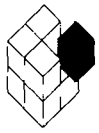
GWS Kenya
IRC



MATRIX consultants in development management

Water for Health

SHINYANGA

Formulation of the Rural Water
Supply and Sanitation Programme (RWSP)
Tanzania

District Profiles

VOLUME II

DRAFT REPORT

MAY 1992

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

Afya	Ministry of Health
AMREF	African Medical and Research Foundation
ARDHI	Institute in Dar es Salaam
CDA	Community Development Assistant
DANIDA	Danish Development Cooperation
DED	District Executive Director
DFA	District Field Assistant (under Maji)
DGIS	Directorate General for International Cooperation, The Netherlands
DHV	DHV Consultants, The Netherlands
D-PSU	District Programme Support Units
DPM	District Programme Manager
DWP	Domestic Water Points
EC	Electrical Conductivity
FINNIDA	Finnish Development Cooperation
GTZ	German Development Cooperation
GWS	Groundwater Survey Ltd. Kenya
GoN	Government of The Netherlands
GoT	Government of Tanzania
HESAWA	HEalth and SAnitation through WAter development
IRC	International Water and Sanitation Centre
IWP	Improved Water Points
IWS	Improved Water Supply
Maendeleo	Ministry of Community Development
Maji	Ministry of Water, Energy and Minerals
MWEM	Ministry of Water, Energy and Minerals
NEPP-plus	National Environmental Policy Plan 1990-1994, The Netherlands
NORAD	Norwegian Development Cooperation
OOP	Objective Oriented Planning
RC	Regional Commissioner
RDD	Regional Development Director
RNE	Royal Netherlands Embassy
R-PSU	Regional Programme Support Unit
RWSP	Rural Water and Sanitation Programme
SIDA	Swedish Development Cooperation
SWL	Static Water Level
SWN (80)	Handpump used in RWSP
TWSSC	Handpump factory Morogoro
UNDP	United Nations Development Programme
VHA	Village Health Assistants
WSU	Watersector Support Unit

1. INTRODUCTION

VOLUME II of the Formulation Mission Report comprises the District Water Profiles. It is the result of a so-called "Rapid Research" on water supply in the Shinyanga Region of Tanzania, and related issues as community participation, hygiene education and sanitation, sustainability and cost recovery. The District Water Profiles provide the background data for the Formulation Report, which has been commissioned to prepare for the next phase of the Netherlands' supported Rural Water Supply Programme in the Region.

The field research has been executed from the 10th of February to the 9th of March 1992, by a team of four researchers (in alphabetical order) :

- Mrs. M. Boesveld social scientist, from the International Reference Centre for Water and Sanitation in The Hague, Netherlands
- Mr. T.N. Kalomo Regional Community Development Officer In-charge of the Programme, Regional Community Development Department, Shinyanga, Tanzania
- Mr. J. Karanja hydrologist, from Groundwater Survey Ltd., Nairobi, Kenya
- Mrs. C. Sana economist, District Programme Adviser in the Planning Office, Bariadi, Tanzania.

The support and cooperation of the Regional and District officials who have been kindly supplying us with valuable information is highly appreciated. We also thank the communities which patiently answered our questions. We are grateful for the generous hospitality shown to us by everybody who received us. Last but not least we thank everybody at the Programme office for being so helpful and supporting in the difficult process of writing up, computerizing and printing our data and this report.

2. THE RURAL WATER AND SANITATION PROGRAMME IN SHINYANGA

2.1 GENERAL BACKGROUND

In November 1988 a Rural Water and Sanitation Programme for the Shinyanga and Morogoro regions was signed between the Tanzanian and the Netherlands Governments. This Tanzanian/ Netherlands cooperation programme has been following the earlier Tanzanian - Netherlands cooperation programmes for rural water supply and sanitation in these regions, dating back almost twenty years.

In the new Programme, which was set up for 3 years with an extension of 1 year, emphasis has been placed on the establishment of an adequate system for operation and maintenance of the water and sanitation facilities installed, and on integration in the water programme of community development, and health education and sanitation.

2.2 INSTITUTIONAL FRAMEWORK

The institutional framework for the Programme is laid down in the "System Design" (1) in which roles, responsibilities and tasks are defined for all people involved in the Programme, at all levels of implementation.

The administrative management of the Programme at District level is in the hands of the ***District Adviser (DA)***, who is a staff member of the District Planning Office. He acts as a liaison officer between the Programme Consultants' Office in Shinyanga and the District, on issues and problems concerning Programme management and implementation.

Programme implementers at District level are the Water Department, the Community Development Department, and the Health Department. For the specific work in the Programme, staff members of these Departments have been defined as ***Officers In-charge*** **(DOI, DCDOI, DHOI)**. Together they form the **District Programme Team.** Coordinator of this Team is the head of the District Community Development Department, the District Community Development Officer.
There has been some ambivalence between the role and tasks of the District Adviser and those of the District Community Development Officer. Although this problem has mostly been solved by putting all administrative tasks and a larger part of planning firmly in the hands of the District Adviser, some unclarity in "who is really responsible" seems to linger on.

Working under the District Programme Team are the **Fieldteams**, each consisting of a **Community Development Assistant (CDA)**, a **Health Assistant (HA)**, and a **District Field Assistant (DFA)** (a pump mechanic). The Fieldteams are responsible for Programme implementation in the villages. Tasks of the respective Fieldteam members are :

- mobilizing the villagers to form Water Committees, and to contribute towards the construction of a new well and towards the maintenance of new and rehabilitated wells;
- promoting cleanliness of the water points, giving hygiene education, and promoting improved sanitation facilities;
- assisting the villagers in the construction of a new well, and in maintenance and repair of well structures and the pumps;
- on-the-job training of two village mechanics, caretakers of the water points, and a village health worker.

It should be mentioned that all people working for the Programme are not employed by the Programme, but only attached to it. They have other, non-Programme duties to perform. Their day to day activities are not primarily focused on the Programme.

At the village level, a **Water Committee** is installed in every Programme village. It usually consists of 5 persons, with at least 2 women members. The Committee is elected by the Village Assembly.

The Committee is responsible for the management of the water points in the village. It has the power to impose water charges, and fines for those who misuse the water points. It has a bank account where water contributions and fines are deposited. Control of expenditure of the money is usually done by the Committee, but sometimes the Secretary of the Village Council is a signatory for the Water Committee's bank account.

For the Programme, in each village there are one **Village Health Worker**, two **Village Mechanics**, and one **Caretaker** for every waterpoint. In some villages there is also a **Village Community Development Worker.** They work under the guidance of the Water Committee in solving any problems that may occur in the operation and maintenance of the water points. The village health worker informs the people about the necessity of using safe water and general cleanliness.

The Programme provides each District with one car, three motorcycles for the District Team, and a bicycle for all the members of the Fieldteams.

For their work in the Programme all District officials, including the Fieldteams, are entitled to get an allowance of TSh. 12,000 per month, paid by the Programme above their normal salaries. This amount is based on Sh. 1,200 field allowance per night, with a maximum of 10 nights out per month, according to Tanzanian government regulations.

The village water assistants (village mechanics, caretakers, village health workers) do not receive a regular salary for their work, nor any allowances. The Water Committee may decide to give them some incentives, like exempting them from any other communal tasks.

2.3 THE STEP-BY-STEP APPROACH

In "System Design" of the Programme all steps are defined to be taken by the Programme implementors, from their first contact with the villagers up to the final handing over of a completed water point, whereby good management and operation must be ensured. Final steps after the handing over are: monitoring and assistance in progress made, follow-up on hygiene education, and evaluation.

In the step-by-step scheme the "village" and "villagers" are treated as homogeneous entities. District Officials and the fiels teams are not made aware of the necessity of paying special attention in each step to the participation of women and of any less well-off people in the villages. They follow the specific requirements, as laid down in the System Design, to have t women members in every Water Committee, but no provision has been made to support these women members where it is necessary.

Generally, the District officials with whom we talked about the step-by-step approach found it a good framework for action, but they judged the time estimates for each step not realistic. Some officials remarked particularly on delays with the survey, and with construction. Reasons given were delays at the Programme office, which is responsible for the surveys, and delays in delivering equipment and materials.

The time estimated for the mobilization of villagers was also too short in the opinion of some officials. Particularly if the first mobilization visits are not followed by immediate action, the villagers quickly loose interest. Then the process has to start all over again.

For some of the steps there are no clear ideas on how they should be executed, as for example in the integration of health and sanitation projects (step 4 and 11). Officials of the District Health Departments usually could not give any ideas for action to be taken beyond telling the villagers to use clean water for health and keeping the wells and their surroundings clean. For sanitation they would build a demonstration VIP latrine; this had been done so far in only a few places, and it had not been followed up by any monitoring of its use, or asking the communities' feelings about it.

Based on the steps as defined in the design, each month the DA or the DCDO makes a plan with a time schedule for all activities to be done in that month by everyone involved. These plans, which are laid down in official planning sheets, are seldom executed according to schedule. The main reason given is lack of transport.

Where the officials of the Health Departments are concerned, lack of funds is mentioned as a constraint. From the Programme funds allocated to the District, only very little seems to reach the Health Departments.

2.4 THE MONITORING SYSTEM

To control and monitor the implementation of the Programme, a monitoring system has been introduced in May 1990, with very comprehensive monitoring forms to be filled at all levels of Programme implementers, up from the village workers, through the Fieldteams and the District team, to the Regional level. A comprehensive manual with instructions on how to use the forms is available for all levels in Swahili. There is a translation into English, with copies of all monitoring forms (2).

All forms should be filled in once a month. The village forms are to be collected by the Fieldteams, who then should discuss any important issues or problems with the villagers. Equally, the District Team should collect the forms from the Fieldteams during monthly visits to the field. The District Team forms are to be collected by the Regional officials who work for the Programme, when they visit the District.

To introduce the monitoring system, two training courses on monitoring and reporting have been given through the Programme to all people involved.

All District officials and the Fieldteams were asked to comment on the monitoring system. All said that the monitoring system is clear, and filling in the forms is easy, for the field teams as well as for the village workers.

However, it is also easy to cheat with the data. The villagers are generally less inclined to do so, because they want to inform the authorities about their problems.

Two District officials said that the system is too rigid; some questions might be irrelevant when they have to be filled in every month, which encourages cheating. A large number of questions are just repeat questions every month. This should be avoided as it has to be filled month after month, which becomes very tedious. The forms leave no room for special events or problems, as for example in the case of a village where water from one of the wells is sold to a water vender in the nearby town.

For any monitoring system to be effective, a close follow-up on the data is necessary. It seems that in none of the Districts there is any integrated action of the District Teams, based on the results of the monitoring forms. Individual members of the Teams may or may not act on any problems signalled from the forms. But there seems to be very little consultation among the District officials, including the Fieldteams, about which approaches are to be used to mobilize and motivate the communities, and on how to solve problems which occur in the villages.

Some problems, particularly technical problems and breakdowns, are reported by the villages over en over every month, without any reaction from the District officials. They say that in these cases they cannot react because they have no spare parts, replacement pumps, or other equipment (transport) available to solve the problems.

The Programme Office is developing a data base for the processing of the monitoring data. So far the data from 28 villages have been processed. It is estimated that at least 30% of the data gathered at village level are reliable. The Office is presently preparing a report on the system, with some suggestions for improvements.

2.5 PROBLEMS

There are several problems and constraints which hinder the Districts in the proper execution of their tasks in the Programme. In the following paragraphs a short overview of the most important problems is given.

a) Management problems
Any ambiguity in the management of the Programme at District level, even if it is not always showing very clearly, is bound to impede Programme activities. Problems with transport, allowances, and the allocation of funds, as mentioned below, may very well be related to general management problems. Clarity in management roles and responsibilities is a first basis for good work.

b) Lack of knowledge and skills
One reason for the District officials and the Fieldteams not following up on the monitoring is perhaps a general lack of knowledge and skills at all levels. From the heads of departments and the District Teams, down to the Fieldteams, people seem to have no clear views on how to mobilize and support the villagers. Everybody we met, knew by heart the requirements of the step-by-step approach and the correct way of using the monitoring forms. However, when we asked questions about the content and the meaning of it all, and about methods of approaching and mobilizing villagers, it became clear that most people had very little insight in what should be done, and particularly, in how it should be done.

c) Transport problems
Another important reason for the difficulties is, that many of the field visits planned for District officials and Fieldteams in the step-by-step approach and the monitoring system, do not take place at the appropriate time, or, in some cases do not take place at all. Most Programme implementers, when asked about their work, explained to us the official requirements of the system design and the monitoring system. In further discussions it became clear that in reality they seldom reach their targets of regular visits to the field.
They consider a lack of sufficient transport the most important problem for a proper execution of their tasks. The Programme car is in many cases used for non-Programme activities, and thus many times not available when it is needed. Some of the motorbikes provided by the Programme are old, and would need to be replaced.

d) Problems with the payment of allowances

The allowances paid by the Programme to the District officials seem to be the source of a number of problems. Firstly, some Fieldteams told us that they were not paid these allowances regularly, with delays up to 8 months. Others said that they have never been paid the full amount due to them. Of course, this demotivates them in their work. On the other hand, the fixed maximum for 10 night-outs per month will induce them to work for not more than 10 days per month for the Programme.

The District Teams and other District officials complain that they, although higher in the hierarchy, are paid the same allowance as the Fieldteams. They probably will look for ways to get a larger share out of the total of allowances allocated to each District, by re-allocating it to their own advantage.

Problems with delays in the monthly reimbursement of funds from the Programme to the Districts further complicate the payments of allowances, simply because the District sometimes lacks the money to pay out fully.

e) Problems with the use of Programme funds

Many of the problems mentioned above seem to be caused by the Districts using Programme funds, and Programme cars, for other purposes. In some Districts we were openly told that this is common practice.

It is not so much the case that funds disappear through fraudulent behaviour, as that the Districts suffer from a general lack of money for a proper execution of all necessary tasks. The system, in which the District Executive Director has in reality the power to allocate all funds for the District, including the Programme funds, makes it easy to "borrow" from the Programme for other purposes.
The District Programme Advisers, who work under the District Executive Director, may try to prevent as much as possible this misuse of Programme funds, and the equally frequent misuse of Programme cars, but generally they do not have the power to go against their superiors.

Within the framework of this study, the Research Team did not consider it its task to go deeper into issues concerning payments of allowances and use of Programme funds, beyond a recognition of their complicated and problematic nature and of the consequences for the Programme.

3. COMMUNITY PARTICIPATION

The promotion of community participation in the Programme is closely linked to the aim of sustainability of an improved water supply and sanitation. The most important objective of the Programme is to develop a functional village based, district supported system for operation and maintenance of rural water supply, so as to ensure its sustainability, and at the same time enhance self-reliance of the communities (see Plan of Operations, 1988).

3.1 WATER COMMITTEES AND FINANCIAL MANAGEMENT

In all 5 Programme villages we visited, Water Committees had been set up, with two women members, as required by the Programme. It has not become quite clear if Committee members had been elected in a democratic process, e.g. as representatives of the users of the improved water points. Particularly through our discussions with the women, we got the impression that Committee members have been nominated by the village government or the village chairman. The obligatory two women members had always been nominated, not elected.

Several Committee members were also members of the village government. It was pointed out to us that this has consequences for the financial management of the Water Committees' funds: in fact it is not the Committee but the village government which decides on the availability and the use of the funds. A brief in-depth study on what decisions are taken, by whom, and on actual use of village funds for water supply, could provide valuable background data for a more appropriate approach towards involvement of the users. Due to time constraints it was not possible to take this up in the present study.

All Programme villages had opened a water account, with amounts of TSh. 1.000 up to TSh. 4.800 for maintenance of the water points. In 2 villages the total amount available in the account had been donated by politicians and District officials when they came to announce the selection of the village for the Programme. These donations seem to be quite common, particularly when communities prepare meals for official visitors.
In the 3 villages the money for the water accounts cam mostly from fines imposed on people who misuse the water point, with additional small sums from the village government.

There is nowhere a regular charge for water use, although those who use occasionally an exceptional amount (e.g. for brewing beer) may be asked to pay something.
In two villages the chairman of the village government said that some part of the proceeds from the cotton harvest may be paid into the water account.

None of the Water Committees had used so far any money for operation and maintenance, although in all villages there were still one or more wells and/or pumps to be repaired, and usually also several wells which would run dry in the dry season. Presumably the village governments (Water Committees) would wait for the Programme to further rehabilitate the non-functioning wells and pumps. In three villages we were told that for many months there had been complaints to the District about broken pumps and dry wells, without any reaction from the District officials. When asked about this, the officials gave lack of spare parts (of pumps), equipment and transport as reasons for not responding on request from the villages.

In discussions with the women we brought up the question of regular water charges for operation and maintenance: would they be able to pay a small amount every month. Although the final answer was always that they could pay something regularly, there was clearly also some reluctance. Many women do not use regularly the wells with handpumps, because they have a more convenient water source near home, or because many wells do not give sufficient water in the dry season. Also they have experiences with frequent breakdowns of pumps which take very long to get repaired. Understandably the women are reluctant to pay for what they judge to be a bad service.

3.2 OPERATION AND MAINTENANCE

In all Programme villages a village mechanic and caretakers for the water points had been nominated. They have received an on-the-job training by the District Field Assistant in how to do small repairs and generally to keep the water points in good condition. Their performance seems to be quite satisfactory. Only minor breakdowns have been reported for the newly constructed and rehabilitated wells. In one village we were told that the village mechanic and the caretaker can do small repairs better and quicker than the District Water Department.

A problem may be the payment of the caretakers and village mechanics. Usually they are paid indirectly, through exemption from certain village taxes or compulsory communal labour, In one village it was said that they would receive something after the cotton harvest.

3.3 CONTRIBUTION TO CONSTRUCTION

The most important criterion for selecting a village for the Programme is willingness of the community to contribute towards construction.Although we met one community)a non-Programme village) which refused to contribute anything to a wen water supply "because others got their wells for free", in many places quite a large sums, from TSh. 30.000 up to TSh. 100.000 or more, are being collected, or set aside by the community for the construction of new wells. Additionally, labour is provided by the community for clearing the site, digging the well, etc.

Through the answers on the questions we asked during the pocket chart game (what are you able to contribute towards the water supply of your choice?) we got the impression that a majority of the men are willing to pay considerable sums for water supply when it can (also) be used for cattle. In all villages we visited, the men asked about possibilities to combine any improvement of domestic water supply with providing water for their cattle. Discussions with the women, on the other hand, made clear that in most cases they do not have the means to provide money for the construction of water points for domestic use. Usually, their contribution consists of cooking meals for the construction teams.

Again, village visiting time was too short for the research team to get a clear idea on the decision-making process in the communities: how are decisions made on what people will contribute? In what way can the women rely on the men contributing to domestic water supply, when there is no additional provision made for water for cattle?
It is crucial that these issues are clarified before any planning for construction is started.

In several villages we asked if the community would be willing and able to pay for a complete new well, including a new pumps (total cost about TSh. 300.000). The people generally said that they would be prepared to pay if they then could be helped with the construction of the well.
The possibility of paying through a credit system was also brought up. This idea was obviously new, but it was generally received well. In one village, after some discussion, the people said that they "were ready to start whenever you are ready".

By also visiting 3 non-Programme villages we had an opportunity to compare different situations. In two of these villages wells had been built in previous phases of the Regional Programme, but they had not been selected for the present phase. As an example, the situation in Ikungulipu (bariadi) is given. This village has 5 wells with pumps, built in 1984, two of which are out of order since no more than two years. A third well is giving only brackish water. There is no Water Committee and no village mechanic or caretaker. The villagers we met said that the District government should repair the pumps because it had built them in the first place. The pocket chart game revealed that most people, men as well as women, now (in the rainy season) use pools and puddles which are dry in the dry season. They would very much like to have more wells with handpump, in places convenient to them, and they are willing to pay for construction as well as maintenance.

3.4 PLANNING WITH COMMUNITIES

In the step-by-step approach scheme several indications are given for informing the communities on decisions concerning their water supply. The necessity to involve the communities in planning is not mentioned.
In reality, any information has been reaching the villages only through formal discussions of the district officials with the village government.

From our discussions with community members, particularly women, it became apparent that they, or any ordinary villagers, had never been consulted on any relevant issues concerning their water supply.
That this may lead to curious situations can be shown with a few examples.

In four Programme villages we were told that rehabilitation, with contributions from the community, had taken place on wells which had a good functioning pump. The pump had been simple replace by a new model. Neither the government officials not the villagers could tell us why this had happened. In one village the mechanic had used the old pump on a new well constructed by the villagers themselves.

Counting the number of the rehabilitated wells in the villages, and the number of wells reported to be dry during part of the year, we found that these partly dry wells had been provided with new pumps without any checking up on their functioning. In a group of women many cynical remarks were made on this omittance.

Women suffer also from the fact that they have never been asked at what most convenient place they would have liked to have their water point. We have seen many good wells with handpumps, which are situated far from most village houses. The pocket chart game revealed that in many cases wells with handpumps are used by only very few women. They find more convenient traditional sources near their homes.

4. SANITATION AND HYGIENE EDUCATION

5. TRAINING

Yet to be finalized by IRC.

6. EXISTING WATER SUPPLIES

6.1 INVENTORY OF WATER POINTS

a) Operational, Improved Water Points (IWP)

The following number of improved water points exist in Shinyanga Region as per February 1992:

- 493 shallow wells
- 20 boreholes
- 52 piped water schemes
  (21 operational and 31 non-operational)

The coverage per district of these water points is shown in Table 5. Non-operational wells are not included in the table. We did not establish the total number of ever constructed wells, through the Netherlands' Programmes (RWSP) or otherwise. Other details are to be found in Appendix 3.

TABLE 5 - Existing Water Supplies in Shinyanga Region (Feb 92)

District	Wells	BH's	Dams	Charcos	Piped W/S	
Bariadi	116	4	6	29	4	5
Maswa	138	7	4	4	5	4
Meatu	38	1	1	-	1	2
Kahama	96	2	1	-	3	6
Shy Rural	105	6	2	13	8	14
Total	493	20	14	46	21	31

b) Operational water points constructed through the Netherlands' Programmes

From all water points and schemes constructed and rehabilitated through RWSP since 1974, the following are operational :

- 369 shallow wells
- 2 piped water schemes

The distribution of these water points per District is shown below.

TABLE 6 - Operational Water Points constructed / operated by RWSP in Shinyanga Region since 1974.

District	Wells	BH's	Piped W/S
Bariadi	90	-	1
Maswa	74	-	-
Meatu	31	-	-
Kahama	96	-	-
Shy Rural	78	-	1
Total	369	0	2

More than 80% of the water points constructed by RWSP in the period between 1974 and 1986 became inoperational mainly due to lack of proper maintenance and unavailability of spare parts.

Since November 1988 the Programme is concentrating its work in a number of intervention areas in each District. Coverage of Programme water points in these intervention areas and proposed construction and rehabilitation activities are given below.

Table 7 : Wells rehabilitated and constructed through the Programme, and proposed activities, in Shinyanga Region (February 1992).

District areas	Intervention villages	No. of wells rehab.	constr.	(target for PoO) No. of rehab.	prop. wells constr.
Bariadi Sagala	3	2	6	2	-
Byuna	1	4	-	-	2
Nyakabindi	4	17	4	2	3
Dutwa	2	14	3	-	2
Ngala	3	10	8	1	4
Total	13	47	21	5	11
Maswa Budekwa	4	13	4	-	3
Ngulinguli	4	20	3	-	1
Malampaka	4	11	-	-	2
Shishiyu	3	11	1	-	3
Njiapanda	2	8	-	1	-
Total	17	63	8	1	9
Meatu Bulyashi	4	17	1	-	2
Mwabusalu	4	14	2	-	2
Total	8	31	3	-	4
Kahama Busangi	3	6	-	5	3
Malunga	3	12	1	1	3
Mpunze	3	15	5	-	-
Iboja	3	12	2	3	-
Isaka	3	3	-	8	2
Total	15	58	-	16	10
Shy. Ishinabulandi	3	12	-	-	3
Rural Mishepo	6	17	-	5	3
Jomu	3	17	-	2	1
Ngaganulwa	3	12	-	9	3
Total	15	58	-	16	10
TOTAL for the Region	68	247	40	38	42

c) Water points constructed through other agencies

Other water points in the Region have mainly been constructed by Central and Local Government, World Vision International, UNICEF, UNDP, AHEAD (Adventures, Health and Agriculture Development), Williamson Diamond Mines Ltd (Mwadui).

No other donors are involved with water activities in the Region. Some broken-down wells which were constructed by RWSP have been rehabilitated through other projects, e.g. UNICEF, World Vision, etc. We did not establish the total number of these rehabilitated wells.

An overview of water points constructed or rehabilitated by the above mentioned agencies is given in Table 8.

TABLE 8 Water Points constructed / rehabilitated by other agencies in Shinyanga (Feb 92).

	Bariadi	Maswa	Meatu	Kahama	Shy Rural	Total
Wells	26	60	7	-	28	121
Boreholes	4	-	1	2	6	13
Dams	6	4	1	1	8	20
Charcos	29	7	-	-	13	49
Roof Catchm	-	-	-	-	1	1
Piped W/S						
- Operat.	4	5	1	3	8	21
- Non-op.	5	4	2	6	14	31
Total	74	80	12	12	78	256

The total coverage of the improved domestic water supplies is less than 11% for the whole region, hence most of the people still depend on traditional sources. These traditional sources include: water holes in or near sandy river beds, ponds, shallow open unprotected wells and the like. A detailed overview of all available water sources is presented in Chapter 9.

6.2 CONDITION OF WELLS WITH HANDPUMPS

a) Siting of wells

Wells built through the RWSP are often quite far from most houses in the villages, from 1 up to 2.5 km. To ensure water availability all year round, most of the wells have been constructed at the bottom of river valleys, while villages are usually built on top of the ridges. As our investigation in the villages has shown, it is quite possible that a large percentage of women in Programme villages do not use the improved wells. They prefer the traditional sources because they are much nearer to their homes.

It is recommended that further investigation be carried out to explore the possibilities of sinking wells near to or even inside the villages.

b) Seasonal differences in use

Over 25% of all operational wells dry up during the dry season i.e July - October. During this period most of the people go back to the old sources. Normally they are within a radius of 0.5 km, but in the dry spell the radius may increase to over 3 km.

c) Water quality

There are a few isolated cases in Meatu and the southern part of Shinyanga Rural where the water from the wells is showing a high content of fluoride (above 8 mg/l- Tanzania Standard), and EC values above 2000 uS/cm. Generally the other regions have water of reasonable quality. However most of the shallow water sources, especially river wells, are suspected to be bacteriologically contaminated. Women complain about some wells having salty, muddy and turbid, or bad smelling and tasting water.

In none of the Districts any water quality tests are done on existing wells. The Region has water testing kits, but no competent personnel nor transport is available. It is recommended to introduce a regular system of water testing, at District level, perhaps to be combined with monitoring. Of course, people will have to be trained for this work.

d) Health Hazard of Fluoride

It is a well-established fact that high Fluoride levels in drinking water lead to fluorosis, an affliction that initially leads to mottling and brittleness of teeth and eventually to skeletal deformities. The Tanzanian authorities have for practical reasons put the permissable limit of Fluoride at 8 ppm, because otherwise about 45% of all borehole water would be unfit for human consumption.

Results of recent investigations give cause for grave concern. It has been shown that even mild dental fluorosis occurs at a level as low as 0.4 ppp. More serious problems occur at concentrations of 2.1 ppm (100% prevalence of dental fluorosis in the age group of 10-15 years), while at 3.6 ppm skeletal changes occur in the same age group. Above 10 ppm skeletal deformities may occur in children.

The World Health Organization uses the guideline limit of 1.5 ppm fluoride. This limit is based on the assumption that people consume 2 litres of water per day.

> Our conclusion is that the Tanzanian maximum permissable limit is far too high and should be brought down to 2 ppm or even less.

Removal of fluoride is possible, and actually quite a large number of methods are available, but virtually all these are complicated, expensive and require laboratory conditions. Recently a few new appropriate methods have been developed which could applicable under the Shinyanga conditions. The Department of Civil Engineering of the University of Dar es Salaam has tested a method developed in Thailand, based on a bone-char filter which proved to be very successful. However, to introduce this system at household level will be a herculanean task.....

6.3 CONDITIONS OF PIPED WATER SCHEMES

Out of a total of 52 piped water schemes in Shinyanga Region only 21 are operational. Most of these 21 schemes rarely operate satisfactory. Lack of funds, spare parts and a proper maintenance system are the main problems associated with piped water schemes. Difficulties arise also from the necessity to have a regular supply of diesel oil to run the pumping machines and with the provision of chemicals for treatment. Although all user households are required to contribute a certain amount every month towards the running costs of their piped supply, including maintenance, it seems that this money is often not even collected. There is no structure for the collection of water charges, nor for community participation in operation and maintenance.

The desire to have piped water supply systems was frequently expressed in the villages visited. It is recommended to study more thoroughly the present conditions of the piped systems, including possibilities for a system for cost recovery with participation of the users.

A remark must be made about the drainage around stand pipes of piped water supplies. In the present design of the standposts no drainage is included. We feel that this is a serious omission, which should be amended. With piped supplies the use of water normally increases, and there should be provisions made for the disposal of waste water.

6.4 CONSTRAINTS IN CONSTRUCTION AND MAINTENANCE ACTIVITIES AT THE DISTRICT WATER DEPARTMENTS

The Water Departments in all Districts find it difficult to properly execute their tasks. They are sometimes far behind their Programme schedule in the construction of new wells, and in rehabilitation. They can not respond to requests from the villages to perform major repair jobs, because they have no spare parts, equipment and adequate transport.
In the whole Region only very scanty and unsatisfactory water quality tests are made. The data we found did not seem to be very reliable, and the dates on which they had been taken could not be properly established. The personnel we met did not seem to be very competent.

The most important reasons for these problems are :

* inadequate personnel and equipment at Regional level to perform co-ordinating tasks, e.g. in water quality analysis, overall assessment of water resources, assessment of environmental issues connected with water resources management;
* inadequate tools and equipment at the Districts for construction and rehabilitation activities;
* insufficient stock of spare parts at the Districts; some spare parts are not easily available;
* inadequate transport facilities, especially for construction and supervision;
* lack of well-trained personnel; insufficient training facilities for field staff;

* problems with the flow of funds, and inappropriate use of Programme funds and transport (see also Section 4).

Apparently some mistakes have been made in the rehabilitation of wells, due to a misunderstanding concerning the objectives of rehabilitation in the Programme.

In several places old pumps installed in 1979 and 1980 and still in good working order, have been exchanged for new ones. Some of these old pumps have been used by the villagers for new wells which were constructed outside the Programme. Others were taken back to the District, where they were used for new wells in other villages.

Broken pumps have been taken back by the district, to use the spareparts. Recently there are plans for broken pumps to be taken back by the Programme Office, which will set up a workshop for spare parts and repairs of old pumps.

7. AVAILABLE WATER RESOURCES AND DEVELOPMENT OPTIONS

7.1 SURFACE WATER RESOURCES

No permanent rivers are found in Shinyanga Region. Direct abstraction of surface water is therefore not possible and storage is indispensable for surface water exploitation.
Different types of impounding reservoirs were identified in an area of 15.000 km2 within the Region (Shinyanga Water Assessment Study, 1974). These reservoirs have a potential total yield of 160 million m3/year. Since 1974 extensive deforestation has taken place, with possibly climatic changes and changes in hydrological regime. Hence the above figures should be reassessed critically.

Possible options for development of surface water resources in the Region include:

7.1.1 Small Earth Dams

In most parts of the region a surface water reservoir can be created by constructing a low earth dam across a stream valley and collecting thus a large proportion of the total annual surface run-off. Local water requirements would determine the size of such a dam. Storage capacity should also make allowance for water losses due to evaporation and seepage, and for storage reduction due to gradual silt accumulation in the reservoir. The environmental impact of earth dams should certainly be taken into account when these are considered for construction.

7.1.2 Charcos

A charco or valley tank is normally built in gently sloping terrain. It consists of an excavated storage tank (capacity about 4,000 m^3), located immediately downstream of a small collecting reservoir (10,000 m^3) formed by a low bund. A catchment of between 0.3 to 0.6 kilometres is normally suitable for a charco. From the reservoir which also acts as a settling basin, the water is discharged through a pipe into the storage tank. Consumers usually draw their water from a well in the tank.
In Shinyanga region what is actually referred to as a charco by the population as well as by District officials, doesn't conform to the above design. In the strict sense it is actually a small earth dam. However in place of the so called charcos, properly designed charcos may be constructed.

Also for charcos the environmental aspects need to be taken into account before construction. Particularly the large number of charcos and dams desired by the population for the watering of cattle will make a critical assessment of this need in relation to the environmental appropriateness necessary.

7.1.3 Hafirs

Hafirs are based on the same principle as charcos, but the storage tank is built upstream of the bunds in the collecting reservoir itself. During the wet season the tanks are submerged so water must be drawn from the shallow reservoir. In the dry season however, the small tanks contain the total storage. Due to the layout, the storage tank(s) of a hafir silt up continuously. In Shinyanga Region there is no clear cut demarcation between a charco and a hafir. The terms "dam", "charco" and "hafir" are used in relation to the sizes of the water bodies, while little or no attention is paid to the design.

7.1.4 Water quality of Surface Water Sources

In general the chemical water quality of the surface water sources is good. In the rainy season water in the rivers mainly consists of the rainwater that fell a few hours or days before. In the course of the dry season the quality of the water in surface water reservoirs is influenced by incoming baseflow and groundwater flow and deteriorates further due to evaporation.

Analysis of water from existing surface water sources in the Region show that the fluoride content never exceeds 8 mg/l, while the EC values are generally lower than 2,000 uS/cm (based upon data from Shinyanga Ministry Water Development Regional Office). The bacteriological water quality of surface waters in the district is generally poor. Bilharzia is a major problem in nearly all the surface water sources.

Whereas it would appear possible to safeguard in general the quality of both deep and shallow groundwater sources, it seems unrealistically optimistic to assume that the quality of surface water can be sufficiently controlled. In view of this constraint, it would be logical that:

- preference is given to groundwater as the source of supplies which distribute untreated water for human consumption;
- to limit the exploitation of surface water resources for drinking water supplies only to small urban schemes, where water treatment is possible (However, the appalling state of the Shinyanga Urban Water Supply, illustrates that even this latter option is not a safe one!).
- water supplies constructed for livestock should be strictly used for that purpose; hygiene education should ensure that people are not tempted to use this heavily contaminated water for domestic use.

7.2 RAIN HARVESTING

Mean annual rainfall in the region ranges between 700-1000mm with an average of 790mm. However, for the planning of most water utilisation projects, it is not so much the mean precipitation which is important, but the reliability of the rains, which is the frequency of occurrence of relatively dry and/or wet years.

The variation in yearly rainfall is some 25% over a period of 10 years. Variations in monthly rainfall during the entire wet season are in the order of 60% or more.

The very local nature of precipitation disrupts the general pattern even more. Showers are usually formed in situ, and as a result rainfall intensity varies considerably even within an small area.

7.2.1 Roof Catchments

Rainwater can be collected by constructing corrugated iron roofs with gutters and a storage tank. The effective run-off from the roof is considered to be around 80%.

Roof catchment systems should only be considered for use at schools and other community institutions where a large area of corrugated iron roofing exists.

The water quality from roof catchment is normally good as it contains little sediments and the organic pollution is low. Nevertheless, precautions should be taken to prevent contamination. Such systems require guttering and storage (either small above ground ferrocement tanks, or large below ground tanks up to $70m^3$ capacity, fitted with a handpump). Given their limited utility in the provision of large volumes of water, they can only function as a supplementary water supply, either on the basis of individual ownership or for utilisation by public institution. Construction of large tanks at schools should be encouraged, and supported by the Programme.

7.2.2 Rock Catchments

Rock catchments are viable where large enough rocks with suitable un-weathered surface occur. Large inselbergs occur in parts of Bariadi, Maswa and Kahama districts. Rock catchments are a viable option for small scale water supplies and can be developed with low level technology. The construction and maintenance costs are also very low. Basically, such a rock catchment consists of a sufficiently large bare rock outcrop (say 5,000 m2 or larger). At a suitable site at the foot of the outcrop a reservoir is built (about 2,000 to 5,000 m3) with a pipe leading to a nearby tap station. Concrete gutters should be constructed on the rock to lead the water into the reservoir.

The reliability of a rock catchment system is relatively good as even small amounts of rainfall will be collected into the reservoir. However, as the storage reservoir is usually not covered, evaporation will take its toll.

7.2.3 Ground Catchments

Such catchments collect rainwater running off sloping and half-hardened surfaces, such as roads, compounds and flat-surfaced rock outcrops. About half of the annual run-off can be collected, depending on the porosity and slope of the catchment surface.

The run-off is led by way of a ditch to a storage tank dug into the ground (a so called "ground tank", usually a ferro concrete construction). The reservoir can easily be covered with a simple roof, diminishing evaporation losses and minimising contamination of the stored water. Since the water is collected from ground surface, it is usually similar quality as that of other surface water sources (discussed earlier in the text), it is advisable that the water is used mainly for livestock.

7.3 GROUNDWATER RESOURCES

The entire Shinyanga region is underlain by a complex of crystalline rocks, mainly of pre-Cambrian age, forming the basement on which accumulations of terrestrial (Tertiary) and lacustrine alluvial (Plio-Pleistocene) deposits have been formed. The dominant rock type of the basement is the non-foliated to streaky biotite granite.
The main groundwater sources are:

7.3.1 Occurrence of Deep Groundwater

Aquifers with deep groundwater are mainly found in:

- joints of decomposed and fissured zones of the upper part of the fresh bedrock;
- weathered bedrock, a zone of variable thickness (0-50m) in which the hard rock has decomposed due to chemical processes in interaction with percolating groundwater;
- alternating sandy, clayey or cemented layers overlying the weathered bedrock.

In Shinyanga region the most promising areas are estimated to have exploitable potentials of more than 5,000m^3/km^2.year. The average yield per borehole varies between 40-80 m^3/day. The average total depth ranges from 50-100m, with an average static water level (SWL) of 10-20m.
Deep ground water in this region may be exploited by sinking boreholes. Boreholes can constructed successfully in most parts of the region (see the maps in the appendices), provided that a detailed hydrogeological and geophysical survey is carried out to determine the precise location.
A serious constraint is the incidence of high fluoride levels in deep groundwater.

7.3.2 Water quality of deep groundwater sources

Deep groundwater may be regarded in general not bacteriologically contaminated. The groundwater table is so deep that contamination is avoided by the natural purification during infiltration.

However, pollution may occur during the storage and distribution phases. An overview of the chemical analyses of boreholes, shallow wells and some improved domestic water points in the region concerning electrical conductivity (EC) and Fluoride (F) is given below.

Table 9: Data of groundwater quality (boreholes, shallow wells, and piped water supplies) in Shinyanga Region.

District	Fluoride * mg/l	E. Conductivity uS/cm
Bariadi	1.0 - 5.0	400 - 7,500
Maswa	1.0 - 5.0	500 - 4,200
Meatu	1.0 - 10.0	130 - 2,400
Kahama	0.5 - 5.0	40 - 3,440
Shinyanga Rural	1.0 - 5.0	500 - 4,200

* Tanzania maximum limit for Fluoride is 8 mg/l, WHO recommended maximum permissible limit is 1.5 mg/l.

Source: Regional Water Department (dates of analysis could not be established).

The quality of groundwater in the central regions of Shinyanga Rural, some parts of Maswa and most of the southern region of Meatu is likely to be a constraining factor for the utilization of groundwater.
However, with a view on the question of reliability of data presently provided by the Region and the Districts, it may be advisable to make a thorough reassessment of deep groundwater quality in the Region before any consideration of its utilization.

7.3.3 *Shallow Groundwater*

Shallow aquifers that may be exploitated by means of digging or hand drilling of wells with depths of less than 30 metres are defined as shallow aquifers. In Shinyanga Region they can be classified as perched aquifers, and comprise:

- alluvial deposits in river beds and old buried, fossil stream beds;
- weathered lateritic layers;
- weathered granites and other sandy (subsurface) layers;
- colluvium near outcropping bedrocks.

Wells constructed in the above environments can yield an average of 10 m^3/day, while exploitable quantities may amount to about 2,000 m^3/km^2.year.

7.3.4 Water quality of shallow groundwater sources

The bacteriological water quality of shallow wells is generally poor; the quality of river wells is usually even worse.
Good quality will only be found in shallow wells which have an effective covering (apron) and drainage system, prohibiting infiltration of waste water.

For the river wells careful execution of the well structure is not sufficient to guarantee safe water quality. Pollution occurs due to easy infiltration through the sandy riverbed of dirty water from nearby watering places of livestock, or from people using these places for washing and defecation. Protection of the catchment (for at least 100m upstream) by means of live fences (sisal, cactus) to prevent contamination is essential.

The likelihood of pollution of shallow wells points to the absolute necessity of making thorough and regular water quality analyses, if the occurrence of water-borne diseases (cholera, dysenteria, typhoid) in the Region is to be prevented.

7.3.5 Sand and Sub-surface Dams

Sand dams are constructed to retain sand, carried suspended in flood water of small seasonal streams. Sand-dams are built up gradually, every dry season one foot height is added. This ensures that the water flowing across the dam during the floods has such a flow speed, that the coarse sand particles precipitate, while silt and clay particles are carried downstream over the dam. An average sand dam of about 3 metres height takes thus about 5 years to build, although water can already be supplies after the first year.
Sub-surface dams are constructed in the bed of (large) sand rivers, where a considerable amount of sandy sediment in a drainage channel has already accumulated. The dam has the purpose of increasing the storage of water in the sediments upstream of the dam. A typical sub-surface dam is only about 1 metre high and lies buried below the sandy surface. It can either be constructed from clay or from concrete (only on hardrock).

A few river channels in the Region, especially in Meatu and the southern regions of Shinyanga Rural, may provide suitable sites for these type of dams, but the exact locations can only be pinpointed by carrying out a detailed survey.

7.3.6 Springs

There are a few springs in Kahama District, with fresh, clean, uncontaminated water. The yield of these springs rarely exceed 100 l/min. Hence, they are not feasible for piped water supply. However, if well protected they can provide safe, clean water to the villages in the immediate vicinity.

People have now destroyed the catchments by felling most of the trees around the springs. If this situation is not rectified soon, the springs may dry up.

7.3.7 Summary of available groundwater

A summary of the total amounts of available groundwater in Shinyanga region is shown in the table on the next page. (Source: Shinyanga Water Supply Survey; Water Master-plan Study for Shinyanga Region, 1974).

In view of the early date of this study, and the changes which are likely to have taken place due to environmental and climatic changes in the Region, it is recommended to make a new study to establish the present level of groundwater resources.

Table 10: Summary of the total amounts of available groundwater

area	exploitable potential of deep groundwater (m^3/year)		exploitable potential of shallow groundwater, (m^3/year)		total exploitable groundwater potential (m^3/year)		total rainfall **) (m^3/year)	recharge **) (m^3/year)	safe yield (m^3/year)
	average	maximum	average	maximum	average	maximum			
Districts:									
Kahama	652.10^4	2205.10^4	1030.10^4	6950.10^4	1682.10^4	9155.10^4	1650.10^7	30.10^7	4934.10^4
Shinyanga	452.10^4	1241.10^4	180.10^4	1340.10^4	632.10^4	2581.10^4	625.10^7	12.10^7	3311.10^4
Maswa and Bariadi	790.10^4	2176.10^4	760.10^4	5200.10^4	1550.10^4	7376.10^4	1660.10^7	33.10^7	7037.10^4
Shinyanga Region	1894.10^4	5622.10^4	1970.10^4	13490.10^4	3864.10^4	19112.10^4	3935.10^7	75.10^7	15282.10^4

Table 11: Summary of the total amounts of available groundwater

	total exploitable groundwater potential as percentage of				exploitable deep groundwater potential as percentage of storage potential		deep groundwater potential as percentage of recharge		shallow groundwater potential as percentage of recharge	
	total rainfall		total recharge							
	average	maximum	average	maximum	average	maximum	average	maximum	average	maximum
Districts:										
Kahama	0.10	0.56	6	31	13	45	2	7	3	23
Shinyanga	0.10	0.41	5	22	14	38	4	10	2	11
Maswa and Bariadi	0.09	0.44	5	22	11	31	2	7	2	16
Shinyanga Region	0.10	0.49	5	25	12	37	3	8	3	18

**) : the average year figure of the period before 1961
***) : the 10%/o year figure (= 15 mm/year)

Kah. : 825 mm
Shy. : 750 mm
Mas. : 750 mm
Reg. : 785 mm

7.4 WATER RESOURCES DEVELOPMENT OPTIONS

A summary is given of the relative importance of each development option per district (details in relation to the respective divisions are in the appendices) in the form of a short table.

Table 12 : Option for the development of water resources in Shinyanga Region, per District

District	Options								
	E/D	C	H	SS/D	R/C	RK/C	G/C	B/H	S/W
Bariadi	+	+	+	+/-	+	+	+/-	+	++
Maswa	+	+	+	+/-	+	+	-	+	++
Meatu	+	+/-	+/-	+/-	+	-	-	+/-	+
Kahama	+/-	+/-	+/-	-	+	+	+	+/-	++
Shinyanga R.	+	+	+	+	+	-	+	+	++

E/D low earth dams
C charcos
H hafir
SS/D sand and sub-surface dams
R/C roof catchments
RK/C rock catchments
G/C ground catchments
B/H boreholes
S/W shallow wells

++ highly viable option; should be given priority for water resources development in the Region.
+ viable option; needs attention and development.
+/- possibly a viable option; needs some attention to estimate its particular value.
- not a very viable option; may only be developed if there are no alternatives.
-- not a viable option at all.

8. WATER DEMAND

8.1 HUMAN POPULATION

Current and projected population figures in the table below are based on the 1988 census figures.

Table 13 : Current and projected population figures, including projected growth per annum, in Shinyanga Region, per District.

District	Population 1992	Population 2002	projected growth per annum
Bariadi	422,574	542,514	2.53
Maswa	243,341	308,922	2.3
Meatu	176,445	234,835	2.9
Kahama	622,437	1,059,187	5.46
Shinyanga R.	423,852	472,852	1.1
Total	1,888,649	2,618,310	

The extremely high growth rate in Kahama is attributed mainly to immigration. This is probably related to the still existing forested areas in the District. People come to live there because there is still firewood to be found in abundance, and more fruit of the many fruit trees. Of course the supply will not last very long, if the influx of people is not brought to a halt.

8.2 WATER DEMAND FOR DOMESTIC PURPOSES

The present rural water demand for domestic purposes is calculated on the basis of 20 lcd (litre per capita per day), including wastages. This is considered to be a reasonable figure, e.g. a small survey conducted by the Research Team in three villages closely concurs with the above.

Table 14 Water demand in 3 villages, in Bariadi and Shinyanga Rural (February 1992)

Village	Number of households	Population of village	Amount per household litres	Per capita water consumption/day lcd
Mwanzoya	401	2,813	120	17
Ikungulipu	655	4,912	160	21
Mishepo	600	2,733	80	18

The following table shows the current and the projected domestic water demand, calculated for all 5 Districts.

Table 15: Current and projected human water demand (Shinyanga rural areas)

District	population 1992	demand 1992 m_3 / day	population 2002	demand 2002 m_3 / day
Bariadi	422,574	8,451	542,514	10,850
Maswa	243,341	4,867	308,922	6,178
Meatu	176,445	3,530	234,835	4,697
Kahama	622,437	12,449	1,059,187	19,771
Shinyanga Rural	423,852	8,477	472,852	9,457
Total	**1,888,649**	**37,774**	**2,618,310**	**60,953**

8.3 LIVESTOCK POPULATION

The factors which affect livestock population are considerably more complex than those determining human populations, notably their progression through cycles brought on by uncontrolled breeding and impact of epidemics. Therefore, we made no estimated projections for livestock population. It is assumed to be the same at that found in the census of 1984. Equally, no estimated projections are made for the year 2002.

Table 16 Livestock population in Shinyanga Region (based on 1984 census) and current livestock water demand.

District	Population 1984			Water Demand
	Cattle	Goats	Sheep	m3/day
Bariadi	437,823	190,723	114,989	14,058
Maswa	290,444	145,401	95,954	9,414
Meatu	321,569	204,332	94,437	10,497
Kahama	333,813	179,446	82,920	10,784
Shinyanga R.	566,762	211,109	136,876	18,118
Total	1,950,411	931,011	525,176	52,861

Water demand for cattle is based on 50 litres per day per stock unit (SU). The 'SU' is a somewhat artificial figure, denoting a grade bull. The herds in Shinyanga region are made up largely of an indigenous breed; there is no data available for the stock ratios in herds in Shinyanga (i.e, the mix of bulls, cows, calves, heifer and steers).

Generally, a good estimate is reached by taking 3 indigenous cows to be equivalent to 1 SU, and 15 goats or sheep to be equivalent to one SU.

Evidently, there is a problem of water for livestock; the present sources are not sufficient because of unreliable rainfall. The problem has increased through the drying up and siltation of pools and dams. Because of water shortage, livestock is herded to other regions, especially to game reserves and the neighbouring regions i.e Mara.

All land belongs now to the government. Quarrels about land use for cattle or agriculture are common. The Regional Administration is trying to regulate land use by demarcating different areas for grazing, agriculture, forestry, etc.

In Shinyanga Region, tickborne disease is a great problem. There is a dipping scheme against this disease which presently is not working. Availability of water in dips is a problem; dipping is very expensive, it needs to be done regularly.

Herds are too big. Government has a policy obliging cattlekeepers to reduce herds by 10%. This does not work, because cattle gives prestige and a good profit to the owner. Because of the high death rate large herds are kept.

Discussions in the villages, and the "voting games", revealed that men in the region may express their water demand particularly in terms of water use for cattle. Although it was not openly said, we may assume that men will use a good water source, e.g. a well with pump or a piped supply, to water their cattle regularly.

8.4 AGRICULTURAL WATER USE

This takes place only near rivers and dams. There are presently no water schemes for agricultural purposes in the region. However, there are official proposals for irrigation projects for rice crops. Rice is the third cash crop in the Region, after cotton and maize.

8.5 WATER DEMAND VERSUS WATER RESOURCES AVAILABILITY

When the water demand is compared with the available water resources (as found in the study of 1974) it seems evident that the available resources far exceed the demand. However, the study is old, it could be that the present situation is much less favourable, and projections for the future even worse, when environmental issues are taken into account.
Besides, it should be noted that in some parts of the region especially in Shinyanga Rural and Meatu Districts the groundwater quality (high fluoride content and salinity) will probably be the constraining factor for its utilization.

A proper exploitation of water resources involves selection of an abstraction technology suitable for the Region. This selection is made, bearing in mind the existing level of safe supply and the projected population for the year 2002.
The levels of service of abstraction technology adopted are based on those used by the Programme, with the exception of sub-surface dams and protected springs. They are :

Table 17 Number of people served by different technology options for water supply and cost estimates per water supply unit.

Technology type	No. served	Cost Tsh.x1000
Rehabilitation S/W	250	150
Construction S/W	250	300
Borehole	250	2,000
Protected spring	150	300
Sub-surface dam	400	1,000
Rock catchment	250	2,000
Communal standpost (piped water supply)	250	-

Roof catchments can only be considered as supplementary sources for individual consumers.

According to the population per water point criterion shown above, one shallow well or borehole should not serve more than 250 people. Population served and the percentage of coverage by existing safe water points per District is shown in the table below. This table further shows the number of water points required to satisfy the current demand and the number required to satisfy the demand up to the year 2002.

Table 18 Coverage of water supplies, and current and future water demand in Shinyanga Region, per District

District	existing w.p.s	Pop served	Coverage %	No, of water points needed in the year 1992	2002
Bariadi	120	45,250	10.7	1,503	1,982
Maswa	143	52,000	21.4	765	1,027
Meatu	39	13,000	7.4	654	887
Kahama	99	34,500	5.5	2,352	4,099
Shinyanga	113	54,250	12.8	1,478	1,674
Region	514	199,000	10.5	6,752	9,669

9. WATER AND THE ENVIRONMENT

At present there is no integrated approach to the management of water catchment areas, and in general to the management of water resources in the Region. In view of the vulnerable and unstable environmental conditions in the Region, it is recommended that such an integrated approach is adopted. The issues to be taken into consideration are as follows.

9.1 DEFORESTATION AND WATER SUPPLY

This is considered currently the most serious environmental problem in the entire Shinyanga Region. The results of deforestation are clearly to be seen in most Districts, notably so in Bariadi, Meatu and Shinyanga Rural.

Deforestation or landmass denudation is very likely to lead to degradation of water resources: cover loss in a moist climatic regime leads to soil loss, accelerated erosion and a reduced recharge. This may directly affect the yields of groundwater resources (and to some extent the quality) and may exacerbate fluctuation across seasons, and increasing changes in climate.
In addition, flashy run-off leads directly to enhanced flood hazard, which in severe cases may lead to loss of lives and property.

It is therefore important that adequate measures are taken to ensure the protection of forest and natural cover, particularly where these are directly associated with water points.

9.2 POPULATION CONCENTRATION AND ENVIRONMENTAL ABUSE

Where a particularly popular or reliable water supply or point exists, human populations may settle around it: this can lead to environmental degradation in much the same way the dry season concentration of cattle around perennial water points does.
Indirectly, this can lead to accelerated deforestation, inappropriate agricultural practices and so on.

With a view on the increasing population in the Region, it would be wise to consider the exploitation of alternative water sources for domestic use (e.g. rainwater catchments, sub-surface dams, etc.), instead of solely relying on exploitation of shallow groundwater sources for meeting present and future demands.

9.3 LIVESTOCK WATERING, OVERSTOCKING AND THE ENVIRONMENT

Overstocking leads to degradation of the environment. This has two particular facets, one being simple overstocking, and consequently overgrazing and loss of vegetative cover: the animals feed on all the greenery to be found, including young trees, which is accelerating deforestation and desertification of the area.

The other facet is directly related to the availability of water resources. Where a large number of livestock are concentrated in too small an area to support them, they make a too heavy demand on the available water resources, in quantity and in quality. They may not only deplete precious fresh water resources, but also contaminate the sources for human consumption.

Most likely this is already occurring during the dry season or during periods of drought in the Region. This is a problem not only in Shinyanga Region, but potentially also for adjoining areas, where part of the livestock is taken during the dry season.

The variation in water resources availability across the seasons, in conjunction with overstocking, has the cumulutative effect of concentrating too much livestock around too few perennial water points, leading to localised but possibly serious damage to the environment in the immediate vicinity of the water points. This leads indirectly to accelerated siltation if the source is a dam or a valley tank, as damaged vegetation cover is unable to retard landmass movement and overland flow carries silt into the dam.

9.4 AGRICULTURE DEVELOPMENT AND ENVIRONMENT

Agriculture can have a significant impact on water resources, both in terms of the physical environment and through the introduction of foreign chemicals into the hydrosphere.
The leaching of pesticides, nitrogenous fertilizers or other chemicals from soils into streams or the groundwater system can create negative impacts on the wider environment: this is by no means limited to human users, but may also affect wildlife and the aquatic environment.

Common practice in the Region is rain-fed rice growing, which creates the likelihood of spreading vector diseases, such as bilharzia which is named as one of most common diseases in the whole Region.

9.5 DIRECT ENVIRONMENTAL IMPACT OF RURAL WATER SUPPLY DEVELOPMENT

The only adverse impacts on the environment brought about by present rural water supply development through shallow wells and piped water supplies will be transitory, and are likely to occur before and during water point construction. During this period, tracks may need to be cut, or sand may need to be won, leading to a short-term negative impact on the environment in the vicinity of the water point.

10. IMPLEMENTATION CAPACITY

The following problems in the implementation of the Programme, and ideas for solutions, were mentioned by the people we met.

- **Management of the Programme**

First and foremost, the ambiguities concerning roles and responsibilities in the management of the Programme at District level will have to be solved, before really satisfactory implementation can take place.

A stronger management will also have to solve the problems with the flow of funds, misuse of funds, and misuse of Programme equipment and transport. It may be expected that issues concerning the payment of allowances will clarify themselves as soon as the administration runs smoothly as required.

- **Personnel**

Generally, the District officials, including the Fieldteams, who are involved in the Programme, lack the appropriate insights, the skills, and in some cases also the motivation, to properly execute the work laid down in the step-by-step approach and the monitoring system.

Many Fieldteam members are not adequately qualified in the first place. They have little formal education and almost no professional training. Most of them are completely untrained in participatory methodology and extension approaches, and they are certainly not sufficiently qualified to train village workers. An exception may be some of the DFA (technicians) who seem to have been doing a good job, training the village mechanics and caretakers in their area.
For a proper execution of their tasks the Fieldteam members, notably CDA and HA, also lack facilities, e.g. the use of information materials, etc.

The District officials and field staff of all levels from the Water Departments have on the whole a sound technical background. However, they lack the capacity to perform major construction and repair jobs. They also do not have the personnel to do water quality tests, and to carry out detailed surveys.

In case the Programme would be extended to include more intervention areas, or more villages, there would be no sufficient personnel in all three departments involved, to carry out the necessary activities.

- **Equipment**

About 3 to 4 wells can be constructed in each District with present construction tools, if used efficiently. On average 40 wells may be constructed per District per year.
Water quality testing apparatus are only found in the Regional office.

The Fieldteams do not have enough tools for everyday maintenance and repairs of handpumps and piped water schemes.

All major breakdowns are referred to the Programme office or the Regional Water Department, which are also not well equipped.

The Districts have design and survey equipments for piped water schemes. Personnel and construction tools for these schemes can only be obtained at the Regional Water Department.

Surveys for construction of shallow wells are limited to hand-drilling. There is no equipment at District level to carry out detailed hydrological surveys. Drilling equipment for deep wells is also stationed at the Regional Water Department. This includes 3 drilling rigs, 1 rotary, and 2 percussions. The test-pumping unit at the Region has broken down.

* **Information materials**

At present there is no information material used in Programme activities in the villages.

The Programme office is preparing a manual with modules for training of Health Assistants and village health workers in hygiene education issues, and an illustrated booklet on "How to build and to use a latrine" for village health workers and communities.

* **Transport**

The currently available transport for Programme activities is generally felt to be inadequate. The Programme car is in most cases controlled through the District Executive Director's office, and often used for purposes outside the Programme.
This means that much required work is not performed at the appropriate time, or in some cases, not at all.

The Water Department feels that it is affected most, because it is often unable to get equipment and materials to the site in time.

* **Operation and maintenance, and sustainability**

At village level a system exists of collecting funds for operation and maintenance. The system needs to be strengthened by restructuring it, so that there are regular and standard ways of collecting funds.
Part of the money should be kept in the account for repairs and spare parts. This fund can be administrated by the communities.
Another part of the users contributions should be paid into a special fund (at the District or otherwise) to pay for major repairs and new water points.

Currently there is no well-organized, effective support from the District Team, which can strengthen cost recovery, and village level operation and maintenance systems.

* **Women's Involvement**

So far very little attention has been paid to the involvement of women in the Programme. This is particularly important where it concerns siting of water points, use of the improved facilities, and health and hygiene issues.
The lack of attention may be largely related to a general lack of knowledge and skills in community participation issues, and in participatory approaches.

Some problems are certainly due to the relatively small number of women Fieldteam members. At District supervision staff level only 1 woman works for the Programme.

The Women and Children's Programme Sections in the District Community Development Departments are not in any way supporting the Programme. In all Districts some women's projects and programmes are being executed.

* **Training**

The only training given within the Programme so far, has concentrated upon the introduction of the step-by-step approach and the monitoring system. This training has focused on process issues, not on content and meaning.

With a view on the general lack of knowledge and skills in participatory methodology and partnership approaches towards a sustainable water supply, and some lack of special technical skills, training of all levels of office and field staff in the Programme is considered a crucial issue in strengthening the implementation capability of the Districts.

To ensure the motivation of the communities for the appropriate operation, maintenance, and financial management of their water supply, training at community level should be also performed in a professional way.

Related to the lack of training is a general unavailability of manuals, handbooks, and other training materials in the Districts.

11. PLANNING FOR THE FUTURE

In this final section we have included some proposals and priorities mentioned by District officials, and our own conclusions and ideas, based on what we found in the Districts.

- **Institutional aspects**

For a more efficient management of the Programme, it is desirable that at least the District Programme Manager, and perhaps also other Programme implementers, are released of their other duties in the Districts, and seconded to the Programme.
Secondment will ensure the independence of the Programme manager at District level, who will have full control of Programme funds.

It is considered desirable to establish a forum where all agencies in the Region, dealing with water supply and related issues, can meet for co-ordination of their activities.

To deal in an effective way with environmental issues connected with water, it is proposed that the existing Regional Water Board should be re-activated. Similar Boards should be established at District level.

- **Personnel**

Modalities should be worked out to ensure a better motivation and more professional capacities of field assistants (community development assistants, health assistants, and water technicians).

- **Training**

A comprehensive training programme, with short courses and workshops for all levels of Programme implementers is a crucial condition for the improvement of Programme activities.
This training should preferably be based within the Region, with professional trainers who are familiar with modern approaches and participatory methodologies, and cost recovery and sustainability issues.

Participation of Programme implementers in relevant seminars and workshops outside the Programme, in Tanzania and other countries, should be included in the budget of the Programme.

- **Training and information materials**

For an appropriate training, manuals, handbooks and other materials are indispensable. Equally, information materials will be needed to be used in villages, among schoolchildren, etc. for the dissemination of messages concerning operation and maintenance of water points, and hygiene and sanitation issues. If the required materials are not available in Tanzania, they should be designed and produced within the framework of the Programme.

- **Women's involvement**

Ways must be found to employ more professionally trained women in the Programme, who can ensure the involvement of women in the Programme at community level.

Women of the communities could be encouraged to participate in Programme activities through special training, e.g. leadership or management training for women at village level.

Women are more actively participating in Programme activities in villages where they have their own income generating projects. These projects can be more encouraged, perhaps through co-operation with the Women's and Children Programmes Sections in the District Community Development Departments.
Some more thorough investigation can be made into possibilities to take these Sections as a starting point for more activities with women in the Programme.

- **Equipment**

Local enterprise could be encouraged for construction and transport activities, and for stocking or manufacturing equipment and spare parts relevant to the Programme.

Local small-scale entrepreneurs at village level should be promoted to deal with maintenance and repair of handpumps and piped water supplies.

- **Transport**

Transport facilities for the Programme should be improved, including transport of construction equipment and materials to the sites. A proper structure should be devised for their use.

- **Special studies**

To support the development of a proper structure for cost recovery, and sustainability of operation and maintenance of water supplies, a special study could be made into different possibilities for payment and collection of water charges, setting up revolving funds for construction of new water points, and funding for maintenance and repairs.

To give a better insight in the present water situation in the Region, an updating of the last Water Master Plan, dated 1974, is absolutely necessary. Special attention should be paid to :

- assessment of the existing water resources (groundwater and surface water);
- establishing the lateral extent of the different water bearing formations, with regard to siting wells or boreholes close by or inside the villages;
- water quality;
- water balance calculations;
- technology options for exploitation of surface, rain, and groundwater;
- environmental issues.

APPENDICES

BARIADI DISTRICT

SHINYANGA

DISTRICT WATER PROFILE

BARIADI DISTRICT

1. INVENTORY OF RWSP WATER POINTS

1.1 WATER POINTS CONSTRUCTED BY RWSP SINCE 1976

- 209 shallow wells
- 1 rehabilitated piped water scheme(Luguru)

1.2 WATER POINTS CONSTRUCTED/REHABILITATED BY RWSP SINCE 1986.

- 21 shallow wells constructed
- 53 shallow wells rehabilitated
- 1 piped water scheme rehabilitated

1.3 COVERAGE OF RWSP WATER POINTS:

Division	Old wells 1976	New const. wells	Rehabilitation wells	Rehabilitation piped w/s
Kanadi	-	6	2	-
Ntuzu	6	8	11	-
Dutwa	5	7	40	-
Itilima	5	-	-	1
Total	16	21	53	1

Total number of operational RWSP water points are 90 shallow wells and one piped water scheme serving a population of about 3,500.

1.4 OTHER OBSERVATIONS

Over 80% of the water points constructed by RWSP in the period between 1976 and 1988 became inoperational mainly due to lack of proper maintenance and unavailability of spareparts.

Other water points mainly constructed by the Central and Local governments.

Division	wells con.	wells reh.	dams good	dams silted	charcos/hafirs good	charcos/hafirs silted	piped w/s oper.	piped w/s inoper.
Kanadi	2	5	-	1	3	4	-	-
Ntuzu	2	4	3	1	2	2	3	1
Dutwa	-	3	-	-	6	4	1	2
Itilima	3	7	1	-	7	3	-	2
Total	7	19	4	2	18	11	4	5

There are no other donors involved with water activities in the district.

Over 25% of all operational wells dry up during the dry spell i.e August - October.

With the exception of a small region in the northern side of Ntuzu and Itilima divisions where wells are suspected to have a relative high content of fluoride most of the other regions have water of reasonable quality. However most of the water sources are bacteriologically contaminated.

Nearly all the wells fitted with hand pumps have good drainage systems(spill ways). However this is not the same with domestic water piped water points. The design of the domestic water points does not take into account the disposal of the waste water.

The coverage of the above water supplies is less than 15% for the whole district hence most of the people still depend on traditional sources. This traditional sources include: water holes along sandy river beds, ponds, shallow open unprotected wells and the like.

During the dry season most of the people get there water within a radius of 0.5 km, but in the dry spell the radius may increase to over 3km.

2. WATER DEMAND

2.1 HUMAN POPULATION

Current and projected population figures are based on the 1988 census figures and a growth rate of 2.53% per annum for the district (Regional Planning office Shinyanga). The table below summarises current and projected Bariadi rural population per division.

Division	Population		
	1984	1992	2002
Kanadi	76,999	85,092	109,244
Ntuzu	107,708	119,029	152,813
Dutwa	107,008	118,255	151,820
Itilima	90,668	100,198	128,637
Total	382,383	422,574	542,514

2.2 LIVESTOCK POPULATION

Livestock population for the district as obtained from the District Veterinary Office Bariadi.

Type of livestock	Population 1992
Cattle	437,823
Goats	190,723
Sheep	114,989

2.3 WATER DEMAND CALCULATIONS

The main objective of the Programme is to meet the water demand of the rural human population. However, also the approximate water demand for livestock is estimated, as this plays a significant role in the distribution of the scarce water resources. There are no projections for the year 2002 for this latter population, however. Livestock demand is therefore assumed to be the same as the present.

2.3.1 Human Water Demand

Human rural water demand is calculated on the basis of 20 litres per head per day. This is the official GoT figure and considered to be a reasonable figure e.g. a survey conducted in one of the villages closely concurs with the above i.e in a household of 6 persons, four 20-litre jerrycans are used every day (13 lcd), the lady of the family uses 7 jerrycans for washing clothes of the entire family every week (5 lcd), totalling 18 lcd.

Current and projected human water demand (rural areas)

Division	Population 1992	Demand 1992 m^3\day	Population 2002	Demand 2002 m^3\day
Kanadi	85,092	1,702	109,244	2,185
Ntuzu	119,029	2,381	152,813	3,056
Dutwa	118,255	2,365	151,820	3,036
Itilima	100,198	2,004	128,637	2,573
Total	422,574	8,451	542,514	10,850

2.3.2 Livestock water demand

To establish livestock water demand it is common practice to use the so-called stock-unit (SU), which is equivalent to one high-grade bull. Three indigenous cattle is taken equivalent to one stock, while 15 goat or sheep are also equivalent one SU as far as water consumption is concerned.

Livestock Water Demand, Bariadi District

Livestock type	% of stock	Total No. of type	Demand lcd	Total Demand (m^3/day)
Bull	3.3	14,448	50	722
Cow	48.0	210,155	40	8,406
Calf	25.6	112,083	10	1,120
Heifer	15.1	66,111	30	1,983
Steer	8.0	35,026	35	1,226
Goat	-	190,723	2	381
Sheep	-	114,989	2	230
Total				14,068

The current water demand in Bariadi district is 14,068 m^3/day. It will also be assumed that the demand will more or less be identical in the year 2002.

3. WATER RESOURCES DEVELOPMENT OPTIONS

A summary is given of the relative importance of each development option per division in the form of a short table. In this table, the symbols have the following meanings:

E/D low earth dam
H hafir
SS/D sand and sub-surface dams
R/C roof catchment
RK/C rock catchment
G/C ground catchment
B/H borehole
S/W shallow well

++ highly viable option; should be given priority for water development of this division.
+ viable option; should be given attention.
+/- possibly a viable option; needs more attention to estimate its particular value in this division.
- not a very viable option, only to be developed if there are no alternatives.
-- not a viable option at all.

Water Development Options per Division

Division	Options								
	E/D	C	H	SS/D	R/C	RK/C	G/C	B/H	S/W
Kanadi	+	+	+	+/-	+	-	+/-	+	++
Dutwa	+	+	+	+/-	+	-	-	+	++
Ntuzu	+	+	+	+/-	+	+	-	+/-	++
Itilima	+	+	+	-	+	-	+	+/-	++

4. IMPLEMENTATION CAPACITY AT DISTRICT LEVEL

4.1 DISTRICT WATER OFFICE

Personnel

- Engineers	1
- Technicians	8
- Craftsmen	16
- Other supporting staff	14

Equipment for construction activities

* Shallow Wells
  Digging and hand drilling equipment plus personnel which can be used to construct 4 tube wells and 2 hand-dug wells per month.
* Piped water schemes
  The district has only design and survey equipment. Personnel and construction equipment can be made available by the Regional Office.
* Roof catchments
  Design and construction equipment plus personnel capable of carrying out the above activities exists at the district office.

Operation and Maintenance

Capacity is available in terms of personnel and equipment for operation, maintenance and monitoring of:

150	Shallow wells
10	Small piped water schemes (serving less than 6,000 people)

Monitoring

With good transport facilities, the district has sufficient personnel to carry out the technical monitoring of the water points.

Water quality

There is no equipment nor personnel to carry out water quality analysis at the district.

5. WATER RESOURCES DEVELOPMENT PLANNING

Planning in the next 5 years (Water development office)

Wells	100
Dams	5
Charcos/Hafirs	20
Piped water schemes	5

MASWA DISTRICT

SHINYANGA

DISTRICT WATER PROFILE

MASWA DISTRICT

1. INVENTORY OF RWSP WATER POINTS

1.1 EXISTING WATER POINTS IN MASWA DISTRICT (1992)

Wells	Boreholes	Dams	Charcos	Piped water supplies
138	7	4	4	9

1.2 WATER POINTS CONSTRUCTED/REHABILITATED BY RWSP SINCE 1986.

- 10 shallow wells constructed
- 58 shallow wells rehabilitated

1.3 COVERAGE OF RWSP WATER POINTS:

There are some wells which were constructed in 1974 phase which are still operation despite the fact that they are not within the programme's intervention areas. This wells are referred to in the table as "old 1974 wells".

Division	Old wells 1974	New const.(1986) wells	Reh. wells	Total
Mwangala	-	6	32	36
Sengerema	4	1	19	24
Nung'hu	2	3	7	12
Total	6	10	58	74

Total number of operational RWSP water points are 74 shallow wells.

1.4 OTHER OBSERVATIONS

Over 80% of the water points constructed by RWSP in the period between 1976 and 1988 became inoperation mainly due to lack of proper maintenance and unavailability of spareparts.

Other water points mainly constructed by the Central and Local governments(G) and World Vision international (W).

Division	wells		dams		charcos		piped w/s	
	con.	reh.	good	silted	good	silted	oper.	inoper.
Mwangala	-	16(G) 9(W)	-	-	2	1	2	1
Sengerema	-	11(G)	1	-	2	1	1	3
Nung'hu	5(G)	24(G)	2	1	1	-	2	-
Total	5	60	3	1	5	2	5	4

All the piped water supplies in Mwangala and Sengerema divisions have river well intakes, while some of those in Nung'hu have borehole intakes. The average population which can be served by each of these water supply - if operational - is 3,500.

There are no other donors involved with water activities in the district.

About 20% of all operational wells dry up during the dry spell i.e August -October.

With the exception of a small fraction (less than 5%) of the wells having E.C's greater than 2,000 uS/cm, water quality of most points is generally good with no reported cases of high fluoride. However most of the shallow water sources, especially river wells are suspected to be bacteriologically contaminated.

Nearly all the wells fitted with hand pumps have good drainage systems. However this is not the case with water stand pipes of the piped supplies. The design of the domestic water points does not take into account the disposal of the waste water.

The coverage of the above water supplies is less than 25% for the whole district hence most of the people still depend on traditional sources. These traditional sources include water holes along sandy river beds, ponds, shallow open unprotected wells and the like.

During the dry season most of the people get there water within a radius of 0.5 km, but in the dry spell the distance may increase to over 3km. The policy of the government is to reduce the maximum radius of accessibility to safe clean water to 0.4 km.

2. WATER DEMAND

2.1 HUMAN POPULATION

Current and projected population figures are based on the 1988 census figures and a growth rates of 2.3, 2.5 and 2.5% per annum for Mwangala, Sengerema and Nung'hu respectively (District Planning Office Maswa). The table below summarises current and projected Maswa rural population per division.

Division	Population 1992	Population 2002
Mwangala	104,025	130,586
Sengerema	78,757	100,816
Nung'hu	60,559	77,520
Total	243,341	308,922

2.2 LIVESTOCK POPULATION

Livestock population for the district is shown below (District Veterinary Office Maswa).

Division	Type of livestock	Population 1992
Mwangala	cattle	129,117
	goats	83,698
	sheep	50,318
Sengerema	cattle	86,978
	goats	32,299
	sheep	23,411
Nung'hu	cattle	74,331
	goats	29,404
	sheep	22,225
Total		

2.3 WATER DEMAND CALCULATIONS

The main objective of the Programme is to meet the water demand of the rural human population. However, also the approximate water demand for livestock is estimated, as this plays a significant role in the distribution of the scarce water resources. There are no projections for the year 2002 for this latter population, however. Livestock demand is therefore assumed to be the same as the present.

2.3.1 Human Water Demand

Human rural water demand is calculated on the basis of 20 litres per head per day. This is the official GoT figure and considered to be a reasonable figure e.g. a survey conducted in one of the villages closely concurs with the above i.e in a household of 6 persons, four 20-litre jerrycans are used every day (13 lcd), the lady of the family uses 7 jerrycans for washing clothes of the entire family every week (5 lcd), totalling 18 lcd.

Current and projected potable water demand

Division	Population 1992	Demand 1992 m^3\day	Population 2002	Demand 2002 m^3\day
Mwangala	104,025	2,081	130,586	2,612
Sengerema	78,757	1,575	100,816	2,016
Nung'hu	60,559	1,211	77,520	1,550
Total	243,341	4,867	308,922	6,178

2.3.2 Livestock water demand

To establish livestock water demand it is common practice to use the so-called stock-unit (SU), which is equivalent to one high-grade bull. Three indigenous cattle is taken equivalent to one stock, while 15 goat or sheep are also equivalent one SU as far as water consumption is concerned.

Livestock Water Demand, Mwangala Division

Livestock type	% of stock	Total No. of type	Demand lcd	Total Demand for type (m^3/day)
Bull	3.3	4,261	50	213
Cow	48.0	61,976	40	2,479
Calf	25.6	33,054	10	331
Heifer	15.1	19,497	30	585
Steer	8.0	10,329	35	362
Goat	-	83,698	2	167
Sheep	-	50,318	2	101
Total				4,238

Livestock Water Demand, Sengerema Division

Livestock type	% of stock	Total No. of type	Demand lcd	Total Demand for type (m^3/day)
Bull	3.3	2,870	50	144
Cow	48.0	41,749	40	1,670
Calf	25.6	22,266	10	223
Heifer	15.1	13,134	30	394
Steer	8.0	6,958	35	244
Goat	-	32,299	2	65
Sheep	-	23,411	2	47
Total				2,787

Livestock Water Demand, Nung'hu Division

Livestock type	% of stock	Total No. of type	Demand lcd	Total Demand for type (m^3/day)
Bull	3.3	2,453	50	123
Cow	48.0	35,697	40	1,427
Calf	25.6	19,029	10	190
Heifer	15.1	11,224	30	337
Steer	8.0	5,947	35	208
Goat	-	29,404	2	59
Sheep	-	22,225	2	45
Total				2,389

The current total livestock water demand in Maswa District is 9,414 m^3/day. It is assumed that this demand will more or less be identical in the year 2002.

3. WATER RESOURCES DEVELOPMENT OPTIONS

A summary is given of the relative importance of each water development option per division in the form of a short table. In this table, the symbols have the following meanings:

E/D low earth dam
H hafir
SS/D sand and sub-surface dams
R/C roof catchment
RK/C rock catchment
G/C ground catchment
B/H borehole
S/W shallow well

++ highly viable option; should be given priority for water development of this division.
+ viable option; should be given attention.
+/- possibly a viable option; needs more attention to estimate its particular value in this division.
- not a very viable option, only to be developed if there are no alternatives.
-- not a viable option at all.

Water Development Options per Division

Division	Options								
	E/D	C	H	SS/D	R/C	RK/C	G/C	B/H	S/W
Mwangala	+	+	+	+/-	+	+	+/-	+	++
Sengerema	+	+	+	-	+	-	-	+	++
Nung'hu	+	+	+	-	+	+	-	+/-	++

4. IMPLEMENTATION CAPACITY AT DISTRICT LEVEL

4.1 DISTRICT WATER OFFICE

Personnel

- Engineers	2
- Technicians	6
- Craftsmen	35
- Other supporting staff	12

Equipment for construction activities

* Shallow Wells

Shallow well construction equipments plus personnel to construct 5 wells per month.

* Piped water schemes

The district has only design and survey equipment. Personnel and construction equipment can be made available by the Regional Office.

* Roof catchments

Design and construction equipment plus personnel capable of carrying out the above activities exists at the district office.

Operation and Maintenance

Capacity is available in terms of personnel and equipment for operation, maintenance and monitoring of:

150 Shallow wells

10 Small piped water schemes (serving less than 6,000 people)

Monitoring

With good transport facilities, the district has sufficient personnel to carry out the technical monitoring of the water points.

Water quality

There is no equipment nor personnel to carry out water quality analysis at the district.

5. WATER RESOURCES DEVELOPMENT PLANNING

Water development planning for the next 5 years (District Water Office):

Shallow Wells	200
Boreholes	2
Piped water schemes	3

The planned piped water schemes include the 65km long New Sola Dam Water project which is expected to serve 8 rural villages (both human and livestock water supply) besides serving Nyalikungu town (Maswa district headquarters). The scheme will be commissioned in 1993.
Plans to start construction of roof catchments in every Health Centre are underway.

Information on future plans in the water sector from World Vision International could not be obtained.

Priority areas as earmarked by district administration

- Northern region of Segerema division
- Northern region of Mwangala division

MEATU DISTRICT

SHINYANGA

DISTRICT WATER PROFILE

MEATU DISTRICT

1. INVENTORY OF EXISTING WATER SUPPLIES

1.1 EXISTING SAFE WATER SUPPLIES (FEBRUARY, 1992):

Wells	Boreholes	Dams	Piped water supplies	
			operational	inoperational
38	1	1	1	2

1.2 OPERATIONAL WATER POINTS CONSTRUCTED/REHABILITATED BY RWSP SINCE 1986:

construction : 4 shallow wells
rehabilitation : 27 shallow wells

1.3 COVERAGE OF RWSP WATER POINTS:

Division	New const.(1986) wells	Rehabilitation wells	Total
Kimali	3	15	18
Kisesa	1	12	13
Nyalanja	-	-	-
Total	4	27	31

Total number of operational RWSP water points amounts to 31 shallow wells.

1.4 OTHER OBSERVATIONS

Over 80% of the water points constructed by RWSP in the period between 1976 and 1988 became inoperation mainly due to lack of proper maintenance and unavailability of spareparts.
Other water points mainly constructed by the Central and Local governments and the communities themselves. There are no other donors involved with water activities in the district.

Division	wells		B/H	dams		piped w/s	
	constr.	rehab.		good	silted	oper.	inoper.
Kimali	1	5		-	1	-	1
Kisesa	-	2	-	-	-	1	-
Nyalanja	-	-	1	-	-	-	1
Total	1	7	1	-	1	1	2

About 25% of all operational wells dry up during the dry spell i.e August - October.

With the exception of a small fraction (less than 5%) of wells having E.C's greater than 2,000 uS/cm, water quality of most points is generally good with no reported cases of high fluoride. However most of the shallow water sources, especially river wells are suspected to be bacteriologically contaminated.

Nearly all the wells fitted with hand pumps have good drainage systems (spill ways). However this is not the case with domestic water piped water points. The design of the domestic water points does not take into account the disposal of the waste water.

The coverage of the above water supplies is less than 10% for the whole district hence most of the people still depend on traditional sources. This traditional sources include: water holes along sandy river beds, ponds, shallow open unprotected wells and the like.

During the dry season most of the people get there water within a radius of 0.5 km, but in the dry spell the radius may increase to over 3km. The policy of the government is to reduce the maximum radius of accessibility to safe clean water to 0.4 km.

2. WATER DEMAND

2.1 HUMAN WATER DEMAND

Current and projected population figures are based on the 1988 census figures and a growth rate of 2.9 per annum for (District Planning office Maswa). The table below summarises current and projected Meatu rural population per division.

Division	Population 1992	Population 2002
Kimali	59,737	79,505
Kisesa	67,832	90,279
Nyalanja	48,876	65,051
Total	176,445	234,835

2.2 LIVESTOCK WATER DEMAND

Livestock population for the district is shown below (District Veterinary Office Meatu).

Division	Type of livestock	Population 1992
Kimali	cattle	109,333
	goats	69,736
	sheep	11,333
Kisesa	cattle	41,804
	goats	73,507
	sheep	22,664
Nyalanja	cattle	170,432
	goats	61,089
	sheep	60,440
Total		620,338

2.3 WATER DEMAND CALCULATIONS

The main objective of the Programme is to meet the water demand of the rural human population. However, also the approximate water demand livestock is estimated, as this plays a significant role in the distribution of the scarce water resources. There are no projections for the year 2002 for this latter population however. Livestock demand is therefore assumed to be the same as the present.

2.3.1 Human Water Demand

Human rural water demand is calculated on the basis of 20 lcd (including wastages). This is considered to be a reasonable figure e.g. a survey conducted in one of the villages closely concurs with the above i.e in a household of 6, four 20-litre jerrycans are used every day (13 lcd), the lady of the family uses 7 jerrycans for washing clothes of the entire family every week (5 lcd), totalling 18 lcd.

Current and projected potable water demand

Division	Population 1992	Demand 1992 m^3\day	Population 2002	Demand 2002 m^3\day
Kimali	59,737	1,195	79,505	1,590
Kisesa	67,832	1,357	90,279	1,806
Nyalanja	48,876	978	65,051	1,301
Total	176,445	3,530	234,835	4,697

2.3.2 Livestock Water Demand

Livestock Water Demand, Kimali Division

Livestock type	% of stock	Total No. of type	Demand lcd	Total Demand (m^3/day)
Bull	3.3	3,608	50	180
Cow	48.0	52,480	40	2,099
Calf	25.6	27,989	10	280
Heifer	15.1	16,509	30	495
Steer	8.0	8,747	35	306
Goat	-	69,736	2	140
Sheep	-	11,333	2	23
Total				3,523

Livestock Water Demand, Kisesa Division

Livestock type	% of stock	Total No. of type	Demand lcd	Total Demand (m^3/day)
Bull	3.3	1,380	50	69
Cow	48.0	20,066	40	803
Calf	25.6	10,702	10	107
Heifer	15.1	6,312	30	189
Steer	8.0	3,344	35	117
Goat	-	73,507	2	147
Sheep	-	22,664	2	45
Total				1,477

Livestock Water Demand, Nyalanja Division

Livestock type	% of stock	Total No. of type	Demand lcd	Total Demand (m^3/day)
Bull	3.3	5,624	50	281
Cow	48.0	81,807	40	3,272
Calf	25.6	43,631	10	436
Heifer	15.1	25,735	30	772
Steer	8.0	13,635	35	477
Goat	-	61,089	2	138
Sheep	-	60,440	2	121
Total				5,497

The current livestock water demand in Meatu district is 10,497m^3/day. It is assumed that the demand will be more or less identical in the year 2002.

3. WATER RESOURCES DEVELOPMENT OPTIONS

Development Options per Division

Division	Options								
	E/D	C	H	SS/D	R/C	RK/C	G/C	B/H	S/W
Kimali	+	+	+	++	+	-	+/-	+	++
Kisesa	+	+	+	++	+	-	-	+	++
Nyalanya	+	+	+	++	+	-	-	+/-	+/-

4. IMPLEMENTATION CAPACITY AT DISTRICT LEVEL

4.1 DISTRICT WATER OFFICE

Personnel

- Engineers 1
- Technicians 4
- Craftsmen 7
- Other supporting staff 8

Equipment for construction activities

* Shallow Wells

Sufficient construction equipment plus personnel to construct 4 tube wells and 2 handdug wells per month.

* Piped water schemes

The district has only design and survey equipment. Trained personnel and construction equipment can only be obtained from the Regional Office.

* Roof catchments

Design and construction equipment plus personnel capable of carrying out one of the above activities is available at the district office.

Operation and Maintenance

The existing capacity in terms of personnel and equipment for operation, maintenance and monitoring is reported to be adequate for:

100 Shallow wells

3 small piped water schemes (serving less than 6,000 people)

Monitoring

If good transport facilities are available, the district has enough personnel to carry out the technical monitoring of the water points.

Water quality

There is no equipment nor qualified personnel to carry out water quality analysis at the district office.

5. WATER RESOURCES DEVELOPMENT PLANNING

5.1 PLANNING IN THE NEXT 5 YEARS (DISTRICT WATER OFFICE):

Activity	Year					
	1992	1993	1994	1995	1996	Total
Rehabilitating shallow wells	10	10	11	10	10	51
Construction new shallow wells	9	10	10	10	10	49
Construction of boreholes	2	2	-	-	-	4
Rehabilitating piped schemes	-	1	-	-	-	-
Construction dams/charcos	2	2	2	2	2	10

5.2 PRIORITY AREAS AS EARMARKED BY DISTRICT ADMINISTRATION:

The entire Nyalanja division and parts of Kimali division.

KAHAMA DISTRICT

SHINYANGA

DISTRICT WATER PROFILE

KAHAMA DISTRICT

1. INVENTORY OF EXISTING WATER SUPPLIES

1.1 EXISTING WATER SUPPLIES IN KAHAMA DISTRICT:

Wells	Boreholes	Dams	Piped water supplies
96	1	1	9

1.2 WATER POINTS CONSTRUCTED/REHABILATED BY RWSP SINCE 1986:

construction : 8 shallow wells
rehabilation : 49 shallow wells

1.3 COVERAGE OF RWSP WATER POINTS:

Division	New const wells 1986	Reh. wells 1986	Old 1974 wells	Total No. wells
Dakama	7	27	16	50
Isagehe	-	3	2	5
Kahama Mjini	1	12	12	25
Msalala	-	6	5	11
Mweli	-	-	1	1
Siloka	-	1	3	4
Total	8	49	39	96

Total number of operational RWSP water points is 96 shallow wells.

Over 80% of the water points constructed by RWSP in the period between 1976 and 1988 became inoperation mainly due to lack of proper maintenance and unavailability of spareparts.

Other water points mainly constructed by the Central and Local governments and the communities themselves.

Division	dams		piped w/s	
	good	silted	oper.	inoper.
Dakama	-	-	1	-
Isagehe	-	-	-	3
Kahama Mjini	-	1	1	-
Msalala	-	-	-	1
Mweli	-	-	-	1
Siloka	-	-	1	1
Total		1	3	6

There are no other donors involved with water activities in the district. World Vision International have plans of rehabilitating some wells in the district.

1.4 OTHER OBSERVATIONS

About 25% of all operational wells dry up during the dry spell i.e August - October. With the exception of a small fraction (less than 5%) of wells having E.C's greater than 2,000 uS/cm, water quality of most points is generally good with no reported cases of high fluoride. However most of the shallow water sources, especially river wells are suspected to be bacteriologically contaminated.

Nearly all the wells fitted with hand pumps have good drainage systems(spill ways). However this is not the case with domestic water piped water points. The design of the domestic water points does not take into account the disposal of the waste water.

The coverage of the above water supplies is less than 6% for the whole district hence most of the people still depend on traditional sources. This traditional sources include: water holes along sandy river beds, ponds, shallow open unprotected wells and the like.

During the dry season most of the people get there water within a radius of 0.5 km, but in the dry spell the radius may increase to over 3km. The policy of the government is to reduce the maximum radius of accessibility to safe clean water to 0.4 km.

2. WATER DEMAND

2.1 HUMAN POPULATION

Current and projected population figures are based on the 1988 census figures and a growth rate of 5.46 per annum for (District Planning office Kahama). The high growth rate is attributed to immigration as opposed to human multiplication. The table below summarises current and projected Kahama rural population per division.

Division	Population		
	1988	1992	2002
Dakama	111,437	137,842	234,562
Isagehe	71,025	87,854	149,500
Kahama Mjini	33,551	41,501	70,621
Maslala	116,844	144,530	245,943
Mweli	28,927	35,781	60,888
Siloka	141,420	174,929	297,673
Total	503,204	622,437	1,059,187

2.2 LIVESTOCK

Livestock population for the district is shown in the table below (District Veterinary Office Maswa).

Division	Type of livestock	Population 1992
Dakama	cattle	62,331
	goats	55,811
	sheep	28,762
Isagehe	cattle	71,763
	goats	21,195
	sheep	16,353
Kahama Mjini	cattle	15,106
	goats	6,207
	sheep	3,131
Msalala	cattle	91,793
	goats	42,265
	sheep	21,494
Mweli	cattle	11,625
	goats	8,977
	sheep	1,676
Siloka	cattle	81,195
	goats	44,991
	sheep	11,504
Totals		

2.3 WATER DEMAND

The main objective of the Programme is to meet the water demand of the rural human population. However, also the approximate water demand for livestock is estimated, as this plays a significant role in the distribution of the scarce water resources. There are no projections for the year 2002 for this latter population, however. Livestock demand is therefore assumed to be the same as the present.

2.3.1 Human Water Demand

Human rural water demand is calculated on the basis of 20 litres per capita per day. This is the official GoT figure and considered to be a reasonable figure e.g. a survey conducted in one of the villages closely concurs with the above i.e in a household of 6 persons, four 20-litre jerrycans are used every day (or about 13 lcd), the lady of the family uses 7 jerrycans for washing clothes of the entire family every week (5 lcd), totalling 18 lcd.

Current and projected potable water demand

Division	Population 1992	Demand 1992 m^3\day	Population 2002	Demand 2002 m^3\day
Dakama	137,842	2,757	234,562	4,691
Isagehe	87,854	1,757	149,500	2,990
Kahama M.	41,501	830	70,621	1,412
Msalala	144,530	2,891	245,943	4,919
Mweli	35,781	715	60,888	1,218
Siloka	174,929	3,449	297,673	5,953
Total	622,437	12,449	1,059,187	19,771

2.3.2 Livestock Water Demand

Livestock Water Demand, Dakama Division

Livestock type	% of stock	Total No. of type	Demand lcd	Total Demand (m^3/day)
Bull	3.3	2,057	50	102
Cow	48.0	29,919	40	1,197
Calf	25.6	15,957	10	160
Heifer	15.1	9,412	30	282
Steer	8.0	4,987	35	175
Goat	-	55,811	2	112
Sheep	-	28,762	2	58
Total				2,086

Livestock Water Demand, Isagehe Division

Livestock type	% of stock	Total No. of type	Demand lcd	Total Demand (m^3/day)
Bull	3.3	2,368	50	118
Cow	48.0	34,446	40	1,377
Calf	25.6	18,371	10	184
Heifer	15.1	10,836	30	325
Steer	8.0	5,741	35	201
Goat	-	21,195	2	42
Sheep	-	16,353	2	33
Total				2,280

Livestock Water Demand, Kahama Mjini Division

Livestock type	% of stock	Total No. of type	Demand lcd	Total Demand (m^3/day)
Bull	3.3	499	50	25
Cow	48.0	7,251	40	290
Calf	25.6	3,867	10	39
Heifer	15.1	2,281	30	68
Steer	8.0	1,209	35	42
Goat	-	6,207	2	12
Sheep	-	3,131	2	6
Total				482

Livestock Water Demand, Msalala Division

Livestock type	% of stock	Total No. of type	Demand lcd	Total Demand (m^3/day)
Bull	3.3	3,029	50	152
Cow	48.0	44,060	40	1,762
Calf	25.6	23,499	10	235
Heifer	15.1	13,861	30	415
Steer	8.0	7,343	35	257
Goat	-	42,265	2	85
Sheep	-	21,494	2	43
Total				2,949

Livestock Water Demand, Mweli Division

Livestock type	% of stock	Total No. of type	Demand lcd	Total Demand (m^3/day)
Bull	3.3	384	50	19
Cow	48.0	5,580	40	223
Calf	25.6	2,976	10	30
Heifer	15.1	1,755	30	52
Steer	8.0	930	35	33
Goat	-	8,977	2	18
Sheep	-	1,676	2	3
Total				378

Livestock Water Demand, Siloka Division

Livestock type	% of stock	Total No. of type	Demand lcd	Total Demand (m^3/day)
Bull	3.3	2,679	50	134
Cow	48.0	38,974	40	1,559
Calf	25.6	20,786	10	208
Heifer	15.1	12,260	30	368
Steer	8.0	6,496	35	227
Goat	-	44,991	2	90
Sheep	-	11,504	2	23
Total				2,609

The current livestock water demand in Kahama district amounts to 10,784m^3/day. It is assumed that the demand will more or less be identical in the year 2002.

3. WATER RESOURCES DEVELOPMENT OPTIONS

Development Options per Division

Division	Options								
	E/D	C	H	SS/D	R/C	RK/C	G/C	B/H	S/W
Dakama	+/-	+/-	+/-	-	+	-	+/-	+	++
Isagehe	+/-	+/-	+/-	-	+	-	-	+	++
Kahama	+/-	+/-	+/-	-	+	-	-	+/-	++
Msalala	+/-	+/-	+/-	-	+	-	+/-	+	++
Mweli	+/-	+/-	+/-	-	+	-	-	+	++
Siloka	+/-	+/-	+/-	-	+	-	-	+/-	++

4. IMPLEMENTATION CAPACITY AT DISTRICT LEVEL

A. DISTRICT WATER OFFICE

Personnel

- Engineers 1
- Technicians 6
- Craftsmen 38
- Other supporting staff 21

Equipment for construction activities

* Shallow Wells

Sufficient construction equipment plus personnel to construct 3 handdug wells per month.

* Piped water schemes

The district has only design and survey equipment. Trained personnel and construction equipment can only be obtained from the Regional Office.

* Roof/rock catchments

Design and construction equipment plus personnel capable of carrying out one of the above activities is available at the district level.

Operation and Maintenance

The existing capacity in terms of personnel and equipment for operation, maintenance and monitoring is reported to be adequate for:

- 250 Shallow wells
- 6 Small piped water schemes (serving less than 6,000 people)

Monitoring

If good transport facilities are available, the district has enough personnel to carry out the technical monitoring of the water points.

Water quality

There is no equipment nor qualified personnel to carry out water quality analysis at the district office.

5. WATER RESOURCES DEVELOPMENT PLANNING

B. PLANNING FOR THE NEXT 5 YEARS (DISTRICT WATER OFFICE)

i) Rehabilitation of 79 shallow wells.
ii) Construction of 100 new wells.
iii) Improvement/expansion of urban water supplies.
iv) Rehabilitation of seven existing piped water schemes.
v) Completion of Chela-Ntundu piped scheme.
vi) Construction of small dams and charcos.

C. PRIORITY AREAS AS EARMARKED BY THE ADMINISTRATION

Isagehe - Eastern region
Mweli - Entire division
Siloka - Bogwe ward

SHINYANGA RURAL DISTRICT

SHINYANGA

DISTRICT WATER PROFILE

SHINYANGA RURAL

1. INVENTORY OF EXISTING WATER SUPPLIES.

1.1 EXISTING WATER SUPPLIES IN SHINYANGA RURAL:

Wells	Boreholes	Dams	Charcos	Piped W/S
105	6	2	19	22

1.2 WATER POINTS CONSTRUCTED/REHABILITATED BY RWSP (SINCE 1986)

construction : - 6 shallow wells
rehabilitation : - 72 shallow wells
- 1 piped scheme (60% completed)

1.3 COVERAGE BY RWSP WATER POINTS (SINCE 1986):

Division	New wells	Rehab. wells	Piped W/S	Total
Itwangi	-	30	-	30
Kishapu	-	-	-	-
Mondo	4	3	-	7
Negezi	2	4	-	6
Nindo	-	5	-	5
Samuye	-	30	1	31
Total	6	72	1	79

Total operational RWSP water points: 78 shallow wells.

1.4 OTHER OBSERVATIONS

Over 80% of the water points constructed by RWSP in the period between 1976 and 1988 became inoperational mainly due to lack of proper maintenance and unavailability of spareparts.

Other water points were constructed by the Central and Local governments (G), the communities themselves, UNICEF(U), UNDP(p), AHEAD (Adventures health and agriculture development) and Mwandui mines (M).

Division	wells		B/H	dams		C/H		R/C	Piped	W/S
	new	reh.		gd	st	gd	st		op.	inop.
Itwangi	-	-	3	1	1	-	-	-	3	5
Kishapu	2p	11u	1	-	1	1	-	-	4	
Mondo	-	-	1	3m	-	-	-	1m	-	
Negezi	3p	12u	-	1	1	1	5	1d	2	1
Nindo	-	-	-	1	-	-	5	-	-	2
Samuye	-	-	1	-	-	-	-	-	-	2
Total	5	23	6	6	3	2	10	2	9	8

About 25% of all operational wells dry up during the dry spell i.e August - October.

With the exception of a small number (less than 5%) of wells having E.C's greater than 2,000 uS/cm, water quality of most points is generally good with no reported cases of high fluoride. However most of the shallow water sources, especially river wells are suspected to be bacteriologically contaminated.

Nearly all the wells fitted with hand pumps have good drainage systems. However this is not the case with domestic water piped water points. The design of the domestic water points does not take into account the disposal of the waste water.

The coverage of the above water supplies is less than 15% for the whole district hence most of the people still depend on traditional sources. This traditional sources include: water holes along sandy river beds, ponds, shallow open unprotected wells and the like.

During the dry season most of the people get there water from within a radius of 0.5 km, but in the dry spell the distance may increase to over 3km. The policy of the government is to reduce the maximum radius of accessibility to safe clean water to 0.4 km.

2. WATER DEMAND

2.1 HUMAN POPULATION

Current and projected population figures are based on the 1988 census figures and a growth rate of 1.1 per annum for (District Planning office Shinyanga). The low growth rate is attributed to migration of people to the neighbouring districts and to Shinyanga urban. The table below summarises current and projected Shinyanga Rural population per division.

Division	Population		
	1988	1992	2002
Itwangi	59,735	62,407	69,622
Nindo	119,282	124,618	139,024
Mondo	78,203	81,701	91,146
Samuye	33,940	35,458	39,557
Negezi	50,888	53,164	59,310
Kishapu	63,657	66,504	74,193
Total	405,705	423,852	472,852

2.2 LIVESTOCK POPULATION

Livestock population for the district is shown in the table below (District Veterinary Office Shinyanga).

Type of livestock	Population 1992
Cattle	566,762
Goats	211,109
Sheep	136,876

2.3 WATER DEMAND CALCULATIONS

The main objective of the Programme is to meet the water demand of the rural human population. However, also the approximate water demand for livestock is estimated, as this plays a significant role in the distribution of the scarce water resources. There are no projections for the year 2002 for this latter population, however. Livestock demand is therefore assumed to be the same as the present.

2.3.1 Human Water Demand

Human rural water demand is calculated on the basis of 20 litres per head per day. This is the official GoT figure and considered to be a reasonable figure e.g. a survey conducted in one of the villages closely concurs with the above i.e in a household of 6 persons, four 20-litre jerrycans are used every day (13 lcd), the lady of the family uses 7 jerrycans for washing clothes of the entire family every week (5 lcd), totalling 18 lcd.

Current and projected potable water demand

Division	Population 1992	Demand 1992 m^3\day	Population 2002	Demand 2002 m^3\day
Itwangi	62,407	1,248	69,622	1,392
Nindo	124,618	2,492	139,024	2,780
Mondo	81,701	1,634	91,146	1,823
Samuye	35,458	709	39,557	791
Negezi	53,164	1,063	59,310	1,186
Kishapu	66,504	1,330	74,193	1,484
Total		8,477		9,457

2.3.2 Livestock water demand

To establish livestock water demand it is common practice to use the so-called stock-unit (SU), which is equivalent to one high-grade bull. Three indigenous cattle is taken equivalent to one stock, while 15 goat or sheep are also equivalent one SU as far as water consumption is concerned.

Livestock Water Demand, Shinyanga Rural.

Livestock type	% of stock	Total No. of type	Demand lcd	Total Demand (m^3/day)
Bull	3.3	18,703	50	935
Cow	48.0	272,046	40	10,882
Calf	25.6	145,091	10	1,451
Heifer	15.1	85,581	30	2,567
Steer	8.0	45,341	35	1,587
Goat	-	211,109	2	422
Sheep	-	136,876	2	274
Total				18,118

The current livestock water demand in Shinyanga Rural is 18,118m^3/day. It will also be assumed that the demand will more or less be identical in the year 2002.

3. WATER RESOURCES DEVELOPMENT OPTIONS

A summary is given of the relative importance of each water development option per division in the form of a short table. In this table, the symbols have the following meanings:

E/D low earth dam
H hafir
SS/D sand and sub-surface dams
R/C roof catchment
RK/C rock catchment
G/C ground catchment
B/H borehole
S/W shallow well

++ highly viable option; should be given priority for water development of this division.
+ viable option; should be given attention.
+/- possibly a viable option; needs more attention to estimate its particular value in this division.
- not a very viable option, only to be developed if there are no alternatives.
-- not a viable option at all.

Water Development Options per Division

Division	Options								
	E/D	C	H	SS/D	R/C	RK/C	G/C	B/H	S/W
Itwangi	+	+	+	-	+	-	+/-	+	++
Kishapu	+	+	+	-	+	-	-	+	++
Mondo	+	+	+	-	+	-	-	+/-	++
Negezi	+	+	+	+	+	-	+/-	+	++
Nindo	+	+	+	-	+	-	-	+	++
Samuye	+	+	+	+	+	-	-	+/-	++

4. IMPLEMENTATION CAPACITY AT DISTRICT

4.1 DISTRICT WATER OFFICE

Personnel

- Engineers 1
- Technicians 6
- Craftsmen 44
- Other supporting staff 6

Equipment for construction activities

* Shallow Wells

Shallow well construction equipments plus personnel to construct 4 wells per month.

* Piped water schemes

The district has no equipment for design and survey, nor qualified personnel and construction equipment. This has to be made available by the Regional Office.

* Roof catchments

Design and construction equipment plus personnel capable of carrying out the above activities exists at the district office.

Operation and Maintenance

Capacity is available in terms of personnel and equipment for operation, maintenance and monitoring of:

300 Shallow wells

10 Small piped water schemes (serving less than 6,000 people)

Monitoring

With good transport facilities, the district has sufficient personnel to carry out the technical monitoring of the water points.

Water quality

There is no equipment nor personnel to carry out water quality analysis at the district.

5. WATER RESOURCES DEVELOPMENT PLANNING

5.1 PLANNING IN THE NEXT 5 YEARS

No data available

5.2 PRIORITY AREAS AS EARMARKED BY THE ADMINISTRATION.

Mondo - most of the division
Nindo - entire division