \_\_\_\_\_
13. What do you think needs to be done to enable you install a  
water connection on your homestead?
- (i) \_\_\_\_\_
- (ii) \_\_\_\_\_

Sanitation

14. (a) What type of toilets do you use?  
 bucket toilets [ ] Other specify \_\_\_\_\_
- 
- ii. Is your toilet private [ ] or Communal [ ]?
- (b)i. What type of bathroom do you use?  
 Enclosure [ ] Other specify [ ] \_\_\_\_\_
- ii. Is it private [ ] or Communal [ ]?
- (c) How do you dispose of household waste water? On ground-in-plot [ ] On ground off-plot [ ] House drainage system [ ] Other specify \_\_\_\_\_
- (d) How do you dispose of your garbage? Collected by town/urban council [ ] Burnt [ ] Buried [ ] Put in open [ ] Put on vacant land [ ] Composted [ ] Other specify \_\_\_\_\_

15. HEALTH - Following the order of the names given in Question 1 give details on health.

General Health Good (G) Fair (F) Poor (P)	No of visit to medical facilities in past 6 months	Cases of MALARIA/DIARRH- EA attacks in past 6 months	Case of MALARIA in past 6 months	Cases of KIPINDU/PINDU/ CHOLERA in pa 6 months.
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				

Socio-Economic Status Questions

23. If have wage-employment: Approximately, What are your monthly family (husband and wife) earnings from wage employment?

Shs. 100 -300 ( ) 301 - 500 ( ) 501-1000 ( ) 1001-1500 ( )  
1501 -2000 ( ) Over2000( ).

24. (a) Do you own this land ? Yes ( ) No ( )

( b) How many acres of land do you own ? \_\_\_\_\_

25. (a) What are your most important cash earning crops?(to be listed)  
(b) How Much of each did you grow last

Season in acres?  
CROP                      ACRES

- 1. \_\_\_\_\_
- 2. \_\_\_\_\_
- 3. \_\_\_\_\_
- 4. \_\_\_\_\_

(c) Approximately how much of those crops did you sell \_\_\_\_\_ and for what value?

	<u>Crop</u>	<u>Amount sold</u>		<u>Value in Shs</u>
		<u>Kgs</u>	<u>bags</u>	
1.	_____	_____	_____	_____
2.	_____	_____	_____	_____
3.	_____	_____	_____	_____
4.	_____	_____	_____	_____

(d) What were your largest forms of expenditure in the production of those crops and approximately how much did you spend?

	<u>Type of Expenditure</u>	<u>Costs in Shs</u>
1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____

26. (a) Do you rear any of the following livestock on your farm - and if Yes how many ?

Cattle: No. of grade cattle \_\_\_\_\_ No of native/zebu cattle \_\_\_\_\_  
Sheep/Goats: No. of grade sheep/goats \_\_\_\_\_ No of Native sheep \_\_\_\_\_

Pigs: No of Pigs \_\_\_\_\_

Poultry: No of poultry \_\_\_\_\_

(b) How much water does your livestock consume per day in debes?

Cattle \_\_\_\_\_ Sheep/pigs/Goats \_\_\_\_\_ Poultry \_\_\_\_\_

(c) Name the different types of livestock products which you sold last month and the approximate value realized.

<u>Livestock product</u>	<u>Value in Shs</u>
Milk in Kgs _____	_____
Eggs in trays _____	_____
Cattle in No. _____	_____
Pigs in No. _____	_____
Goats in No. _____	_____
Other specify _____	_____

27. (a) Do you own any buildings? Yes ( ) No ( )

(b) If Yes : How much did you earn from them last month?

Up to Shs 300 ( ) 301 -500 ( ) 501 -1000 ( ) 1001-2000 ( ) Over 2000 ( )

- (e) i. Have you invested in any business enterprise? Yes [ ]  
No [ ]
- ii. If Yes Approximately, what were your earnings from business investment (s) last year (1981)?
- Up to 500 Shs [ ] 501-1000 [ ] 1001-1500 [ ] 1501-2000 [ ]  
2001-4000 [ ] 4001-6000 [ ] over 6000 [ ]

18. Household expenditure:

- (a) If you rent this house: How much do you pay per month?
- 200 [ ] 400-500 [ ] 501-1000 [ ] 1001-1500 [ ]  
1501-2000 [ ] Over 2000 [ ]

- (b) i. Do you pay any school fees? Yes [ ] No [ ]

- ii. If Yes: Approximately, how much is the total per term?
- 100- 500 [ ] 501-1000 [ ] 1001-2000 [ ] 2001-3000 [ ]  
3001 - 5000 [ ] Over 5000 [ ]

- (c) Approximately, what are your monthly expenses on things like food, lighting, transport etc. Up to Shs.
- 200 [ ] 201-500 [ ] 501-1000 [ ] 1001-1500 [ ] 1501-2000 [ ]  
[ ] Over 2000

- (d) i. What are your other major household expenses not covered above?

- ii. Approximately how much do you spend on them per month?
- 200 [ ] 400-500 [ ] 501-1000 [ ] 1001-1500 [ ]  
1501-2000 [ ] Over 2000 [ ]

- 19 Are you able to have a saving from your earnings? Yes [ ]  
No [ ]

\* \* \* \* \*

\* Before you leave the respondent check through the questionnaire \*  
\* and make sure all the questions have been answered. Do not forget \*  
\* to thank the respondent. \* \* \* \* \*

\* \* \* \* \*

BUSINESS AND ECONOMIC RESEARCH Ltd.

Job NORAD/1

HOUSEHOLD QUESTIONNAIRE - RURAL IC

Name of Water Scheme \_\_\_\_\_ Questionnaire No. \_\_\_\_\_

Sublocation \_\_\_\_\_

Name of Head of Household \_\_\_\_\_ Sex \_\_\_\_\_

A/C NO. \_\_\_\_\_

Name of Respondent\* \_\_\_\_\_

Date of Interview : \_\_\_\_\_

Name of Interviewer \_\_\_\_\_

\_\_\_\_\_  
Signature of Field Supervisor

\*The respondent must either be the head of Household or the wife.



Socio-Economic Questions

1. (a) How many people live on this homestead? \_\_\_\_\_  
 (b) Give details on them below starting with the eldest/household head

Name	Sex F/M	Age	Relationship to head
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			

2. (a) In which year did you settle on this farm/here? \_\_\_\_\_  
 (b) Which district/country did you move from? \_\_\_\_\_
3. (a) What is the level of education of the head of household?  
 \*(Insert tick in appropriate bracket) None [ ] Primary [ ]  
 Secondary [ ] Post Secondary [ ]  
 (b) What is the occupation of the head of household?  
 Self-Employed: Shop-keeping [ ] market trading [ ] Farming [ ]  
 Wage-Employment: by local council [ ] central govt. [ ]  
 Private sector [ ]  
 Unemployed [ ]
4. (a) Do you own this house [ ] or rent it [ ]?  
 (b) How many rooms do you have in the house? \_\_\_\_\_  
 (c) Which is your most important means of cooking? (Tick one)  
 Charcoal Jiko [ ] Paraffin stove [ ] Firewood [ ]  
 Electric Cooker [ ] Gas cooker [ ] Other Specify \_\_\_\_\_  
 (d) What do you use for lighting? (Tick one) Electricity [ ]  
 Paraffin-Lamps [ ] Gas Lamps [ ] Other specify \_\_\_\_\_

\* Interviewer to indicate whether type of dwelling is:  
Permanent [ ] Semi-Permanent [ ] or Temporary [ ]

Water Use Questions

Note if Renter go to question 6\*; Question 5 to be answered by Owner Occupiers only. (i.e Quest.5-owner occupier<sup>r</sup>; Quest.6-Renters<sup>^</sup>)

5. (a) In which year did you install the water connection? \_\_\_\_\_
- (b) How much did it cost you to install the connection?  
Shs: Up to 500 [ ] 501-1000 [ ] 1001-1500 [ ] 1501-2000 [ ]  
[ ] Over 2000 Shs [ ]
- (c) List the main reasons which motivated you to install the connection -by order of importance.  
(i) \_\_\_\_\_  
(ii) \_\_\_\_\_  
(iii) \_\_\_\_\_
- (d) To what extent have you been satisfied? Very satisfied [ ]  
satisfied [ ] Not very satisfied [ ] Disappointed [ ]
- (e) Is the water tap connection outside [ ] or inside your house [ ]?
- (f) If inside: How many water taps do you have? \_\_\_\_\_

- 6\*. (a) Is the water tap connection inside [ ] or outside [ ] your house?
- (b) If inside: How many water taps do you have? \_\_\_\_\_
- (c) If outside: Is it shared with other tenants? Yes [ ]  
No [ ]
- (d) If shared: how many other house<sup>holds</sup> (other than your own) draw water from the connection?
- (e) How do you pay for your monthly water consumption?  
Personal/Tenant Account [ ] Through landlord [ ]
- (f) To what extent are your water needs satisfied? Very satisfied [ ]  
Satisfied [ ] Not very satisfied [ ] Disappointed [ ]

7. (a) List the four most important uses to which you put water in this household.  
(i) \_\_\_\_\_  
(ii) \_\_\_\_\_  
(iii) \_\_\_\_\_  
(iv) \_\_\_\_\_

- (b) Among these uses which takes most water?  
(i) [ ] (ii) [ ] (iii) [ ] (iv) [ ]

- (d) How many other households use your connection? (owner-occupiers only) \_\_\_\_\_
- (e) If other households use your connection:
- (i) How regularly do you supply <sup>them</sup> with water? Daily [ ]  
2-3 times a week [ ] 4-5 times a week [ ]
- (ii) How much water in debes do they receive from you in a day \_\_\_\_\_
- (iii) Do you give them water as gift [ ] or for sale [ ]? other specify \_\_\_\_\_
- (f) If sellwater: how much do you sell per debe? \_\_\_\_\_
8. (a) Do you get a regular supply of water during the day?  
Yes [ ] Sometimes [ ] No [ ]
- (b) If No or Sometimes: What time of the day do you usually not get water? Morning [ ] Mid-day [ ] Evenings [ ]
- (c) During the past week how many days did you not receive water? \_\_\_\_\_
- (d) What do you think are the two main reasons the Scheme fail to deliver water all the time?  
(i) \_\_\_\_\_  
(ii) \_\_\_\_\_
- (f) What is the quality of water in this Scheme? clean [ ]  
Sometimes dirty [ ] Dirty [ ]
9. (a) Do you think the distribution of water to different types of consumers in this Scheme is fair? Yes [ ] No [ ]
- (b) Why? \_\_\_\_\_
10. (a) Which is your most important source of water when there is no water from the Scheme? Stream/River [ ]  
Well [ ] Rain tank [ ] other specify \_\_\_\_\_
- (b) If buy<sup>s</sup>water: How much do you pay per debe? \_\_\_\_\_
- (c) Do you have water storage facilities? Yes [ ] No [ ]  
storage capacity in debes \_\_\_\_\_
- (d) Who fetches water? Men [ ] Children [ ] women [ ]  
Hired labour [ ]
11. (a) On average how much do you pay for water per month? \_\_\_\_\_
- (b) Do you think the cost of water is low [ ] high [ ] or reasonable [ ]?
- (c) Do you have any difficulties in paying your water bills?  
Yes [ ] No [ ]

(ii) Which? \_\_\_\_\_

Sanitation

12. (a) What type of toilets do you use? WC [ ] Pit latrine [ ]  
Other specify [ ] \_\_\_\_\_  
(i) If use WC: is it connected to Septic tank [ ]?  
(ii) is your toilet private [ ] or Communal [ ]?  
(b) i. What type of bathroom do you use? Shower [ ] Bathtub  
[ ] Other specify \_\_\_\_\_  
ii. Is is private [ ] or Communal [ ]  
(c) How do you dispose of household waste water? On ground [ ]  
House drainage system [ ] Other specify [ ] \_\_\_\_\_  
(d) How do you dispose of your garbage? Collected by market /  
area council [ ] Burnt [ ] Buried [ ] Put in open pit  
Composted [ ] Other specify [ ] \_\_\_\_\_

Attitude Questions

13. (a) What is the name of your water supply? \_\_\_\_\_  
(b) Have you ever visited the intake and/or the treatment  
plant? Yes [ ] No [ ]
14. (a) Have you ever contributed to the water Scheme? Yes [ ]  
No [ ]  
(b) If Yes in what form? Financial (other than payment for  
water) Labour [ ] Materials [ ] Attended meetings  
relating to scheme [ ] Other specify \_\_\_\_\_
15. (a) How much influence do you as a Consumer have on the running  
of the scheme? None [ ] Very little [ ] Little [ ]  
Some [ ] Significant [ ]  
(b) How much influence does the local community have on the  
running of the scheme? None [ ] Very little [ ]  
Little [ ] Some [ ] Significant [ ]  
(c) i. Do you think that local participation would enhance  
the success of this scheme? Yes [ ] No [ ]  
ii. If Yes how? \_\_\_\_\_
16. (a) Have you ever noticed people damaging pipes and/or valves?  
Yes [ ] No [ ]  
(b) If Yes what did you do? \_\_\_\_\_
17. (a) Have you ever come across a burst pipe or leakage? Yes [ ]  
No [ ]  
(b) If Yes what did you do? \_\_\_\_\_
18. (a) How well is this scheme \_\_\_\_\_

19. (a) Has any officer discussed with or trained you on how to use water? Yes ( ) No ( )

20. (b) If Yes who? \_\_\_\_\_

(c) What did he discuss/train? \_\_\_\_\_

20. (a) Has any officer discussed with/trained you on how to dispose of waste water? Yes [ ] No [ ]

(b) If Yes who? \_\_\_\_\_

(c) What did he discuss /train? \_\_\_\_\_

21. (a) How has this family benefited from the availability of water at the homestead Give 2 major benefits.

(i) \_\_\_\_\_

(ii.) \_\_\_\_\_

(b) Which was your most important source of water before this scheme started to provide you:

(i) During the Dry season? River/stream ( ) Well ( ) Lake ( ) Other specify \_\_\_\_\_

(ii) During the Wet season? Rain tank ( ) River/stream ( ) Well ( ) Lake ( ) Other specify \_\_\_\_\_

(iii) How reliable were these sources ? Always Available ( ) sometimes Avail ( ) Rarely Avail. ( ) Never Avail. ( )

22. (a) Has the provision of water at the homestead altered the daily tasks and responsibilities i.e of the following:

Men: Yes ( ) No ( ) if yes How? \_\_\_\_\_

Women: Yes ( ) No ( ) If Yes How? \_\_\_\_\_

Children: Yes ( ) No ( ) If Yes How? \_\_\_\_\_

(b) How does the person (s) who used to fetch water use up his/her extra time as a result of availability of water at the homestead? \_\_\_\_\_



Socio-Economic Status Questions

23. If have wage-employment: Approximately, What are your monthly family (husband and wife) earnings from wage employment?

Shs. 100 -300 ( ) 301 - 500 ( ) 501-1000 ( ) 1001-1500 ( )  
1501 -2000 ( ) Over2000( ).

24. (a) Do you own this land ? Yes ( ) No ( )

( b) How many acres of land do you own ? \_\_\_\_\_

25. (a) What are your most important cash earning crops?(to be listed)  
(b) How Much of each did you grow last

Season in acres?

	<u>CROP</u>	<u>ACRES</u>
1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____

(c) Approximately how much of those crops did you sell \_\_\_\_\_ and for what value?

	<u>Crop</u>	<u>Amount sold</u>		<u>Value in Shs</u>
		<u>Kgs</u>	<u>bags</u>	
1.	_____	_____	_____	_____
2.	_____	_____	_____	_____
3.	_____	_____	_____	_____
4.	_____	_____	_____	_____

(d) What were your largest forms of expenditure in the production of those crops and approximately how much did you spend?

	<u>Type of Expenditure</u>	<u>Costs in Shs</u>
1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____

26. (a) Do you rear any of the following livestock on your farm - and if Yes how many ?

Cattle: No. of grade cattle \_\_\_\_\_ No of native/zeb cattle \_\_\_\_\_  
Sheep/Goats: \_\_\_\_\_

Pigs: No of Pigs \_\_\_\_\_

Poultry: No of poultry \_\_\_\_\_

(b) How much water does your livestock consume per day in debes?

Cattle \_\_\_\_\_ Sheep/pigs/Goats \_\_\_\_\_ Poultry \_\_\_\_\_

(c) Name the different types of livestock products which you sold last month and the approximate value realized.

<u>Livestock product</u>	<u>Value in Shs</u>
Milk in Kgs _____	_____
Eggs in trays _____	_____
Cattle in No. _____	_____
Pigs in No. _____	_____
Goats in No. _____	_____
Other specify _____	_____

27. (a) Do you own any buildings? Yes ( ) No ( )

(b) If Yes : How much did you earn from them last month?

Up to Shs 300 ( ) 301 -500 ( ) 501 -1000 ( ) 1001-2000 ( ) Over 2000 ( )



- 28.(a) Have you invested in any business enterprise? Yes [ ]  
 No [ ]
- (b) If Yes Approximately, what were your earnings from business investment (s) last year (1981)?  
 Up to 500 Shs [ ] 501-1000 [ ] 1001-1500 [ ] 1501-2000 [ ]  
 2001-4000 [ ] 4001-6000 [ ] over 6000 [ ]

29. Household expenditure:

- (a) If you rent this house: How much do you pay per month?  
 200 [ ] 400-500 [ ] 501-1000 [ ] 1001-1500 [ ]  
 1501-2000 [ ] Over 2000 [ ]
- (b) (i). Do you pay any school fees? Yes [ ] No [ ]  
 (ii). If Yes Approximately how much is the total per term?  
 100- 500 [ ] 501-1000 [ ] 1001-2000 [ ] 2001-3000 [ ]  
 3001 - 5000 [ ] Over 5000 [ ]
- (c) Approximately what are your monthly expenses on things like food, lighting, transport etc. Up to Shs.  
 200 [ ] 201-500 [ ] 501-1000 [ ] 1001-1500 [ ] 1501-2000 [ ]  
 [ ] Over 2000
- (d) (i) What are your other major household expenses not covered above? \_\_\_\_\_  
 (ii). Approximately how much do you spend on them per month?  
 200 [ ] 400-500 [ ] 501-1000 [ ] 1001-1500 [ ]  
 1501-2000 [ ] Over 2000 [ ]

30. Are you able to have a saving from your earnings? Yes [ ]  
 No [ ]

31. Do you have a pipe and/or tap leakage within your premises  
 Yes [ ] No [ ]

32. Instructions to interviewer:

- (a) Please physically check whether there is a pipe and/or a tap leakage at the homestead Yes [ ] No [ ]
- (b) Read the meter on the day of the interview [ ] [ ] [ ] M<sup>3</sup>
- \* What is the last meter -reading at water office [ ] [ ] [ ] M<sup>3</sup>
- Date of meter reading \_\_\_\_\_

\* \* \* \* \*

\* Before you leave the respondent check through the questionnaire \*  
and make sure all the questions have been answered. Do not forget \*  
 \* to thank the respondent. \*

\* \* \* \* \*

BUSINESS AND ECONOMIC RESEARCH Ltd.

Job NORAD/1

INSTITUTION QUESTIONNAIRE - IC

Name of Water Scheme: \_\_\_\_\_

Questionnaire No: \_\_\_\_\_

Sublocation /Zone \_\_\_\_\_

Name of Institution; \_\_\_\_\_

A/C No: \_\_\_\_\_

Name of Respondent: \_\_\_\_\_

Job Title \_\_\_\_\_

Date of Interview: \_\_\_\_\_

Name of Interviewer \_\_\_\_\_

\_\_\_\_\_  
Signature of Field Supervisor

1. Give a brief description of <sup>the</sup> institution (ie type)  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
2. What is the size of the institution by :
  - (a) Number of users/clients \_\_\_\_\_
  - (b) Number of employees? \_\_\_\_\_
  - (c) Number of buildings? \_\_\_\_\_
- 3) a) How many of the users/clients are resident? \_\_\_\_\_  
b) How many of the employees are resident? \_\_\_\_\_
- 4(a) Is the water connection at this institution inside [ ] outside [ ] or (both) some inside some outside [ ] of the buildings?  
(b) If both: How many of the buildings have connection inside? \_\_\_\_\_
- 5(a) Which are the four major uses of water at this institution ?
  - (i) \_\_\_\_\_
  - (ii) \_\_\_\_\_
  - (iii) \_\_\_\_\_
  - (iv) \_\_\_\_\_

(b) Which use takes most water? (i) [ ] (ii) [ ] (iii) [ ] (iv) [ ]

(c) Approximately, how much water do you use per day in gallons \_\_\_\_\_ or debes \_\_\_\_\_

(d) i. Does the institution have water storage facilities? Yes [ ] No [ ]  
ii. If yes: What is the storage capacity in gallons \_\_\_\_\_ or debes \_\_\_\_\_?

(e) What is the quality of water in this scheme? Clean [ ] Sometimes dirty [ ]  
dirty [ ].
- 6 (a) i. Do you allow non-resident staff to collect water from the institution? Yes [ ] No [ ]  
ii. If Yes: How often in a week are they free to use it? Daily [ ] 2-3 times [ ] 4-5 times [ ] Other arrangement specify \_\_\_\_\_  
(iii) Do you give them water as gift [ ] or for sale [ ]? Other specify \_\_\_\_\_  
(iv) If sells water: How much do you sell per debe? \_\_\_\_\_
- (b) i. Do you allow neighbouring households to collect water from the institution? Yes [ ] No [ ]  
ii. If Yes: About how many households collect water from this institution? \_\_\_\_\_  
(iii) How often in a week are they allowed to collect water? Daily [ ] 2-3 times a week [ ] 4-5 times a week [ ] Other specify \_\_\_\_\_  
(iv) Do you give them water as a gift [ ] or for sale [ ]? Other specify \_\_\_\_\_  
(v) If sells water : How much do you sell per debe? \_\_\_\_\_
- 7 (a) Do you get a regular supply of water during the day? Yes [ ] Sometimes [ ]  
No [ ]

(b) If Sometimes or No : What time of the day do you usually not get water? Morning  
[ ] Mid-day [ ] Evenings [ ]

(c) During the past week how many days did you not receive water? \_\_\_\_\_

(d) In general how often do you receive water? Always [ ] Most time [ ] 50/50  
[ ] Rarely [ ] Never [ ]

(e) What do you think are the reasons the scheme fails to deliver water all the  
time ? (i) \_\_\_\_\_

(ii) \_\_\_\_\_

8(a) Do you think that the scheme's water is adequate for your needs? Yes [ ] No [ ]

(b) Do you think the distribution of water to different type <sup>of</sup> consumers in this scheme  
is fair? Yes [ ] No [ ]

(c) If No Why? \_\_\_\_\_

9(a) What is the institution's average monthly payment for water? \_\_\_\_\_

(b) Do you think the cost of water is high [ ] Reasonable [ ] or low [ ] ?

(c) i. Do you have any difficulties in paying your monthly water bills? Yes [ ]  
No [ ]

ii. If Yes: Which? \_\_\_\_\_

10. (a) Does the institution have any other source of water besides the scheme connection?  
Yes [ ] No [ ]

(b) If Yes: Which ? Borehole [ ] Well [ ] Stream/River [ ] Spring [ ] Dam  
[ ] Rain tank [ ] other specify \_\_\_\_\_

ii. How often is it used? Throughout the year [ ] Half the year [ ] Only when have  
water from the scheme [ ] Rarely [ ] Other arrangement specify \_\_\_\_\_

iii) On average, approximately how much is drawn from this source per day when used?  
gallons \_\_\_\_\_ or debes \_\_\_\_\_

(iv) What is its daily supply capacity? gallons \_\_\_\_\_ / debes \_\_\_\_\_

(v) Is water from this source treated? Yes [ ] No [ ]

(vi) If Yes: give brief description of treatment process \_\_\_\_\_

(vii) Approximately how much per month does it cost you to maintain this system?  
Shs \_\_\_\_\_

Sanitation and Sewerage Questions

11.a) i. What type of toilets do you use? WC [ ] Pit latrine [ ] bucket toilets [ ]  
Other specify \_\_\_\_\_

ii. If use WC is it connected to sewer [ ] or septic tank [ ]?

(b) What type of bathroom do you use? Shower [ ] bathtub [ ] enclosure [ ]  
Other (specify) \_\_\_\_\_

12.(a) How do you dispose of institution waste water? on ground [ ] Institution  
private drainage system [ ] Town council system [ ]  
Other (specify) \_\_\_\_\_

b) If use private installed system: Give a brief description \_\_\_\_\_

ii. Is waste water treated before disposal? Yes [ ] No [ ]

iii. If Yes: Give brief description of treatment \_\_\_\_\_

IV) How much does it cost the institution to maintain that system? Shs. \_\_\_\_\_

(c) i. Does the institution have any problems with the used system? Yes [ ] No [ ]

ii. If Yes: Which? \_\_\_\_\_

iii) Has the institution found any solution to that problem? Yes [ ] No [ ]

iv) If Yes: Which? \_\_\_\_\_

13. (a) How do you dispose of institution garbage? Collected by town /urban council  
[ ] Burnt [ ] Buried [ ] Put in open pit [ ] Composted [ ] Other specify

(b) i. Does the institution have any problem with the used system? Yes [ ] No [ ]

ii. If Yes: Which? \_\_\_\_\_

iii. Has the institution found any solution to that problem. Yes [ ] No [ ]

Iv. If Yes: Which? \_\_\_\_\_

14. General remarks on aspects not covered above by the interviewer.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

BUSINESS AND ECONOMIC RESEARCH Ltd.

Job NORAD/1

INSTITUTION QUESTIONNAIRE - NC

Name of Water Scheme: \_\_\_\_\_

Questionnaire No: \_\_\_\_\_

Sublocation /Zone \_\_\_\_\_

Name of Institution; \_\_\_\_\_

A/C No: \_\_\_\_\_

Name of Respondent: \_\_\_\_\_

Job Title \_\_\_\_\_

Date of Interview: \_\_\_\_\_

Name of Interviewer \_\_\_\_\_

\_\_\_\_\_  
Signature of Field Supervisor

1. Give a brief description of <sup>the</sup> institution (ie type)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2. What is the size of the institution by :

(a) Number of user/clients? \_\_\_\_\_

(b) Number of employees? \_\_\_\_\_

(c) Number of buildings? \_\_\_\_\_

3)a) How many of the user/clients are resident? \_\_\_\_\_

b) How many of the employees are resident? \_\_\_\_\_

Water Use Questions

4. Why has the institution not installed a connection at its premises? ( Give reasons in order of importance)

(i) \_\_\_\_\_

(ii) \_\_\_\_\_

(iii) \_\_\_\_\_

5a) Which is your most ~~important~~ source of water during the dry season? Private pumped System [ ] Kiosk [ ] CWP [ ] River/Stream [ ] Other Specify \_\_\_\_\_

b) How reliable is this source ? Always Available [ ] Usually Available [ ] Rarely Available [ ] Never Available [ ]

c) If not a Private pumped system: who fetches water from the given source? Hired labour [ ] Other Specify \_\_\_\_\_

d)i. If use Private pumped system? Give a brief description of the installed system

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

ii. On average, approximately how much do you draw from this source per day? \_\_\_\_\_  
Gallons \_\_\_\_\_ or debes \_\_\_\_\_

iii) What is the system daily supply capacity? \_\_\_\_\_ gallons or  
debes \_\_\_\_\_

iv) Is water treated before it is used? Yes [ ] No [ ]

v) If Yes : Give a brief description fo the treatment process \_\_\_\_\_  
\_\_\_\_\_

vi) Approximately, how much per month does it cost the institution to maintain this system? Shs \_\_\_\_\_

6.a) Is your source of water during the wet season different from that used during the dry season? Yes [ ] No [ ]

River/Stream [ ] Other Specify \_\_\_\_\_

(ii) How reliable is this source? Always Available [ ] Usually Available [ ]  
Rarely Available [ ] Never Available [ ]

7.a) Which are the four major uses of water at the institution?

- (i) \_\_\_\_\_
- (ii) \_\_\_\_\_
- (iii) \_\_\_\_\_
- (iv) \_\_\_\_\_

b) Which of the uses takes most water? (i) [ ] (ii) [ ] (iii) [ ] (iv) [ ]

Sanitation and Sewerage Questions

8.a) What type of toilets do you use? Pit latrine [ ] bucket toilets [ ]  
Other specify \_\_\_\_\_

(b) What type of bathroom do you use? Enclosure [ ] Other [ ]  
Specify \_\_\_\_\_

9.(a) How do you dispose of institution waste water? on ground [ ] Institution  
private drainage system [ ] Town council system [ ] Other Specify  
\_\_\_\_\_

b) If use private installed system: Give a brief description \_\_\_\_\_

ii. Is waste water treated before disposal? Yes [ ] No [ ]

iii. If Yes: Give brief description of treatment \_\_\_\_\_

IV) How much does it cost the institution to maintain this system? Shs. \_\_\_\_\_

(c)i. Does the institution have any problems with the used system? Yes [ ] No [ ]

ii. If Yes: Which? \_\_\_\_\_

iii) Has the institution found any solution to that problem? Yes [ ] No [ ]

iv) If Yes: Which? \_\_\_\_\_

10. (a) How do you dispose of institution garbage? Collected by town /urban council  
[ ] Burnt [ ] Buried [ ] Put in open pit [ ] Composted [ ] Other specify \_\_\_\_\_



(b) i. Does the institution have any problem with the used system? Yes [ ] No [ ]

ii. If Yes : Which? \_\_\_\_\_

iii. Has the institution found any solution to that problem Yes [ ] No [ ]

Iv. If Yes: Which? \_\_\_\_\_

11. General ~~remarks~~ on aspects not covered above by the interviewer.

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BUSINESS AND ECONOMIC RESEARCH Ltd.

Job NORAD/1

BUSINESS QUESTIONNAIRE - IC

Name of Water Scheme: \_\_\_\_\_

Questionnaire No: \_\_\_\_\_

Sublocation /Zone \_\_\_\_\_

Name of Business \_\_\_\_\_

A/C No: \_\_\_\_\_

Name of Respondent: \_\_\_\_\_

Job Title \_\_\_\_\_

Date of Interview: \_\_\_\_\_

Name of Interviewer \_\_\_\_\_

\_\_\_\_\_  
Signature of Field Supervisor

1. Give a brief description on the nature of business \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
- 2.a) What is the size of the business firm by:
  - (i) Number of employees \_\_\_\_\_
  - (ii) Number of buildings on the business premises \_\_\_\_\_
  - (iii) Annual turnover in Shs \_\_\_\_\_

(b) What are the number of years the business has been in operation? \_\_\_\_\_

(c) What are your expansion plans within this coming year if any? \_\_\_\_\_
3. a) What are the major 4 uses of water in this firm?
  - (i) \_\_\_\_\_
  - (ii) \_\_\_\_\_
  - (iii) \_\_\_\_\_
  - (iv) \_\_\_\_\_

(b) Which use takes most water? (i) [ ] (ii) [ ] (iii) [ ] (iv) [ ]

(c) Do you allow the employees to collect water from the business connection? Yes [ ]  
No [ ]

  - (i) If Yes: About how many households draw water from the connection? \_\_\_\_\_
  - (ii) How often in a week are they allowed to draw? Daily [ ] 2-3 times a week [ ]  
4-5 times a week [ ] other arrangement (specify) \_\_\_\_\_
  - (iii) Do you give them water as a gift [ ] or for sale [ ]?  
Other arrangement specify \_\_\_\_\_
  - (iv) If sells water: How much do you sell per debe? \_\_\_\_\_

(d) Do you allow other business concerns to draw water from your connection? Yes [ ]  
No [ ]

  - (i) If Yes: About how many business firms draw water from the connection? \_\_\_\_\_
  - (ii) How often in a week are they allowed to draw? Daily [ ] 2-3 a times a wee  
[ ] 4-5 times a weeks [ ] other specify \_\_\_\_\_
  - (iii) Do you give them water as a gift [ ] or for sale [ ]?  
Other specify \_\_\_\_\_
  - (iv) If sells water : How much do you sell per debe? \_\_\_\_\_

(e) Approximately, how much water do you use per day? gallons \_\_\_\_\_ or debes  
\_\_\_\_\_

(f) What is the quality of water in the scheme? clean [ ] sometimes dirty [ ] dirty  
[ ]
4. (a) Do you get a regular supply of water during the day? Yes [ ] sometimes [ ]  
No [ ]
- (b) If Sometimes or No: What time of the day do you usually/receive water? Morning  
[ ] Mid-day [ ] Evening [ ]

- (c) During the past week how many days did you not receive water? \_\_\_\_\_
- (d) In general how often do you receive water? Always [ ] Most times [ ] Rarely [ ] Never [ ]

(e) i. If not Always: Has your business suffered as a result of inadequate water supply in the last six months? Yes [ ] No [ ]

ii. If Yes: how and to what extent? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(f) What do you think are the reasons the Scheme fails to deliver water all the time? (i) \_\_\_\_\_

ii) \_\_\_\_\_

5. (a) Do you think the distribution of water to different types of consumers in this Scheme is fair? Yes [ ] No [ ]

(b) If No: Why? \_\_\_\_\_

6. a) What is the business average monthly payment for water? Shs \_\_\_\_\_

b) Do you think the cost of water is high [ ] Reasonable [ ] or low [ ]

c) i. Do you have any difficulties in paying your monthly water bills? Yes [ ] No [ ]

ii. If Yes: Which? \_\_\_\_\_  
\_\_\_\_\_

7. a) Does the business have any other source of water besides the scheme connections? Yes [ ] No [ ]

b) i. If Yes: which? Borehole [ ] Well [ ] Stream/River [ ] Spring [ ] Dam [ ] Rain tank [ ] Other (specify) \_\_\_\_\_

ii. How often is it used? Throughout the year [ ] Half the year [ ] only when have no water from the scheme [ ] Rarely [ ] Other arrangement specify \_\_\_\_\_

iii) On average, approximately how much is drawn from this source per day when used? gallons \_\_\_\_\_ or debes \_\_\_\_\_

iv) What is its daily supply capacity? gallons \_\_\_\_\_ / debes \_\_\_\_\_

v) Is water from this source treated? Yes [ ] No [ ]

iv) If Yes: Give brief description of treatment process \_\_\_\_\_  
\_\_\_\_\_

vii) Approximately how much per month does it cost you to maintain this system? Shs \_\_\_\_\_

Sanitation and Sewerage Questions

8. a) If Restaurant /Hotel or Bar: What is the number of times your business has been closed down by Health Inspectors and/or due to health reasons in the past six (6) months? \_\_\_\_\_

b) Have you experienced any waste-water disposal problems? Yes [ ] No [ ]

c) If Yes: Explain the extent of the problem \_\_\_\_\_  
\_\_\_\_\_

9. If Industry /Factory: Approximately what is the amount of waste water from this firm per day? \_\_\_\_\_ gallons or debes \_\_\_\_\_

10. a) How do you dispose of business waste water? Surface drain to road [ ] drain to sewer [ ] Soakway [ ] Drain to River [ ] Private installed system [ ] Other specify \_\_\_\_\_

b)i. If Use Private installed disposal system: Give a brief description of system  
\_\_\_\_\_

ii. Do you treat your waste water before disposal? Yes [ ] No [ ]

iii. If Yes: Give description of treatment system. \_\_\_\_\_

iv). Does the firm have any problems in maintaining this system? Yes [ ] No [ ]  
If yes, which?  
\_\_\_\_\_

c) If not Private installed system: Does the institution have any problem with the system used? Yes [ ] No [ ]

ii) If Yes: Which \_\_\_\_\_

iii) Has the business firm tried to find a solution to that problem? Yes [ ] No [ ]

iv) If Yes: Which \_\_\_\_\_

11.a) How do you dispose of business garbage? collected by town/urban council [ ]  
Burnt [ ] Buried [ ] Put in open pit [ ] Composted [ ] Other Specify \_\_\_\_\_

b)i. Does the business have any problem with the system used? Yes [ ] No [ ]

ii. If Yes: Which \_\_\_\_\_

iii. Has the business found any solutions to that problem? Yes [ ] No [ ]

iv. If yes: Which \_\_\_\_\_

12. a) i. What type of toilets do you use? WC [ ] Pit latrines [ ] bucket toilets [ ] Other specify \_\_\_\_\_

ii. If use WC: Is it connected to sewer [ ] a septic tank [ ] ?

BUSINESS AND ECONOMIC RESEARCH Ltd.

Job NORAD/1

BUSINESS QUESTIONNAIRE - NC

Name of Water Scheme: \_\_\_\_\_

Questionnaire No: \_\_\_\_\_

Sublocation /Zone \_\_\_\_\_

Name of Business \_\_\_\_\_

A/C No: \_\_\_\_\_

Name of Respondent: \_\_\_\_\_

Job Title \_\_\_\_\_

Date of Interview: \_\_\_\_\_

Name of Interviewer \_\_\_\_\_

\_\_\_\_\_  
Signature of Field Supervisor

1. Give a brief description on the nature of business \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2.a) What is the size of the business firm by:  
(i) Number of employees \_\_\_\_\_  
(ii) Number of buildings on the business premises \_\_\_\_\_  
(iii) Annual turnover in Shs \_\_\_\_\_  
(b) What are the number of years the business has been in operation? \_\_\_\_\_  
(c) What are your expansion plans within this coming year if any? \_\_\_\_\_  
\_\_\_\_\_

Water Use Questions

3. Why has this firm not installed a connection at its premises? ( Give reasons in order of importance)  
(i) \_\_\_\_\_  
(ii) \_\_\_\_\_  
(iii) \_\_\_\_\_

4.a) Which is your most important source of water during the dry season? Private pumped System [ ] Kiosk [ ] CWP [ ] River/Stream [ ] Other Specify \_\_\_\_\_

b) How reliable is this source ? Always Available [ ] Usually Available [ ] Rarely Available [ ] Never Available [ ]

c) If not a Private pumped system: who fetches water from the given source? Hired labour [ ] Other Specify \_\_\_\_\_

d) i. If use Private pumped system? Give a brief description of the installed system

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

ii. On average, approximately how much do you draw from this source per day? \_\_\_\_\_  
Gallons \_\_\_\_\_ or debes \_\_\_\_\_

iii) What is the system's daily capacity ? \_\_\_\_\_ gallons or  
debes \_\_\_\_\_

iv) Is water treated before it is used? Yes [ ] No [ ]

v) If Yes : Give a brief description fo the treatment process \_\_\_\_\_  
\_\_\_\_\_

vi) Approximately, how much per month does it cost this firm to maintain this system? Shs \_\_\_\_\_

5.a) Is your source of water during the wet season different from that used during the dry season? Yes [ ] No [ ]

b) If Yes, what is the source?

River/Stream [ ] Other Specify \_\_\_\_\_

(ii) How reliable is this source? Always Available [ ] Usually Available [ ]  
Rarely Available [ ] Never Available [ ]

6. a) Which are the four major uses of water at this business firm?

- (i) \_\_\_\_\_
- (ii) \_\_\_\_\_
- (iii) \_\_\_\_\_
- (iv) \_\_\_\_\_

b) Which of the uses takes most water? (i) [ ] (ii) [ ] (iii) [ ] (iv) [ ]

Sanitation and Sewerage Questions

7.a) If Restaurant /Hotel or Bar: What is the number of times your business has been closed down by Health Inspectors and/or due to health reasons in the past six (6) months? \_\_\_\_\_

b) Have you experienced any waste-water disposal problems? Yes [ ] No [ ]

c) If Yes : Explain the extent of the problem \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



8. If Industry /Factory: Approximately what is the amount of waste water from this firm per day? \_\_\_\_\_ gallons or debes \_\_\_\_\_
9. a) How do you dispose of business waste water? Surface drain to road [ ] drain to sewer [ ] Soakway [ ] Drain to River [ ] Private installed system [ ]  
Other specify \_\_\_\_\_
- b)i. If Use Private installed disposal system: Give a brief description of system  
\_\_\_\_\_  
\_\_\_\_\_
- ii. Do you treat your waste water before disposal? Yes [ ] No [ ]
- iii. If Yes: Give description of treatment system. \_\_\_\_\_  
\_\_\_\_\_
- iv). Does this firm have any problem in maintaining this system Yes [ ] No [ ]  
If Yes, Which \_\_\_\_\_
- c) If not Private installed system: Does the institution have any problems with the system used? Yes [ ] No [ ]
- ii) If Yes: Which \_\_\_\_\_
- iii) Has the business firm tried to find a solution to that problem? Yes [ ] No [ ]
- iv) If Yes: Which \_\_\_\_\_  
\_\_\_\_\_
- 10 a) How do you dispose of business garbage? collected by town/urban council [ ]  
Burnt [ ] Buried [ ] Put in open pit [ ] Composted [ ] Other Specify \_\_\_\_\_
- b)i. Does the business have any problem with the system used? Yes [ ] No [ ]
- ii. If Yes: Which \_\_\_\_\_
- iii. Has the business found any solutions to that problem? Yes [ ] No [ ]
- iv. If yes: Which \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
11. What type of toilets do you use? Pit latrines [ ] bucket toilets [ ] Other specify \_\_\_\_\_  
\_\_\_\_\_

BUSINESS AND ECONOMIC RESEARCH Ltd.

Job NORAD/1

SEWERAGE -QUESTIONNAIRE (Scheme Level)

Town \_\_\_\_\_

Year Scheme Commissioned \_\_\_\_\_

Name of Respondent \_\_\_\_\_ Job Title \_\_\_\_\_

Date of Interview \_\_\_\_\_

\*Note Interviewer should be the field Supervisor

\_\_\_\_\_  
Signature

1.a) How is domestic waste disposed off in this town/area? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

b) How is industrial waste disposed off in this town? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2. Who manages and runs the waste and sewerage disposal systems in this town/area? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

3. How many sewerage schemes exist in this town? Give a brief description including design and operational capacity of each \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

4. Write below the names of all zones served by the sewer giving the approximate number of connections served per zone.

<u>Zone</u>	<u>No of Connection</u>
1. _____	_____
2. _____	_____
3. _____	_____
4. _____	_____
5. _____	_____
6. _____	_____
7. _____	_____
8. _____	_____
9. _____	_____
10. _____	_____

5.a) Does the town have sewerage exhauster vehicles? Yes [ ] No [ ]

b) If No How does it handle septic tanks? \_\_\_\_\_  
\_\_\_\_\_

6.a) Does the town have sewerage treatment works? Yes [ ] No [ ]

b) If Yes , give the different forms of treatment works by types and capacities

	<u>Type</u>	<u>Capacity</u>
(i)	_____	_____
(ii)	_____	_____
(iii)	_____	_____
(iv)	_____	_____

c)i. Does the town have any minimum health standards that must be met before the effluent is finally discharged? Yes [ ] No [ ]

ii. if Yes: What are the standards? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

d) Who certifies that treated and discharged effluent is within the allowable standards? \_\_\_\_\_

e) Where is the effluent finally discharged? \_\_\_\_\_

7.a) Does the town sewerage<sup>a</sup> system cater for industrial waste? Yes [ ] No [ ]

b) Do different factories/industries have own treatment works? Yes [ ] No [ ]

i) What are the major chemical wastes found in raw industrial effluent? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(ii) What treatment is given to the effluent before discharging it to town treatment works? \_\_\_\_\_

iii.) Who certifies that treated and discharged industrial effluent is within the allowable health standards? \_\_\_\_\_

8.a) Give a record of sewer blockages in the last six months, in number per month

<u>Month</u>	<u>No. of sewer blockage</u>
Sept '81	_____
Oct '81	_____
Nov '81	_____
Dec '81	_____
Jan '82	_____
Feb '82	_____

b) What are the causes of blockages if known? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

c) What maintenance problems are experienced at the treatment works?  
\_\_\_\_\_  
\_\_\_\_\_

d) What other operational and maintenance problems, not specifically covered above, are experienced? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

9.b)i. Is the department adequately staffed? Yes [ ] No [ ]  
ii. If No, give reasons \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

c)i. Does the sewerage department have facilities for further training of its personnel? Yes [ ] No [ ]

2. Give the following details on persons employed in the sewerage department.

	Name	Job Description	Level of Formal Education	Technical Qualification	place of Training	No. of Years of experience in Sewerage.
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						



BUSINESS AND ECONOMIC RESEARCH Ltd.

Job NORAD/1

WATER SUPPLY -QUESTIONNAIRE ( Scheme-level)

Name of Water Supply \_\_\_\_\_

Year Commissioned \_\_\_\_\_

Name of Respondent \_\_\_\_\_ Job Title \_\_\_\_\_

Date of Interview \_\_\_\_\_

\*Note Interviewer should be the Field Supervisor

\_\_\_\_\_  
Signature.



1. Who manages and runs this water Supply? Ministry of Water Development [ ]  
Local authority [ ] Private Company [ ] Other specify \_\_\_\_\_
  - 2.a) What is/are the source(s) of water? River [ ] boreholes [ ] Other specify \_\_\_\_\_
    - b) Give a brief description of the intake (indicate its capacity): \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
    - c) What problems are encountered at the intake? Silting of dam [ ] Excessive [ ]  
evaporation [ ] Drying up of the dam [ ] Other Specify \_\_\_\_\_
    - d) Describe the immediate vicinity of the intake: Forested [ ] Under cultivation  
[ ] Rocky [ ] Other Specify \_\_\_\_\_
    - e) What is the protection at the intake against :
      - i) Children \_\_\_\_\_
      - ii) Animals \_\_\_\_\_
      - iii) Any other (specify) \_\_\_\_\_  
\_\_\_\_\_
  - 3a) Describe the water reticulation system? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
  - b) If water flows through pipe by gravity:
    - i) What is the altitude at intake? \_\_\_\_\_ m
    - ii) What is the altitude at storage tanks \_\_\_\_\_ m
  - c) i) What is the type and size of the rising main \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
  - ii) What is its length in KM? \_\_\_\_\_
- 4.a) Do you have a treatment plant? Yes [ ] No [ ]
    - b) If Yes Give a brief description of type of plant and treatment process  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
    - i. What is the design capacity of treatment plant \_\_\_\_\_ M<sup>3</sup>/day
    - ii. What is the Operational capacity of treatment plant \_\_\_\_\_ M<sup>3</sup>/day
  - c) i. Give the record of breakdowns of the treatment plant in the last six months.

<u>Month</u>	<u>No of breakdowns</u>
Sept '81	_____
Oct. '81	_____
Nov. '81	_____
Dec. '81	_____
Jan. '82	_____
Feb. '82	_____

ii) Give a brief description of the kinds of breakdowns most often met \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

d) List below the Chemicals used for water treatment, indicate their source and availability.

	<u>Chemical</u>	<u>Source</u>	<u>Available</u>	<u>Not Readily Available</u>
i)	_____	_____	[ ]	[ ]
ii)	_____	_____	[ ]	[ ]
iii)	_____	_____	[ ]	[ ]
iv)	_____	_____	[ ]	[ ]

5. Give the following details on pumps at:

	No. Operating	No. on standby	Capacity in M <sup>3</sup> / hours	Average pumping hrs	Source Energy
i) Intake					
ii) treatment					
iii) Any other Specify					

6a) Give the record of pump breakdown in the last six months per month

<u>Month</u>	<u>No of breakdowns</u>
September '81	_____
October '81	_____
November '81	_____
December '81	_____
January '82	_____
February '82	_____

b) What do you do when pump(s) breakdown ? use standby pump [ ] Water is

served to consumer by tankers [ ] Consumer fetch water from river [ ]  
Other specify \_\_\_\_\_

- 7.a) How many storage tanks does the scheme have? \_\_\_\_\_
- b) What is the total storage capacity of the tanks \_\_\_\_\_ M<sup>3</sup>
- c) What is the storage capacity of the tanks in terms of number of days they can supply the consumers if not refilled? \_\_\_\_\_

- 8.a) Give the type and sizes of the main distribution pipes:
 

(i) From the treatment plant to storage	<u>Type</u>	<u>Size</u>
	_____	_____
(ii) Storage tank to distribution	_____	_____

b) Which are the most frequent type of breakdowns in the distribution system, give the record of their occurrence in the last six months.

<u>Type of breakdown</u>	<u>No. of occurrence last six months</u>
i) _____	_____
ii) _____	_____
iii) _____	_____
iv) _____	_____
c) Remarks _____	
_____	
_____	

- d) i. On average how long does it take to repair a reported trunk main pipe burst?  
\_\_\_\_\_
- ii. On average how long does it take to repair a reported consumer pipe burst?  
\_\_\_\_\_

9. Which are the principal operational and maintenance problems at this water supply? Rank them from 1 onwards in their order of importance: lack of spare parts and fittings \_\_\_\_\_ inadequate water at intake \_\_\_\_\_ lack of tools \_\_\_\_\_ lack of transport \_\_\_\_\_ lack of fuel \_\_\_\_\_ lack of chemicals \_\_\_\_\_ other specify and rank \_\_\_\_\_

10.a) How does this water scheme ensure that it satisfies the water needs of its different types of consumers? (ie Houesholds, Institutions and business concerns)  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

b) When there is shortage of water how is it rationed to the consumers?  
\_\_\_\_\_

11a) Does this water supply measure water distributed to each of its zones in the the supply area? Yes [ ] No [ ]

b) If Yes i) How? \_\_\_\_\_

ii) On average how much water is distributed to each zone per day

<u>Name of Zone</u>	<u>Amount of water per day M<sup>3</sup></u>
1) _____	_____
2) _____	_____
3) _____	_____
4) _____	_____
5) _____	_____
6) _____	_____
7) _____	_____
8) _____	_____
9) _____	_____
10) _____	_____
11) _____	_____

12a) What is the monthly average dailly water pumped, supplied to consumers and lost/wasted - last six months:

<u>MON·H</u>	<u>water pumped Daily</u>	<u>Daily Supply</u>	<u>Daily loss</u>
March '81	_____	_____	_____
April '81	_____	_____	_____
May '81	_____	_____	_____
June '81	_____	_____	_____
July '81	_____	_____	_____
Aug. '81	_____	_____	_____
Sept. '81	_____	_____	_____
Oct. '81	_____	_____	_____
Nov. '81	_____	_____	_____
Dec. '81	_____	_____	_____
Jan. '82	_____	_____	_____
Feb. '82	_____	_____	_____

b) On average does the daily water supply satisfy consumers needs? Yes [ ] No [ ]

13. What is the total water sold as per total consumer records in the months of

i) March '81 \_\_\_\_\_

ii) Aug. '81 \_\_\_\_\_

iii) Jan. '82 \_\_\_\_\_

14b) Is the water supply adequately staffed? Yes [ ] No [ ]

c) i) Does the personel have facilities for further training Yes [ ] No [ ]

ii) If yes, Where? \_\_\_\_\_

14.a) Give the following details on persons employed at this water supply

	Name	job description	Level of Formal Education	Technical Qualification	Place of Training	No of years experience in water work
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						

14 (a)





FINANCIAL YEAR	MONTHLY CONSUMPTION (M <sup>3</sup> )	WATER CHARGE		METER RENT		TOTAL CHARGES		Date Billing		Amount Paid		Date Payment		COM
		Shs.	Cts.	Shs.	Cts.	Shs.	Cts.	Date	Date	Shs.	Cts.	Date	Date	
1979/80	Cubic meter													
	Dec.													
	Jan.													
	Feb.													
	Mar.													
	Apr.													
	May													
	June													
TOTAL														
980/81														
	July													
	Aug.													
	Sept													
	Oct.													
	Nov.													
	Dec.													
	Jan.													
	Feb.													
	Mar.													
	April													
	May													
	June													
TOTAL														



FINANCIAL YEAR	MONTHLY CONSUMPTION (M <sup>3</sup> )	WATER CHARGES		METER RENT		TOTAL CHARGES		DATE BILLING	AMOUNT PAID		DATE Payment	COMMENT
		Shs.	Cts.	Shs.	Cts.	Shs.	Cts.		Shs.	Cts.		
1981/82	Cubic metres											
	July											
	Aug.											
	Sept.											
	Oct.											
	Nov.											
	Dec.											
TOTAL												

NOTES:

- NM = Meter not read
- NR = No records available
- MW = No water
- FM = Faulty meter
- D = Disconnected
- R = Reconnected
- NB = No Bill Prepared

