THE UNITED REPUBLIC OF TANZANIA
THE REPUBLIC OF FINLAND

MTWARA-LINDI WATER MASTER PLAN

REVISION
Part: WATER SUPPLY

VOLUME I
MAIN REPORT

April 1986

FINNWATER
CONSULTING ENGINEERS
HELSINKI, FINLAND

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WATER SUPPLY DEVELOPMENT PLAN 1986 - 2001

VOLUME 1 MAIN REPORT

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ABBREVIATIONS AND ACRONYMS

AfDB	African Development Bank
AFYA	Ministry of Health
CCT	Christian Council of Tanzania
C.I.	Cast Iron
DED	District Executive Director
DP	Domestic Water Point (public tap)
DTH	Down-the-Hole Hammer (drilling rig)
DWE	District Water Engineer
EC	Electrical Conductivity
EEC	European Economic Community
FIM	Finnish Mark
FINNIDA	Finnish International Development Agency
FW	Finnwater Consulting Engineers
GDP	Gross Domestic Product
G.S.	Galvanized Steel
lcd	Litres per capita per day
MAJI	Ministry of Water, Land, Housing and Urban Development
ODA	Overseas Development Administration (United Kingdom)
O & M	Operation and Maintenance
PMO	Prime Minister's Office
Project	Mtwara-Lindi Rural Water Supply Project
PVC	Polyvinyl Chloride
RDD	Regional Development Director
RIPED	Regional Integrated Development Programme
RWE	Regional Water Engineer
TAS	Tanzanian Shilling
UNDP	United Nations Development Programme

UNICEF	United Nations Children's Fund
USD	United States Dollar
WMP-77	The Mtwara-Lindi Water Master Plan (1977)
WMPCU	Water Master Planning Coordination Unit

Exchange rates used:

USD 1.00 = TAS 18.00

FIM 1.00 = TAS 3.00

1 INTRODUCTION

The Mtwara-Lindi Water Master Plan Study was carried out in 1974-76 and a report was completed in 1977.

The need to update the WMP-77 has already been recognized for some time and this work was included in the Phase III Programme of the Mtwara-Lindi Rural Water Supply Development Project. The importance of the updating was emphazised during the evaluation of the Project at the beginning of 1984 and Terms of Reference for it were included in the evaluation report.

Due to the financial constraints it was agreed that the revised plan shall deal with the water supply sector only. Other use of water - irrigation and hydropower - will have to be studied separately. Sanitation which is closely related to weater supply has been mentioned only briefly in this report and should be considered in more detail in a separate report.

The objectives of the updating work were outlined in the evaluation report:

(a) To update the assessment of both groundwater and surface water resources.

(b) To assess the present level of water service and the relationship of this to the pre-Project level.

(c) To make a proposal for the future water supply development, taking into account following aspects:

- community involvement in Project activities,
- district focus (district and village councils),
- selection of suitable technologies,
- the current national economic situation,
- population growth since the 1978 census,
- any other local factor.

The work was started in June, 1984 and was carried out by the Finnwater organization which was strengthened by experts specifically assigned to this work. Co-operation with the local MAJI organization has been close and staff were made available for this work, particularly for the village survey. Contacts with the Water Master Planning Co-ordination Unit and other authorities especially on the regional and district levels have been frequent.

The Draft Interim Report including the assessment of the present water supply situation, the water resources review, water demand estimates and the proposed planning criteria was presented in May, 1985. The report was discussed and commented upon in May-July, 1985.

The Draft Water Supply Development Plan including presentation of water supply methods and their costs, alternative projects, and the actual water supply development plan, was completed in October, 1985. The report was discussed and commented upon in December, 1985.

This Final Report comprises three volumes:

Volume 1	Main Report
Volume 2	Studies
Volume 3	Maps

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ACKNOWLEDGMENTS

The Mtwara-Lindi Water Master Plan Revision team wishes to express its sincere gratitude for the co-operation and assistance received from the Government Officers at various levels of administration and also from the officials of FINNIDA.

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SUMMARY

Mtwara and Lindi Regions together cover an area of about 83,000 km^2. The estimated present and future population and water demands are as follows:

	1984		2001	
	People	Water Demand	People	Water Demand
Total Area	1,462,700	40,300 m^3/d	2,111,500	71,500 m^3/d
- rural	1,259,600	30,100 m^3/d	1,616,700	46,000 m^3/d
- urban	203,100	10,200 m^3/d	494,800	27,500 m^3/d

The future water supply development possibilities have been considered based mainly on present water supply situation, the available water sources and the available financies and manpower.

The distribution of the population as to their principal water supplies is as follows:

- Piped W/S 38 %
- Hand pump well 26 %
- Open well or pit 25 %
- Stream 5 %
- Dam 1 %
- Spring 5 %
- Rainwater collection < 1 %

Improved water supplies, 143 piped water schemes and 1,817 hand pump wells, have been constructed for about 1,170,000 people (80 %). Nevertheless, the piped water schemes often operate poorly with only 50 % of the people within their service areas getting water regularly.

The service levels of the various water supplies have been evaluated and the overall situation is as follows:

1.	No improved W/S constructed:	20 % of people
2.	Improved W/S constructed, but no real service:	19 % of people
3.	Improved W/S constructed and some water obtained:	34 % of people
4.	Service of W/S according to standards:	27 % of people

The reasons for the unsatisfactory operation of the water supplies are manifold, the most important being lack of fuel and spare parts. MAJI, responsible for the development and operation of water supplies, has an almost satisfactory number of personnel but there is still in a serious shortage of skilled and experienced personnel especially in the operation and maintenance sector.

The present level of financing of the water supply sector, coming from different sources, is about TAS 70 million annually. Of this budget, 40 million is used for development and 30 million for operation and maintenance.

The water resources assessment, regarding both surface water and groundwater, brings no drastic changes to the conclusions drawn in WMP-77. Groundwater still appears the best source of domestic water supplies in most parts of the area. The Basement area covering most of Masasi and Nachingwea Districts has proved even more difficult than estimated. The surface water resources are limited and mainly seasonal with only four rivers in the area being perennial.

The proposed plan, covering the period of 1986-2001, emphazises the use of groundwater and community participation in construction and operation.

The aim of the plan is to provide everybody with good and wholesome water (25 lcd) by the year 2001. An intermediate target is to provide improved water supply to all villages by 1991 quaranteering a minimum requirement of water - 10 l/capita/day.

The plan proposes following physical water supply development:

- construction of 2,340 new hand pump wells,
- rehabilitation and deepening of 225 existing hand pump wells,
- rehabilitation and expansion of 91 existing piped water supply schemes,
- construction of 7 new piped water supply schemes.

MAJI is assumed to remain responsible for planning, constructing and operating the water supplies. Upgrading MAJI's personnel and improving the facilities and equipment are included in the plan.

Direct development costs are estimated at TAS 622 million. This does not include the renewal of structures, machinery and equipment for which TAS 415 million should be allocated during the planning period.

Recurrent costs, including the operation of water supplies and the costs of MAJI organization, are estimated at TAS 53.4 million in 1986 and at TAS 113.8 million in 2001.

Total budget requirement during the planning period including the reservation for the necessary renewal is TAS 2,370 million.

The present level of financing -TAS 69 million per annum - is not sufficient. TAS 107 million is required in 1986 and TAS 178 million in 2001 at 1985 cost level. To cover the difference, extension and improvement in collecting the water charges is proposed. In general, the financial responsibility shall be shifted more from the Central Government to the District Councils and to the consumers themselves.

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GENERAL BACKGROUND INFORMATION

The Project area comprises the Mtwara and Lindi Regions, which are situated in the south-eastern corner of Tanzanian mainland. The longitude of the area varies between 37 and 40 degrees east and latitude between 8 and 11 degrees south. The area has two natural boundaries, the Indian Ocean in the east and the Ruvuma River in the south against Mozambique. The border against Ruvuma Region in the west is formed by the Lumesule River, while rivers Mbarangandu and Rufiji, flowing through the vast areas of Selous Game Reserve, separate this area from Morogoro Region in the west and north-west. In the north the boundary against Coast Region cuts through the Selous towards the coast which it meets in Mohoro Bay in the Rufiji Delta.

The location of the project area is illustrated in the Figures 1 and 2 and in Drawing 1, 1:750,000. (Volume 3).

FIGURE 1 TANZANIA

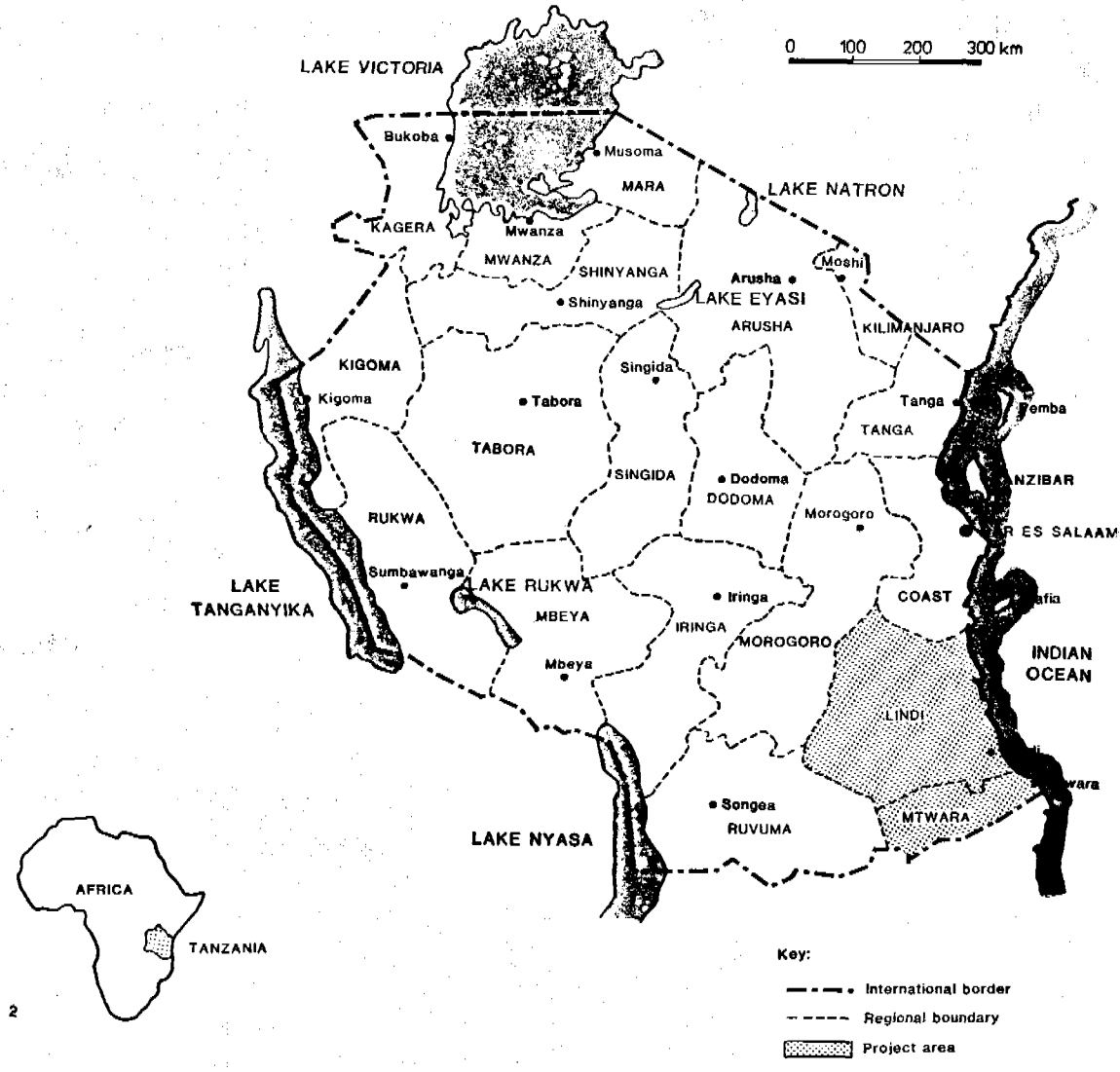

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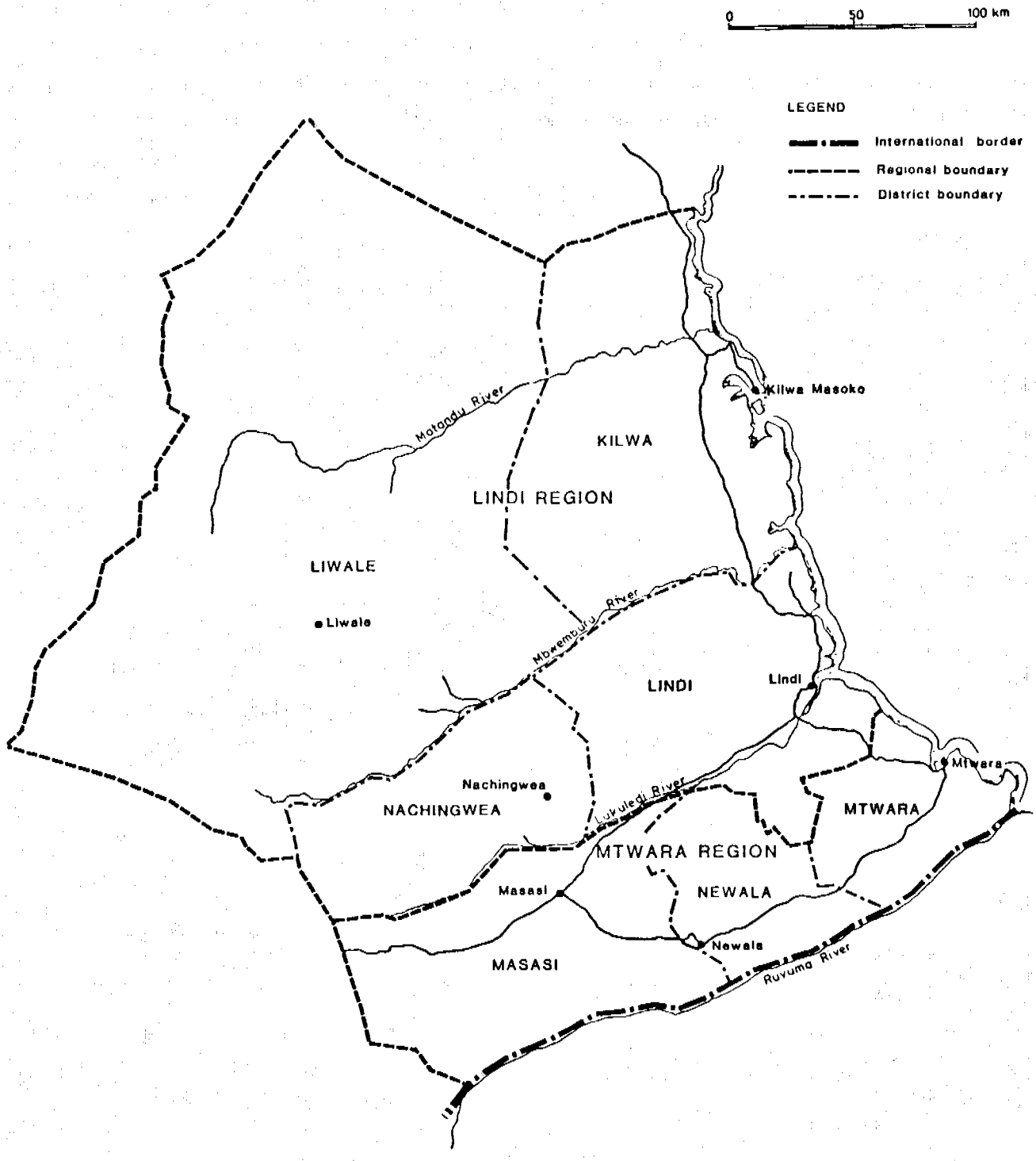
FIGURE 2 MTWARA AND LINDI REGIONS



The total area of the two regions is 82,753 km^2, Mtwara Region covering 16,707 km^2 and Lindi Region 66,046 km^2. Less than one per cent of the total area is covered by water. The area of small lakes in the regions is insignificant. The only major water area is that of the Ruvuma River, the Tanzanian side of which covers some 150 km^2 in Mtwara Region.

The topography of the south-eastern parts of Tanzania is mostly low and slightly undulating. The dominant features are two plateau areas, the Makonde and Rondo plateaus, as well as some river valleys, i.e. those of the Ruvuma, the Lukuledi, the Mbwemkuru and the Matandu. The Makonde Plateau which slopes gradually towards the coast has an altitude of 600 to 900 metres above sea level. It separates the coastal area from the lower basement area west and south of Masasi town. In the north, across the Lukuledi Valley, lies the smaller Rondo Plateau which reaches a maximum elevation of 900 metres, the medium altitude of the plateau being around 600 metres.

Except for the plateau areas, the terrain rises gradually towards the hinterland, a major part of the area lying at an altitude of less than 500 metres. The largest river valley in the project area is the Ruvuma Valley which descends gently towards the Indian Ocean from the Mtwara-Ruvuma regional boundary to the sea, the slope being some 250 metres within a distance of 300 kilometres.

The area has a two season climate: a hot and humid rainy season from November/December to April/May and a cooler less humid dry season from June to October. The pattern of rainfall is single peaked with an April maximum although with often less rain in February than either January or March. Mean annual rainfall ranges from 800 mm to 1,200 mm. Variability is great, however, with extreme totals of 200 mm and 2,000 mm having been recorded at several locations. Air temperatures are slightly higher along the coast than inland with monthly averages ranging from 27° at the Kilwa coast in March to 22° in Nachingwea in July. Relative humidity is also highest in the coastal areas averaging 87 per cent at Lindi town during March to April.

Three geological zones can be identified: a coastal sedimentary zone, a central zone of Precambrian Basement Rocks and a sedimentary zone in the western side of the project area. Landform is closely related to geology.

The outstanding feature of the vegetation is its complexity, particularly in coastal areas. A long history of disturbance by man has resulted in different stages and forms of secondary growth. In the coastal sedimentary zone, thicket development is often a result of bush clearing for cultivation and subsequent fallowing, while isolated forest remnants reflect the original vegetation. On the central plain the vegetation is less disturbed consisting of woodland/bushland on higher ground with grassland in the drainage lines.

The present (1984) total population of the project area is estimated at 1,463,000, the population of Mtwara Region being 868,300 and that of Lindi Region 594,700. The average population density is 52 persons/km^2 in Mtwara Region and 9 persons/km^2 in Lindi Region. The eastern and southern parts of the area are quite densely populated, while the population is very sparse in the north-western parts of the area, especially in Liwale District. The major population centres in the area are Mtwara-Mikindani, Lindi, Newala, Masasi, Kilwa Masoko, Kilwa Kivinje and Nachingwea. Nearly 90 per cent of the population live in the rural area.

The economy of the area is based on agriculture, the principal products being sorgum, cassava, maize, rise, cashewnuts and coconuts. According to the Bureau of Statistics the annual per capita GDP was TAS 1,970 in Mtwara Region and TAS 1,580 in Lindi Region in 1984. These are among the lowest regional GDPs in the country. The national average in 1984 was TAS 3,930 per capita.

The towns Mtwara and Lindi are the administrative centres of their respective regions. Mtwara Region comprises Mtwara, Newala and Masasi districts. Their district administrative centres are the population centres of the same name. Mtwara-Mikindani town has an independent town council. Lindi Region, at present, consists of four districts, i.e. Lindi, Kilwa, Nachingwea and Liwale. Lindi town has its town council. Liwale District was separated from Nachingwea District in 1975. The corresponding administrative centres are Lindi, Kilwa Masoko, Nachingwea and Liwale. The districts are further divided into divisions and the divisions into wards. There are 21 divisions in Mtwara Region and 28 in Lindi Region.

5
WATER MASTER PLAN 1977

As a part of the Technical Co-operation between the Governments of Tanzania and Finland, an agreenment was reached in 1973 on a Water Resources Inventory and Development Plan for Mtwara and Lindi Regions. Finnwater Consulting Engineers were appointed to carry out the work, which started in the same year and was completed in March, 1977.

The work was determined to consist of:

a) an inventory and development of the water resources in Mtwara and Lindi regions, consisting of
   - an inventory of groundwater resources
   - an inventory of surface water resources
   - development of water resources

b) a survey of necessary improvements of current water supplies

c) a phased rural water supply development plan for the regions, with time schedule and a financial plan for each phase, summarizing the results of the study

d) acting as an agent of the Client in purchasing equipment and supplies needed for the services.

In the water resources inventory, the surface water and the groundwater potentials of the area were investigated. Groundwater was found to be a feasible source for most water supply development. Surface water resources were found quite limited and unevenly distributed.

The service levels of the existing water supply systems were found unsatisfactory particularly in the rural areas. Therefore, in the preparation of the water supply development plan, special emphasis was put on supplying water for rural villages and cattle in rural areas.

In the Water Master Plan (1977) the long-term objective was sufficient, wholesome water within reasonable distance for everybody by the year 1991. As a planning guide this objetive was interpreted as requiring that everybody was to have a public service point within a distance of 500 metres, yielding 30 litres per person per day (different from the present MAJI guidelines). The service points were either public taps or public wells equipped with handpumps.

The medium-term objective in WMP-77 was for every village to have a reliable water source by the year 1981. This medium-term objective was also called a crash programme. The emphasis during the crash programme was laid on the construction of water sources; the extension and improvement of the distribution system was to come later.

The construction programme, included in WMP-77, was scheduled to be carried out during the next three five year periods and to be completed by the year 1991.

The proposed programme in Mtwara Region consisted of the construction of 69 piped water supply systems and around 1,170 wells with handpumps. Most of these wells were included in the crash programme. Some of the piped systems were to be constructed in two or more phases. Wells with handpumps were estimated to serve a population of 130,000 people in 1995. The Makonde Water Supply system in Newala District was designed to serve a population of 550,000 people in 1995. The average capacity of the rest of the piped systems was 8,000 consumers. The average construction cost of wells with handpumps was estimated at 75 shillings/capita. The construction cost of the Makonde Water Supply was estimated at 180 shillings/capita at 1977 cost level, and the average cost of the other piped systems in the Mtwara Region at 140 shillings/capita.

The construction costs of the implementation project in Mtwara Region were 163 million shillings. The operation and maintenance costs were estimated at 13 million shillings in 1991, of which approx 8 million shillings were fuel expenses. Carrying out the programme and maintaining and operating the new and existing systems was estimated to require an average annual budget of 16 million shillings during the third five year period in 1976...1981 with an annual growth rate of 6 per cent.

The proposed programme in Lindi Region provided for the construction of 149 piped water supply systems and about 600 wells with handpumps. Most of these wells were included in the crash programme. Some of the piped systems were to be constructed in two or more phases. The average capacity of the piped systems was 5,400 consumers. Wells with handpumps were estimated to serve a population of 60,000 people in 1995. The average cost of the wells with hand-pumps was estimated at 75 shillings/capita. The cost of the piped water supply systems was reckoned to be 110 shillings/capita on the average.

The construction costs of the implementation project in Lindi Region were 76 million shillings up to the year 1991. The operation and maintenance costs were estimated at 6.5 million shillings in 1991, of which 1.3 million fuel expenses. In order to carry out the programme and operating and maintaining the new and existing systems, it was estimated that the annual budget during the third five year period should be 10 million shillings on the average and the annual growth rate of the budget should be 4.6 per cent.

The final report, Mtwara-Lindi Water Master Plan (WMP-77), consists of the Main Report and Annexes from A to L as follows:

Annex A	Hydrology
Annex B	Hydrological Data
Annex C	Groundwater Resources Inventory, Mtwara Region
Annex D	Groundwater Resources Inventory, Lindi Region
Annex E	General Hydrogeology
Annex F	Geophysical Investigations
Annex G	Administration, Population and Infrastructure, Mtwara Region
Annex H	Administration, Population and Infrastructure, Lindi Region
Annex I	Water Supply Studies, Mtwara Region
Annex J	Water Supply Studies, Lindi Region
Annex K	Water Development Programme, Mtwara Region
Annex L	Water Development Programme, Lindi Region

6
WATER SUPPLY SITUATION IN 1975

During the preparation of Water Master Plan the water supply situation in the area was investigated. The results are shown in Tables 1 and 2.

TABLE 1 **Population Using Different Types of Water Sources in Mtwara Region in 1975**

Source	Masasi		Mtwara		Newala		Region	
	People	%	People	%	People	%	People	%
Piped supply	52,000	20	53,000	34	223,000	71	328,000	45
Pit	96,000	37	50,000	32	13,000	4	159,000	22
River or stream	66,000	25	4,000	3	22,000	7	92,000	13
Spring	24,000	9	10,000	6	28,000	9	62,000	9
Dam	4,000	2	11,000	7	17,000	6	32,000	4
Pond	-	-	10,000	6	-	-	10,000	1
Well	3,000	1	18,000	11	-	-	21,000	3
Borehole	-	-	1,000	1	-	-	1,000	0.1
Not known	17,000	6	-	-	10,000	3	27,000	4
Total	**262,000**	**100**	**157,000**	**100**	**313,000**	**100**	**732,000**	**100**

TABLE 2 **Population Using Different Types of Water Sources in Lindi Region in 1975**

Source	Kilwa		Lindi		Liwale		Nachingwea		Region	
	People	%	People	%	People	%	People	%	People	%
Piped supply	19,000	18	55,000	21	12,000	28	44,000	50	130,000	26
Pit	57,000	53	100,000	37	5,000	12	18,000	20	180,000	35
River	15,000	14	34,000	12	19,000	45	3,000	3	71,000	14
Spring	9,000	8	7,000	3	500	1		-	16,500	3
Dam or pond			15,000	6	4,000	9	12,000	14	64,000	13
Well	5,000	5	43,000	16		-	6,000	7	6,000	1
Not known	2,000	2	13,000	5	4,000	9		-	19,000	4
Total	**107,000**	**100**	**267,000**	**100**	**43,000**	**100**	**88,000**	**100**	**506,000**	**100**

The number of piped water supply schemes was 21 in Mtwara Region and 34 in Lindi Region at the end of 1975.

It should be noted that the above tables give figures of population within the service areas of the piped schemes. Depending on the condition of the systems and on the availability of fuel and spare parts, the number of people actually served may have been considerably less than indicated above. In Newala District, the high percentage of population being served by piped water supplies is due to the situation in the Makonde Plateau. The Mkunya-Makote W/S has practically been the only source of water there, and people have been assumed served by it even if walking distances of more than 10 km to the nearest tap were not uncommon.

The average distance to a water source in Mtwara Region was 1.9 km and in Lindi Region 1.6 km in 1975.

Water quality was found bacteorologically satisfactory in most borehole sources and piped schemes, doubtful in most wells and polluted in all traditional sources. Salinity was too high in several boreholes and in some wells. Also manganese exceeded the acceptable level in several water sources of different types.

7
WATER SUPPLY DEVELOPMENT 1976-1984

7.1 Construction of Water Supplies

The Ministry of Water and Energy through its Regional Offices is responsible for implementing the water supply development in the regions. Financing is channeled through the Regional Development Director with the approval of the Regional Development Committee. For the larger projects; so called "National Projects"; financing comes directly from the Ministry.

The water supply schemes implemented during 1976-84 and the population of the service areas are summarized in Table 3.

TABLE 3 **Implementation of Water Supplies in 1976-1984**

	Mtwara		Lindi		Total	
	No.	Population	No.	Population	No.	Population
New piped schemes	24	251,000	59	154,900	83	405,900
Extensions of piped schemes	1	19,700	3	69,500	4	89,200
Rehabilitations of piped schemes	2	29,700	0	0	2	29,700
Handpump wells	980	245,000	880	220,000	1,860	465,000
Dams	3	4,200	0	0	3	4,200

NB. Different types of schemes, e.g. piped schemes and handpumps may be serving the same population.

Although the overall responsibility of the development has lain with the MAJI, support has come from several aid programmes:

- FINNIDA. Mtwara-Lindi Rural Water Supply Project
- UNICEF. Rural Water Projects in Mtwara Region
- UK. Commodity Aid for Kitangari W/S
- African Development Bank. Loan for Lindi Town W/S
- EEC. Mtwara Town W/S Development. Loan
- The Christian Council of Tanzania (CCT). Rural Water Projects

Contributions towards the water supply development in Mtwara and Lindi Regions during the period 1976-84:

Government of Tanzania (incl. CCT)		78.1 mill TAS
FINNIDA		125.3 "
ODA (UK)		25.8 "
UNICEF		20.4 "
AfDB (Loan)		15.4 "
EEC (Loan)		5.0 "
	Total	270.0 mill TAS

7.2 Mtwara-Lindi Rural Water Supply Project

After the completion of the Water Master Plan, the Government of Finland agreed to finance part of the rural water supply development proposed in the plan. The first contract on the Project was signed between the Ministry for Foreign Affairs of Finland, the Ministry of Water and Energy of Tanzania and Finnwater Consulting Engineers in 1977. The United Kingdom and UNICEF have separate agreements with Tanzania through which they supply materials and equipment to the Project.

The Project has continued in three phases up to the end of 1984 and will continue with phase IV in 1985-87.

The main objective of the Project has been "to improve the water supply situation in the rural areas of Mtwara and Lindi Regions in order to achieve an improvement in the general health of the population and to create higher potential for economic development".

The main assignments of the Project have been:

(a) Hydrogeological and geophysical investigations.

(b) Engineering designs of handpump wells and piped water supply schemes.

(c) Construction of handpump wells and piped water supply schemes.

(d) Establishment of a handpump maintenance system.

(e) Establishment of a waterworks operation and maintenance (O & M) system.

(f) Training of national staff in (a) to (e) above.

(g) Revision of the 1977 Mtwara-Lindi Water Master Plan.

(h) Preparation of a feasibility study for water supplies to Nachingwea and Masasi towns and to the northern part of the Makonde Plateau.

Project activities have consisted of the construction of handpump wells and piped water supply schemes together with related groundwater investigations and the engineering designs of wells and water supply systems. In addition to the actual construction of water supplies, the Project has carried out in-service-training of well caretakers and pumping station (plant) attendants. The Project has also carried out extensive training of skilled labour in a wide range of water supply related activities.

The water supply systems constructed during the Project by the end of 1984 include 1,800 handpump wells designed to serve about 425,000 people and fourteen piped water supply schemes designed for 367,000 people. The combined construction targets of the three phases were 1,950 wells and twelve piped schemes. Compared with the original Water Master Plan (Chapter 5) the emphasis has shifted from piped schemes towards the handpump wells.

The Consultants have been responsible for all operations of the Project including investigations, engineering designs, supervision of construction work, purchasing of materials and equipment, training, etc.

8
PRESENT SITUATION

8.1 Investigations

To obtain a true picture on the present water supply situation in the area, following investigations were carried out:

1. Village Survey
2. Piped Water Supply Investigation

The results of these investigations have been compared with the available data on the coverage by piped schemes and handpump wells.

The village survey covered about 1100 villages - practically all of the 900 main villages plus approx 200 sub-villages. During the survey, village officials and villagers were interviewed. Questions were asked concerning the location of a village, its population, livestock, present water situation, future water supply, health, sanitation, village economy and villingness to participate in a water supply development project. Water supply systems used by the villages were visited by the survey teams.

The detailed results of the village survey are presented in Volume 2.

During the piped water supply investigation, all piped schemes in the area were visited by a senior water supply technician. Together with the local MAJI technician he inspected and evaluated the scheme and assessed the need and usefulness of a rehabilitation.

The detailed results of the piped water supply investigation are presented in Volume 2.

8.2 Water Supply Situation in 1984

There are 1,463,000 people in the area at present (1984).

Improved water supplies, 143 piped water schemes and 1,800 handpump wells, have been constructed for about 1,170,000 people (80 %). The performance of these systems is often poor, however, and improved water supply is therefore not always the main source of water. This is demonstrated by the village survey (Table 4).

TABLE 4 Principal Sources of Water

Type of W/S	Users	
1. Piped W/S	550,000	38 %
2. Handpump well	380,000	26 %
3. Open well of pit	360,000	25 %
4. River	80,000	5 %
5. Dam	15,000	1 %
6. Undeveloped spring	80,000	5 %
7. Rainwater	-	0 %

It can be seen that 240,000 people within improved water supplies use some undeveloped source as their principal source of water. In all, more than one third (36 %) of the population rely on traditional sources for principal water supply.

The operational performance of the piped schemes, as found during the piped W/S investigation, is presented in Table 5.

TABLE 5 **Operation of Piped Water Schemes**

	Mtwara Region nos popul. %	Lindi Region nos popul. %	Total Area nos popul. %
1. Schemes operating > 50 % of time	15 316,600 59	14 123,200 39	29 439,900 52
2. Schemes operating < 50 % of time but operational	14 78,800 15	29 73,200 23	43 152,000 18
3. Non-operational Schemes	23 138,600 26	48 121,400 38	71 260,000 30
Total Schemes	52 534,000	91 317,800	143 851,800

It can be seen that only half of the population covered by the piped water schemes are getting water regularily. There are many reasons for the unsatisfactory operation of the water supplies the most important being shortage of fuel and spare parts. The number of staff within the MAJI responsible for the development and operation of water supplies is close to adequate but there is a severe shortage of skilled and experienced individuals especially in the operation of the water supplies.

The performance of hand pump wells has been reasonable so far. It is estimated that under the present maintenance system 90 % of the pumps are functioning . The availability of water in the wells varies according to the season. While practically all the wells have water during and after the rainy season, a considerable number of them have insufficient yield or dry up completely during the dry season. In the 1983 dry season, 62 % of wells were sufficient, 17 % insufficient and 21 % dry. The rainfall during the 1982 - 83 rainy season was near average.

As can be seen, there is a considerable difference between the number of people within the service areas of the improved water systems and the number of people actually beeing served by them. During the village survey, the service levels of the water supplies were studied and the overall situation is as follows:

1.	No improved W/S constructed:	290,000	20 %
2.	Improved W/S constructed, but no real service given:	280,000	19 %
3.	Improved W/S constructed and water is obtained through it, but the quantity of water, its quality or hauling distance does not meet to standards:	500,000	34 %
4.	Service of W/S according to standards:	395,000	27 %

8.3 Comparison between 1975 and 1984

Considerable development in the water supply sector has taken place between 1975 (Chapter 6)and 1984. The number of people within improved water supplies (piped W/S or handpumps) has risen from 460,000 (37 %) to 1,170,000 (80 %). The number of piped water supplies has increased from 55 to 143 and their coverage from 458,000 to 852,000 people. After 1975, handpump wells have been introduced in the area and a total of 1,800 of them have been constructed up to 1984 serving approx 450,000 people, partly overlapping with the piped schemes.

The actual service provided by the improved water supplies is rather poor. Although the operational status of the piped schemes was not investigated in detail in 1975, there are clear indications that the condition of the piped schemes has delayed considerably between 1975 and 1984. The number of people getting reasonable service from improved water supplies has therefore not increased at the same rate as the theoretical coverage.

8.4 Water Supply Management

8.41 Organization

The executive responsibility for the water supply development and operation lies with MAJI.

The MAJI organization is divided into the following levels:

1. The MAJI Head Office in the Ministry of Water, Lands, Housing and Urban Development, Dar es Salaam
2. Regional MAJI Office
3. District MAJI Office

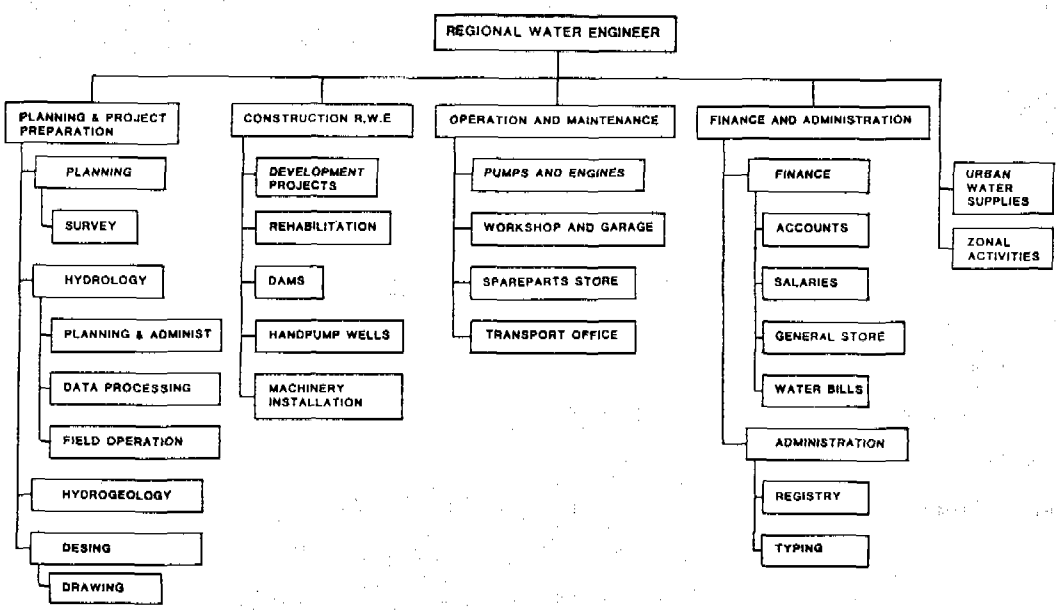
The Ministry and the Head Office are responsible for the overall planning and implementation of the water development in the country.

The Regional MAJI Office (Regional Water Development Divisions) is the executing agency in the water sector of the region. The office uses development funds coming through the regional budgets, supervises the District MAJI Offices, operates directly the urban water supplies and collects basic data on the water supply situation, hydrology, hydrogeology and meteorology. The head of the office is the Regional Water Engineer who advises the Regional Development Director in matters concerning questions of water supply. The Regional Water Engineer participates in drawing up the annual and 5 years plans for the region (and for the individual districts) within the water sector. He also prepares the budget proposals for the Regional Development Committee within the water sector.

- The Regional Water Engineer acts as a coordinator between the Ministry and the region in technical matters. He is subordinate to both the Ministry Headquarters and the RDD.

The organization chart of the Regional Water Development Division is presented in Figure 3.

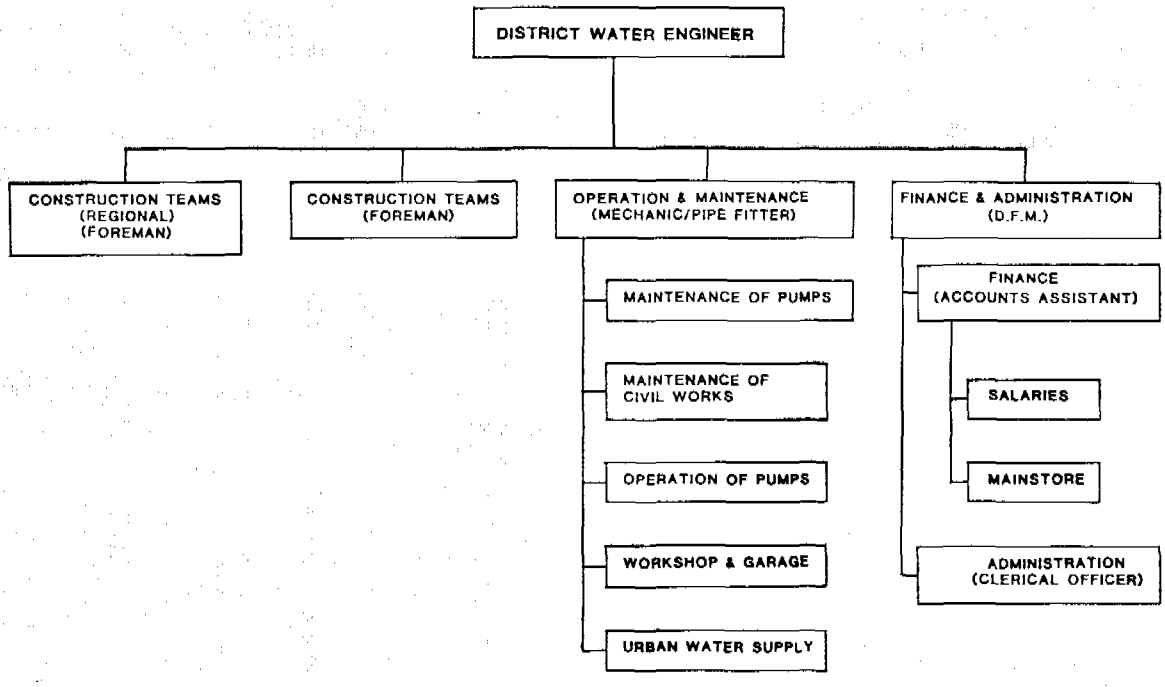
FIGURE 3 MAJI Regional Office



The District MAJI Office is the principal responsible for the operation of water supplies. In some cases, minor water projects have been constructed by the District Office. The office is managed by the District Water Engineer who is an expert member of to the District Council in the questions on water. He is directly responsible to the RWE (technical matters) and the District Executive Director (administration).

The organization chart for District MAJI Offices is presented in Figure 4.

FIGURE 4 MAJI District Office



8.42 Staff

The total number of permanent staff (both regional and district offices) in the water sector is presented in Tables 6 and 7.

TABLE 6 MAJI Staff, Mtwara Region

	Regional Office	Masasi Distr.	Mtwara Distr.	Newala Distr.	Total
Engineers, Hydrologists and Hydrogeologists	6	-	-	-	6
Technicians	25	8	1	4	38
Assist. Technicians	21	-	1	8	30
Other Techn. Staff	58	30	11	29	128
Office Staff	9	9	-	3	21
Watchmen	5	5	-	4	14
Plant Operators	-	-	-	-	-
Skilled Labourers	-	8	3	-	11
Total	**124**	**60**	**16**	**48**	**248**

TABLE 7 MAJI Staff, Lindi Region

	Regional Office	Kilwa Distr.	Lindi Distr.	Liwale Distr.	Nachingwea Distr.	Total
Engineers, Hydrologists and Hydrogeologists	7	-	-	-	-	7
Technicians	30	2	3	1	3	39
Assist. Technicians	13	2	7	2	1	25
Other Technical Staff	54	22	26	20	23	145
Office Staff	7	5	9	-	3	24
Watchmen	7	-	4	-	1	12
Plant Operators	10	3	22	2	29	66
Skilled Labourers	-	1	-	-	-	1
Total	**128**	**35**	**71**	**25**	**60**	**319**

In some rural piped water schemes the operating personnel are not employed by MAJI but are provided by the villages themselves. Such personnel receive only a minor allowance from MAJI.

The construction teams employ casual labourers at the site.

8.43 Facilities and Equipment

The present MAJI facilities - offices, workshops, stores, yards, etc. - are generally sufficient after the completion of the Liwale District MAJI Office, although some offices need repair or extension in near future.

The total number of vehicles in both regions is presented in Table 8.

TABLE 8 Vehicles

Type	Mtwara		Lindi		Total		
					Work-ing	Unserviceable	
	Work-ing	Unservice-able	Work-ing	Unservice-able		Repair-able	To be boarded
Car, 2WD	1	-	-	-	1	-	-
Car, 4WD	10	15	4	14	14	10	19
Lorry	4	25	7	12	11	20	16
Tanker	-	-	-	-	-	-	-

Other equipment such as workshop machinery and tools and surveying instruments, are available but, especially in the District, not sufficient.

8.5 Financing

MAJI activities are financed from the following sources:

- government funds through the national budget,
- government funds through regional budgets,
- government funds through district budgets,
- foreign donor funds through the national budget,
- foreign donor funds through regional budgets,
- foreign and local funds through non-government organizations.

Funds are divided into two main categories:

- development funds for constructing new facilities or for rehabilitating old ones,
- recurrent funds for operation and maintenance of MAJI organization and the water supplies.

Most of the development funds come from the Central Government via regional/national budgets. The Regional Development Committee allocates funds to the different project although final decisions are made in the Prime Minister's Office and finally approved in Parliament. Expenditures are authorized by Regional Water Engineers. The Regional Development Director supervises the use of funds.

The recurrent funds to the MAJI regional offices come from government funds via regional budgets. The operations of the district MAJI offices, including the O & M of the water supplies is financed through district budgets which draw funds collected as development levies. Part of a district's budget, including the water sector, however, is financed from government funds. Salaries are paid in total from the funds from the Central Government.

The development and recurrent funds used in water supply sector are shown in Table 9.

TABLE 9 **Water Supply Sector Financing**

	Development Funds TAS, mill.			Recurrent Funds TAS, mill.		
	1982-83	1983-84	1984-85	1982-83	1983-84	1984-85
Mtwara Region	20.6	24.4	24.7	21.0	22.1	27.4
Lindi Region	26.7	22.0	26.2	11.7	12.9	14.4
Total	**47.3**	**46.4**	**50.9**	**32.7**	**35.0**	**41.8**

The trend in real terms of money seems to be slightly decreasing in both development and recurrent funds.

Progress made in the construction of new water supplies demonstrates that the development funds have been satisfactory although the target of providing a water supply for everybody by 1991 cannot be accomplished at the present level of funding. On the operating side, however, funds are not sufficient especially in view of the increasing number of water supplies in operation every year.

8.6 Problems

Problems in the water supply sector are many and the situation has not improved since 1976. The underlying reason is the continuing poor economical situation of the country. It limits the available funds and causes shortage of fuel, spares, equipment and material. It has a large negative effect on personnel management as well.

The staff of situation MAJI at all levels is unsatisfactory. Especially senior staff posts are too few and a number of them are vacant. The worst problem is still that the full potential of the staff is not taken advantage of as a result of shortage of transport facilities, insufficient operating funds and lack of supervision. The motivation of the staff, furthermore, is undermined by this impossibility to perform to their fullest measure.

9
WATER RESOURCES REVIEW

9.1 Surface Water

The surface water resources in the area depend largely on the precipitation, its yearly distribution and evaporation conditions.

The mean annual precipitation of the area is relatively even varying from 1,200 mm to 800 mm. Annual variations, on the contrary are rather large. Precipitation may rise up to 2,000 mm or remain at 500 mm once in twenty years on the average. Variations between individual stations are even greater. The highest single annual precipitation reading registered in the area is over 2,700 mm in a year and the lowest below 200 mm.

The rainy season normally lasts from mid November to the beginning of May. Maximum precipitation takes place between January and April. The second half of the year is normally practically dry.

Mean annual evaporation from an open water surface varies from 2,200 mm at the Coast to 2,000 mm in the western part of the area.

There are five main rivers running in to the Indian Ocean in the project area: The Matandu, the Mavuji, the Mbwemkuru, the Lukuledi and the Ruvuma. In spite of the large catchment basins the minimum flows are very small. The Matandu and the Mbwemkuru dry up completely in dry seasons.

There are five rather small lakes in the area which carry water all year round, i.e. Lake Chidya, Lake Kitere, Lake Rutamba, Lake Mkoe and Lake Maliwe. The lake areas vary depending on the season. The total lake area is estimated to be only 18 km^2.

The present hydrometric network in Mtwara and Lindi Regions consists of 12 stations. At only 5 of them more or less continuous recordings are available. Since rating curve measurements are too few as well, little useful data is on hand.

The estimated potential surface water resources of the different river basins are presented in Table 10. The run-off values are based on the results of the earlier report adjusted by using the recent data. The figures represent the minimum run-offs occurring once in five to ten years.

TABLE 10 **Surface Water Resources**

River Basin	Catchment Area assessed km^2	Annual Net Runoff	
		mm	10^3 m^3/day
Matandu	11,700	3.7	119.3
Mavuji	2,900	3.3	26.0
Mbwemkuru	11,600	7.6	240.0
Lukuledi	4,200	3.0	34.5
Lindi Region Total	**30,200**	**5.1**	**419.8**
Mwiti	900	2.8	6.8
Miesi	520	2.8	6.8
Mbangala	3,200	9.9	87.1
Lukwimba	370	12.0	12.2
Lumesule	1,880	12.8	65.5
Mtwara Region Total	**6,870**	**9.8**	**177.4**
Ruvuma River			2,500.0

The above amount of surface water resources are available only with extensive conservation (dams) to store water over the dry season.

The present source of water supplies in Mtwara and Lindi Regions is nearly entirely groundwater and the same trend seems to continue in future. Therefore the importance of surface water is limited from the water supply point of view. In some areas, however, the use of surface water may become important. Big towns such as Mtwara, Lindi, Masasi, Liwale and Kilwa-Masoko with developing industries are probably going to use surface water sometime in the future. Water conservation is required in most cases.

In areas where the number of livestock is large, e.g. in Masasi, surface water can be utilized by constructing small dams to supply low quality water for cattle.

In areas where ground or surface water is not availabe, such as the Makonde Plateau, Rondo Plateau and along the coast, rainwater collection can be used as an addition or alternative to other types of water supplies.

A more detailed surface water resources assessment is presented in Volume 2.

9.2 Groundwater

The general groundwater potential in the area varies according to different geological formations:

1. Coast: Tertiary - Quaternary bed in the coastal area. Composed of fairly permeable sand and laterite layers, which generally form good groundwater infiltration areas and reasonably good aquifers.

2. Plateau: Mesozoic beds between coastal strip and Basement consisting of silty clays, silts, sands and sandstones, forming good infiltration areas and good aquifers, but with an often very deep groundwater table.

3. Basement: Crystalline basement rock. Hard bedrock covered with relatively thin latrinic soil material. Groundwater occurance generally poor the best aquifers being found in faults and in the porous weathered mantle covering the fresh rock.

4. Karroo: Sandstones, other main rock types being limestone, mudstone, claystone and conglomerate. Groundwater potential, both shallow and deep, is assumed to be generally good.

Shallow groundwater, used by ring wells, hand-auger wells and shallow boreholes, is found in Coastal Plateau and river sediments in all geological zones.

Shallow groundwater is often in perched water form. This causes large fluctuations in the water table and contributes to the relatively big number of seasonally insufficient or dry wells.

The general shallow groundwater potential in the area is illustrated in Figure 5.

Up to the end of 1984, the number of shallow wells constructed in the area was 1,187. Approx 20 % of these wells dry up during the dry season.

The quality of shallow groundwater is generally good.

Deep groundwater, utilized by deep boreholes, is found by means of specific groundwater surveys. The potential for deep groundwater is generally good in an are where groundwater potential is high, although expeptionally good boreholes have been drilled in parts of the Plateau where the groundwater table is too deep for shallow wells. In the Basement, high yielding boreholes have been drilled though high salinity of water has often prevented their utilization.

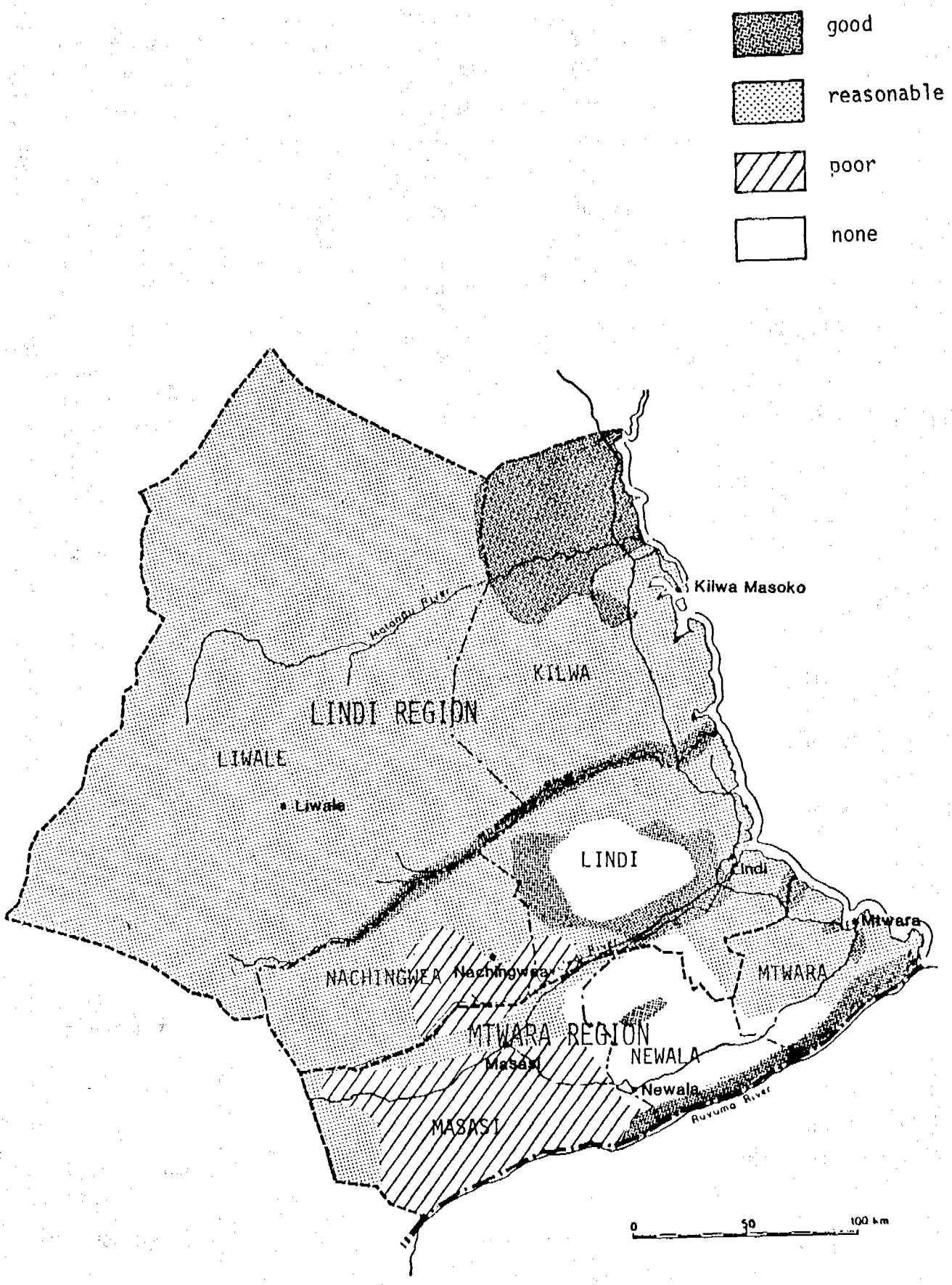
After 1976 altogether 115 boreholes have been drilled. 47 have been equipped with motorized pumps and 17 with hand pumps. The yields of the boreholes have been as follows:

Yield	0 - 50 m^3d	18 %
	50 - 100 m^3/d	11 %
	100 - 200 m^3/d	24 %
	200 - 400 m^3/d	27 %
	400 - 800 m^3/d	7 %
	> - 800 m^3/d	13 %

In general, groundwater has been, and is obviously going to be, the most important source of water for human consumption in the Mtwara-Lindi area.

The detailed groundwater resources assessment is presented in Volume 2.

FIGURE 5 **Shallow Groundwater Potential**



10
WATER DEMAND

10.1 Population

The last general population census was taken in 1978 and the earlier ones in 1967, 1957 and 1948. Their results are summarized in Tables 11 - 13.

TABLE 11 Population 1967-1978

	Population 1967	1978	Growth rate
Mtwara Region	621,293	771,818	2.0 %
Lindi Region	419,853	527,624	2.1 %
Tanzania Total	12,313,469	17,512,610	3.2 %

TABLE 12 Population 1948-1978; Mtwara Region

	Popul. 1948	Growth rate 48-57	Popul. 1957	Growth rate 57-67	Popul. 1967	Growth rate 67-78	Popul. 1978
Mtwara Region	**261,496**	**5.5**	**424,213**	**3.9**	**621,293**	**2.0**	**771,818**
Rural population	247,096	5.8	408,947	3.9	594,866	1.2	679,463
Urban population	14,400	0.7	15,266	5.6	26,427	11.2	92,355
Masasi District	**122,624**	**2.3**	**150,864**	**3.9**	**213,683**	**2.2**	**271,909**
Rural	...		...		210,793	1.9	258,780
Urban	...		...		2,890	14.8	13,129
Mtwara District	**84,583**	**1.4**	**95,981**	**3.5**	**134,758**	**3.3**	**192,521**
Rural	70,183	1.6	80,715	3.5	114,345	2.1	144,033
Urban	14,400	0.7	15,266	2.9	20,413	8.2	48,491
Newala District	**154,289**	**1.6**	**177,368**	**4.4**	**272,852**	**1.1**	**307,395**
Rural	...		...		269,728	0.2	276,650
Urban	...		...		3,124	23.1	30,735

TABLE 13 Population 1948-1978; Lindi Region

	Popul. 1948	Growth rate 48-57	Popul. 1957	Growth rate 57-67	Popul. 1967	Growth rate 67-78	Popul. 1978
Lindi Region	**314,806**	**0.3**	**323,073**	**2.7**	**419,853**	**2.1**	**527,624**
Rural population	303,314	0.2	307,575	2.5	394,223	1.7	474,434
Urban Population	11,492	3.4	15,498	5.2	25,630	6.9	53,190
Kilwa District	**96,884**	**-1.0**	**88,682**	**1.0**	**97,957**	**1.4**	**113,872**
Rural	93,969	-1.1	85,192	0.6	90,881	1.2	104,140
Urban	2,915	2.0	3,400	7.3	7,076	6.6	9,732
Lindi District	**178,707**	**-0.0**	**178,174**	**3.1**	**241,414**	**1.1**	**272,295**
Rural	170,130	-0.1	167,859	3.1	228,062	0.7	244,983
Urban	8,577	2.1	10,315	2.6	13,352	6.7	27,312
Liwale District	- 1)		- 1)		**27,184**	**3.4**	**39,406**
Rural	-		-		25,733	2.0	32,146
Urban	-		-		1,451	15.8	7,260
Nachingwea District	**39,215**	**4.1**	**56,217**	**-0.5**	**53,298**	**6.1**	**102,051**
Rural	...		54,524	-1.0	49,547	5.9	93,165
Urban	...		1,693	8.3	3,751	8.2	8,086

1) included in Nachingwea

The population densities in the area vary very much but are still mostly relatively low (Table 14) compared to agricultural potential.

TABLE 14 **Population Densities**

Area	Area, km^2	Density pers/km^2
Mtwara Region	16,707	46
- Masasi	8,936	30
- Mtwara	3,756	51
- Newala	4,015	77
Lindi Region	66,046	8
- Kilwa	13,857	8
- Lindi	9,454	29
- Liwale	36,620	1
- Nachingwea	6,115	17
Tanzania Mainland		19

The growth of the population has been lower in the area than the Tanzanian average. This can be explained by the following statistics collected during the 1978 census:

	Mtwara R.	Lindi R.	Tanzania
Crude Birth rate/1,000	47	43	49
Crude Death rate/1,000	22.3	20.4	19.1
Infant mortality/1,000	161	151	137
Expectation of life at birth	40	42	44
The age group below 15 year	42 %	42 %	46 %

The migration is another factor influencing the growth. It both regions the balance during 1967-1978 was clearly negative, in Mtwara 19,000 and in Lindi 10,000 people. From Mtwara people have moved mainly to Lindi Region probably to Nachingwea and Liwale and secondarily to Dar es Salaam, whereas from Lindi people have moved mainly to Dar es Salaam and to the Coast.

Statistics on the present population are available at village, district and regional levels. Estimates on the growth after 1978 have been made by the Bureau of Statistics and by RIDEP. The information from the different sources is contradicting in several cases. The data obtained directly from the villages are considered unreliable by the authorities although opposite views could also be justified. Since the detailed survey has not been possible the following approach has been adopted:

- The basis for the estimates has been the 1978 census.
- During the period of 1978-84 the RIDEP projections have been followed on the regional and district levels, with two exceptions: in Nachingwea District the RIDEP growth rate for the rural population - 4.9 % - seems to be an overestimation and therefore the rate of 2.4 % given by the district authorities has been adopted. In Kilwa District the RIDEP growth rate is 2.0 % whereas the district authorities are proposing 3.2 %. As a compromise which is based mainly on the results of the village survey, the rate of 2.3 % has been used.
- During the period of 1984-2001 the Bureau of Statistics projections at the regional level have been followed. On the district level the growth rates used during 1978-84 have been adjusted to produce the designed regional figures. The expected rapid growth of Kilwa-Masoko town has been considered separately. This has increased the growth in Lindi Region from 2.0 % up to 2.2 %.
- The village populations have been estimated based on the projections from the 1978 census figures. Since sub-divisions and changes in names and locations have taken place, adjustments have been made according to the results of the village survey.

The growth rates 1967-78, those used in the projections by RIDEP and by the Bureau of Statistics and the rates used in this study are presented in Table 15.

TABLE 15 Growth Rates

	Growth Rates % per annum				
	1967-78	RIDEP 1978-86	B. of Stat 1978-2000	Used rates 1978-84	Used rates 1984-2001
Mtwara Region	2.0	1.2 -2.0	2.0	2.0	2.0
- rural	1.2			1.4	1.3
- urban	11.2			6.1	5.4
Masasi District	2.2			2.1	2.0
- rural	1.9	0.95-1.78		1.8	1.6
- urban	14.8	4.60-7.82		7.8	6.0
Mtwara Rural District					
	2.1	1.05-1.78		1.8	1.9
- rural	2.1	1.05-1.78		1.9	
- urban	-	-		-	-
Mtwara-Mikindani Town					
	8.2	4.10-6.97		5.3	
- rural				1.8	1.9
- urban				7.0	6.0
Newala District	1.1			1.1	1.2
- rural	0.2	0.45-0.76		0.7	0.7
- urban	23.1	2.45-4.16		4.2	4.0
Lindi Region	2.1	2.6	2.0	2.0	2.2
- rural	1.7				
- urban	6.9				
Kilwa District	1.4	2.0		2.3	2.4
- rural	1.2	1.5		2.0	1.8
- urban	6.6	6.5		5.2	6.1
Lindi Rural District	0.7	1.0		1.0	1.0
- rural	0.7			1.0	1.0
- urban	-			-	
Lindi Town	6.7	5.0		5.0	5.0
Liwale District	3.4	4.0		4.0	4.0
- rural	2.0	3.8		3.8	3.8
- urban	15.8	5.0		5.0	5.0
Nachingwea	6.1	5.0		2.4	2.4
- rural	5.9	4.9		2.1	2.1
- urban	8.2	7.0		7.0	5.0
Tanzania	3.2		3.3		
- rural	2.7				
- urban	12.1				

The estimated present (1984) and future population are presented in Tables 16 and 17.

TABLE 16 **Estimated Present and Future Population; Mtwara Region**

	1978	1984	1991	2001
Mtwara Region	771,818	868,300	998,000	1,248,100
- rural	679,463	736,800	807,600	923,300
- urban	92,355	131,500	190,400	324,800
Masasi District	271,909	307,400	351,100	430,600
- rural	258,780	287,700	321,500	377,600
- urban	13,129	19,700	29,600	53,000
Mtwara Rural District		142,100	162,100	195,900
- rural	144,033	142,100	162,100	195,900
- urban		-	-	-
Newala District	307,385	328,200	354,100	401,300
- rural	276,650	289,000	303,500	325,000
- urban	30,735	39,200	51,600	76,300
Mtwara-Mikindani Town		90,600	129,700	220,300
- rural		18,000	20,500	24,800
- urban	48,491	72,600	109,200	195,500

TABLE 17 **Estimated Present and Future Population; Lindi Region**

	1978	1984	1991	2001
Lindi Region	527,624	594,400	687,800	863,400
- rural	474,434	522,800	585,700	693,400
- urban	53,190	71,600	102,100	170,000
Kilwa District	113,872	130,500	152,900	196,100
- rural	104,140	117,300	132,900	159,900
- urban	9,732	13,200	20,000	36,200
Lindi Rural District	244,983	260,000	278,800	307,900
- rural		260,000	278,800	307,900
- urban		-	-	-
Lindi Town	27,312	36,600	51,500	83,900
Liwale District	39,406	49,900	65,800	98,000
- rural	32,146	40,200	52,200	75,800
- urban	7,260	9,700	13,600	22,200
Nachingwea	102,051	117,400	138,800	177,500
- rural	93,165	105,300	121,800	149,800
- urban	8,086	12,100	17,000	27,700

The projections used in WMP-77 were considerably higher as can be seen in Table 18.

TABLE 18 **Present and WMP-77 Population Projections**

	1984	1991	2001
Present Projection	1,462,700	1,685,800	2,111,500
WMP-77 Projection	1,599,000	1,963,000	2,503,000

10.2 Livestock

A livestock census was carried out in June 1984. Preliminary results are presented in Tables 19 and 20.

TABLE 19 **Livestock 1984, Mtwara Region**

	Cattle	Sheep	Goats	Pigs
Masasi	8,797	7,605	4,771	3,948
Mtwara	2,534	2,762	12,610	146
Newala	3,545	2,323	68,982	179
Mtwara Region	**13,874**	**12,690**	**86,372**	**4,279**
Annual Growth 1978-84	**4 %**	**12.5 %**	**5.5 %**	

TABLE 20 **Livestock 1984, Lindi Region**

	Cattle	Sheep	Goats	Pigs
Kilwa	464	1,263	2,251	73
Lindi	4,745	5,650	9,362	668
Liwale	257	20	441	9
Nachingwea	1,028	1,665	906	1,550
Lindi Region	**6,494**	**8,598**	**12,960**	**2,300**
Annual Growth 1978-84	**0 %**	**16 %**	**10 %**	**20 %**

As can be seen above, livestock development has been quite rapid although the total number is still generally low compared to the population. There are intensive livestock development programmes ongoing including the extensions of livestock multiplication centres, improvement of cattle dipping facilities and expansion of extension services. On the other hand there are still serious problems such as generally low grade of livestock, little good natural grazing for cattle and sheep, high incidence of diseases, insufficient veterinary services, etc. Thus the rate of future livestock development is uncertain.

The estimated growth rates of the different categories of livestock are presented in Table 21. The estimates are based on past growth, RIDEP estimates and on figures obtained from livestock officers.

TABLE 21 **Annual Livestock Growth Rates 1984-2001**

	Cattle	Small Stock
- Masasi	2.0 %	5.0 %
- Mtwara	4.0 %	5.0 %
- Newala	4.0 %	5.0 %
Mtwara Region	3.9 %	5.0 %
- Kilwa	1.0 %	1.0 %
- Lindi	5.0 %	1.0 %
- Liwale	5.0 %	5.0 %
- Nachingwea	5.0 %	5.0 %
Lindi Region	4.7 %	1.9 %

The estimated numbers of livestock in each district and region are presented in Tables 22 and 23.

TABLE 22 Livestock Estimates, Mtwara Region

	Cattle		Sheep		Goats		Pigs	
	1991	2001	1991	2001	1991	2001	1991	2001
Masasi	10,100	12,300	10,700	17,400	6,700	10,900	5,600	9,000
Mtwara	3,300	4,900	3,900	6,300	17,800	28,900	200	300
Newala	4,700	6,900	3,100	5,300	97,100	158,100	300	400
Mtwara Region	**18,100**	**24,100**	**17,700**	**29.00**	**121,600**	**197,900**	**6,100**	**9,700**

TABLE 23 Livestock Estimates, Lindi Region

	Cattle		Sheep		Goats		Pigs	
	1991	2001	1991	2001	1991	2001	1991	2001
Kilwa	500	600	1,400	1,500	2,400	2,700	100	100
Lindi	6,700	10,900	6,100	6,700	10,000	11,000	700	800
Liwale	400	600	100	100	600	1,000	-	-
Nachingwea	1,400	2,400	2,300	3,800	1,300	2,100	2,200	3,600
Lindi Region	**9,000**	**14,200**	**9,900**	**12,100**	**14,300**	**16,900**	**3,000**	**4,500**

Livestock water demand has been estimated village by village except for major cattle breeding centres and ranches, which have been considered separately in chapter 10.3 Institutions and Industries.

10.3 Institutions and Industries

There are relatively few large institutional or industrial consumers in these rural areas. They are listed in Tables 24 and 25.

TABLE 24 Rural Institutional and Industrial Consumers, Mtwara Region

Institution or Industry	Location	District	Water Demand m^3/d		
			1984	1991	2001
- District Livestock Multiplication Centre (L.M.C.)	Nangamaro	Masasi	30	60	100
- Namajani Prison farm	Namajani	"	10	20	30
- Ndanda Mission and Hospital	Ndanda	"	200	250	300
- Ndwika Teacher's College	Ndwika	"	15	20	25
- Chidya Sec. School	Chidya	"	30	40	50
- St. Elizabeth Leprosarium	Mwena	"	10	10	10
- Lulindi Health Centre (H.C.)	Lulindi	"	10	10	10
- Nanyumba H.C.	Nanyumba	"	10	10	10
- Lime Factory	Mahurunga	Mtwara	-	30	60
- Kitere L.M.C.	Kitere	"	50	50	50
- Kabisera Sisal Estate and Ranch	Mikindani	"	20	20	20
- Mbarawala L.M.C.	Mbawala	"	10	30	50
- Ndirungu Prison Farm	Ndirungu	"	5	10	15
- Nanguruwe H.C.	Nanguruwe	"	5	10	10
- Kitere H.C.	Kitere	"	5	10	10
- Nanyamba H.C.	Nanyamba	"	5	10	10
- Starch Factory	Kitangari	Newala	-	200	400
- Mahuta H.C.	Mahuta	"	5	10	10
- Kitangari H.C.	Kitangari	"	5	10	10
- Luagala H.C.	Luagala	"	5	10	10
- Namikupa H.C.	Namikupa	"	5	10	10
- Mnima L.M.C.	Mnima	"	5	10	20
- Tandahimba H.C	Tandahimba	"	5	10	15
- Namindondi Ranch	Namindondi	"	-	10	20
- Likolombe Ranch	Likolombe	"	-	10	20
- Chilangala Ranch	Chilangala	"	5	10	15

TABLE 25 Rural Institutional and Industrial Consumers, Lindi Region

Name	Location	District	Water Demand m^3/d		
			1984	1991	2001
- Pande H.C.	Pande	Kilwa	5	5	5
- Kipatimu Hospital	Kipatimu	"	15	20	20
- Mtanga Prison Farm	Mpara	"	5	10	15
- Jinjo H.C.	Jinjo	"	5	10	10
- Ngongo L.M.C.	Ngongo	Lindi	50	80	100
- Nyangamara H.C.	Nyangamara	"	5	10	15
- Mtama Sec. School	Mtama	"	-	10	20
- Mtama Cashew Factory	"	"	100	100	100
- Rural Training Centre	Ruo	"	5	10	15
- Soap & Oil Factory	Mnazimmoja	"	10	10	10
- Mingoyo Sawmill	Mingoyo	"	5	10	10
- Nyangao Hospital	Nyangao	"	20	25	30
- Rutamba H.C.	Rutamba	"	5	10	10
- Mkowe H.C.	Mkowe	"	5	10	10
- Mandawa H.C.	Mandawa	"	5	10	10
- Ruangwa H.C.	Ruangwa	"	5	10	15
- Kitomanga H.C.	Kitomanga	"	5	10	10
- Kikwetu Sisal Factory	Kikwetu	"	30	30	30
- Nyangao Training Centre	Nyangao	"	5	10	15
- Farm 1	Nambambo	Nachingwea	20	25	30
- Farm 4	"	"	20	25	30
- Mnero Hospital	Mnero	"	15	20	25
- Kilimarondo H.C.	Kilimarondo	"	5	10	10
- Namupa Sec. School	Namupa	"	15	20	20

10.4 Unit Water Demand

Water is needed by homes, livestock, institutions, commerce and idustry. In addition come waste and leakage. In most rural areas, water demand other than domestic and that of livestock is small and need not to be considered separately.

In rural areas, where all water is assumed to be drawn from public taps or communal water points, following requirements are applied:

-	domestic water demand	25 l/capita/day
-	livestock	25 l/livestock unit/day

One livestock unit (L.U.) equals to one cow or 5 sheep, goats or pigs. Grade cattle equals to 3 L.U.

The above rates also include consumption by institus and commerce. Where major institutional, industrial or other special users, such as hospitals, prisons and factories are located in the scheme area, their consumption is estimated separately.

When calculating the total water requirement at the source, a 20 % allowance for waste and leakage has to be added in the case of piped water supply schemes.

On special occasions where arranging a water supply is very difficult or expensive, a rate of 10 l/capita/day is used as a first step. This rate can be considered a minimum requirement.

In urban areas preliminary calculations are made in terms of an overall requirement of 50 l/capita/day. In more detailed estimates the norms applied are given in "Design Criteria for Water Supply Schemes", Draft presented by MAJI (Table 26).

TABLE 26 Unit Water Demand in Urban Schemes

Consumer	Unit	Urban Area	Peak Day Factor	Remarks
People using kiosks or Public taps	l/p.d			
People with house connection	"	70	1.5	Low class housing No inside installations Pit latrine
"	"	130	1.3	Medium class housing sewer or septic tank
"	"	200	1.1	High class housing sewer or septic tank
Schools		10		With pit latrine
- Day school	l/std.d	25		With WC
- Boarding school	"	80	1.1	With WC
Health care				
- Dispensaries	l/visitor.d	10		Out patients only
Health centres	l/bed.d	50		No modern facilities
		100	1.1	With WC and sewer
		200		District
Hospitals	l/bed.d	400		Regional with surgery
Administrative	l/worker	10	1.1	With pit latrine
Offices		70		With WC
Hotels	l/bed.d	70	1.5	Low class
		200	1.5	Medium class
		400	1.1	High class

l/p.d = Liters per person per day

10.5 Water Demand

The water demand estimates based on the population and livestock predictions, on the water consumption criteria (10.3) and on separate estimates of the institutional and commercial water demand, are presented in Tables 27 and 28. As livestock partly uses traditional sources, it has been assumed that 25 % of the livestock was served by domestic water supplies in 1984. The estimates for 1991 and for 2001 are 40 % and 50 %. No allowance for leakage and waste is made.

TABLE 27 **Water Demand Estimates, Mtwara Region**

	Water demand, m^3/d		
	1984	1991	2001
Masasi District	8,760	10,100	12,790
- rural	7,620	8,610	10,120
- urban	1,000	1,490	2,670
Mtwara District	3,830	4,480	5,420
- rural	3,830	4,480	5,420
- urban	-	-	-
Newala District	10,370	11,420	13,380
- rural	8,380	8,800	9,510
- urban	1,990	2,620	3,870
Mtwara-Mikindani Town	4,110	5,990	10,430
- rural	460	520	630
- urban	3,650	5,470	9,800
Mtwara Region	23,100	31,990	42,020
- rural	16,460	22,410	25,680
- urban	6,640	3,580	16,340

TABLE 28 Water Demand Estimates, Lindi Region

	Water demand, m^3/d		
	1984	1991	2001
Kilwa	3,650	5,600	8,520
- rural	2,990	3,400	4,100
- urban	660	2,200	4,420
Lindi District	6,890	7,530	8,410
- rural	6,890	7,530	8,410
- urban	-	-	-
Liwale District	1,500	1,990	3,030
- rural	1,010	1,310	1,910
- urban	490	680	1,120
Nachingwea District	3,350	4,040	5,330
- rural	2,740	3,190	3,930
- urban	610	860	1,400
Lindi Town	1,830	2,580	4,190
Lindi Region Total	17,220	21,750	29,480
- rural	13,630	15,430	18,350
- urban	3,590	6,320	11,130

The total water demand of the area was 40,300 m^3/d in 1984, out of which 30,100 m^3/d rural and 10,200 m^3/d urban. The demand for human consumption was 37,000 m^3/d, 500 m^3/d for livestock and 2,800 m^3/d for institutions and industries.

The total water demand is estimated to rise to 53,700 m^3/d in 1991 and to 71,500 m^3/d in 2001.

The actual use of water will depend on the service level and the availability of water. At present the amount of water reaching consumers through improved water supply systems is considerably below the demand, maybe less than 30 % of it.

11
PLANNING CRITERIA

11.1. General

In the preparation of the updated Water Supply Development Plan for Mtwara and Lindi Regions, the following points have been considered:

1. Present water supply situation
2. Available water resources
3. Present and future consumers and their water consumption
4. Required service level
5. Constraints caused by manpower and technology
6. Financial constraints

Setting planning criteria, prevailing practices within MAJI particularly in Mtwara-Lindi area as well as the guidelines set by MAJI Headquarters have been followed to the extent possible.

11.2 Planning Horizon

The plan coveres the years 1986-2001 with the period 1986-1991 considered in more detail.

11.3 Service Levels

Service level of water supplies in this context is a measure of how much water per capita of what quality and at what distance is supplied to people. Considering that the present water supply situation is still far from the set target, "safe and wholesome water for everybody by the year 1991", two stages have been applied:

Level I

Minimum level which should be reached in all villages as soon as possible:

- amount of water $\geq$ 10 l/capita/day in all circumstances
- distance to the water point $\leq$ 2.0 km
- provision for urgent institutional use (dispensaries, schools, etc.)
- acceptable water quality

Level II

Target level which, as a common rule, should be reached and kept in the long run:

- amount of water 25 l/capita/day
- distance to the water drawing point $\leq$ 400 m
- provision for institutional use such as hospitals, schools, administration, etc.
- provision for domestic animals, not necessarily from the same water supply system
- water quality acceptable

In urban areas Level I should be as the above Level II. Level II should include house connections with higher per capita consumption rates.

It should be noted that there are areas and villages where even Level I is difficult or impossible to reach at any reasonable cost. In such cases there are no alternatives than recommending moving settlements to more favourable areas. Before definite decisions of resettlement, socio-economic factors should be carefully considered

11.4 Water Quality

Water supplied to people should be fit for human consumption and should therefore meet the WHO Standard for Drinking Water in urban areas and the "Temporary Standards of Quality of Domestic Water in Tanzania" in rural areas. (See Appendix 1). Following allowances can be made in rural areas if better water is not available at a reasonable cost:

- Electrical conductivity (indicator of salinity)	2,800 S/cm
- Fluorides	8 mg/l
- Iron	1.5 mg/l

Water should not have an unpleasant taste or odour. It should be bacteorologically clean.

When groundwater is used, acceptable quality is normally more easily obtainable than with surface water.

11.5 Technology

The technologies made use of in constructing and operating water supplies should, considering the circumstances, be of appropriate standards.

When selecting systems and methods of water supply, the following points should be considered:

- favor gravity systemes in piped water schemes
- favor the use of local materials and locally manufactured products
- minimize the use of fuel
- minimize the use of imported machinery, equipment and spares
- favor the use of electricity rather than the use of fuel.

Experience shows that piped water supply schemes with pumping are very difficult to operate in the present circumstances especially in rural areas.

11.6 Institutional Aspects

Recent experience has demonstrated that MAJI together with the local councils are not fully in a position to take care of operating and maintaining the water supplies. Problems will increase when new water supplies are constructed for the growing population without service. Considering this, new sources and means have to be mobilized together with the strengthening of the present institutions responsible.

The following institutional aspects are emphasized in the Plan:

- strengthening the MAJI organization at all levels, especially at the district level,
- improving the capacity and motivation of the personnel at all levels by training and by incentives,
- involvement of the consumers, i.e. the villages, to participate in the construction and operation of their own water supplies. The target is that the villages would provide the manpower needed for the construction of their water supply and be responsible, also financially, for the operation and maintenance after its completion. In case of piped water schemes, MAJI would remain responsible for the pumping stations, treatment works, trunk mains and reservoirs. MAJI, futher, would remain responsible for the planning, design and survey of new schemes and also any the technical assistance needed by the villages.

The above development idea of involving the villages (village governments) in operating and financing their water supplies also requires a general review of the present policy of water beeing free to consumers using public water points.

11.7 Financial Aspects

There has been the average of TAS 17.0 mill a year (1.1.1984 value) allocated to water supply construction in the area over the past 5 years although the trend has been declining. In addition to this, the average foreign donor contribution has been TAS 30.0 mill a year. The total the investments have been TAS 47.0 million per year. It may be correct to assume that the local contribution will remain at the present level in real terms, whereas the foreign contribution is likely to decline, as a result of the decreasing involvement of FINNIDA. The average annual operating expenditures of the water supplies have been TAS 35.0 mill with the inflation adjusted cost remaining rather constant over the years. The total amount of money used in the water supply sector has thus been TAS 82.0 mill per year.

In the preparation of the Plan it has been assumed that local funds available for water supplies will remain at the present level and that the foreign donor contribution will decrease to the same level as the local annual investment. Thus the total amount of funds available for the water supply sector will be TAS 69 mill per annum. The relative shares of investment and operation and maintenance should remain roughly as they are at present although a shift in favour of operation and maintenance may be necessary.

The above assumption of limited funds will have a great impact on the time schedule of the development, on the choice of technology, on the service level, etc. Higher standard of water supplies, piped schemes for example, higher consumption rates, shorter walking distances, etc. will result in a lower implementation rate and usually also higher operation and maintenance costs.

A promising approach towards meeting target of providing water to all people is increasing community participation. Simple construction methods and simple systems whenever possible facilitate community participation. This means, among other things, shifting emphasis even more from piped water supplies to handpump wells. The hand pumps should be simple, durable and easy to maintain and possible to manufacture locally.

11.8 Priority Ranking

Priorities in constructing water supplies are normally set by District Councils and District and Regional Development Committees. In decision making, weight is normally given to need, costs and technical feasibility but other factors are considered as well.

In planning the construction of water supplies, high priority should be given to:

1. Villages, where there are no improved water supply systems as yet especially, where the water situation is poor (bad quality, far away source, etc.).

2. Simple systems. Systems easy to construct and operate should be preferred.

3. Low costs. Systems with low per capita costs and inexpensive maintenance should be favoured.

4. Rehabilitation. Repairing and improving of existing schemes is usually more economical than the construction of new ones.

5. Villages which are active and willing to participate in the construction, operation and maintenance of the scheme should have the first priority. In fact new water supplies should not be constructed without the full concent and involvement of the local people. To increase village participation, the importance of mobilizing the local leadership is emphazised.

12
WATER SUPPLY METHODS

12.1 Piped Water Supplies

Piped water system is a common form of improved water supply. It normally consists of the following: intake, treatment, pumping, reservoir and distribution network. When boreholes are used, treatment can usually be limited to chlorination. In favourable conditions water can be distributed by gravity. In rural areas water is normally drawn through public taps (Figure 6). In urban areas house connections are used as well.

In Mtwara and Lindi regions, the most common source of piped water is groundwater and the trend seems to continue. Groundwater normally does not require treatment, but salinity is a common problem in the Basement area and near the coast. Most water sources suitable for gravity systems have already been taken into use.

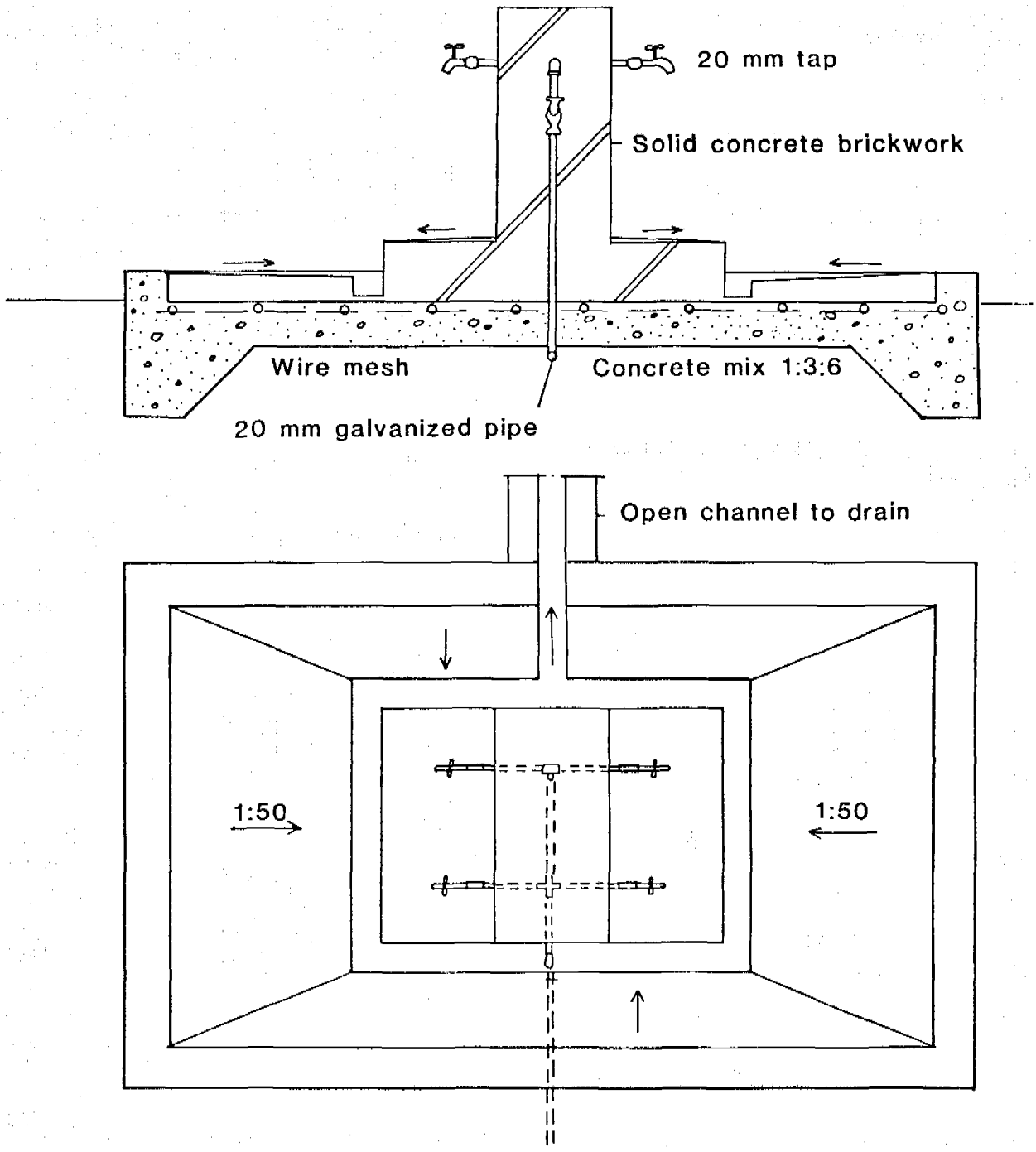
Surface water sources are limited because all the water courses are seasonal except for four major rivers. In the perennial rivers great fluctuations of flow make the abstraction of water difficult. In areas where no perennial water courses exist, the use of surface water will require dams to store water for the relatively long dry period.

In pumping, which is used in over 90 % of the existing schemes, diesel pumps are the norm, because electricity is available only in the principal towns and along the Mtwara-Lindi road.

Following advantages of piped water schemes can be named:

1. Good service by bringing water to or near the consumers.
2. Water quality easily controlled and contamination between the source and the consumer abstraction point easily avoided.
3. Water can be supplied to areas where no local water sources are available.
4. Water can be abstracted from difficult water sources, such as deep boreholes, which cannot be taken advantage of by other methods.
5. Water can be supplied to a large number of consumers.

FIGURE 6 **Domestic Water Point in Piped Water Scheme**



All brickwork to be cement plastered
brickwork cement mortar mix 1:6
cement plaster mix 1:3

It should be noted that the advantages of piped water supply schemes apply only where the schemes are operating continuously and according to design.

There are several disadvantages particularly serious in rural areas:

1. Piped schemes require sufficient numbers of skilled manpower for operation and maintenance. Especially demanding are schemes with water treatment and pumping.
2. Piped schemes require a constant and reliable supply of fuel and spares, both imported for the time being.
3. Piped schemes are costly to operate, except for gravity schemes.
4. Piped schems are costly to construct.
5. Unsatisfactorily operating piped schemes cause serious health hazards as a result of poor water quality and break-downs occasionally forcing people to use undeveloped and unkept water sources, etc. The same applies to other water supply methods but the problem appears more serious with piped schemes.

12.2 Hand pump Wells

Hand pump wells tap groundwater usually out of shallow or medium depth formations (< 50 m deep). Wells can be constructed by hand or by excavator and lined by rings, bricks, stones, cement, etc. In most cases the depth of a ring well is 5 -10 m, although even 20 - 30 m deep wells have been dug. Tube wells are constructed by hand or by machine auger and cased with Ø 110 - 160 mm pipe, usually of PVC. Auger wells can normally be made up to 15 m deep. The different types of wells are shown in Figures 7 and 8.

Small diameter borehole wells drilled either by a DTH-hammer drill or by a light cable tool rig can be constencted where groundwater lies too deep for dug wells or for auger wells. The practical maximum pumping depth of about 50 m limits the depth of a borehole. Low yielding boreholes drilled for motorized pumps, or test boreholes, can usually be made use of by hand pumps. A borehole equipped with a hand pump is illustrated in Figure 9.

FIGURE 7 **Ring Well**

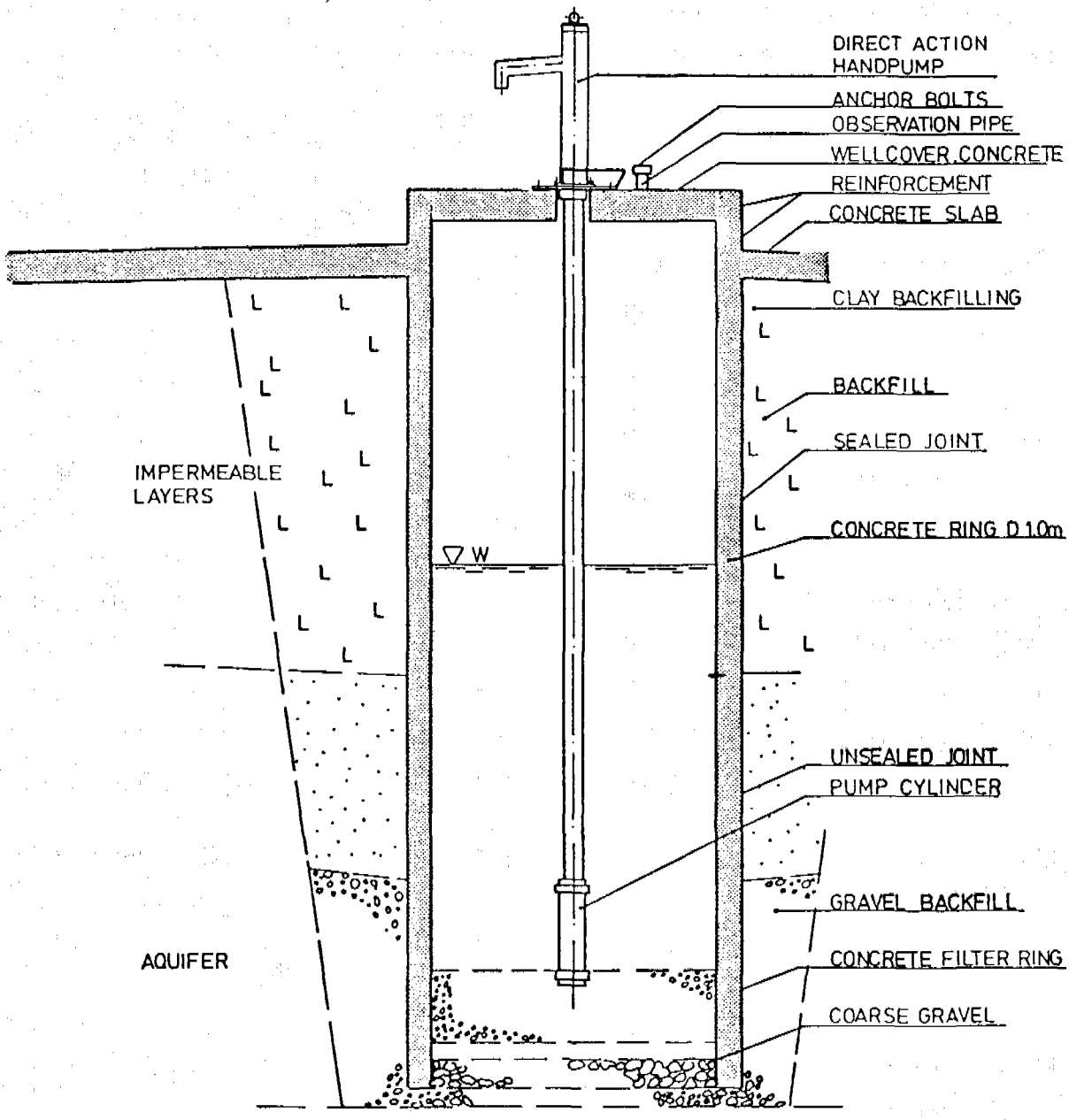


FIGURE 8 **Hand Auger Well**

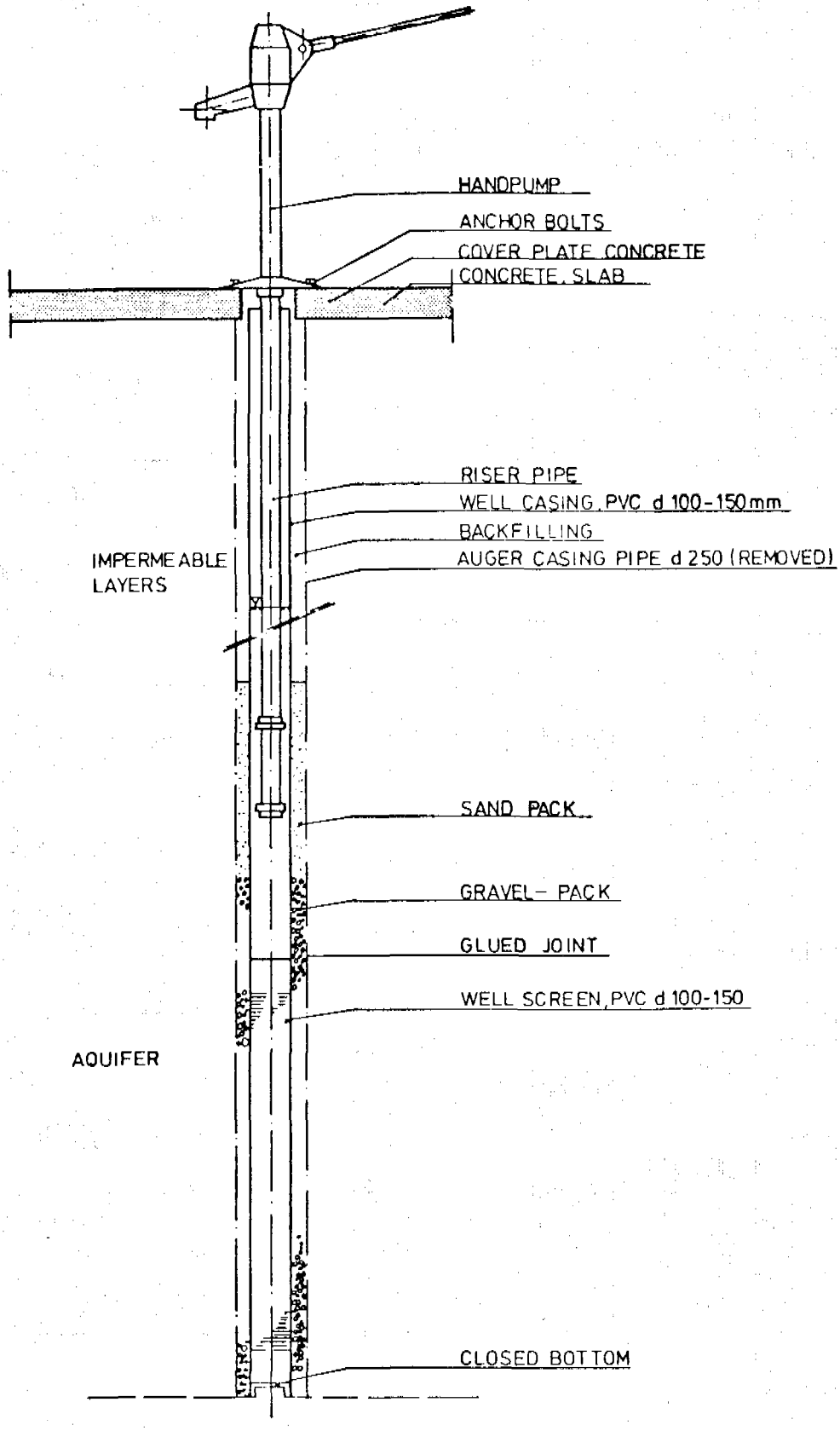
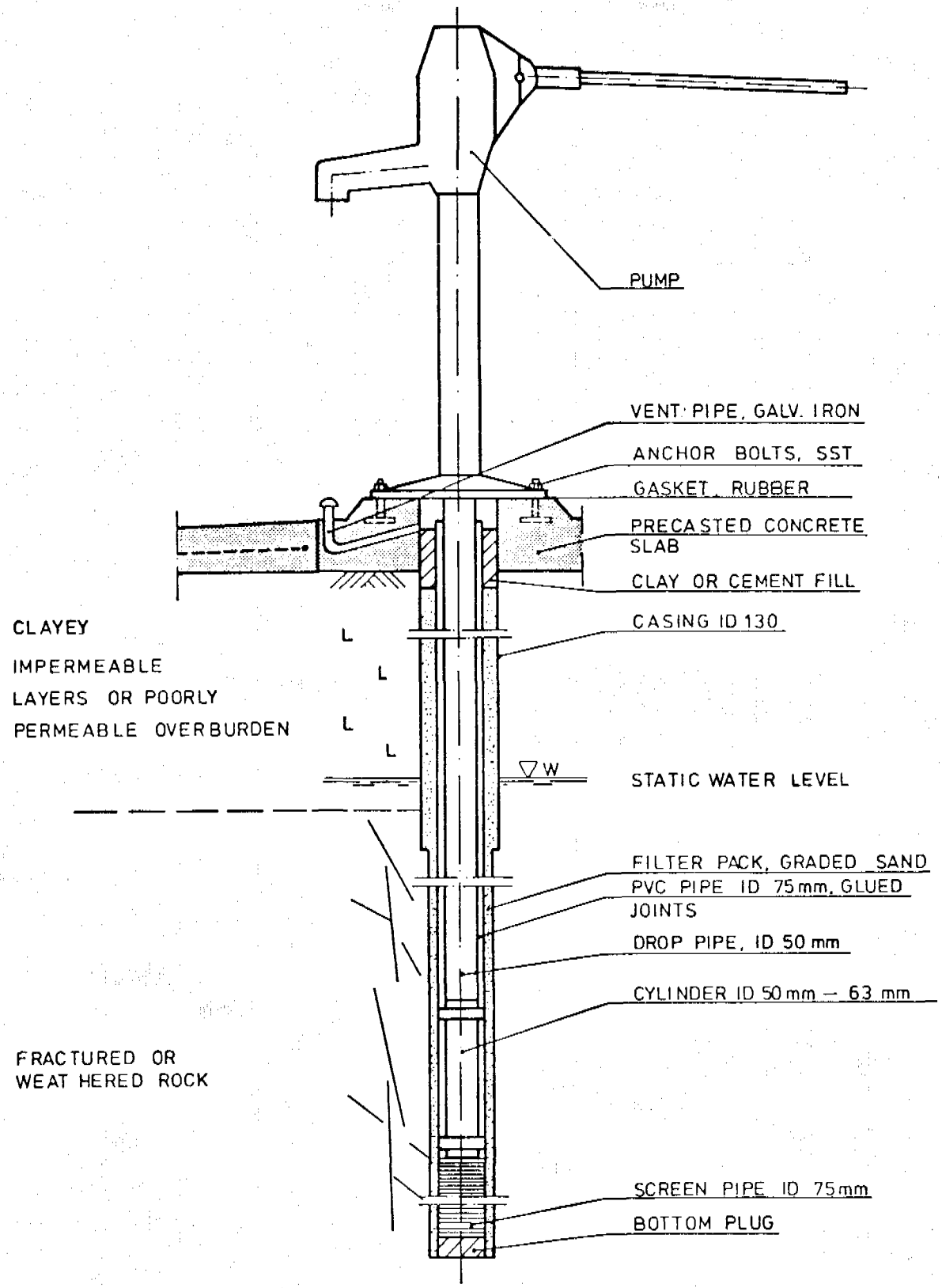


FIGURE 9 **Medium Deep Borehole with Handpump**



Following advantages of hand pump wells stand out:

1. Water is relatively safe without treatment.
2. Wells, especially hand dug shallow wells, are inexpensive and can be constructed by local labour and mostly local materials. They are therefore, advantagious for community participation.
3. The operation of handpumps requires no fuel and local technicians can be trained for the maintenance. The need of spares is small.
4. Local aquifers not suitable for piped schemes can be used.

Disadvantages of shallow wells:

1. Service level normally lower than in piped schemes. Water has to be pumped, and house connections are not possible.
2. Hygiene of the wells, especially ring wells, is not always satisfactory as a result of leaking spill and surface water.
3. Reliability of shallow wells tapping small local often perched aquifers is not as good as those reaching the deeper groundwater. It is strongly affected by unusually long dry periods. On the other hand, the more reliable operation of shallow wells balances this disadvantage when compared with piped schemes.
4. The capacity of a well is limited to serve properly about 200 - 300 people only. On the other hand, a large number of wells can tap a single large aquifer.
5. Handpump wells are suitable only in areas where good quality groundwater is available at a shallow depth.

12.3 Dams

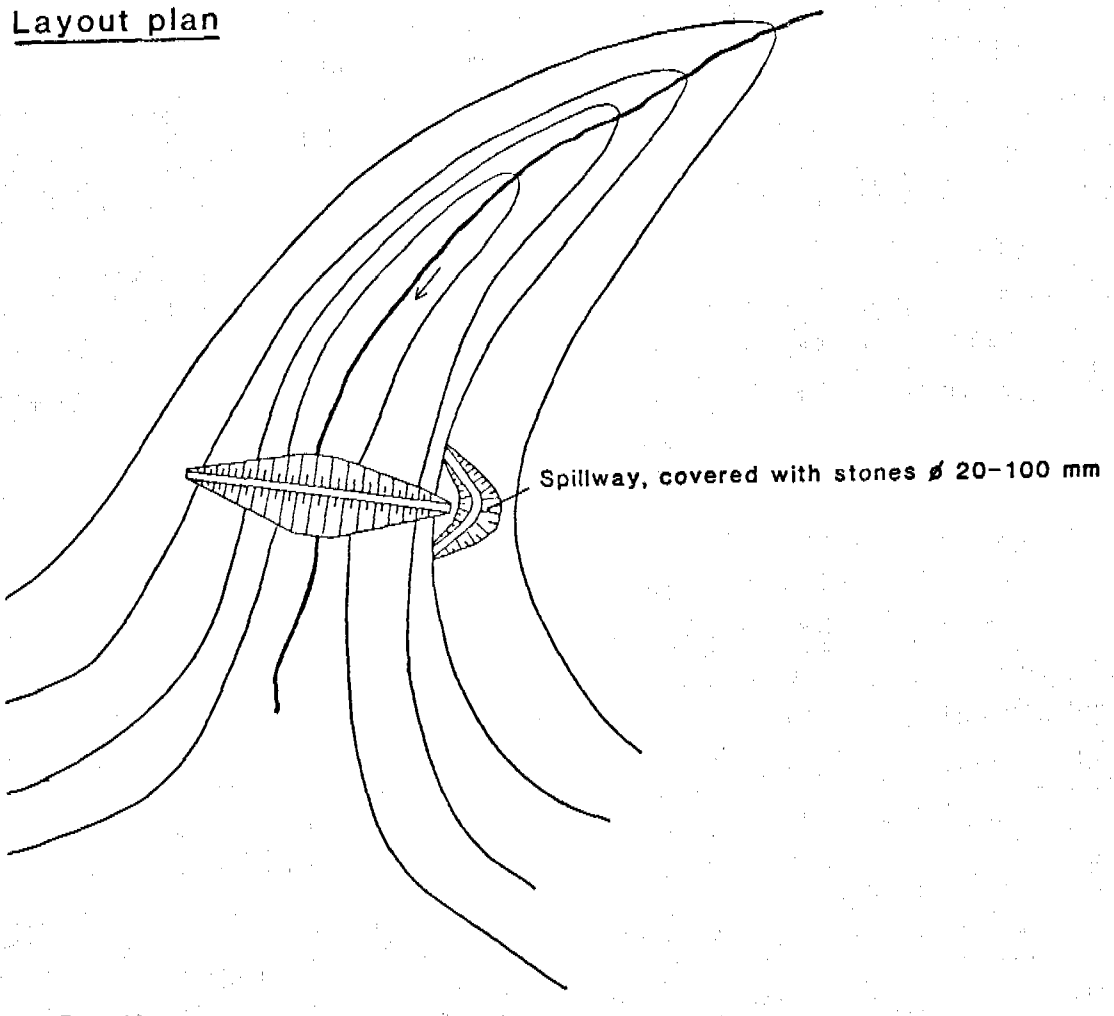
Dams are used to store seasonal surface water to last over the dry periods. A dam (also called cargo or haffir)for a water supply consists of a reservoir, an embankment, a spillway and water abstraction systems. A typical small dam is presented in Figure 10.

Selection of the site and design of even a small dam is an extensive engineering excercise where at least following points have to be considered:

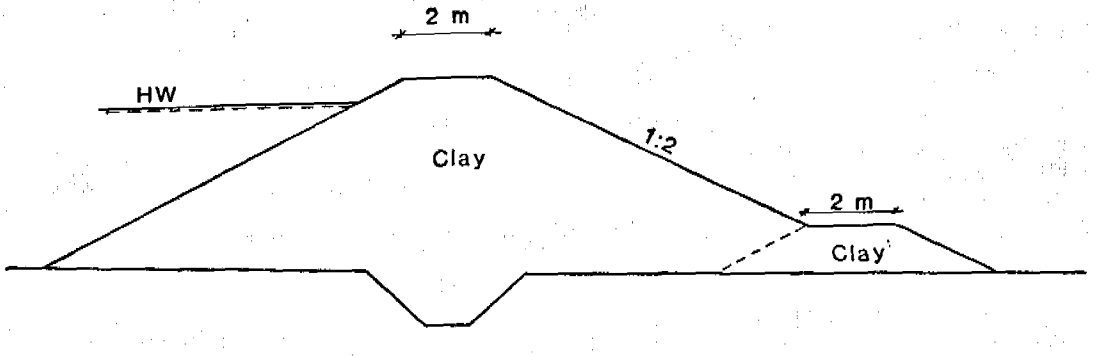
- Water demand: domestic, cattle and eventual irrigation.
- Hydrology: flow and runoff rates, length of dry periods, size and nature of catchment area, flood flow.

FIGURE 10 Earth Dam, Homogenous, Medium Size

Layout plan



Section



- Geology: geological condition of dam site, availability of dam fill, seepage.
- Soil erosion and silt load.
- Location of dam in relation to consumers.
- Evaporation.

Small dams for rural water supplies are normally located near the consumers in a river valley. The catchment area must be sufficient to fill the dam even in unusually dry years. Very large catchment areas create heavy floods and cause additional problems with spillway structures. Small dams are usually made of sufficiently impermeable earth fill with an excavated spillway.

In conditions normal to Mtwara-Lindi area, a water demand of 2,000 people and 300 cattle - about 60 m^3/d - can be satisfied by a dam with a maximum crest height of 5.5 m and a maximum water depth of 4.5 m. The maximum water storage capacity of such a dam is 30,000 m^3 and the volume of earth fill about 3,000 m^3. A catchment area of more than 12 km^2 is necessary if an annual net runoff of 2.8 mm is assumed and no dry season flow exists.

In theory, a small rural dam can be constructed by hand by the villagers themselves. In practice, however, moving several thousand cubic metres of soil in addition to clearing the dam area and constructing a spillway proves impossible, especially given that the work must be completed in one dry season. Heavy earth moving machinery: bulldozers, scrapers, excavators and rollers operated by skilled drivers are normally required.

Advantages of dams:

- Water can be conserved in places where natural water sources are insufficient.
- In favourable conditions, river flow dries only for a short period at the end of the dry season, a reasonable size dam at a reasonable cost can be construted.
- In large scale dams, several ends can be combined: water supply, irrigation, hydropower. In Mtwara-Lindi area, the conditions for multi-purpose dams are not favourable.

- Materials needed for a dam, especially a small earth dam, are mostly local.
- Dams can be used to recharge handpump wells when natural groundwater sources are poor.

Disadvantages of dams are multiple:

- An experienced engineer is required to site and design a dam. Examples of unsuccessful dams are a score, the most common reasons for failure being too small a storage capacity allowing a the dam to dry up, too small a spillway letting a flood wash away a dam, permeable soil under the embankment causing high seepage, high erosion in the catchment area filling a dam with silt after a few years, etc.
- Conditions - soils, terrain, catchment area - are seldom suitable near villages, and a dam often has to be constructed far away from the consumers.
- Water quality in a dam is always poor requiring full treatment. The situation is particularly hazarouds in small rural dams with normally unrestricted access for people and cattle. In small water supplies using such dams as sources, treatment facilities are difficult to contruct and practically impossible to operate. A method of circumventing the problem of poor water quality is constructing handpump wells around a dam and arranging permeable soil between the dam and the wells. Water becoms purified seeping into the well through the soil layers.
- Dams are not very reliable: they are vulnerable to exceptional flooding and may silt up sooner than expected. During droughts dams dry up easier than the groundwater resources.
- Dams are expensive to construct because of the special heavy machinery required. When a dam is a part of a water supply, a treatment plant and a pumping station are required.

12.4 Other Methods

Hand pumps and piped schemes, gravity or pumping, are the normal water supply systems of the area. There are other means which can be used in special conditions:

- rainwater collection,
- sub-surface dams,
- windmills,
- water rams,
- desalination.

Of the above methods, only rainwater collection and sub-surface dams are a viable alternative as domestic water supplies in Mtwara-Lindi area. Winds are too light in the area for windmills to offer considerable advances over hand pumps. Water rams need running perennial water, rare in the area, and desalination is too costly and sofisticated for rural water supplies.

Rainwater collection is a modification of a dam system, whereby water is collected during rains and consumed during the dry period. Water is collected from a small area - roof, yard, specially paved surface area or a rocky hillside. The collection area is usually kept as clean as possible and access to it is restricted. A water storage tank is normally dug into the ground to allow water to flow in by gravity. To avoid dust, dirt and algae growth the collection basin should be covered. Water can abstracted by a hand pump or by a motorized pump and it should be filtered and chlorinated. Rainwater collection systems are illustrated in Figures 11 and 12.

Rainwater collection is a costly method, basically because of the large storage requirement. To allow a minimum water supply of 10 l/day/capita during a 6 months dry period, a storage of 1.8 m^3/consumer is required.

Rainwater collection systems are best suited to small scale water supplies, e.g. to individual homes and institutions in areas where no natural groundwater or surface water is available. In Makonde Plateau, rainwater collection is common although the standard of the systems is poor.

Sub-surface dams can be constructed in small seasonal sandy river beds to cut sub-surface flow and to impound water in an underground reservoir upstream of a dam. A dam is made of clay by filling a 2 -3 m wide trench excavated across a riverbed. Careful surveys and investigations are necessary prior to the design and construction so as to ensure that all permeable layers in the riverbed are cut by the dam. The top of the clay embankment must lie below the river bottom in order to prevent washing away during rains. The principle of a sub-surface dam is presented in Figure 13.

Another kind of sub-surface dam, a sand-trap, consists of a concrete weir across a river making sand accumulate upstream of the weir during flood. Water will then be stored in the sand. Places where river bottom is rocky are suitable places for such weirs. The principle of a sand-trap dam is presented in Figure 14.

Advantages of sub-surface dams:

- less evaporation than from an open water surface,
- better water quality than in open dams, often good enough without treatment.

Water can be abstracted by installing perforated pipes at the bottom of the dam and leading water either downstream by gravity or into a sump at the river bank from where it can be taken by a pump.

FIGURE 11 **Rainwater Collection System for One Family (10 m^3)**

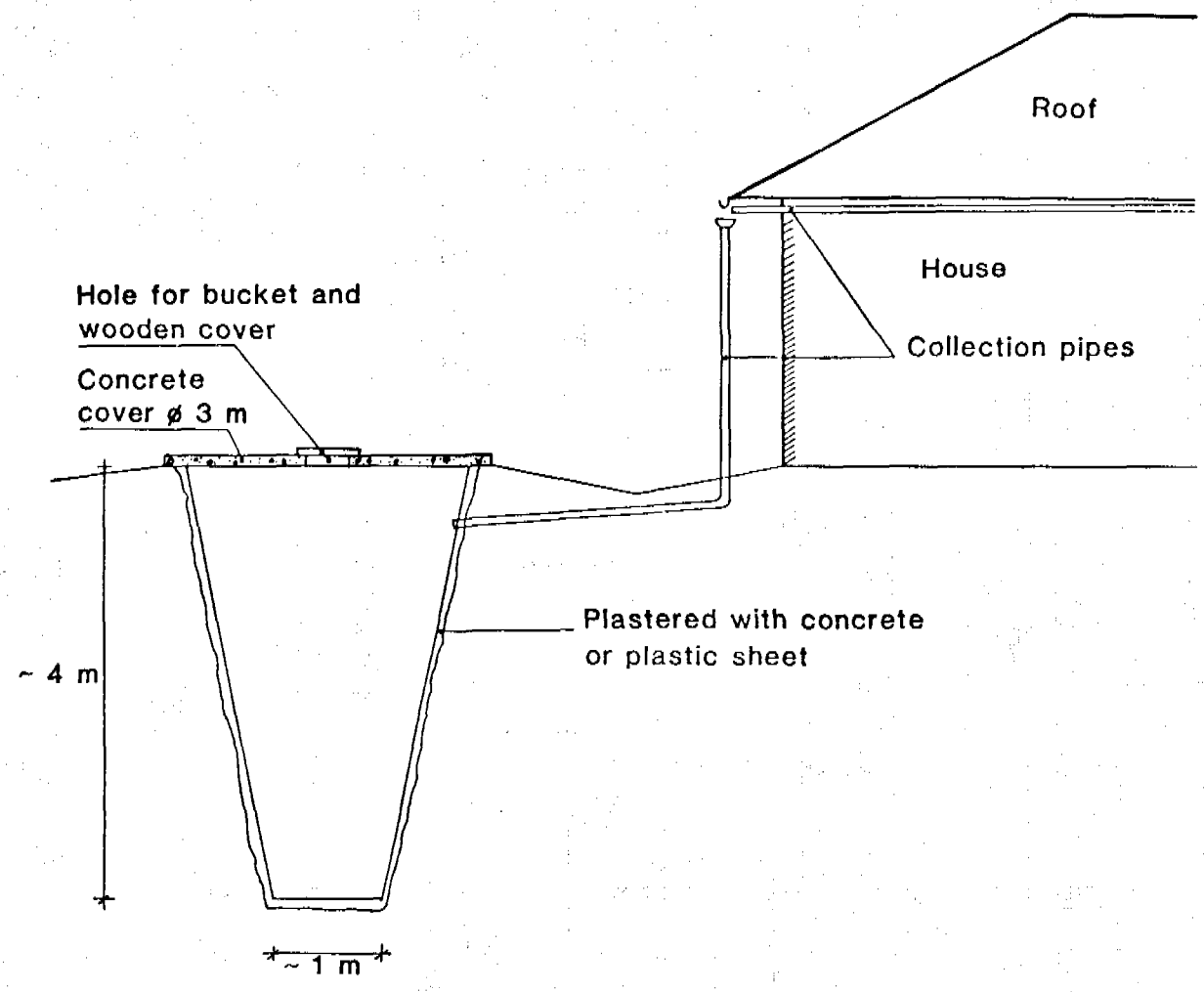


FIGURE 12 **Rainwater Collection System for 600 People (1,000 m^3)**
Ground Catchment

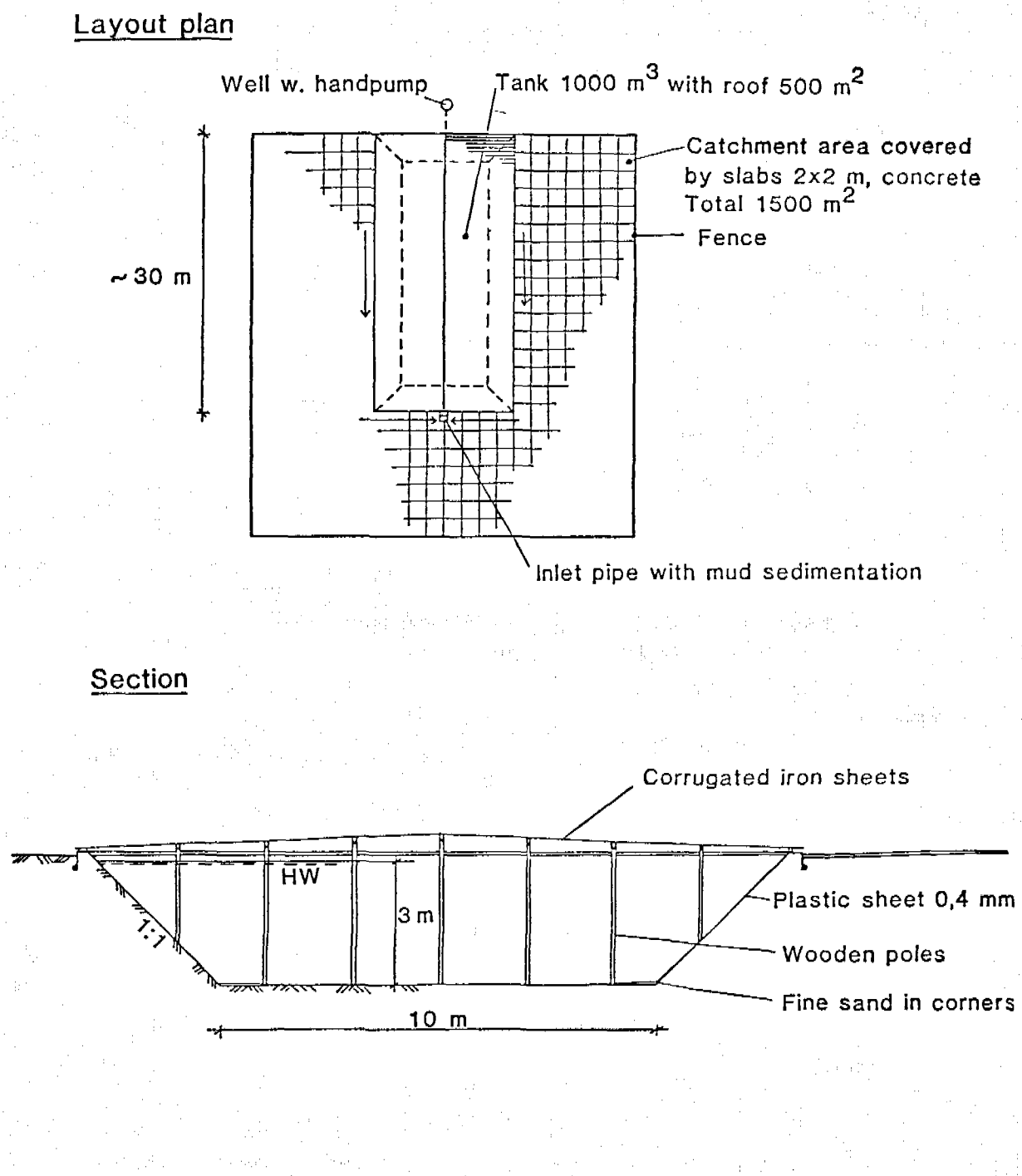
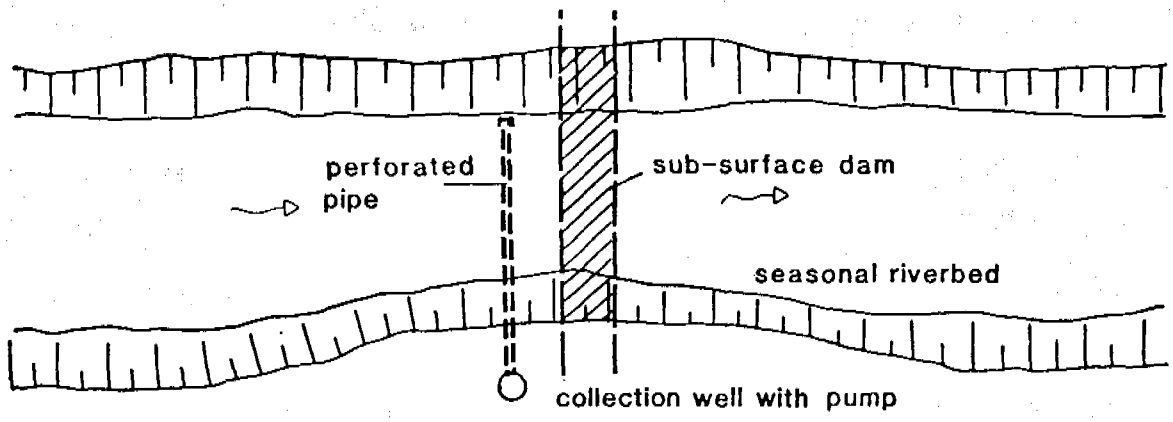


FIGURE 13 Sub-surface Dam (not in scale)



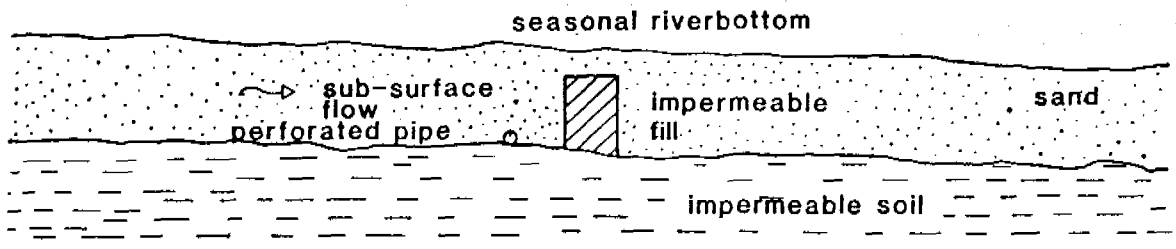
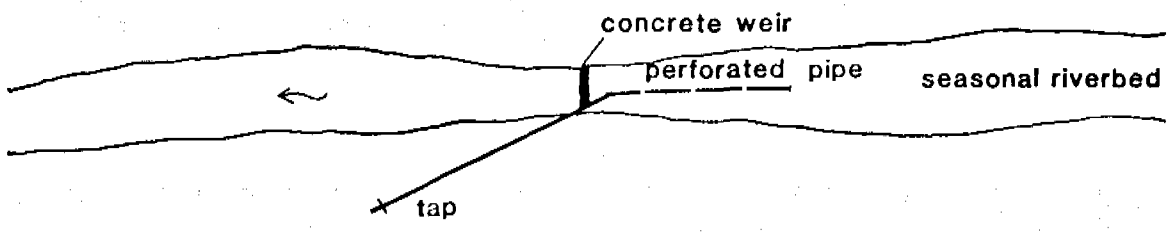
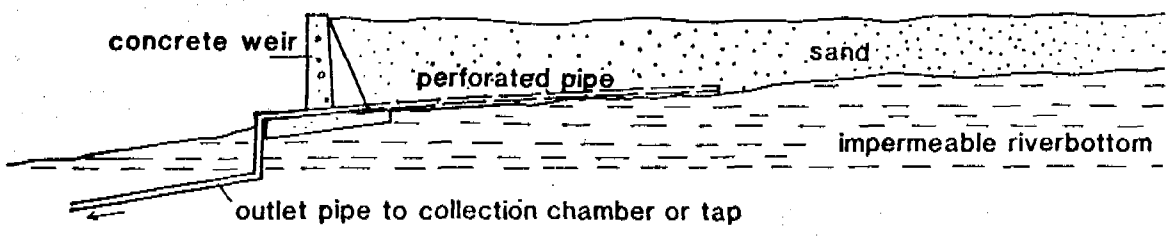


FIGURE 14 Sand Trap (not in scale)





12.5 Costs

12.51 Basis of Estimates

The costs of different types of water supplies have been calculated at the October 1985 price level based on the following premises:

1. MAJI will be responsible for both the new water supply development and the operation and maintenance of the water supply systems.

2. For the above task, MAJI will have sufficient manpower, facilities and equipment. The costs of MAJI's organization, i.e. salaries, the construction of new facilities and the purchasing of new equipment, are basic costs which do not depend on the proposed type of water supply development.

3. Village participation has been incorporated assuming unskilled labour costless. Urban water schemes have been assumed constructed by contractors.

4. The cost of a new water supply development in rural areas is calculated based expressed on unit prices of the different types of water systems and their parts. In the unit prices, only direct costs have been included, i.e. materials, transport, direct salaries and allowances. Salaries of the permanent MAJI-staff, the amortization of the construction and transport equipment etc., have not been included since they will be considered separately in MAJI's basic costs (point 2).

5. In operation and maintenance costs, only direct costs have been included such as fuel, chemicals, spares and salaries of operators. Maintenance costs have been estimated as percentages of the construction costs of the different parts of the schemes.

6. Pumping schemes are assumed to operate 16 hrs per day and gravity schemes 24 hrs per day. The required storage capacity has been taken as 50 % of the daily demand in the pumping schemes and 30 % in the gravity schemes.

7. The prices of the basic materials such as cement, iron, pipes, etc. have been calculated at world market prices adding transport and handling costs (20 %).

8. The following exchange rates have been assumed:

USD 1.00	=	TAS 18.00
TAS 1.00	=	FIM 0.33
FIM 1.00	=	TAS 3.00
USD 1.00	=	FIM 6.00

12.52 Development Costs

The construction costs of the different types of rural piped water supply schemes are shown in Figures 15 and 16. The costs include 1 km pipeline (rising main) between the abstraction point and the consumption area. Costs of a longer rising main or pipeline between different consumption points are shown in Table 29.

TABLE 29 Cost of Pipelines

Capacity	Population served	Dia	Cost per km
< 150 m^3/d	< 6,000	Ø 75 mm	TAS 100,000
150 - 300 m^3/d	6,000 - 12,000	Ø 100 mm	TAS 150,000
300 - 750 m^3/d	12,000 - 30,000	Ø 150 mm	TAS 325,000
750 - 1,750 m^3/d	30,000 - 70,000	Ø 200 mm	TAS 575,000

FIGURE 15 Construction Costs of Small Rural Piped Water Schemes

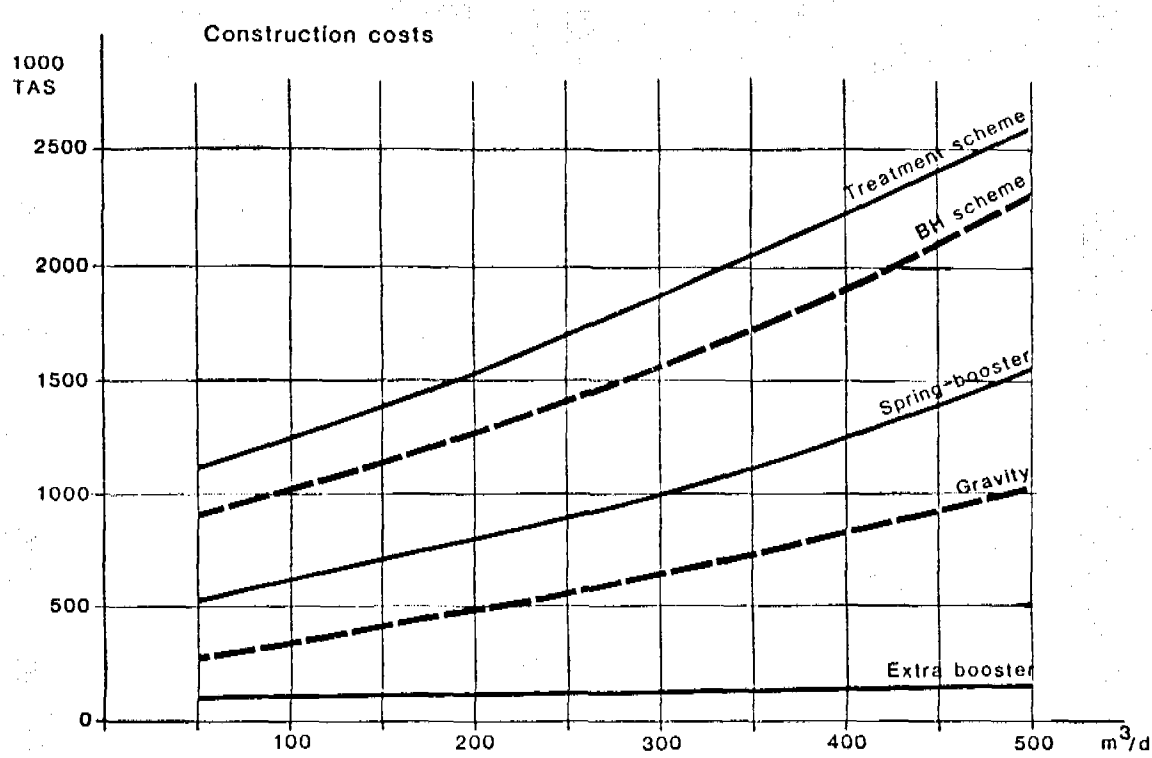
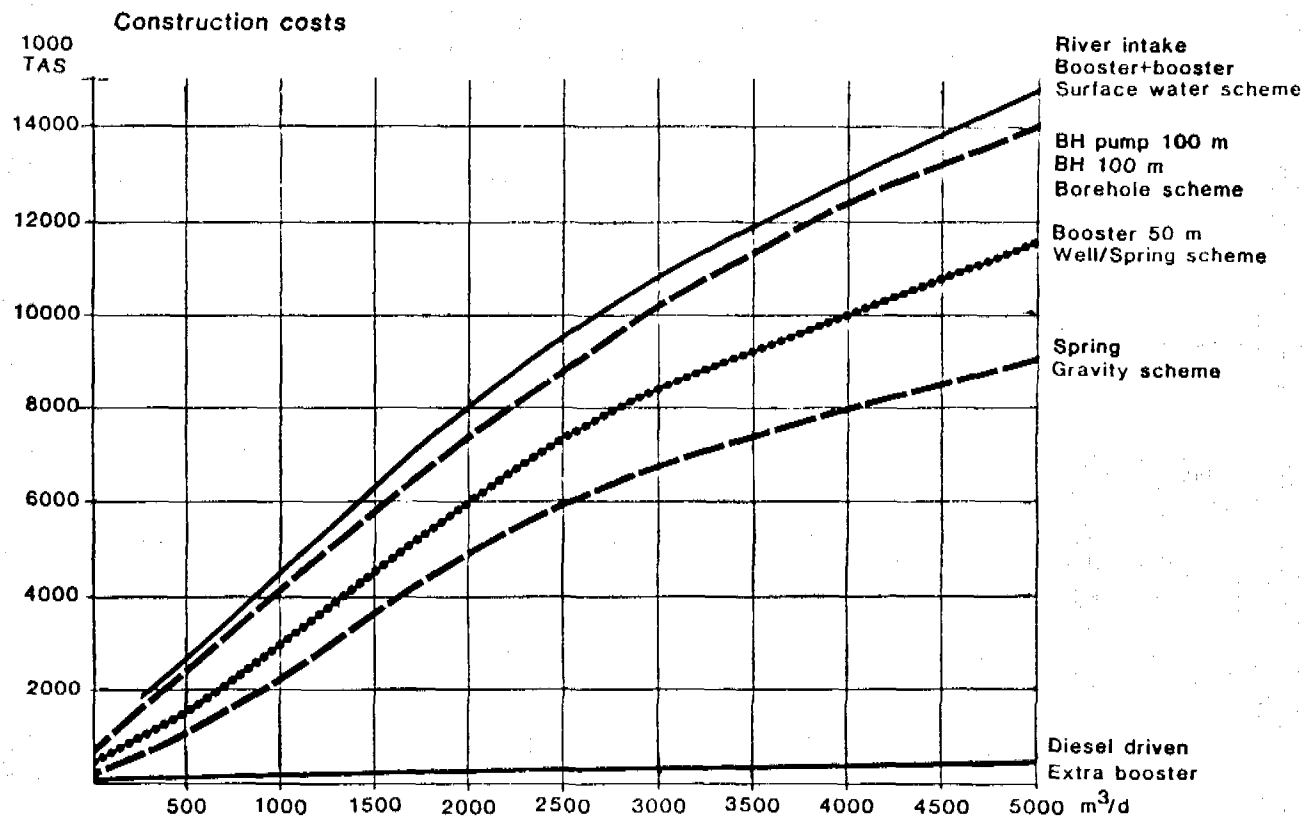


FIGURE 16 Construction Costs of Large Rural Piped Water Schemes



Costs of handpump wells:

- ring well (average depth 6 m): TAS 21,500
- tube well (average depth 12 m): TAS 16,200
- medium depth (40 m) B/H well: TAS 44,500

The cost of a small dam - 6 m high, earth fill volume 3,000 m^3 - is TAS 310,000.

The cost of a rainwater collection system for an individual house serving 6 people is TAS 3,000 - 3,500. A larger system with paved catchment, roofed storage reservoir and a hand pump for abstraction serving 600 people costs TAS 205,000.

A sub-surface dam including a 30 m long and 3 m deep fill, piping, a collection sump and a handpump, costs TAS 80,000 in normal conditions. A sand-trap with a 20 m long and 2 m high concrete weir, piping, a collection sump and a hand pump costs TAS 50,000.

The more detailed cost calculations are presented in Appendix 2.

12.53 Operation and Maintenance Costs

O & M costs of piped water supply schemes are shown in Figures 17 and 18.

FIGURE 17 O & M Costs, Small Rural Piped Water Schemes

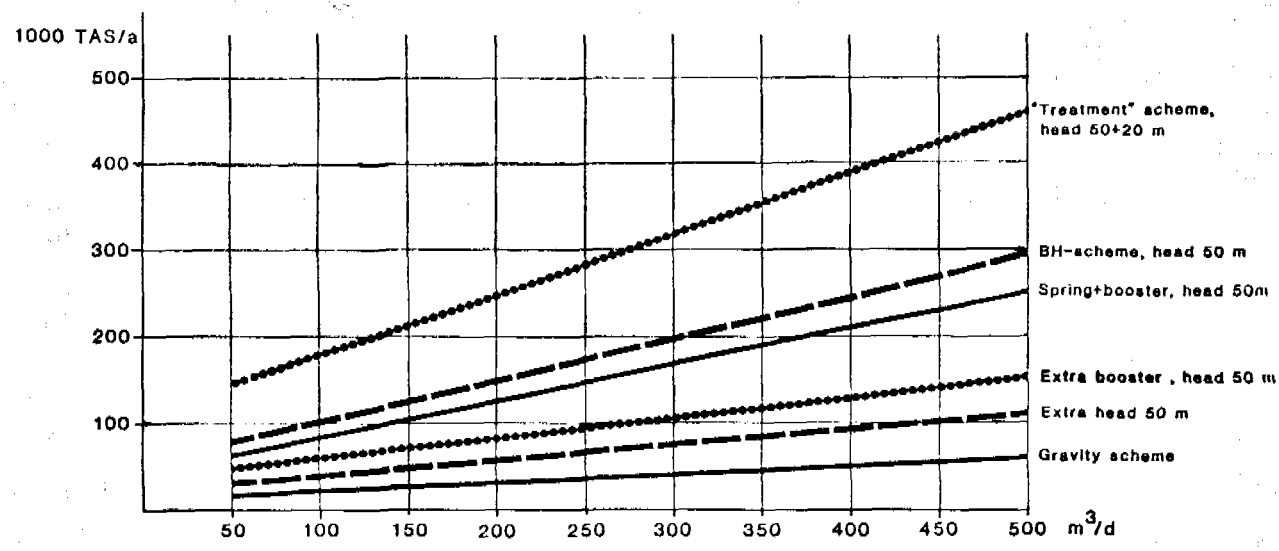
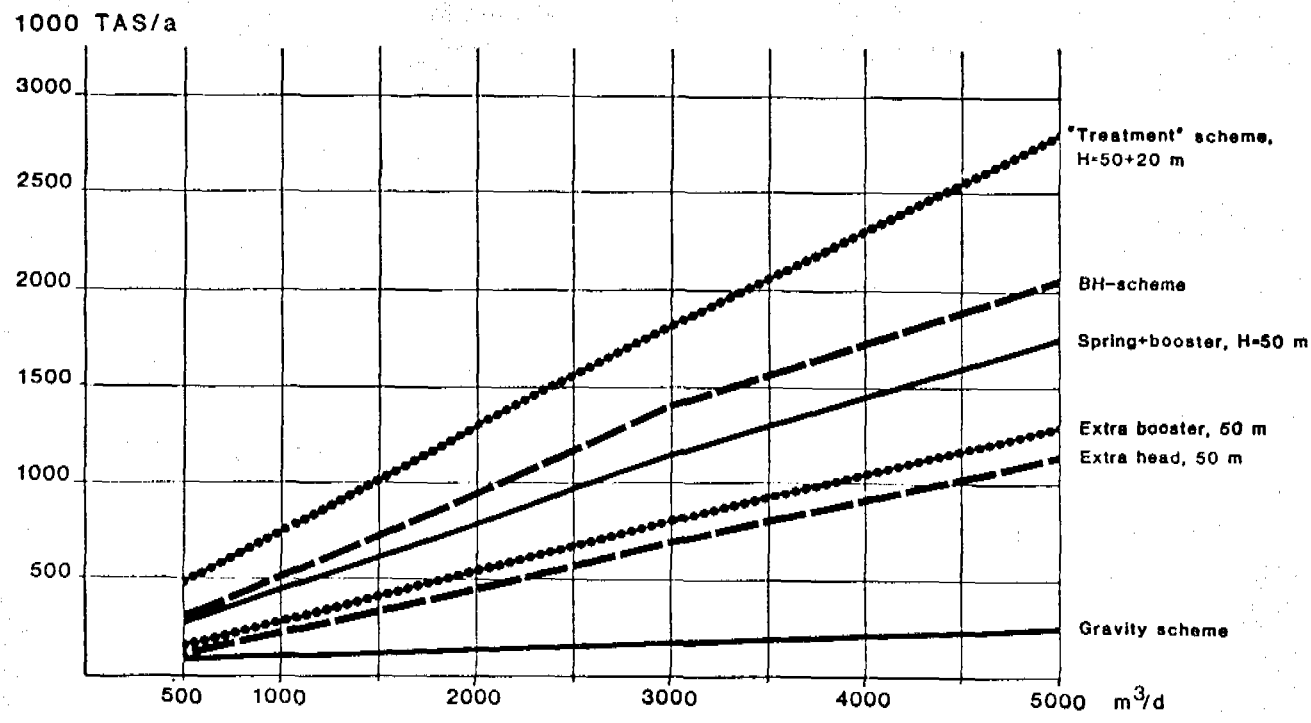


FIGURE 18 O & M Costs, Large Rural Piped Schemes



Annual maintenance costs have been calculated based on the following percentages of construction costs in rural schemes:

-	mechanical and electrical installations	20 %/yr
-	pipelines and structures	2 %/yr
-	treatment works	5 %/yr

In urban schemes, larger but more compact and thus easier to maintain, the corresponding percentages are:

-	mechanical and electrical installations	10 %/yr
-	pipelines and structures	1 %/yr
-	treatment works	5 %/yr

Detailed calculations are presented in Appendix 3.

Annual O & M costs of other types of water supply systems

-	hand pump well	TAS 2,620 /yr
-	roof catchment	5 % of constr. costs
-	ground catchment	5 % of "
-	sub-surface dam	5 % of "
-	sand-trap	3 % of "
-	dam	2 % of "

12.54 Cost Comparisons

Per capita construction and O & M costs of the different types of water supply systems are presented in Table 30.

TABLE 30 **Costs per Capita in Water Supplies**

	Construction Cost TAS / capita	O & M Costs TAS/capita /yr
Small piped W/S (2,000 pers)		
- gravity	130	18
- B/H (50 m pumping)	480	38
- treatment (70 m pumping)	530	75
- extra booster 100 m	25	23
- extra length of rising main 5,000 m	250	3
Large piped W/S (50,000 pers)		
- gravity	58	2
- B/H (50 m pumping)	100	13
- treatment (70 m pumping)	110	18
- extra booster 100 m		14
- extra length of rising main 5,000 m	115	1
Hand pump well		
- ring well	86	10
- tube well	65	10
- borehole well	178	10
Roof Catchment	500	50
Ground Catchment	350	20

It is emphazised that the above are average costs. Real costs may vary considerably depending on local conditions.

13
ALTERNATIVE PROJECTS

13.1 General Approach in Rural Water Supplies

At present, 400,000 people are getting satisfactory service by improved water supplies in Mtwara-Lindi area. By the year 2001, existing water supplies have to be rehabilitated and improved and new supplies constructed to cover the present unserved (560,000) and unsatisfactorily served (500,000) population. In addition, the natural growth brings 650,000 new people to be supplied by water.

According to the planning criteria (Chapter 11) technical, financial and institutional aspects together with the available water resources have to be considered when formulating development proposals. It seems that financial constraints in construction in particular are severe as the increasing water supply coverage requires an increasingly bigger share of the funds for operation and maintenance sector.

For the development of water supplies in the area the following approach is suggested:

1. Handpump wells should be constructed to serve new people whenever suitable groundwater resources are available. Ring wells or tube wells drilled by hand augers should be preferred. In deeper formations, DTH-rigs or light cable tool rigs should be used.

2. Existing piped water systems which are not operating properly should be rehabilitated when technically and financially feasible. Priority in rehabilitation should be given to gravity schemes and to pumping schemes with minor problems. Schemes which have been out of use for an extended period and have unsatisfactory sources or serious technical problems should be abandoned.

3. Construction of new piped schemes should be restricted to urban areas and to such rural areas where either the construction of a piped scheme is particularly easy (gravity schemes) or no alternative solutions exist. Urban water supplies can, capacity allowing and other solutions being expensive, be extended to surrounding rural areas.

4. Dams alone should not be used as water supply systems. They should be used only in connection with proper treatment of water, usually as parts of piped water supply schemes. For financial and technical reasons, dams are viable only in major water supply schemes. If dams are constructed for agricultural purposes (irrigation) they can be utilized as sources of water supplies as well.

5. Considering the problems experienced in the operation of piped water schemes, it is advisable to construct hand pump wells in the service areas of piped schemes.

6. In difficult areas, special water supply systems such as rainwater collection or sub-surface dams can be used.

13.2 Rural Water Supply Projects

Although existing piped water schemes and existing and new hand pump wells should be the backbone of the water supply of rural areas, there are places where other solutions have to be contemplated. Below are the summaries of the schemes considered. More detailed desciptions of the projects are to be found in Appendix 4.

1. Makonde Plateau W/S

(Newala District)
1984: 310,000 people
2001: 380,000 people
Total Development Costs:
1986: TAS 9.4 mill
2001: TAS 18.7 mill

At present 6 piped schemes, partly in poor condition. Proposal: Expansion of Kitangari W/S, rehabilitation of Mkunya-Makote W/S, and Mahuta W/S and completion of Mwinji W/S, forming an independent authority to manage the water supply in Makonde Planteau

2. Mbembaleo W/S

(Mtwara District)
1984: 8,100 people
2001: 11,000 people

At present no improved water supply. Proposal: Connecting Kitangari W/S and Nanyamba W/S, to the area. Nanyamba W/S to remain in operation. Scheme covering 12 villages

Total Development Costs:
TAS 4.0 mill
O & M Costs:
2001: TAS 0.32 mill/yr

3. Lukuledi W/S

(Masasi District)
1984: 7,501 people
2001: 9,820 people
Total Development Costs:
TAS 4.65 mill.
O & M Costs:
2001: TAS 0.05 mill/yr

At present some hand pump wells, water quality poor. Proposal: When Masasi town W/S is improved by constructing the Mbwinji scheme, a brach should be constructed to Lukuledi area. The scheme will operate by gravity and serve 8 villages.

4. Mtama-Nyengedi W/S

(Lindi District)
1984: 30.916 people
2001: 36,600 people
Total Development Costs:
TAS 3.8 mill
O & M Costs:
2001: TAS 0.60 mill/yr

At present there are 44 hand pump and 4 piped schemes in the area. None of the piped W/S are operating. Proposal: Mtama W/S should be reconstructed and Nygengedi W/S serving also Luwale, Mbale, Mtua and Longa should be rehabilitated. Other 5 villages should be served by hand pump wells.

13.3 Urban Water Supplies

The urban water supply schemes - present situation, future development and costs - are summarized below. More detailed descriptions are to be found in Appendix 5.

1. Mtwara Town W/S:

1984: 61,300 people
2001: 165,000 people
Total Development Costs:
TAS 111.0 mill
O & M Costs:
1986: TAS 2.20 mill/yr
2001: TAS 6.40 mill/yr

Drilling of boreholes in Mtawanya and Ziwani area. Augmentation of water treatment works and water transfer system. Rehabilitation and extension of water distribution system. Further expansion of capacity in 1992, by drilling boreholes in Mikindani-Nanyati valley.

2. Mikindani Town W/S

1984: 11,300 people
2001: 30,400 people
Total Development Costs:
TAS 6.3 mill
O & M Costs:
1986: TAS 0.40 mill/yr
2001: TAS 0.90 mill/yr

Rehabilitation and extension of distribution system including reservoir. Additional capacity in 1992 by drilling more boreholes in Mikindani-Nanyati valley.

3. Lindi Town W/S

1984: 36,600 people
2001: 83,900 people
Total Development Costs:
TAS 60.1 mill
O & M Costs:
1986: TAS 1.02 mill/yr
2001: TAS 3.23 mill/yr

Rehabilitation of present water supply. Expansion of distribution. Additional capacity in 1990 by drilling boreholes in Mingoyo-Mkwaya area. Pumping station and pipeline Mingoyo-Lindi.

4. Kilwa-Masoko Town W/S

1984: 7,000 people
2001: 22,100 people
Total Development Costs:
TAS 77.00 mill
O & M Costs:
1986: TAS 0.4 mill/yr
2001: TAS 4.0 mill/yr

Augmentation of Mpara pumping. Rehabilitatation of distribution system including booster pumping station and water reservoirs. Expansion of water supply by constructing the Mavuji River scheme in 1993 in co-operation with industrial consumers.

5. Kilwa-Kivinje Town W/S

1984: 6,161 people
2001: 14.100 people
Total Development Costs:
TAS 4.2 mill
O & M Costs:
1986: TAS 0.10 mill/yr
2001: TAS 0.13 mill/yr

Rehabilitation of distribution network. Expansion of water supply by improving and extending present intake in 1995.

6. Nachingwea Town W/S

1984: 21,000 people
2001: 40,000 people
Total Development Costs:
TAS 18.9 mill
O & M Costs:
1986: TAS 1.2 mill/yr
2001: TAS 2.0 mill/yr

Rehabilitation of distribution system, the Mkumba Shamba rising main and Mkumba Pacha pumping station. Extension of Mkumba Shamba well field in 1995.

7. Masasi Town W/S

1984: 19,700 people
2001: 53,000 people
Total Development Costs:
TAS 71.5 mill
O & M Costs:
1986: TAS 0.9 mill/yr
2001: TAS 1.9 mill/yr

Rehabilitation of distribution system and Mchema pumping station. Construction of a new water supply system from Mbwinji 1990.

8. Liwale Town W/S

1984: 9,700 people
2001: 22,000 people
Total Development Costs:
TAS 11.1 mill
O & M Costs:
1986: TAS 0.5 mill/yr
2001: TAS 0.9 mill/yr

Augmentation of water supply: intake, pumping pipelines, distribution.

9. Newala Town W/S

1984: 23,400 people
2001: 45,600 people
Total Development Costs:
TAS 11.3 mill
O & M Costs:
1986: TAS 4.0 mill/yr
2001: TAS 7.9 mill/yr

A part of Mkunya-Makote W/S. Rehabilitation of pumping stations, tanks and distribution. Increase of capacity by extending Kitangari W/S to Newala in 1990.

14
WATER SUPPLY DEVELOPMENT PLAN

14.1 Water Supply Development

The water supply development plan is based on the knowledge of water resources and on the existing situation in the villages. Available finances and manpower determine to large extent the standard and service levels of the supply systems.

The plan which includes all rural and urban areas covers the period 1986-2001. Particular emphasis will be on handpump wells and on the rehabilitation of existing piped water supply schemes. Major expansions of all urban schemes and of a number of rural piped schemes, such as Makonde W/S, are proposed. Only 3 new schemes have been proposed in rural areas: Mbemba Leo W/S in Mtwara District, Lukuledi W/S in Masasi District and Mtama W/S in Lindi District, replacing the old Mtama water scheme. Before 2001, 4 new urban schemes in all to supplement the existing schemes, are required in Masasi, Lindi, Mtwara and Kilwa towns.

The water supply development of 1986 - 2001 is summarized in Table 31.

TABLE 31 **Water Supply Development 1986 - 2001**

	Rural Areas	Urban areas
Rehabilitation, expansion or completion of existing piped schemes	81	10
New piped schemes	3	4
Deepening and rehabilitation of existing hand pump wells	225	30
New hand pump wells	2 340	*)
Rainwater collection systems	13	0

*) The construction of new handpump wells as stand-by systems is recommended where possible.

20 rural piped schemes are viewed as impossible or uneconomical to rehabilitate.

Detailed proposals for each village are presented in Appendix 6. The suggested urban development is described in Appendix 5.

According to the Plan, all people will be served with improved water supplies by the end of the planning period. The situation in 2001 is projected in Table 32.

TABLE 32 **Water Supply Systems in 2001**

	Rural Areas		Urban Areas	
	No of schemes	People served	No of schemes	People served
Piped Water Scemes	126	846,00	14	495,000
Handpump wells	3,705	770,500	115	0

Part of the rural handpump wells and all urban wells are within service areas of piped schemes and will function as supplementary and stand-by systems. The rainwater collection systems proposed in Pande Division and in Rondo Division will also supplement piped water supplies or handpumps.

The plan is based on optimistic assumption that a water supply can be arangged in all villages. No detailed studies back up this assessment. Part of the proposals are therefore tentative. It can be assumed that a number of villages - maybe 5 - 10 % -will be found, where no water supply can be arranged at any reasonable cost.

14.2 Institutional Development

14.21 General

When considering the necessary institutional development of the water sector in Mtwara and Lindi Regions it is assumed that MAJI will remain the responsible agency in developing and operating water supply systems and in collecting data on water resources. It is also assumed that construction of rural water supplies will be carried out by MAJI's own organization, whereas major projects in urban schemes and in the Makonde Plateau W/S will be handled by contractors under the supervision of MAJI.

Following general development is suggested:

- More responsibilities should be transferred to district level. Facilities and manpower should be improved accordingly.
- Regional MAJI offices should be developed into co-ordinating and advisory bodies responsible for the planning and design of major water supply systems, water resources data collection, bulk purchase of material, equipment and spares, special services (deep drilling, special machinery, etc.), central workshops for major repairs of pumps and engines, the development and operation of major urban water supplies and national schemes (Makonde Plateau).
- Financial independence of MAJI, especially at district level, should be increased.
- The involvement of the villages in the construction and operation of their water supplies should be increased. This involvement should also include, to some extent, financial responsibility.

14.22 Manpower

The future manpower requirements depend on the present manpower situation, future water supply development and the increasing number of water supply systems to be operated and maintained. If development targets or the of level operation of the water supplies change, manpower requirements will change accordingly.

The present situation and the proposed development are presented in Tables 33 and 34.

District offices should be strengthened because more responsibilities will be assigned to that level. Well construction and maintenance, in particular. will require more manpower.

At least one operator in each piped water supply scheme should be a permanent employee of MAJI instead of the present system where the operators of several rural schemes are employed by the villages and only receive monthly allowances.

It is emphasized, however, that operators of only such schemes should be employed by MAJI whose continued operation has been secured by rehabilitation or otherwise.

TABLE 33 **Manpower Development, Mtwara Region**

	Present no.	Present required no.	Required no. in 2001
Engineers, Hydrologists and Hydrogeologists	6	10	15
Technicians	38	50	70
Assistant Technicians	30	60	100
Other Technical Staff	90	130	200
Office Staff	21	25	35
Watchmen	14	35	50
Plant Operators	38	70	140
Skilled Labourers	11	20	30
Total	**248**	**400**	**640**

TABLE 34 **Manpower Development, Lindi Region**

	Present no.	Present required no.	Required no. in 2001
Engineers, Hydrologists and Hydrogeologists	7	10	15
Technicians	39	40	60
Assistant Technicians	25	50	80
Other Technical Staff	145	140	180
Office Staff	24	25	30
Watchmen	12	30	40
Plant Operators	66	100	180
Skillet Labourers	1	20	30
Total	**319**	**415**	**615**

14.23 Facilities and Equipment

Facilities and equipment requirements have been set so as to make possible the proposed development according to the principles of Chapter 14.21 ad to guarantee the staff optional working conditions.

Office facilities are adequate after the completion of the new Liwale District MAJI Office. In the future, following extensions are needed:

- Nachingwea, office,
- Nachingwea, workshop,
- Mtwara MAJI, office,
- Lindi MAJI HQ, office,
- Lindi MAJI HQ, water laboratory,
- Masasi, workshop,
- Liwale, workshop,
- Kilwa, workshop
- Lindi, workshop
- Kilwa, office extention
- Newala, office.

Normal maintenance of buildings is necessary. Major repairs are likely to be required in all buildings during the planning period.

In theory, the present equipment - machinery and vehicles - are sufficient to take care of the required work. In practice, most of the equipment is out of order and totally beyond repair, only a small number remaining in use.

The equipment required is presented in Tables 35 and 36.

TABLE 35 **Equipment Requirement,** Mtwara Region

Type	Present situation Total Requirement	Operating	2001 Requirement	Life Time
Cars	18	11	25	5 years
Lorries	10	4	16	5 "
Tanker	1	0	2	5 "
Tractor	3	0	8	5 "
Welding machines	8	3	10	5 "
Lathe	2	2	1	10 "
Excavator	1	0	1	5 "
Buldozer	1	0	1	5 "
Crushing plant	1	0	1	5 "
Generating machine	6	0	9	5 "
Rotary drill	1	1	1	5 "
DTH-drill	1	1	1	5 "
Percussion drill	1	1	1	5 "
Drainage pump	8	0	9	5 "
Survey equipment	5	2	6	5 "
Soil Survey equipment	3	0	4	10 "
Resistivity sounding equipment	1	1	1	5 "
Seismic Survey equip.	1	0	1	5 "
Test pumps	2	0	3	5 "

Equipment belonging to the Mtwara-Lindi Rural Water Supply Project (FINNIDA) is not included in the above list.

The Makonde Plateau Water Supply requires a communication system linking the pumping stations and the zonal offices.

TABLE 36 Equipment Requirement, Lindi Region

Type	Present situation Total Requirement	Operating	2001 Requirement	Life Time
Cars	15	4	20	5 years
Lorries	11	7	17	5 "
Tanker	1	0	1	5 "
Tractor	4	0	6	5 "
Welding machines	6	1	8	5 "
Lathe	1	1	1	10 "
Excavator	1	0	1	5 "
Buldozer	0	0	1	5 "
Crushing plant	1	0	1	5 "
Generating machine	5	0	7	5 "
Rotary drill	0	0	0	10 "
DTH-drill	0	0	1	5 "
Percussion drill	1	1	1	5 "
Drainage pump	4	0	6	5 "
Survey equipment	5	3	5	5 "
Soil Survey equipment	4	0	5	10 "
Resistivity sounding equipment	1	1	1	5 "
Seismic Survey equip.	1	0	1	5 "
Test pumps	1	0	2	5 "

In addition to the presently operating equipment, there are non-operational but serviceable vehicles and machinery which can be rehabilitated in both regions.

14.3 Costs

14.31 Development Costs

Development Costs covering the expansion and rehabilitation of existing water supplies and the construction of new ones are presented in Tables 37 and 38. Of detailed break-down of the expenditures are presented in Appendix 6.

TABLE 37 **Development Costs of Rural Water Supplies 1986 - 2001**

	Development
Masasi District	TAS 27.3 million
Mtwara District	TAS 13.5 "
Newala District	TAS 100.6 "
Mtwara-Mikindani	TAS 1.2 "
Mtwara Region	**TAS 142.6 million**
Kilwa District	TAS 11.1 million
Lindi District	TAS 18.5 "
Liwale District	TAS 5.3 "
Nachingwea District	TAS 10.6 "
Lindi Region	**TAS 45.5 million**
Total	**TAS 188.1 million**

TABLE 38 **Development Costs of Urban Water Supplies 1986 - 2001**

Mtwara Town W/S	TAS	111.0	million
Mikindani Town W/S	TAS	6.3	"
Masasi Town W/S	TAS	72.6	"
Newala Town W/S	TAS	11.4	"
Mahuta Urban Area W/S	TAS	16.3	"
Mtwara Region Total	**TAS**	**217.6**	**million**
Lindi Town W/S	TAS	60.1	million
Kilwa-Masoko Town W/S	TAS	77.0	"
Kilwa-Kivinje Town W/S	TAS	4.3	"
Nachingwea Town W/S	TAS	18.9	"
Liwale Town W/S	TAS	11.1	"
Lindi Region Total	**TAS**	**171.4**	**million**
Total	**TAS**	**389.0**	**million**

The above do not include renewal costs of water supply systems. The average life time of a piped water supply scheme is an estimated 20 years and that of a hand pump well 10 years. The considerable cost of the proposed rehabilitation reveals the past negligence in that sector. At the beginning of the planning period, the need of renewal is taken care by rehabilitation. In 2001, TAS 41 mill should be reserved annually for renewal of the water supplies.

The above figures show clearly the two major absorbers of development expenditures: firstly the urban water supplies, which, although representing only 23 % of the total estimated population in 2001, require 70 % of the funds during the planning period, and secondly Makonde Plateau W/S which will require 63 % of the total rural water supply development expenditures, although it will serve only 20 % of the total rural population.

The costs of providing the necessary facilities and equipment are presented in Tables 39 and 40. The figures include both new inventories and the replacement of the old ones according to the respective life times.

TABLE 39 **Development Costs of Facilities and Equipment, Mtwara Region, 1986 - 2001**

	Costs TAS mill		
	Development	Renewal	Total
Buildings	1.5	5.0	6.5
Vehicles	12.4	40.2	52.6
Machinery and equipment	8.1	23.1	31.2
Renewal of gauges	1.0	1.0	2.0
Total	**23.0**	**69.3**	**92.3**

TABLE 40 **Development Costs of Facilities and Equipment, Lindi Region, 1986 - 2001**

	Costs TAS mill		
	Development	Renewal	Total
Buildings	3.5	5.0	8.5
Vehicles	12.9	39.2	52.1
Machinery and equipment	4.2	13.8	18.0
Renewal of gauges	1.0	1.0	2.0
Total	**21.6**	**59.0**	**80.6**

The estimated cost of closing the gap between the present required and available equiment and facilities is TAS 30 million. The rest of the cost is mainly for the renewal of worn out vehicles and machinery.

Total requirement of development expenditures during 1986 - 2001 is summarized in Table 41.

TABLE 41 Total Development Costs 1986 - 2001

	Costs TAS mill		
	Mtwara Region	Lindi Region	Total
Rural Water Supplies	142.6	45.5	188.1
Urban Water Supplies	217.6	171.4	389.0
Facilities and equipment	23.0	21.6	44.6
Renewal	230.0	125.0	415.0
Total	**613.2**	**423.5**	**1 036.7**

14.32 Operation and Maintenance Costs

Operation and Maintenance costs of the water supply systems are shown in Tables 42. A more detailed break-down of the expenditures is presented in Appendix 6.

TABLE 42 Annual Operation and Maintenance Costs of Water Supplies

	Cost TAS mill					
	Mtwara Region		Lindi Region		Total	
	1986	2001	1986	2001	1986	2001
Rural Water Supplies	13.3	24.8	7.1	11.9	20.4	36.7
Urban Water Supplies	8.5	19.7	3.3	10.4	11.8	30.1
Total	**21.8**	**44.5**	**10.4**	**22.3**	**32.2**	**66.8**

It should be noted that the above costs represent the full 100 % operation of the water supplies. In practice, break-downs and shortages of fuel will result in a lower rate of operation, which may bring considerable savings in O & M costs.

Annual recurrent costs necessary to operate MAJI's offices, workshops and general supervision and data collection are presented in Table 43.

TABLE 43 **Recurrent Costs, MAJI Organization**

	Costs TAS mill/yr					
	Mtwara		**Lindi**		**Total**	
	1986	2001	1986	2001	1986	2001
Salaries and allowances[1)]	7.6	17.6	9.0	15.3	16.6	32.9
Transport[2)]	2.1	6.5	1.6	5.8	3.7	12.3
Miscellaneous	0.5	1.0	0.4	0.8	0.9	1.8
Total	**10.2**	**25.1**	**11.0**	**21.9**	**21.2**	**47.0**

1) Salaries of W/S operators are included in the O & M costs (table 41).

Total Recurrent costs are TAS 53.4 mill per year in 1986 and TAS 113.8 mill per year in 2001. Cumulative recurrent costs during 1986 -2001 are TAS 1 338 mill.

14.33 Total Expenditures

Assuming the proposed plan fully implemented, all systems operated according to demand and facilities renewed and rehabilitated according to need will lead to total expenditures -development and cumulative recurrent:

1. Development
   - Water Supplies (Tables 36 and 37) TAS 577 million
   - Facilities & Equipment (Tables 38 and 39) TAS 45 million
2. Recurrent
   - Water Supplies O & M (Table 41) TAS 792 million
   - MAJI (Table 42) TAS 548 million
3. Renewal
   - Water Supplies TAS 283 million
   - Facilities & Equipment (Tables 38 and 39) TAS 128 million

Total . **TAS 2,373.0 million**

14.4 Development Targets

There is an officially accepted development target of providing good and sufficient water to everybody by the year 1991. Meeting this target seems impossible because of financial and manpower constraints. Therefore, the target year of this plan is 2001 with an intermediate end of providing everybody at least with reduced service (10 lcd) by 1991. The financial requirements of the diffirent targets are presented below.

Target 1: As per Plan: Water for everybody by 1991, at least 10 lcd

Target 2: As per Plan: Water for everybody by 2001 according to standards

Target 3: Official target: Water for everybody by 1991 according to standards.

TABLE 44 **Water Supply Development Targets and Costs**

	Costs, TAS, million		
	TARGET 1	TARGET 2	TARGET 3
Total Development Cost	325 1)	968 2)	490 1)
Annual Dev.Cost 1986-91	54	54	82
" 1992-2001		64	
Annual Reccurent Cost 1986	53	53	53
" 1991	76	76	88
" 2001		114	
Total Annual Expenditure 1986	107	107	135
" 1991	130	130	170
" 2001		178	

1) by 1991

2) by 2001

The financial requirements are illustrated in Figures 19 and 20.

FIGURE 19 **Water Supply Development Targets: Development Costs**

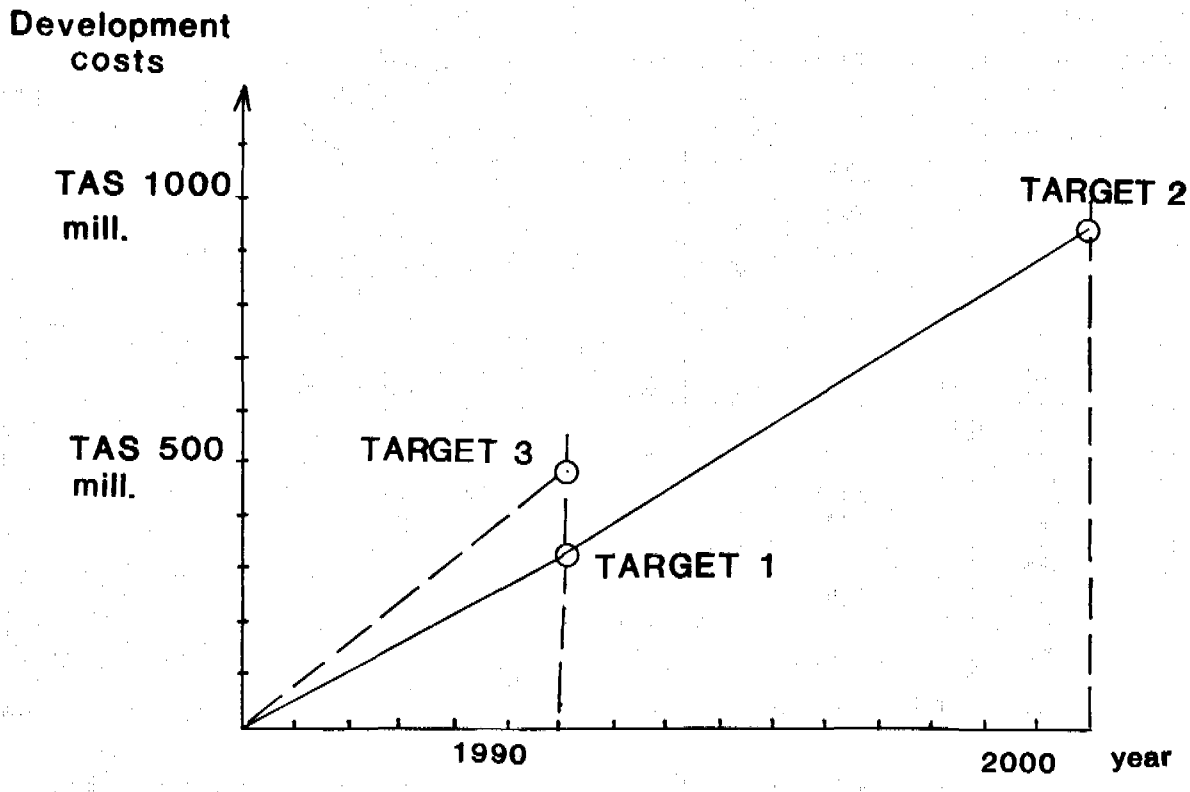
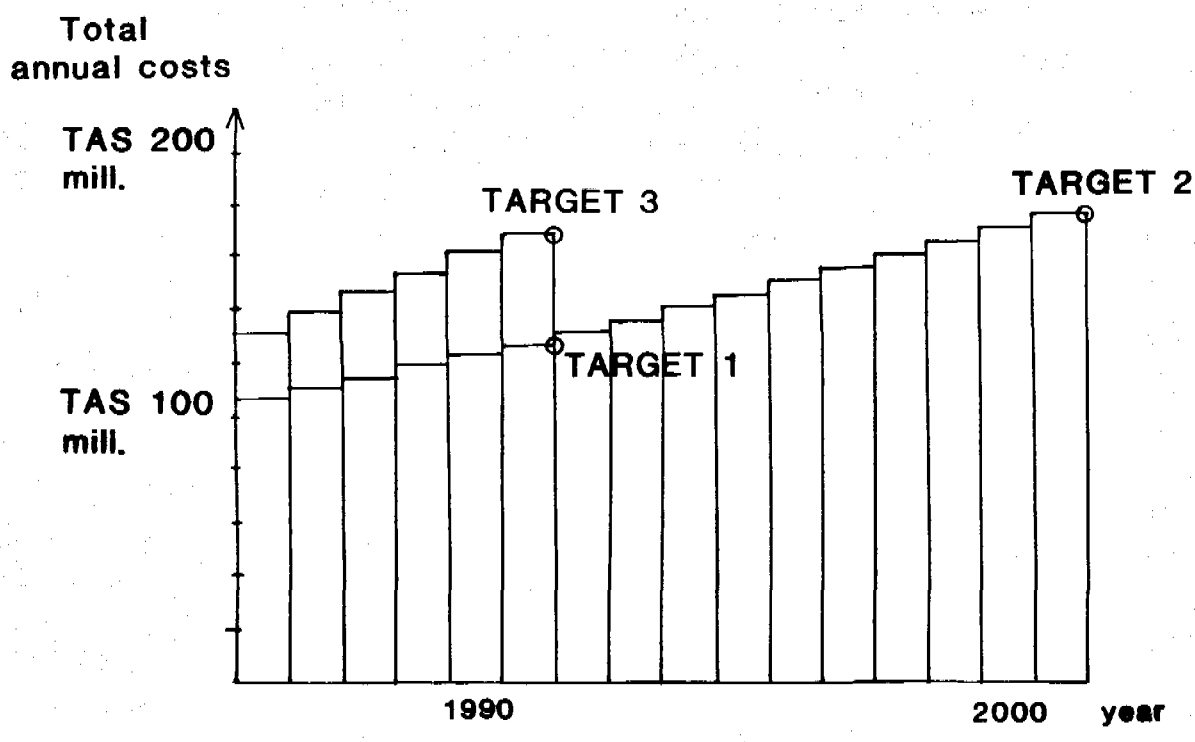


FIGURE 20 **Water Supply Development Targets: Total Annual Expenditures**



In this plan the target or providing good and sufficient water by 2001 has been adopted.

14.5 Alternative Low Standard Development

As can be seen, the set water supply development targets can not be met with a budget of TAS 69 mill per annun. There are three solutions to this problem.

1. Raising the financial limits (see Chapter 14.63)
2. Postponing the target year 2001
3. Lowering the required service standards.

Postponing the target year would somewhat reduce the necessary expenditure. The effect would be rather small since the need of rehabilitation and renewal and the recurrent costs would remain. In the long run, savings could be achieved in O & M costs, in salaries and in transport costs. Even to keep the present proportion of the population provided will require new development because of population growht.

If service standards of water supplies are lowered greatest financial savings can be achieved by decreasing the consumption rate in urban water supplies. Other possibilities are the general lowering of consumption rates, shifting even more than proposed to handpumps also in urban areas and adandoning more rural piped schemes than proposed. The effects of the different measures of lowering the standard of service are given in Table 45.

TABLE 45 **Financial Effects of Lowering Service Standards**

Measure	Saving in Development Cost 1986 - 2001	Saving in O & M Cost, average	Total Saving 1986 -2001
1. Urban consumption rate 30 lcd instead of 50 lcd	TAS 240 million	TAS 19 million/yr	TAS 540 million
2. Rural consumption rate: 20 lcd instead of 25 lcd	TAS 30 million	TAS 4 million/yr	TAS 90 million
3. Serving 200,000 more people by hand pumps instead of piped W/S	TAS 20 million	TAS 8 million/yr	TAS 150 million
4. Measures 1, 2 and 3 together	TAS 290 million	TAS 31 million/yr	TAS 790 million

The above are direct savings in development and O & M costs. In addition, considerable savings would be achieved via the reduced need of renewal.

14.6 Water Supply Development Programme

14.61 Contents

The Water Supply Development Programme details the implementation schedule of the Plan and suggests priorities in the development. The Programme is based on the following principles in addition to the planning criteria (Chapter 11):

- The target is to provide an improved water supply for everybody by the year 2001.

- An improved water supply implies clean and wholesome water, in normal circumstances 25 l/d • capita in rural areas and 50 l/d • capita in urban areas. In difficult conditions, a lower consumption rate of 10 l/d • capita may be accepted as an intermediate target. The lower consumption rate can be applied especially where wells are in use. It is assumed that 20 % of the population will be limited to that lower consumption rate in 2001.
- Priority will be given to villages with no improved water supplies or with water supplies, which in actually provide no service (service levels 0 and 1). The aim is to cover all villages by 1991 with systems furnishing clean water at least at the minimum rate - 10 l/d • capita.
- During the first period 1986 - 1991, following water supply developments will have priority:
  a) Village without water supply (service level 0 and 1). Improved systems should provide at least the minimum consumption rate , 10 l/d/capita.
  b) Rehabilitation of piped schemes with highest priority (Appendix 5).
  c) Continuation of ongoing piped W/S construction projects.

The programme which covers the period of 1986 - 2001 is presented in Appendix 6.

14.62 Implementation

For the implementation of the Plan and the Water Supply Development Programme, following steps are required:

1. Approval of the Plan and the Programme,

2. Detailed schedule for the first implementation period 1986/87 - 1990/91 covering
   - manpower,
   - facilities,
   - equipment,

- investigations,
- hand pump production programme,
- Piped W/S rehabilitation,
- Piped W/S development programme,
- Urban W/S development programme,
- technical assistance,

3. Detailed investigations and necessary design for the proposed projects,

4. Plan for the necessary changes in the administrative and operative structures of MAJI Regional and District Offices,

5. Financial Plan for the period 1986/87 - 1990/91. The budget estimates should be made according to the Plan.

14.63 Financing

The expected level of financing of TAS 69 million per year - TAS 35 million for recurrent and TAS 34 million for development - is not sufficient to meet the requirements in total of TAS 107 million in 1986 and TAS 178 million in 2001.

There are various (alternative) solutions to this financial problem:

1. Increasing the allocations in the Government budget. The present economic situation hardly admits this solution. Extending the involvement of foreign donors may also be difficult.

2. Increasing the financial responsibility of the District Councils. This may be possible to a certain extent although the development levy may be difficult to increase.

3. Improving and extending the collection of water charges in the piped schemes. In the past, the collected revenue has been around TAS 2.0 million. It has been levied as normally flat monthly rates from urban households with house connections only. In order to augement the increase revenus, following measures are recommended:

- periodic revision of water charges according to the cost of fuel, spares and salaries,
- improving billing practices and strengthening the collection of charges,
- introducing water charges also to urban consumers using public taps,
- introducing water charges in rural water supplies
- giving village councils financial responsibility for the operation of their water supplies - piped W/S as well as hand pumps.

Theoretically approximately TAS 15 mill/yr in 1986 and TAS 77 mill/yr in 2001 could be collected from consumers toward the operation and development of water supplies with the above measures and applying the rates TAS 4.00/m^3 in urban areas in Makonde Plateau and TAS 2.00/m^3 in rural areas.

4. Lowering the set target service levels of water supplies (see Chapter 14.5). Implementing all the proposed measures, enough savings can be achieved to make the average Government contribution of TAS 69 million per annum nearly sufficient.

15
SANITATION

Rural sanitation falls under the responsibility of the Ministry of Health (AFYA). In urban areas Sanitation belongs to the domain of Urban Councils.

In Mtwara-Lindi area urban sanitation is arranged with septic tanks or pit latrines. Sewage systems, with exception of some institutions, do not exist.

In rural areas sanitation is based on pit latrines only. Most households have their own latrines. According to the village survey, the majority (60 %) of households in rural areas have their own pit latrines. The standard pit latrined is generally poor. Normally, there is a wooden superstructure, grass fence and no protection against flies. More detailed information on the sanitation situation is given in Appendix 4, Volume 2.

Since 1985, a sanitation component has been included as a pilot programme in Mtwara-Lindi Rural Water Supply Project. The aim of the pilot programme has been to provide demonstration latrines, to train the local craftsmen and to provide educational material.

In view of the improving water supply situation, strong emphasis should be given to the improvement of sanitation and hygienic conditions as well in order to improve the general health situation of the people. The assignment of providing proper sanitation to the latrines (1.5 mill. in 1985 are 2.1 mill in 2001) is difficult. Therefore, the responsibility for the construction and maintenance of latrines and other sanitation facilities should be with the people themselves. The authorities, AFYA and local councils should provide the necessary education and advice and assist in making the necessary nonlocal materials available. Work of developing and testing suitable technologies should continue.

Most serious efforts in improving sanitation facilities should be directed to areas where the importance of proper sanitation is greatest: urban areas and major rural settlements.

WHO AND TANZANIAN STANDARDS OF WATER QUALITY

No.	Water Classification and Substances	STANDARDS OF WATER QUALITY				
			WHO, International (a)		WHO, European (b)	Tanzanian (c)
		Units	Acceptable	Allowable		
1.	**Water causing toxic effects**					
1.1	Lead, Pb	mg/l	n.m.	0.05	0.10	0.10
1.2	Arsenic, As	mg/l	n.m.	0.05	0.05	0.05
1.3	Selenium, Se	mg/l	n.m.	0.01	0.01	0.05
1.4	Chromium (b+), Cr	mg/l	n.m.	0.05	0.05	0.05
1.5	Cyanide, CN	mg/l	n.m.	0.20	0.05	0.20
1.6	Cadmium, Cd	mg/l	n.m.	0.01	0.01	0.05
1.7	Barium, Ba	mg/l	n.m.	1.00	1.00	1.00
1.8	Mercury, Hg	mg/l	n.m.	n.m.	n.m.	n.m.
1.9	Silver, Ag	mg/l	n.m.	n.m.	n.m.	n.m.
2.	**Water affecting human health**					
2.1	Fluoride, F	mg/l	n.m.	1.5	0.7-1.7	8.0
2.2	Nitrate, No_3	mg/l	n.m.	30.0	50/100	(100)
3.	**Water for general domestic use**					
3.1	Water being organoseptic					
3.1.1	Colour	mgPt/l	5	50	n.m.	50*
3.1.2	Turbidity	mgSiO_2/l	5	25	n.m.	30*
3.1.3	Taste	-	n.o.	n.o.	n.m.	n.o.*
3.1.4	Odour	-	n.o.	n.o.	n.m.	n.o.*
3.2	Water of salinity and hardness					
3.2.1	pH	-	7.0-8.5	6.5-9.2	n.m.	6.5-9.2*
3.2.2	Total filtrable residue	mg/l	500	1,500	n.m.	2,000*
3.2.3	Total hardness	mg$CaCO_3$/l	n.m.	n.m.	500	600*
3.2.4	Calcium, Ca	mg/l	75	200	n.m.	n.m.

No.	Water Classification and Substances	STANDARDS OF WATER QUALITY				
			WHO, International (a)		WHO, European (b)	Tanzanian (c)
		Units	Acceptable	Allowable		
3.2.5	Magnesium, Mg	mg/l	50	150	125	n.m.
3.2.6	Magnesium-Sodium Sulphate	mg/l	500	1,000	n.m.	n.m.
3.2.7	Sulphate, SO_4	mg/l	200	400	250	600*
3.2.8	Chloride, Cl	mg/l	200	600	600	800*
3.3	Water with non toxic metals					
3.3.1	Iron, Fe	mg/l	0.3	1.0	1.0	1.0*
3.3.2	Mangenese, Mn	mg/l	0.1	0.5	0.05	0.5*
3.3.3	Copper, Cu	mg/l	1.0	1.5	0.05/3.00	3.0*
3.3.4	Zinc, Zn	mg/l	5.0	15.0	5.0	15.0*
3.4	Water with organic pollution of natural origin					
3.4.1	BOD 5	mgO_2/l	n.m.	6.0	n.m.	6.0
3.4.2	PV (Oxygen abs. K MnO_4)	mgO_2/l	n.m.	10	n.m.	20
3.4.3	Ammonium, NH_3	mg/l	n.m.	0.5	0.05	n.m.
3.4.4	Total Nitrogen, exclusive Nitrate	mg/l	n.m.	0.1	n.m.	1.0
3.5	Water with organic pollution introduced artificially					
3.5.1	Surfactants ABS	mg/l	0.5	1.0	n.m.	2.0*
3.5.2	Organic matter as carbon in chloroform extract	mg/l	0.2	0.5	0.5	0.5
3.5.3	Phenolic substance as phenol	mg/l	0.001	0.002	0.001	0.002

NOTES

n.m.	=	not mentioned
n.o.	=	unobjectionable
(x)	=	Odour scale in use in U.S.A.
(y)	=	Transparency measured as thickness of water layer through which standard type can be read.
(z)	=	Bal-unit of odour in the scale used in U.S.S.R.
(a)	=	International Standards for Drinking Water, WHO, Geneva, 1963.
(b)	=	European Standards for Drinking Water, WHO, Geneva, 1970.
(c)	=	Proposed temporary standards for Rural Water Supplies by RWSHSC, 1973.
*	=	tentative figures.

UNIT COSTS OF WATER SUPPLIES

1
Basic Prices

Cement		120	TAS/bag
Iron bars	Ø 6-10 mm	5	TAS/m
	Ø 12-16 mm	10	"
Sand (incl. transport 50 km)		200	TAS/m^3
Gravel (crushed, incl. transport 100 km)		500	"
Concrete rings, incl. transport 200 km			
	Ø 800	500	TAS/pc
	Ø 1000	600	"
	Ø 2000	1,700	"
	Cover	600	"
Concrete block (incl. transp. 200 km)		40	TAS/pc
Hand pumps, compl. with pipes			
	Depth = 6 m	7,500	TAS/pc
	Depth = 30 m	18,600	"
Salaries,	supervisor	2,000	TAS/month
	skilled labour	1,500	"
Allowances,	supervisor	100	TAS/day
	skilled labour	50	"
Transportation,	lorry	10	TAS/km
	Land-Rover	7	"

2
Unit Costs

The unit costs of different structures are as follows:

Handpump wells

<u>Dug well</u>	H = 6 m		
Survey costs		500	TAS
Rings	Ø1000, 13 pc	7,800	
Handpump		7,500	
Cover		600	

Apron	800	
Transport of materials	2,000	
Supervision + installation, transport	1,500	
Community work, transport	400	
Training, transport	400	
	21,500	TAS

Hand auger wells, Depth = 12 m

Survey	500	TAS
Pipes + screen	1,800	
Handpump	8,700	
Cover	600	
Apron	800	
Transport of materials	1,500	
Supervision + installation, transport	1,500	
Community work, transport	400	
Training, transport	400	
	16,200	TAS

Drilled well (w. DTH or percussion rig), Depth = 40 m

Skilled labour, 5 pers, one week/well	3,000	
Supervision, allowance	500	
Casing 10 m steel	3,000	
Pipe PVC	4,000	
Handpump 3 m	18,600	
Cover	600	
Apron	800	
Gravel 0,5 m^3	300	
Fuel + oil + foam	4,000	
Transport (lorries + L/R:s)	6,500	
Seismic sounding	2,500	
Community work, transport	400	
Training, transport	400	
	44,600	TAS

Piped schemes

Intakes

Well	Ø 1000, concr.rings + cover	20,000 TAS/pc
	Ø 2000, concr.rings + cover	40,000 "
Protected spring; spring box of concrete		30,000 "
River intake; box of concrete		30,000 "
Boreholes,50 m, incl. drilling + screens + pipes + pipes for pump		325,000 TAS/pc
100 m, incl. drilling +screens + pipes + pipes for pump		450,000 "

Treatment plants, concrete mixing chamber, sedimentation basin, filtration unit

100 m^3/d	500,000 TAS
500 m^3/d	800,000 "
1000 m^3/d	1,200,000 "

Pumphouse

3 x 3 m, approx. 10 m^2

Concrete floor 9 x 0,2	=	1,8 m^3
Walls		7,5 "
		10 m^3

Concrete;	Cement	6 x 120	720
	Gravel	0,5 x 0,7 x 500	175
	Sand	0,5 x 0,7 x 200	70
			965 TAS/m^3

Total approx. 20,000 TAS

Pump attendants house

25 m^2	approx. 50,000 TAS

Generating Units — including switch board and cables, fuel tank and accessories

0 - 10 kW	90,000 TAS/unit
10 - 30 kW	150,000 "
30 - 100 kW	5,000 TAS/kW
100 -	4,000 "

Pumping Units — including engine, pump and 20 % accessories

Borehole pumps

	0-5 m^3/h	5-20	20-50	50-100
20 m	20,000 TAS	30,000 TAS	40,000 TAS	50,000 TAS
50 "	25,000 "	40,000 "	60,000 "	80,000 "
100 "	30,000 "	60,000 "	90,000 "	150,000 "
150 "	50,000 "	90,000 "	130,000 "	-

Boosterpumps

	0-5 m^3/h	5-20	20-50	50-100
20 m	20,000 TAS	25,000 TAS	30,000 TAS	40,000 TAS
50 "	25,000 "	30,000 "	40,000 "	60,000 "
100 "	30,000 "	50,000 "	70,000 "	100,000 "
150 "	50,000 "	70,000 "	100,000 "	-

Pipelines, including pipes + 20 % for joints + accessories and transport

8" PCV, cast iron	575 TAS/m
6" PVC, cast iron	325 "
4" PVC, cast iron	150 "
3" PVC, cast iron	100 "
Dom. lines 1" - 2"	45 "

Tanks

Concrete, ground level

20 m^3	30,000 TAS
50 m^3	50,000 "
100 m^3	100,000 "
200 m^3	180,000 "
300 m^3	250,000 "

Elevated, 10 m

10 m^3, concr. or steel	30,000 TAS/pc
20 m^3, concr. or steel	70,000 "
50 m^3, concr. or steel	100,000 "
100 m^3, concr. or steel	180,000 "

Domestic points, with two taps 2,500 TAS/pc

Dams

Homogeneous earth dam, max. H = 6 m
lenght 100 m, Volume 2000 m^3

Constructed with roller, bulldozer and excavator,
1 dam/3 months

Labour,	salaries 10 men x 1500 TAS/month x 3	45,000 TAS
	allow. 10 men x 50 TAS/day x 20 day x 3	30,000 "
Transport,	Trailer 200 km x 20	4,000 "
	Lorry 1,000 km x 10	10,000 "
	L/R 1,000 km x 7	7,000 "
Fuel,	300 h/dam x 40 l/h x 3 x 8,5 TAS/l	204,000 "
	(Roller, bulldozer, excavator)	
Oil and spares		10,000 "
		310,000 TAS

Rainwater Collection

Basis

Consumption;	10 l/d/person
Dry season =>	1,8 m^3/person
Collected precipitation	500 mm/wet season

Collection System for One Family, 10 m^3 (6 persons)

Hole about 10 m^3 (made by self-help) h = 4 m. Covered by concrete cover Ø about 3 m (two parts or one). Plastered inside with concrete / or with big plastic bag. Roof catchment with steel or plastic pipes.

Costs;

		self-help
Digging		
Plastering, 6 bags of cement		720 TAS
(Plastic bag		1,200 TAS)
Concrete cover		700 TAS
Wooden cover		100 "
Pipes	25 m	1,500 "
		3,020 TAS
	(with plastic bag	3,500 TAS)

Collection System for 600 people, 1,000 m^3

Tank 1,000 m^3, dug by self-help, roof made of corrugated iron sheets. Catchment area made of concrete slabs 2 x 2 m. Water is taken by hand pump from a separate well, which is connected to the tank. Catchment area + tank is fenced.

Costs;

Digging		self-help
Plastic sheet	550 m^2 à 30 TAS	16,500 TAS
Wooden poles approx. 3 m, 110 pcs à 100 TAS		11,000 "
Wooden beams	250 m à 30 TAS	7,500 "
Iron sheets	500 m^2 à 80 TAS	40,000 "
Concrete plates	375 pcs à 300 TAS	112,500 "
Fence		self-help
Well with hand pump		15,000 TAS
Connection pipes	approx. 10 m	1,000 "
Inlet structures	10 bags cement	1,200 "
		204,700 TAS

OPERATION AND MAINTENANCE COSTS

1
Basic Prices

Fuel, diesel oil	8,5	TAS/l
Labour, skilled	1,500	TAS/ month
Allowance, skilled labour	50	TAS/day
Allowance, supervisor	100	"
Transportation, Lorry	10	TAS/km
Transportation, Land-Rover	7	"

2
Unit costs

Piped Schmes

O + M costs of piped scheme without treatment
(borehole, pump, tank, booster, main, pipes, tanks, taps)

Fuel costs:

Formula: $$\frac{8,5 \text{ TAS/l} \times 0,3 \text{ l/kWh} \times \text{Daily consumpt. } (m^3) \times \text{head (m)} \times 365}{367 \times 0,6}$$

$$= 4,23 \times Q \times H \quad \text{TAS/year}$$

Oil costs; 10 % of fuel costs, TAS/year

Spare parts: 20 % of machinery costs, TAS/year
or 10 % in urban

Operation: pump attendant: 20 000 TAS/year

maintenance of pipelines and structures
2 % of pipe, housing and tank costs + 20,000 TAS/pump-attendant/year, 1 % in main lines

Maintenance and repair of machine and equipment:
4 vistis/year

Group; 4 men 200 km transport/scheme, 1 scheme/day

Allowance;	4 x(3 x 50 + 1 x 100)	1,000 TAS/year
Transport;	4 x 200 x 7 TAS	5,600 "
		6,600 TAS/year

Hand Pumps

Operation and maintenance costs of handpump wells

1)	4 visits/year;	transport + allowance;	
	2 men, 5 wells/day	50 km/well	
	Allowance 4 x	2 x 50	80 TAS/well/year
	Transp. 4 x	30 x 7 TAS	840 "
2)	Spareparts 20 % of handpump costs		1,500 TAS/well/year
3)	Well maintenance		200 "
			2,620 TAS/well/year

RURAL WATER SUPPLY PROJECTS

1. Makonde Plateau Water Supply

2. Mbembaleo Water Supply

3. Lukuledi Water Supply

4. Mtama-Nyengedi Water Supply

1
MAKONDE PLATEAU WATER SUPPLY

Makonde Plateau which covers practically the whole Newala District is a geological formation where no perennial surface water exists and groundwater level is commonly several hundred meters below the surface level. Piped water schemes or rainwater collection are the only solutions for water supply in the area.

There are about 310,000 people in Makonde Plateau at present (1984) including 39,200 urban people in Newala town and in Mahuta. The population is estimated to be 380,000 in 2001, out of it 76,300 belonging to urban population.

The water demand is estimated to grow from 9,100 m^3/d in 1984 to 12,600 m^3/d in 2001.

Although rainwater collection is a common practice in Makonde Plateau, the great number of population and the importance of the water supply leaves piped water as the only solution.

There are six piped water schemes in Makonde Plateau at present, namely Kitangari W/S, Mkunya-Makote W/S, Mahuta W/S, Chiwambo W/S, Majembe Juu W/S and Mwinji W/S. Out of them, only Kitangari W/S serving about 120,000 people is in good condition and functioning properly.

The area of Makonde Water Supply is shown in Drawing 7, Volume 3.

The water supply in Makonde Plateau is proposed to be developed by following measures:

1. Interconnecting all existing water supply schemes.

2. Extending Kitangari W/S to cover the villages not yet served. The capacity of Kitangari shall be increased to 9,200 m^3/d by 2001.

3. Rehabilitating Mkunya-Makote W/S to produce 2,000 m^3/d and to serve especially Newala town.

4. Completing Mwinji W/S to produce 500 m^3/d. The scheme shall be extended to cover the whole northern plateau.

5. Incorporating Mahuta W/S to Kitangari W/S. Later, Mahuta scheme shall be reconstructed to take care of the increasing water demand in Mahuta and surrounding area.

6. The distribution systems of other smaller schemes - Chiwambo W/S and Majembe Juu W/S - shall be incorporated in Kitangari W/S. Their pumping stations shall remain as stand-by systems in full working order.

7. An independent water authority shall be formed to be responsible in all piped water supplies in Makonde Plateau. The authority should be given right to collect water charges to cover the exceptionally high operating costs.

The required investment costs excluding Newala town water supply are TAS 113.8 mill during the planning period. The operation and maintenance costs will be TAS 9.4 mill/yr in 1986 and TAS 18.7 mill/yr in 2001.

2
MBEMBALEO WATER SUPPLY

In Mtwara District, east of the existing Nanyumba Water Supply, there is an area covering parts of Nanyumbu, Mtiniko and Kiromba wards, where local water resources are practically non-existing and present water supply in the villages is based mainly on traditional sources, i.e. pits. The villages without improved water supply in that area are Mwanganga, Mbembaleo, Mtimbwilimbwi, Mbanbakofi, Mpayani, Myambo and Mkahara, two last ones sub-villages of Kiynga. The locations of the villages are shown in Figure 1.

The present (1984) population of the area is 8,100 and it is estimated to be 11,000 in 2001. The water demand is estimated to grow from 205 m^3/d to 280 m^3/d during the same period.

Due to the geology of the area the possibilities for shallow and meduim depth groundwater are very small. Thus the alternatives to supply the area are:

1. Boreholes near Mbambakofi in Mutumnudi Valley. Pumping up to Mbambakofi and distribution by gravity to the area. The total pumping head will be 100 m. The source has to be confirmed.

2. Boreholes near the boreholes for the present Nanyumba W/S at Mnyawi Barabarani. Pumping up to Mbembaleo. Boosting to the northern parts of the area. The total head to the southern part of the area is 150 m and to the northern part 250 m.

3. Extension of Nanyumbu W/S to the area. Additional water will be obtained from Kitangari W/S. The pumping head is 220 m.

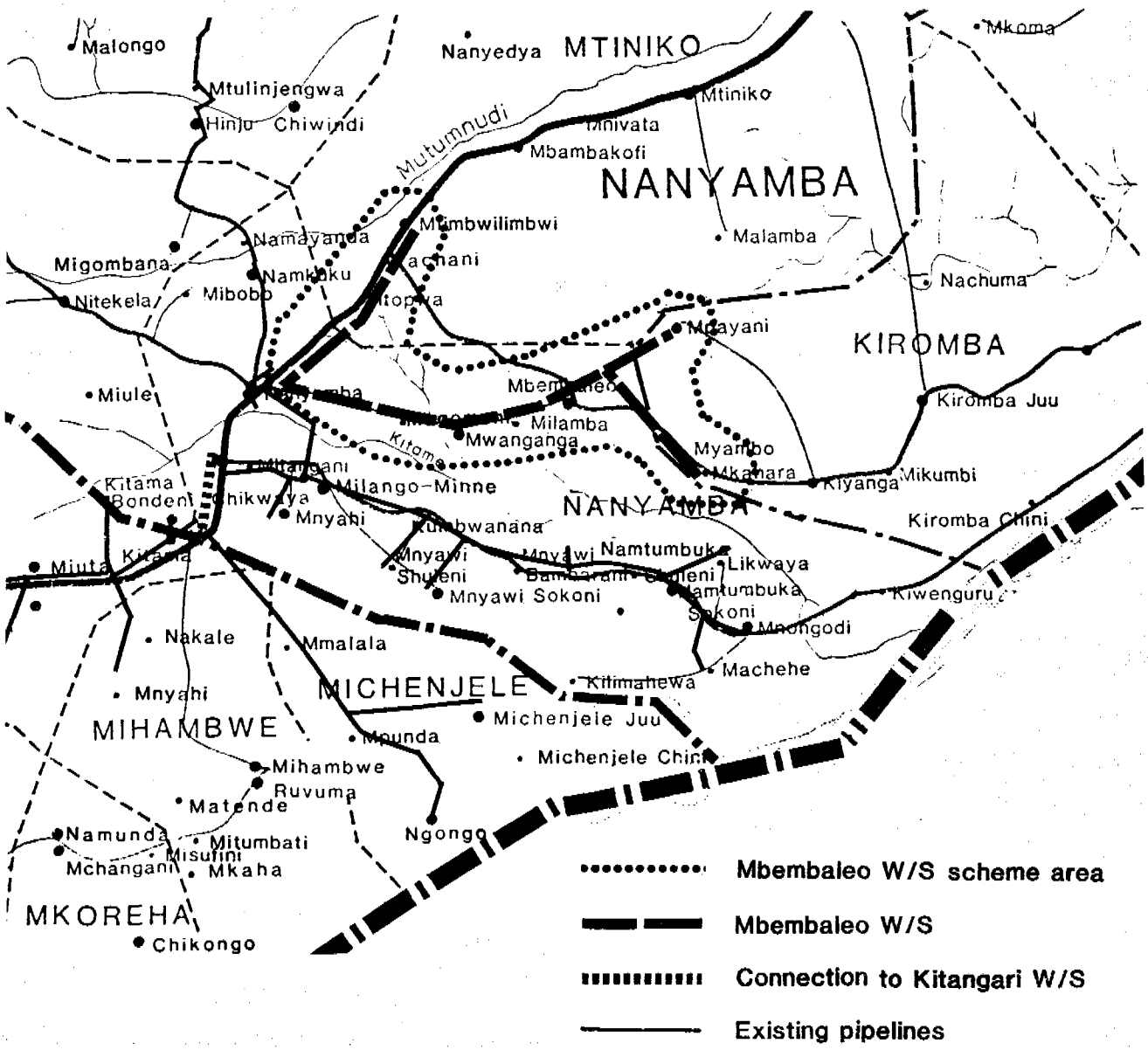
The costs of the schemes are:

Alternative	Development Costs 1986 - 2001	O & M Costs 2001
1	TAS 6.8 mill	TAS 0.33 mill/yr
2	TAS 5.6 mill	TAS 0.51 mill/yr
3	TAS 4.0 mill	TAS 0.32 mill/yr

Alternative 3, supplying water through Nanyamba W/S from Kitangari W/S is the cheapest and operationnaly best alternative. The investment will be TAS 500/capita, which can be considered quite high. Therefore possibilities for local medium deep boreholes equipped with hand pumps should still be investigated especially in Mbambakofi and Mtwimbwilimbwi.

The proposed lay-out of the system is shown in Figure 1.

FIGURE 1



3
LUKULEDI WATER SUPPLY

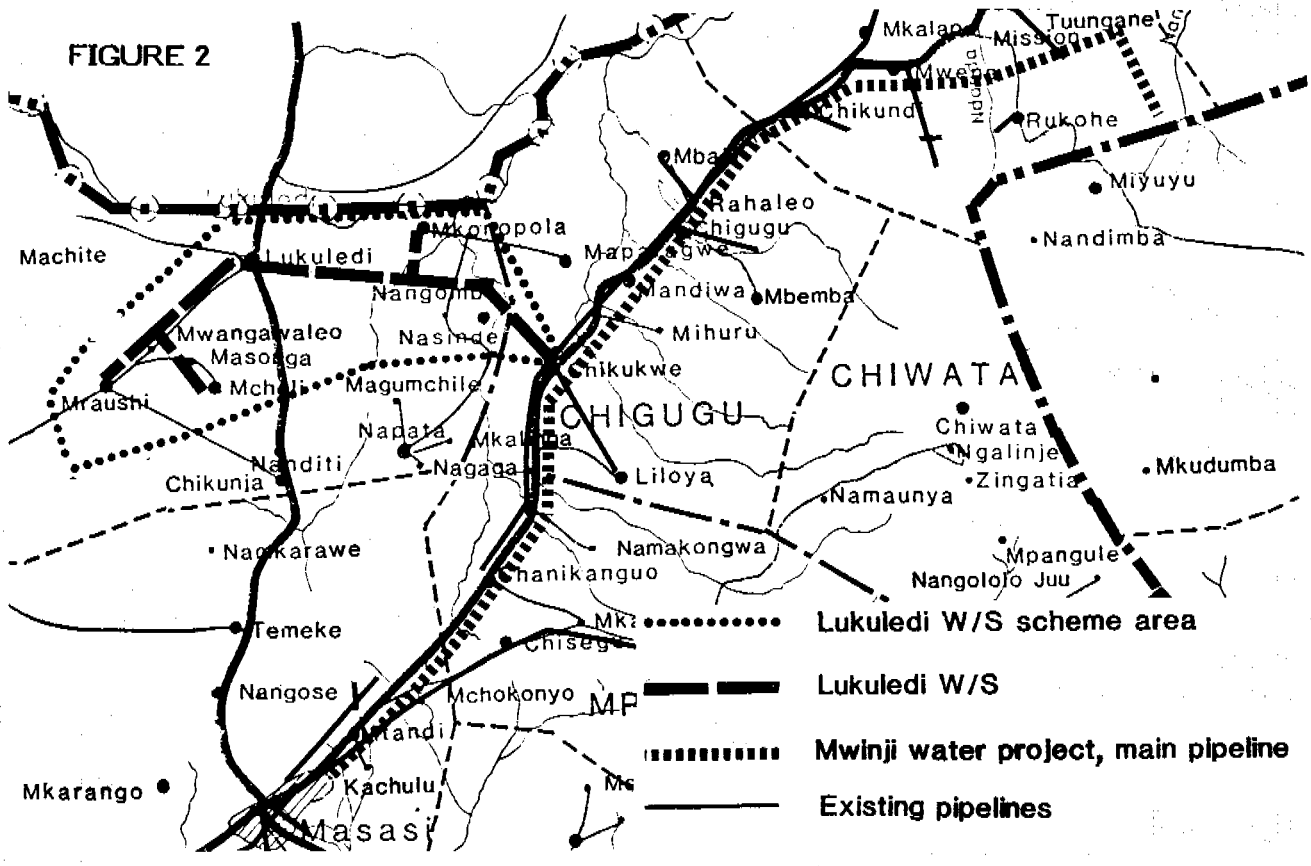
There are 9 villages in Lukuledi area with poor or non-existing water supply at the moment: Lukuledi, Mkoropola, Nangomba, Nasinde, Mraushi Mraushi, Mwanga-waleo, Masenga and Mcholi. The population at present (1984) is 7,501 and is estimated at 9,820 in 2001. The water demands are 200 m^3/d and 260 m^3/d respectively.

There are no perennial rivers in the area and groundwater resources are very limited with poor quality - salinity being the main problem. In view of poor local water resources, the only feasible solution to improve the water supply situation is to bring piped water into the area from outside.

Masasi town water supply needs to be expanded and it is proposed that the new phase bringing water from Mwinji spring to Masasi should be completed by 1993. The main pipeline will be constructed along Masasi -Lindi road and a branch to Lukuledi can be taken directly from it. The proposed lay-out of the water supply system is presented in Figure 2. The scheme will operate by gravity.

The estimated development costs during the planning period are TAS 4.65 mill. The operation and maintenance costs in 2001 will be TAS 50,000/yr.

FIGURE 2



4
MTAMA - NYENGEDI

Along Lindi - Masasi road between Kiwalala and Mahiwa there are 11 villages with 30,916 people in 1984. The population is estimated to grow up to 36,600 in 2001. The water demand will grow from 750 m^3/d to 900 m^3/d during the same period. The area is shown in Figure 3.

The area is served at present by 4 piped water schemes and by 44 hand pump wells. All piped schemes are in poor condition and none of them is operating at the moment. The people are relying on unimproved water sources and hand pump wells, which are too few.

The water resources are quite good. Nyengedi river and Lukuledi river are perennial and groundwater resources are estimated to be good. Groundwater is recommended as the source of the future water supplies.

There are 4 main possibilities to improve the water supply situation in the area:

1. To construct a piped water scheme to cover the whole area. The present distribution systems can be utilized.

2. To rehabilitate the present water supplies and to extend them to cover the unserved villages.

3. To rehabilitate the piped water supplies only in the main villages, Mtama, Nyengedi, Luwale, Mbale, Longa and Mtua and to serve the other villages by hand pump wells. In practice, rehabilitation of Mtama W/S means construction of a new water supply.

4. To serve all villages by hand pump wells.

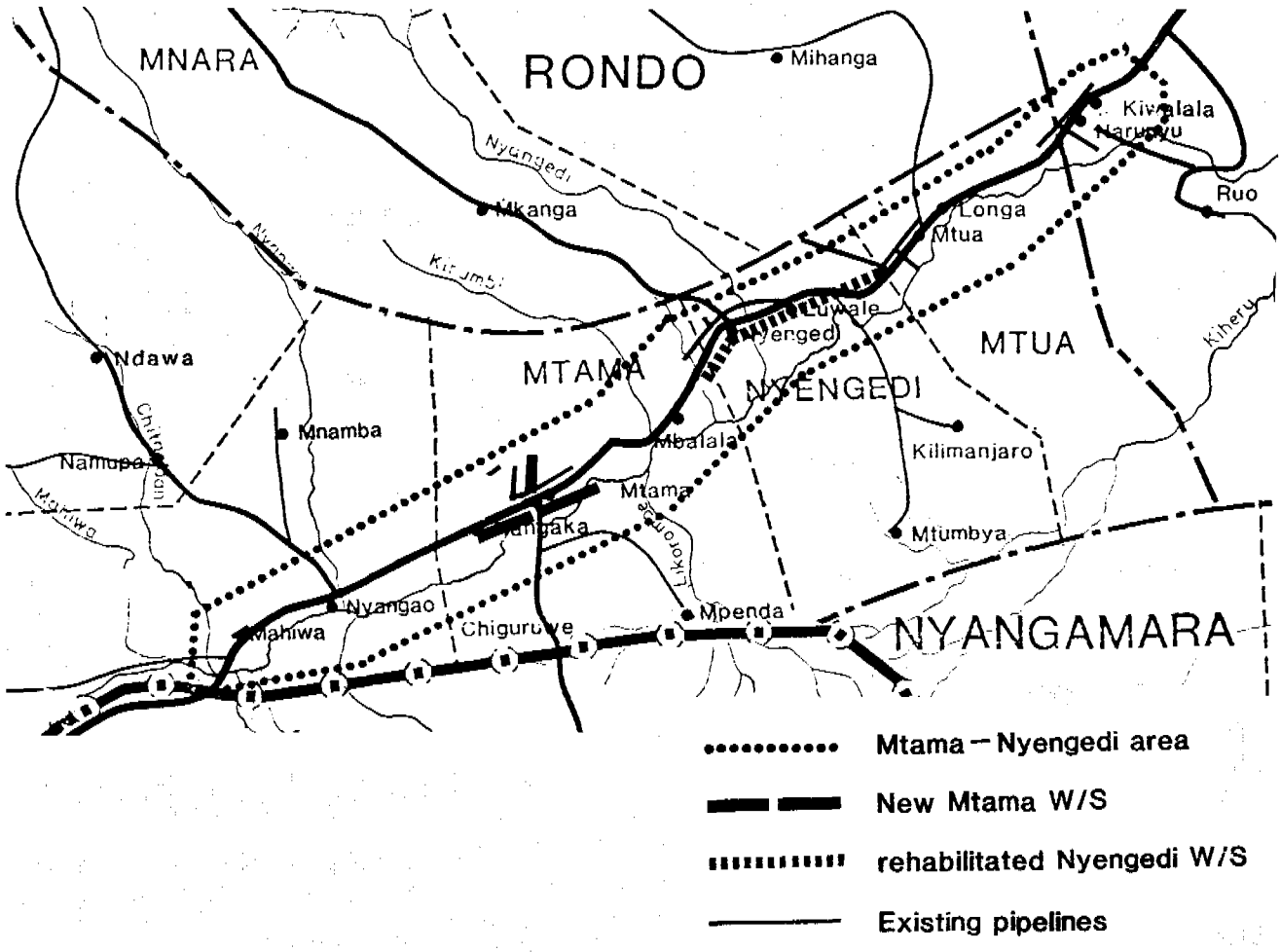
The costs of the different alternatives are:

Alternative	Development Costs	O & M Costs in 2001
1	TAS 10.5 mill	TAS 0.88 mill/yr
2	TAS 5.1 mill	TAS 0.66 mill/yr
3	TAS 3.8 mill	TAS 0.60 mill/yr
4	TAS 2.2 mill	TAS 0.39 mill/yr

It can be seen that alternative 4 using hand pump wells only is the cheapest to construct and to operate. However, since Mtama can be considered as an urban area and the boreholes for Nyengedi W/S rehabilitation are already drilled, it is recommended to develop the water supply situation in the area according to alternative 3.

The proposed water supply schemes are shown in Figure 3.

FIGURE 3



URBAN WATER SUPPLIES

1. Mtwara Town Water Supply

2. Mikindani Town Water Supply

3. Lindi Town Water Supply

4. Kilwa-Masoko Town Water Supply

5. Kilwa-Kivinje Town Water Supply

6. Nachingwea Town Water Supply

7. Masasi Town Water Supply

8. Liwale Town Water Supply

1
MTWARA TOWN WATER SUPPLY

Mtwara town water supply covers the main urban area of Mtwara excluding Mikindani and the relatively large rural area included in Mtwara Mikindani township. The main parts of the water supply system are more than 20 years old.

The water supply is based on the use of groundwater and it consists of:

- four wells in the Mtawanya Valley, 8 km south-east of the town centre,
- two parallel rising mains DN 150 and DN 250 mm,
- treatment plant, consisting of an aeration chamber, settling tanks, rapid gravity filters, and unit for disinfection and dosing of chemicals,
- three gravity mains DN 150 mm to the town,
- a distribution network (32 km of pipework).

The water supply system is illustrated in Figure 1.

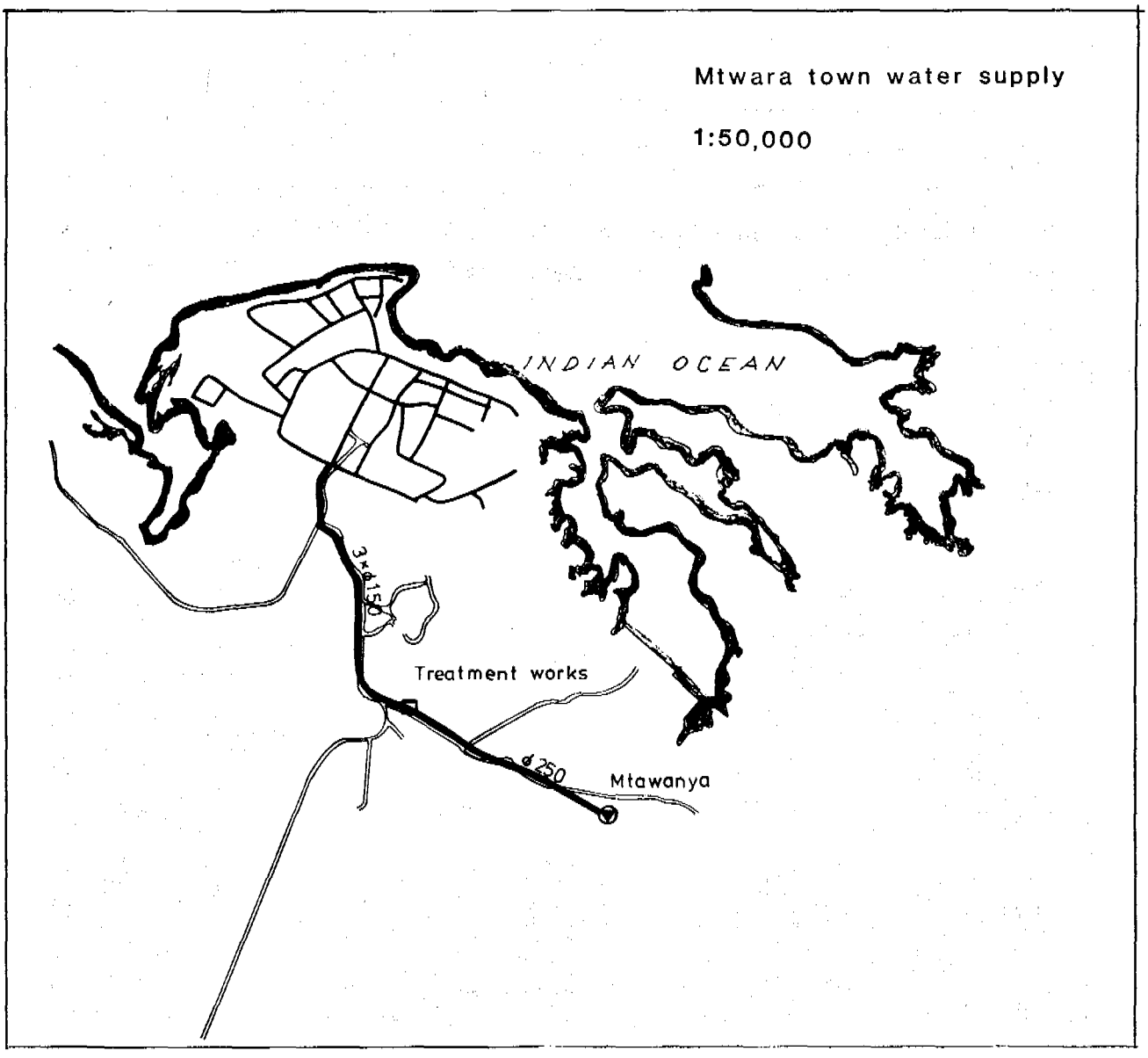
During the last years the existing water supply system has operated at a capacity of 1,200 to 1,800 m^3/day. The raw water is aggressive, with an average hardness of 24 degrees. The salinity is high. Iron and manganese contents reach 2.0 ppm and 2.5 ppm respectively.

The treatment process includes reduction of iron as well as reduction of the temporary hardness. The quality of the distributed water is within the permissible limits of the WHO Standards.

The units of the water supply system are badly corroded; pipes, mechanical equipment and the whole treatment plant being beyond repair.

Frequent break-downs of the water supply occur, usually as a consequence of power supply failures, but also failures in the plant, ruptures of transmission mains or collapsing of wells reduce the potential output of the water system.

FIGURE 1 **Mtwara Town Water Supply**



The urban population of Mtwara town is 61,300 at present (1984) and is estimated to be 165,000 in 2001. The water demand will inrease from the present 3,080 m^3/d to 8,300 m^3/d. The present production is not sufficient and part of the demand is satisfied by the hand pump wells and also by local water sources.

The augmentation of the water supply will include drilling of new boreholes, installation of new pumps, renovation of the treatment works, increasing the capacity of the rising main and improvement and extending of the distribution system. The final capacity of the system will depend upon the yields of the boreholes, but it is estimated to be at least 5,000 m^3/d. The estimated cost of the augmentation is TAS 45 mill. The financing is going to be done through a loan from EEC. The estimated ealiest completion time is 1989.

At the end of the planning period additional water supply capacity will be needed. The additional water could be taken most economically from Mikindani -Nanyati valley, where the groundwater potential is estimated at 2,000...4,000 m^3/d. Detailed investingations are needed to confirm this. An alternative future solution is the groundwater in Mbuo valley located about 25-30 km to the west of Mtwara.

The additional water supply system for Mtwara town required at the end of the planning period should be decided in connection with Mikindani water supply.

The estimated development costs up to year 2001 including the ongoing augementation, the necessary future expansion of the distribution and the provision for the additional capacity at the end of planning period are TAS 111.0 mill. The estimated operation and maintenance costs are TAS 2.2 mill/yr in 1986 and TAS 6.4 mill/yr in 2001.

2
MIKINDANI TOWN WATER SUPPLY

Mikindani town water supply which covers the urban area only, is more than 20 years old. Part of the scheme has been rehabilitated during 1984-85. The scheme comprises now two new boreholes equipped with submersible borehole pumps, 30 m^3/h each, a new Ø 6" PVC rising main connected to the old Ø 6" G.S. rising main, a 90 m^3 water reservoir and the distribution network made of G.S. and C.I. mainly. The condition of the old part of the system - reservoir, distribution and the old part of the rising main - is poor.

The maximum capacity of the present system is about 600 m^3/d.

The present (1984) population is 11,300 and it is estimated at 30,400 in 2001. The water demands are is 565 m^3/d and 1,200 m^3/d respectively. The present water supply is sufficient up to 1989.

The new developments needed for Mikindani W/S during the planning period are the rehabilitation and expansion of the distribution system and the increasing of the capacity of water supply up to 1,500 m^3/d. Most probably, the additional water can be abstracted from the present aquifer.

The further expansion of Mikindani water supply should be done in connection with Mtwara town water supply.

The estimated development costs up to year 2001 including rehabilitation and necessary expansion of the water supply system are TAS 6.3 mill. The operation and maintenance costs are TAS 0.4 mill in 1986 and TAS 0.9 mill in 2001.

3
LINDI TOWN WATER SUPPLY

Lindi Urban Water Supply is covering the area of Lindi town. The scheme is operated by the Regional Water Engineer, Lindi. The general lay-out of the water supply system is shown in Figure 2.

There are two sources of water supply, namely Mmongo spring and Kitunda springs.

The Mmongo spring is located 6 km north of Lindi town, about 1 km east of the Lindi - Dar es Salaam road. Water is collected from the ground by wells and perforated pipes in to a chlorination chamber. An intake weir has also been constructed near the chamber. The watershed area of Mmongo spring is a little less than 10 km^2, and the estimated minimum flow is about 1,000 m^3/d. The system has been designed for a flow of 800 m^3/d (17,800 gpd). Water is conducted from the chlorination chamber to town by gravity via a Ø 150 mm cast iron pipe.

CATA (the Cashewnut factory) is abstracting water from the intake weir into a Ø 150 mm PVC pipe. The abstraction of CATA doesn't affect the amount of water obtained by the town water supply.

Kitunda springs consist of 5 springs, located about 2 km west of Lindi town on the eastern side of the Lukuledi estuary. Three of the springs have been tapped and their measured minimum flows are as follows:

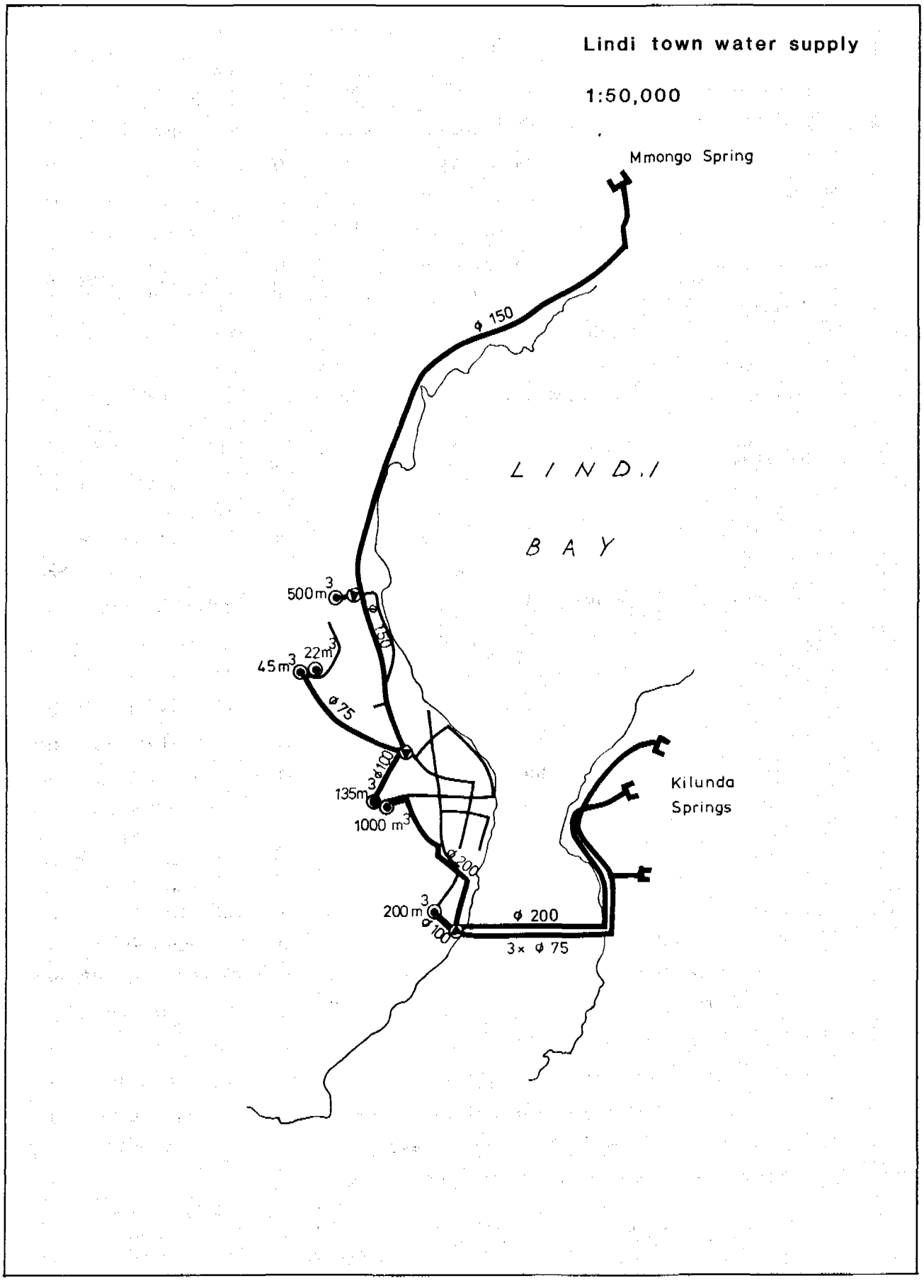
1.	Big Kitunda	835 m^3/d
2.	Kimbunga B	176 m^3/d
3.	Mchororo	297 m^3/d

Thus, the total minimum yield of the springs is 1,300 m^3/d.

The big Kitunda spring was taken into use in 1978 and the system consists of an intake chamber and a Ø 150 PVC pipe which is divided into 3 x Ø 75 mm PEH pipes in the estuary crossing.

The two other springs were taken into use in 1982 by a system which consists of an intake weir and an intake chamber in both springs, connection mains from 100 mm to 225 mm PVC and of the estuary crossing, Ø 250 PEH. These two

FIGURE 2 **Lindi Town Water Supply**



systems are interconnected and both discharging into the sump of the pumping station no. 3 on the western shore of the estuary. The capacity of the system has not yet been finally established due to the problems in estuary crossing but according to the pipe dimensions it by far exceeds the minimum yield of the springs.

The total capacity of the water resources supplying Lindi Town is about 2,300 m^3/d, whereas the present actual maximum capacity is about 1,000-1,500 m^3/d and the present actual supply about 700-800 m^3/d only. The supply is not sufficient and a great number of people (20-40 %) are relying on the traditional private wells common in the town area.

The present (1984) population is 36,600 and it is estimated to grow up to 83,900 in 2001. The respective water demands are 1,800 m^3/d and 4,200 m^3/d. The present water supply, when in full use, is sufficient up to 1989.

The alternative sources to supply the additional water to Lindi are:

1. Mingoyo boreholes. Successful boreholes have been drilled in the Mingoyo area, and according to geoelectrical soundings, the valley along the Mingoyo-Masasi road up to Kiwalala has a high groundwater potential. Another promising area for boreholes is a valley located south of the Mkwaya village. It has been estimated that at least 5,000 m^3/day can be abstracted from these sources by using boreholes. The distance from Lindi to the Mingoyo area is about 25 kilometres, and to Mkwaya 5 km more. Water has a low salinity content, but iron and manganese concentrations are excessive. Thus, a treatment to remove these constituents may be necessary.

2. Lake Rutamba is located at a distance of 40 kilometres from Lindi. The minimum inflow to the lake is over 40,000 m^3/day, but Lupululu River, which is the outlet of the lake, has a minimum flow of 5,000 m^3/day only. The discharge has been measured on the upper course of the river. The discharge on the lower course is smaller, due to losses through evaporation, infiltration and irrigation. If water is drawn directly from the lake, and not from the outlet river, even more that 5,000 m^3/day can be used for the Lindi town water supply, especially if the water level of the lake is raised by a regulating dam.

3. Lukuledi River at Mingoyo. The distance is about 25 km. The recorded minimum flow in Lukeledi near that point (I.N.4 at Mtua) is 0,34 m^3/s equal to about 30,000 m^3/d. Water needs full chemical treatment. Due to the great fluctuations in the flow and water level the abstraction of water is difficult.

The cost of water supply schemes using the above alternative sources with the capacity of 1,900 m^3/d is as follows:

	Construction TAS	Operation and Maintenance TAS/yr
1. Mingoyo-Mkwaya	45.5 mill	3.4 mill/yr
2. Lake Rutamba	67.7 mill	4.4 mill/yr
3. Lukeledi	54.8 mill	4.4 mill/yr

It is recommended to carry out detailed investigations to confirm the availability of groundwater in Mingoyo-Mkwaya area. If the results are positive, expansion of Lindi W/S should be done by using that source. The rural areas along the pipeline should be served by it. Also connections to Mnazimmoja water supply should be made.

In addition to additional water source, the water distribution system in town needs to rehabilitated and extended.

The reguired investments during the planning period are altogether TAS 60.1 mill. The operation and maintenance costs are TAS 1.02 mill/yr in 1986 and TAS 3.23 mill/yr in 2001.

4
KILWA-MASOKO TOWN WATER SUPPLY

The present water supply, which is run and administrated by Maji, was started in 1952 and is drawing water from the Mpara swamp and from four recently drilled boreholes in the town.

The capacity of the Mpara intake is about 250 m^3/d at the minimum and the town boreholes could produce together about 1,000 m^3/d. Owing to the shortage of diesel, short hours of electricity supply and the break-downs of equipment the pesent production is only about 100 m^3/d and cannot satisfy the demand.

Water from Mpara flows to town by gravity via a 11 km long, Ø 150 mm asbestos cement pipeline. In town water is pumped into elevated reservoirs, from which it flows to consumption by gravity.

The boreholes are equipped with electrical or diesel-driven borehole pumps. Water is pumped either into the elevated reservoir or directly into consumption.

Water is distributed to the consumers through about 220 house connections and through 5 public taps. The public taps are supplemented by 4 hand pump wells. A connenction with a public tap is made from the Mpara - town pipeline for the Mkanyula and Kisangi villages.

The present (1984) population of Kilwa-Masoko is 7,000 and is estimated to grow up to 22,100 by year 2001. The rapid growth of the town will be caused by the upcoming ammonium-urea factory and by other expected industries. The dometic water demand is expected to grow from the present 350 m^3/d up to 4,000 m^3/d during the planning period. The new ammonium-urea factory will have it's own independent water supply based on desalination. Other industries, such as methanol plant and cement factory, are proposed. Reservation for the industrial consumption of 6,900 m^3/d at the end of the planning period is made.

A feasibility study of Kilwa-Masoko water supply was completed in 1983 and the expansion was proposed to be done in two phases:

Phase I: Full utilization of the local and Mpara groundwater to bring the capacity up to 2,000 m^3/d. The works include pumping station at Mpara, new Ø225 PVC, 11 km long, between Mpara and town, booster pumping station, ground level and elevated reservoirs in town and the rehabilitation and expansion of the distribution network.

Phase II: Abstraction of water from the Mavuji River, where the minimum of 17,300 m^3/d is estimated to be available. Water is proposed to be abstracted near the river mouth, pumped via a 17 km long pipeline to town across the bay, treated fully in a treatment plant in town and pumped then to consumption.

The first phase should be implemented immediately and it will satisfy the water demand up to about 1992 depending on the completion of the ammonium-urea factory. The capacity of Phase II can be decided, when the plan for the other industrial development is better known.

The development expenditures during the planning period are:

-	Phase I	TAS 32.0 mill
-	Phase II (2,000 m^3/d)	TAS 45.0 mill
		TAS 77.0 mill

The operation and maintenance costs are TAS 0.4 mill/yr in 1986 and TAS 4.0 mill in 2001.

5
KILWA - KIVINJE TOWN WATER SUPPLY

Kilwa-Kivinje water supply which serves the town area only comprises intakes in three springs about 2.5 km outside the town, a gravity main Ø6" to town and a distribution system with 225 private connections and 9 public taps. The present capacity is about 200 m^3/d. The distribution system, especially the public taps, needs rehabilitation.

The present (1984) population is 6,161 and it is estimated to grow up to 13,500 by the year 2001. The water demand is estimated to grow from 310 m^3/d to 680 m^3/d.

The present source, the springs below the Singino Hill, is also used for Singino water supply. It is assumed that the abstraction can still increse, although the potential of the springs has to be investigated. The abstraction may be increased by drilling boreholes at the springs. If the total yield will still not be sufficient the additional water can be supplied most economically from Mpara after the Phase II of Kilwa-Masoko water supply has been completed.

The necessary development of Kilwa-Kivinje water supply includes rehabilitation and expansion of the distribution and the expansion of the capacity of the scheme. If the local groundwater source is sufficient, the development costs during the planning period are TAS 4.3 mill. The operation and maintenance costs are TAS 0.10 mill in 1986 and TAS 0.13 mill/yr in 2001.

6
NACHINGWEA TOWN WATER SUPPLY

The Nachingwea water supply covers Nachingwea urban area, the villages of Stesheni, Nangoe and Namatula and also the prison and the army camp.

The first parts of the scheme were constructed in 1954 and additions have been made from time to time.

The water supply is based on the utilization of groundwater. At the moment four different groundwater intakes are used, each with several boreholes. The main data are presented in Table 1.

TABLE 1 **Water Sources of Nachingwea W/S**

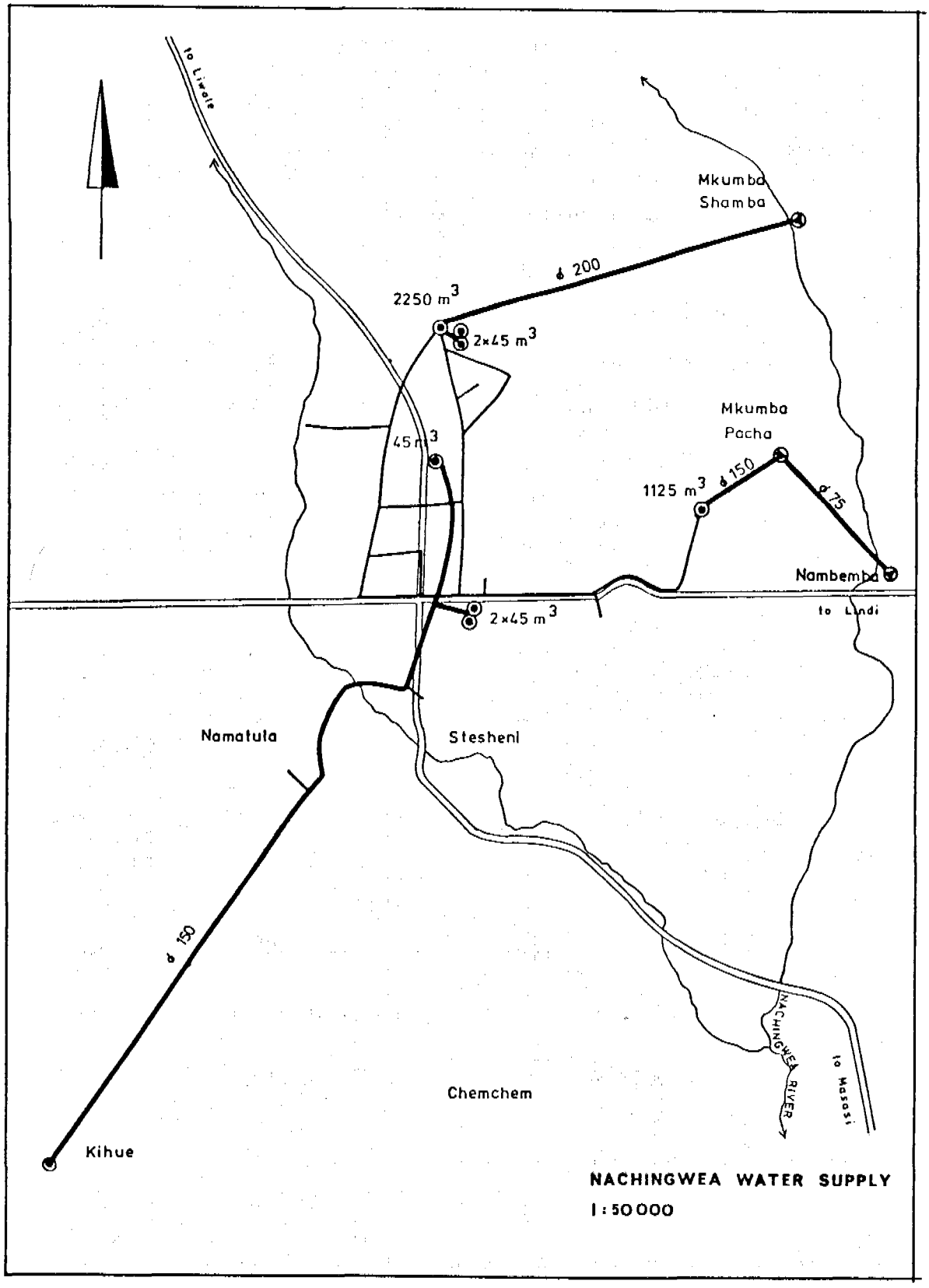
Borehole Field	No. of B/Hs	Estim. tot. yield m^2/h	Pumping capac. m^2/h	Power	Rising main Ø, mm	Rising main L, km	Water quality	Present use
1. Mkumba Shamba	6	100	39	electr. diesel	200	4.2	accept-able	3 B/Hs in use, 600 m^3/d
2. Mkumba Pacha	2	44	25	electr. diesel	150	1.1	accept-able	1 B/H opera-tional, no diesel
3. Nam-penda	2	11	4	diesel	75	1.5	saline	1 B/H opera-tional, not in use
4. Kihue	4	28	19	electr.	15	11.0	saline	Booster pump out of order, not in use

The schematic lay-out of the water supply system is presented in Figure 3.

The distribution system consists of two main storage tanks, five smaller storage tanks and the distribution network. The distribution system is mainly made of steel and galvanized steel pipes and is in a very poor condition so that more than 30-40 % of water is estimated to be lost due to leakages.

The present daily production is about 300-600 m^3/d depending on the electricity and diesel supply. Water supply is supplemented by 24 hand pump wells.

FIGURE 3 **Nachingwea Town Water Supply**



The present population served is about 21,000 and it is estimated to be 40,000 in 2001. The respective water demands are 1,050 m^3/d and 2,000 m^3/d.

The useful local water sources are Mkumba Shamba and Mkumba Pacha well fields. According to recent test pumpings it is estimated that there are possibilities to increase the total abstraction at Mkumba Shamba up to 1,500 m^3/d. Together with Mkumba Pacha (600 m^3/d) and the local hand pump wells (150 m^3/d) the total groundwater abstraction in Nachingwea could be raised up to about 2,250 m^3/d which is sufficient at the end of the planning period.

A more detailed test pumping to confirm the yield of Mkumba Shamba is ongoing.

An alternative source for Nachingwea water supply is Mbwinji springs at the northern side of Makonde Plateau. An other potential place for groundwater is located near Chiumbati village along Masasi-Nachingwea road, about 10 km south-east of Nachingwea. Explorations to establish the groundwater potential at Chiumbati are ongoing.

Mbwinji springs have got a safe yield of about 5,000 m^3/d, of which about 1,400 m^3/d is reserved for local use. A feasibility study was completed in 1983 to study the alternatives for Nachingwea water supply and Mbwinji spring was proposed as long term solution. The estimated cost of the scheme - considering 40 % price escalation - is TAS 81.0 mill.

It is recommended to develop the local groundwater resources near Nachingwea up to the maximum before other alternatives. Since the major problems of the water supply at present are the poor operation and heavy leakages, it is advisable to give the highest priority to the rehabilitation.

The necessary development of Nachingwea water supply includes rehabilitation of the Mkumba Shamba and Mkumba Pacha pumping stations, the rising main from Mkumba Shamba and the whole distribution system. It also includes the expansion of Mkumba Shamba well field if the test pumping will give positive results. The estimated costs during the planning period are TAS 18.9 mill. The operation and maintenance costs are TAS 1.2 mill in 1986 and TAS 2.0 mill in 2001.

7
MASASI TOWN WATER SUPPLY

Masasi Town Water Supply is covering the area of Masasi town. The scheme is operated by the District Water Engineer, Masasi.

There are two main sources of the piped water supply, Magumchila boreholes and Mchema dam. The water supply is supplemented by 50 hand pump wells located within the town area. Work is also going on to extend Mwiti W/S to Masasi.

There are four MAJI boreholes in the Magumchila wellfield. The normal operation is 24 hours per day with 2 pumps running. The daily pumping is 400 -500 m^3. Water is pumped via Ø 100 mm rising into 225 m^3 tank from where water flows to town by gravity. The system was constructed in 1980.

There is also one borehole for CATA Masasi factories in the same wellfield with a capacity of 200 m^3/day. The use of that borehole has been very small during the recent years.

The total storage of Mchema dam is 110,000 m^3. About half of that will evaporate every year. During a normal year the safe yield of the source is about 350 m^3/day. However, during dry years the dam does not get full and water is available only part of the year. E.g. in 1981 the dam dried up in July and after the rainy season 1982 it was still almost dry with water less than 5 % of the dam's total capacity.

At Mchema intake, arrangements are made for a simple chemical treatment, although it is normally not in use. Water is pumped by diesel-driven pumping units into a 225 m^3 ground level concrete tank in town. The rising main is Ø 160 mm PVC. From the tank, water flows to town by gravity. The present operating capacity is about 220 m^3/d. The dam was constructed in 1942.

Both systems, Magumchila and Mchema, can serve any part of the town.

The distribution network is mainly G.S., old and in a poor condition.

There are about 50 shallow wells equipped with handpumps in Masasi supplementing the piped water supply. The yield of the wells decreases during the dry season but most of the wells are perennial.

The total present and future capacity of the water supply is as follows:

	Present capacity		Future safe max. capacity
	Very dry period	Normal year	
Magumchila Boreholes	600 m^3/d	600 m^3/d	1,000 m^3/d
Mchema Dam	-	350 m^3/d	350 m^3/d
Handpumps	40 m^3/d	200 m^3/d	200 m^3/d
Mwiti W/S	-	-	100 m^3/d
Total	**640 m^3/d**	**1,150 m^3/d**	**1,650 m^3/d**

During exceptionally dry periods, such as 1980-82, the future safe maximum capacity may not be more than 1,000 m^3/d.

The present population (1984) in Masasi is about 19,700 people and it is estimated to grow up to 53,000 by the year 2001. The water demand is estimated to grow from 1,000 m^3/d up to 2,650 m^3/d during the same period. The maximum capacity of the present sources - 1,650 m^3/d -will be sufficient up to 1993.

The possible additional water sources are:

- Kitangari Water Supply
- Mbwinji Springs
- Miesi Dam

Alternative 1 (Kitangari W/S)

The capacity of Kitangari water supply is 2,500 m^3/d but can be increased up to 7,200 m^3/d from the present borehole. The total groundwater potential is at least 12,000 m^3/d but may be more than double of that amount. Due to the agressiveness water has to be aerated and pH has to be adjusted. When supplying water to Masasi, it has to be pumped to Malatu Chini from where it will flow by gravity. The total pumping head will be 260 m. On the way water can be distributed to rural areas. The length of the pipeline is 49 km.

Alternative 2 (Mbwinji Spring)

A gravity intake will be constructed in the area of the present pumping station. From there water will be conducted by gravity about 40 km into a ground level tank near Masasi. From there it has to be pumpud into tank on Masasi Hill. The total length of the pipeline will be 46 km and the total pumping head 60 m. Along the way the present rural schemes can be connected to the system. In addition, there would be a possibility to divert water to Lukuledi area where the local water sources are very limited.

Alternative 3 (Miesi Dam)

A dam site has been identified in Miesi river about 20 km south of Masasi. The catchment area is 520 km^2 and the dam volume 4.5 mill m^3. The estimated safe yield is 5,500 m^3/d which would be sufficient for Masasi town. The total pumping head to Masasi is about 260 m. The length of the pipeline is 21 km.

The costs of the different alternatives are, if the capacity of the system will be designed for 2,050 m^3/d:

Alternative	Construction costs, TAS	Annual O&M costs TAS
1. Kitangari	82.0 mill	3.9 mill/yr
2. Mbwinji Spring	65.2 mill	1.4 mill/yr
3. Miesi Dam	48.0 mill	3.7 mill/yr

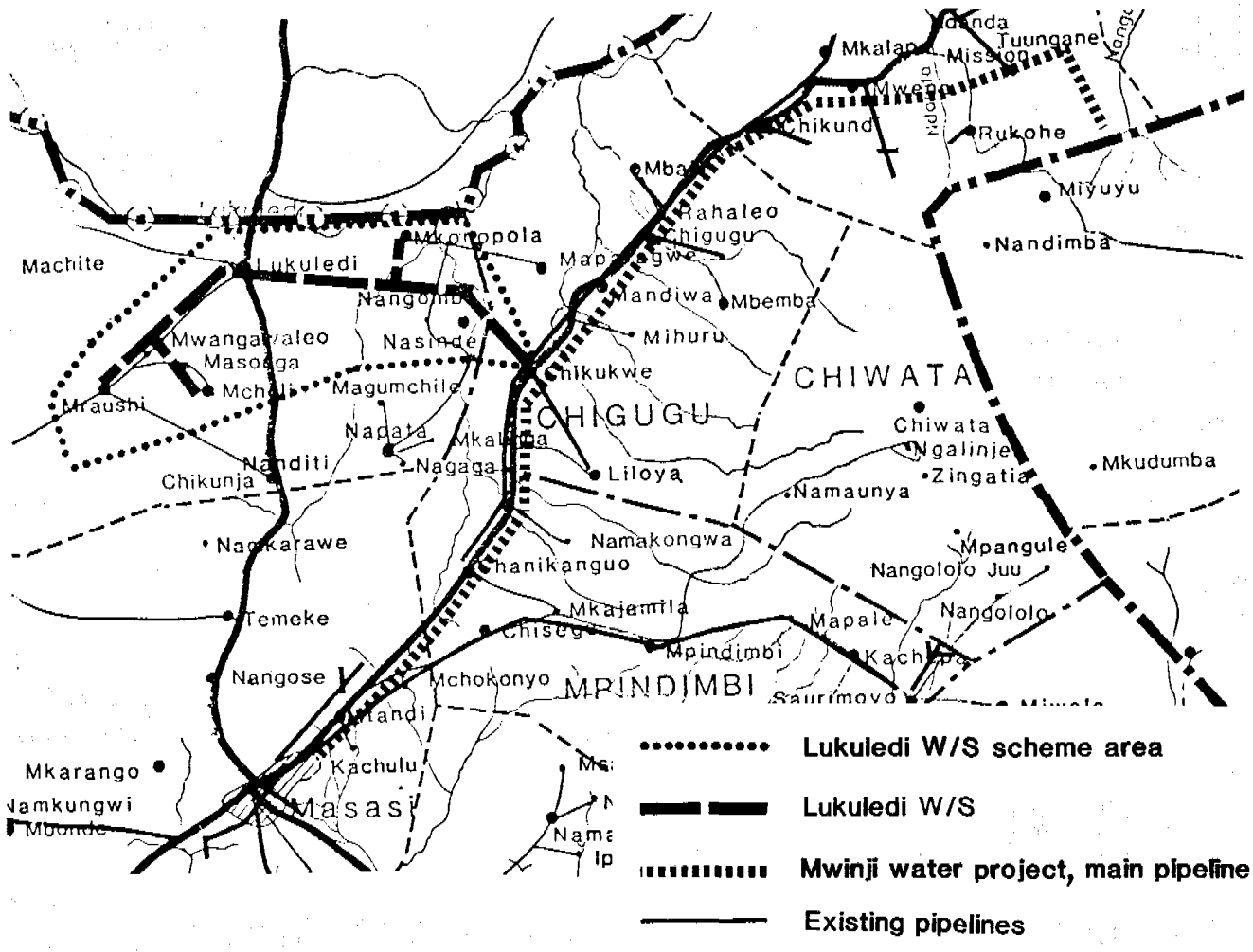
Miesi Dam is the cheapest alternative to construct but Mbwinji Spring is the cheapest to operate. Considering the reliability, the water quality, the need for fuel and spares it is recommended to supply water to Masasi from Mbwinji Springs after the local water resources have been fully exploited. An additional advantage of this solution is the possibility of diverting part of the water to very difficult areas north of Masasi.

The expansion of Masasi W/S is illustrated in Figure 4.

The development necessary for Masasi water supply during the planning period is rehabilitation and extension of the distribution system and construction of the intake at Mbwinji, the pipeline Ø 300 and the booster pumping station at Masasi. The costs, excluding the share of Lukuledi water supply (500 m^3/d), are TAS 71.5 mill. The operation and maintenance costs will be TAS 0.9 mill/yr in 1986 and TAS 1.9 mill/yr in 2001.

After completion of the water supply from Mbwinji Springs, Mchema Dam can be left as a stand-by system.

FIGURE 4 **Expansion of Masasi Town Water Supply from Mbwinji.**



8
LIWALE TOWN WATER SUPPLY

Liwale town water supply covers the urban area only.

The source is Liwale river, from where water is abstracted by a diversion channel and taken through a sedimentation well into a sump. From there water is pumped into a ground level tank (300 m^3) near the Mission via a Ø 4" A.C. rising main, about 1.0 km long. The pumps are run partly by diesel engines and partly by electricity. The pumping head is about 70 m. From the tank, water flows to town by gravity.

The system was constructed in 1966 and has been extended and modified several times since. The source at the point of abstraction is polluted and in practice there is no treatment. The condition of the pumps is poor and the operation is unreliable due to the lack of fuel and due to the irregular and insufficient electricity supply. The condition of the piping system is also poor.

The present (1984) population of Liwale is 9,700 and it is estimated to grow up to 22,200 by the year 2001. The water demand is estimated to grow from 490 m^3/d up to 1,110 m^3/d during the planning period. The present maximum capacity is about 700 m^3/d.

To improve the source attempts were made in 1984 to construct tube wells along the river, but they failed. Investigations for deeper boreholes are under way. If suitable groundwater source is not found, an alternative solution is to move the intake about 1 km upstream to an unpolluted point, bring the water to the pump house in a pipeline and arrange proper treatment for it; presedimentation and slow sand filtration.

The following work is necessary during the planning period: rehabilitation of the rising main and distributing network, renewal of intake and pumping. The estimated development costs are TAS 11.1 mill. The average annual operation costs are TAS 0.5 mill/yr in 1986 and TAS 0.9 mill/yr in 2001.

WATER SUPPLY DEVELOPMENT PLAN 1986 - 2001

The water supply development plan is presented separately for each village in district order:

Mtwara Region	Masasi District
	Mtwara District
	Newala District
	Mtwara-Mikindani Town
Lindi Region	Kilwa District
	Lindi District
	Liwale District
	Nachingwea District
	Lindi Town

The list of divisions and wards is presented at the beginning of each district.

The abreviations used in the colums are:

Existing W/S	1	piped W/S
	2	hand pump well
	3	open well
	4	river
	5	dam
	6	open pit
	7	spring
	8	rainwater collection
Future Systems	11	new piped scheme
	12	extension or expansion of a piped scheme
	13	rehabilitation of the piped scheme
	21	new ring well with hand pump
	22	new hand auger well with hand pump
	23	new borehole well with hand pump
	24	deepening or rehabilitation of a hand pump well
	8	rainwater collection

Rehabilitation %

Cost of the rehabilitation as a percentage of the construction of a new scheme.

Priority

1	to be implemented as soon as possible
2	to be implemented at the end of the period 1986-91
3	to be implemented at the beginning of the period 1992-2001
4	to be implemented at the end of the period 1992-2001

Explanatory Notes

1. "Water Demand 2001" includes also the livestock requirement.

2. Future Development, 1986-91, Systems: in case of hand pumps, their number have been calculated so, that together with the possible existing sufficient hand pumps people should get water at least 10 l/capita/day.

3. Deepening of the existing insufficient or seasonal hand pump wells (ring wells) is assumed to be successful in 50 % of the cases.

4. When rainwater collection is proposed, the consumption is estimated at the rate of 10 l/capita/day.

5. All the costs of the piped schemes - both development and O & M -are shown for that village which is considered to be the main village of the scheme. For other villages belonging to the same scheme, no costs of the piped W/S are given.

6. The O & M costs of a piped water supply include salaries of the operators but only allowances of the supervisory staff.

11 MASASI DISTRICT

Divisions		Wards	
01	Nakopi	01	Lumesule
		02	Napacho
		03	Likokona
02	Nanyumbu	01	Nangomba
		02	Nanyumbu
		03	Masuguru
		04	Mkonona
03	Lisekese	01	Namatutwe
		02	Mikangaula
		03	Maratani
		04	Lukuledi
		05	Lisekese
		06	Nandete
		07	Mpindimbi
		08	Marika
04	Chiungutwa	01	Nanjota
		02	Chiungutwa
		03	Lipumburu
		04	Mbuymi
05	Mchauru	01	Sindano
		02	Mchauru
		03	Mnavira
06	Lulindi	01	Namalenga
		02	Lulindi
		03	Mkululu
		04	Mkundi
07	Chikundi	01	Chiwata
		02	Chigugu
		03	Mwena
		04	Nanganga

MASASI DISTRICT Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m³/d	Existing W/S: Systems	Existing W/S: No of suff. Hp-wells	Future Development 1986 - 1991: Systems	1986 - 1991: New hand-pumps	1986 - 1991: Hand-pumps to be deepened	1986 - 1991: Piped W/S rehab. %	Future Development 1992 - 2001: Systems	1992 - 2001: New hand-pumps	1992 - 2001: Piped W/S rehab. %	Development costs TAS 1,000: 1986-1991	Development costs TAS 1,000: 1992-2001	Operation and maintenance costs TAS 1,000/yr: 1986	Operation and maintenance costs TAS 1,000/yr: 2001	Priority
NAKOPI DIVISION																	
LUMESULE **Code: 110101**																	
LUMESULE - NAKANYUNYA - MAKANDAVALE	1,010	1,323	33	4 2	4					21	2		0	43	10	16	4
CHIGWEJE - NAMIUNGO - CHANGWALE	1,148	1,504	38	6		21	2			21	4		43	86		16	1
NANDEMBO - NGALINJE	1,320	1,729	43	6 1		21	3			13		40	65	400		100	1
Total Ward	3,478	4,555	114		4		5				6		108	529	10	132	
NAPACHO **Code: 110102**																	
CHIMIKA	950	1,244	31	6		21	2			21	3		43	65		8	1
- KAZAMOYO	691	905	23	2	2					21	2		0	43	5	10	4
NDACHELA - MITONGA	777	1,018	25	6 4		21	2			21	2		43	43		10	1
NAKOPI - MIKANGAULA - MITUMBATI	1,395	1,827	46	2 6	6					21	2		0	43	16	21	4
MPOMBE - MTEMAUPINDE	1,555	2,037	51	2	4					21	4		0	86	10	21	4
MBURUSA - NAPACHO	1,255	1,644	41	6 2	1	21	1			21	5		22	108	3	18	2
Total Ward	6,623	8,675	217		13		5				18		108	388	34	88	
LIKOKONA **Code: 110103**																	
MICHIGA - NAIPINGO	2,917	3,821	96	6		21	5			21	11		108	237		42	1
MAKONGONDERA	1,216	1,593	40	2	5					21	2		0	43	13	18	4
MKUMBARU - MWAMBO - SONGAMBELE - LUKUMBI	1,882	2,465	62	6		21	3			21	7		65	151		26	1
MSINYASI - MISAWAJI - KAZAMOYO	715	936	24	6		21	2			21	2		43	43		10	1
LIKOKONA	1,715	2,246	57	6 2	3	21 23	3			21 23	6		88	241	8	24	1
Total Ward	8,445	11,061	278		8		13				28		304	715	21	120	
TOTAL DIVISION	18,546	24,291	609		25		23	0			52		520	1,632	65	340	
NANYUMBU DIVISION																	
NANGOMBA **Code: 110201**																	
MASWERA	878	1,150	29	6		21 23	2			21	3		66	65		13	1
MARA	1,244	1,629	41	3		21 23	2			21 23	5		66	131		18	1
MSENGENYA	1,716	2,248	57	2 6 3	5					21	4		0	86	13	24	4
KILIMA HEWA	3,039	3,980	101	6 1		13			30					300	90	100	2
MANGAKA	2,207	2,891	73	6 1		13			10					80	80	90	2
MNEMEKA - MKOMA	1,024	1,341	34	6		21 23	2			21 23	3		66	88		13	1
NDWIKA	564	739	43	6 3 1		21	1			21 23	2		22	66		8	1
MNONIA	895	1,172	29	2 4		21 24	1	2		21	3		31	65	3	13	1
NGALINJE	816	1,069	27	6		21 23	2			21	3		66	65		13	1
MWAMBANI	689	902	23	4 6		21	1			21 23	3		22	88		10	1
NAHAWARA	1,575	2,063	52	2	6					21	3		0	65	16	24	4
NACHIURA	1,512	1,980	50	6		21 23	3			21 28	5		88	131		21	1
NANGOMBA	2,193	2,872	75	2 6 1	2	13			10				100	0	80	95	2
MSYALELE	844	1,105	28	6		21 23	2			21	3		66	65		13	1
MTOKORA	1,200	1,572	39	6		21 23	2			21 23	4		66	131		16	1
Total Ward	20,396	26,714	701		13		18	2			41		659	1,426	282	471	
NANYUMBU **Code: 110202**																	
NANYUMBU	1,286	1,684	53	2 1	2					21	5		0	108	5	18	3
CHUNGU	617	808	20	2 1	2					21	2		0	43	5	10	4
MAKANYA	789	1,033	27	6		21 23	2			21	2		66	43		10	1
NAMASONGO	1,014	1,328	34	2 6	1	21	1			21	4		22	86	3	16	1
MANEME	501	656	16	2	2					21	1		0	22	5	8	4
CHIPUPUTA - CHIPUPUTA SHULENI	2,035	2,665	67	2 6		21 24	3	1		21 23	8		69	219	3	29	1
CHITOWE - NAKARARA	668	875	22	6 5		21 23	2			21	2		66	43		10	1
NAMAGURUVI	2,577	3,375	84	6		21 23	5			21 23	9		154	217		37	1
MPWAKIA - TAWANI	988	1,294	33	6		21 23	2			21	4		66	86		16	1
MKUULA	1,041	1,363	35	6 1		21 23	2			21	4		66	86		16	1
NANDERU	1,118	1,464	37	2	4					21	2		0	43	10	16	1
Total Ward	12,634	16,548	428		11		17	1			43		509	996	31	186	

MTWARA DISTRICT Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m³/d	Existing W/S Systems	Existing W/S No of suff. Hp-wells	Future Development 1986 - 1991 Systems	1986 - 1991 New hand-pumps	1986 - 1991 Hand-pumps to be deepened	1986 - 1991 Piped W/S rehab. %	1992 - 2001 Systems	1992 - 2001 New hand-pumps	1992 - 2001 Piped W/S rehab. %	Development costs TAS 1,000 1986-1991	Development costs TAS 1,000 1992-2001	Operation and maintenance costs TAS 1,000/yr 1986	Operation and maintenance costs TAS 1,000/yr 2001	Priority
NANYUMBU DIVISION																	
MASUGURU **Code: 110203**																	
LUKWIKA	460	602	15	2 4 6	1					21	2		0	43	3	8	4
LUKULA - LUNGOMBE	1,378	1,805	45	6 1		21 23	3			21	5		88	131		21	1
MASUGURU	1,194	1,564	39	2 6	2					21	5		0	108	5	18	2
Total Ward	3,032	3,971	99		3		3				12		88	282	8	47	
MKONONA **Code: 110204**																	
NAMIJATI	734	961	26	2	2					21	2		0	43	5	10	4
MARUMBA - NAMBUNDA	476	623	16	6		21	1			21 23	2		22	66		8	1
CHILUNDA - MTANDI	535	701	18	2	4								0	0	10	10	
MITUMBATI	726	951	25	2	5								0	0	13	13	
NJISA	806	1,056	28	6		21 23	2			21	3		66	65		13	1
Total Ward	3,277	4,292	112		11		3				7		88	173	28	54	
TOTAL DIVISION	39,339	51,235	1,340		38		41	3			103		1,344	2,877	349	758	
LISEKESE DIVISION																	
NAMATUTWE **Code: 110301**																	
MKWAPA - MKWAPA SHULENI - MKWAPA OFISINI	805	1,054	11	6		21	2			21	3		43	65		13	1
CHIKOWETI	1,488	1,949	50	2 3 1		24 23	1	6		21 23	4		72	109	16	21	1
NAMAJANI	1,550	2,030	91	2 3 1		24		10					45	0	106	116	3
- NAMICHI	600	786	20	2 3		24		2		21	2		9	43	5	8	1
MSIKISI	786	1,029	26	2 4	2					21	2		0	43	5	10	4
NAMATUTWE	704	922	23	2 1 4	2	24		2		21	1		9	22	10	10	3
CHINGULUNGULU - PACHANI	1,280	1,677	42	2 5		24		4		21	5		18	108	10	18	1
NAMALEMBO	911	1,193	24	6		21	2			21	3		43	65		13	1
AMANI CHILOLO	1,812	2,373	59	2 3	18								0	0	47	47	
- AMANI NGALOLE	2,278	2,984	76	2 3	6	24		6		21	3		27	65	31	31	3
- AMANI MAGEREZA	500	655	26	2 1		24		3					13	0	8	8	4
MLINGULA	2,477	3,244	82	2 1									0	0	90	100	
Total Ward	15,191	19,897	527		28		5	33			23		279	520	328	395	
MIKANGAULA **Code: 110302**																	
NANGARAMO	510	668	152	6 2	2	21	1			21	6		22	129	5	24	2
MIKANGAULA	3,989	5,225	132	6 2 1	2	21	5			21	2		108	43	10	29	3
NAHIMBA - MSANGUSANGU - NGALINJE	1,161	1,521	39	6		21 23	2			21	5		66	129		18	1
KILOSA - MBARA - MBARUKU	1,587	2,079	52	1 6		21 23	2			21	2		66	43		10	2
MKWAJUNI - NAWAJI - KILIMAHEWA - CHITWANGULE	1,090	1,428	37	6		21 23	2			21	4		66	86		16	1
KAMUNDI - MKOROMWANA - CHITANDI - KITANGALI	634	830	21	4 6		21	1			21 22	2		22	66		8	1
NAMATUMBUSI - MIRAMBO - NAPAKO	1,918	2,512	83	6 1		13			30	21 24	4		460	132	240	250	
Total Ward	10,889	14,262	516		4		13				25		810	628	255	355	

MASASI DISTRICT Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m³/d	Existing W/S: Systems	Existing W/S: No of suff. Hp-wells	Future Development 1986 - 1991: Systems	1986 - 1991: New hand-pumps	1986 - 1991: Hand-pumps to be deepened	1986 - 1991: Piped W/S rehab. %	Future Development 1992 - 2001: Systems	1992 - 2001: New hand-pumps	1992 - 2001: Piped W/S rehab. %	Development costs TAS 1,000: 1986-1991	Development costs TAS 1,000: 1992-2001	Operation and maintenance costs TAS 1,000/yr: 1986	Operation and maintenance costs TAS 1,000/yr: 2001	Priority
LISEKESE DIVISION																	
MARATANI **Code: 110303**																	
MARATANI - MALEMA - MCHANGANI A, B - MAJENGO - MRAUSHI	2,099	2,749	73	6 7		21 23	4			21	8		132	172		31	1
MIKUVA	1,400	1,834	48	6		21 23	3			21	5		88	131		21	1
LIPUPU - NAMILOLO	577	756	19	6		21	1			21 23	2		22	66		8	1
HOLOLA - MWAMBA - MITIMINGI	1,165	1,526	40	6 4		21 23	2			21	5		66	108		18	1
MNANJE - CHIKUNJA SHULENI - MNANJE CHINI	1,781	2,333	60	6		21 23	3			21 23	7		88	174		26	1
NGUPE - MAPINDUZI	1,674	2,193	55	5 6		21 23	3			21 23	6		88	152		24	1
Total Ward	8,696	11,390	296		0		16				33		484	803	0	128	
LUKULEDI **Code: 110304**																	
NAMBAWALA - MACHITE	1,094	1,433	36	2 6	8								0	0	21	21	
MRAUSHI - MWANGAWAKO - MASONGA - MCHOLI	1,945	2,547	64	2 3 6	1	21 24	2	1		12 12 12 12			48	950	5	29	2
NANYINDWA	1,188	1,556	39	1 6 2	1	13 24		2	10				99	0	68	73	1
LILALA	1,172	1,535	39	2 3	3					21	4		0	86	8	18	4
CHIWALE	1,284	1,682	66	2 3 1		24		5					23	0	90	95	4
LUKULEDI	3,780	4,951	128	2 6 5	8	24		3		12			13	3,350	29	29	1
MKOROPOLA	1,153	1,510	38	6						12			0	350	0	0	2
NASINDE - NASINDE NANGOMBA	1,305	1,356	37	2 6	2					12 12			0	0	5	5	
NAPATA - MAGUMCHILE - MKALINGA - NAGAGA	1,544	2,022	52	2 6	3					21	5		0	108	8	21	4
CHIKUNJA - NANDITI	1,898	2,486	64	2 6	5					21	5		0	108	13	26	4
Total Ward	16,093	2,078	540		31		2	11			14		183	4,952	247	317	
LISEKESE **Code: 110305**																	
MBONDE	2,030	2,659	72	2 6	5	24		3		21	7		13	151	21	29	3
TEMEKE - NAMKARAWE	1,293	1,694	46	6													
TUKAEWOTE - NGALINJE - CHIWISI	1,630	2,135	55	6 7 4		21 23	3			21 23	6		88	152		24	1
MKARANGO	1,949	2,553	65	6		21 23	4			21	7		132	151		29	1
MTAKUJA - MAROKOPALENI	1,489	1,950	50	2 6	5	24		3		21	2		13	43	21	21	2
NANGOSE	1,000	1,310	35	2 6	1	24		2		21	4		9	86	8	16	1
MAKULANI	2,542	3,329	87	2 1	2	13							0	0	5	5	
MKARAKATE	1,504	1,970	51	1		13					•	0	0				
SULULU - CHIUNGUTWA	2,091	2,739	70	6 1		13							0	0			
MKAPUNDA - NANDUMBILI	2,084	2,730	70	2 6	10	24		1		21	1		5	22	29	29	4
MPEKESO - MPEKESO JUU - MPEKESO CHINI - NGUPE MACHENJE	1,713	2,244	58	6		21 23	3			21 23	7		88	174	8	26	1
MATAWALE	1,324	1,734	44	6		21 23	3			21 23	5		88	131	8	21	1
MWENGE MTAPIKA	1,562	2,046	53	2 6	5					21	4		0	86	16	24	4
NAMKUNGWI - MTOWASIRI	1,088	1,425	36	1 6								0	0				
MTANDI - KACHULU - MCHOKONYO	2,035	2,665	70	1 2	3	13			5								
MASASI TOWN - MKOMAINDO BLOCK - MAKUTI BLOCK	19,700	53,048	2,666	1 2	20	13 24		30	20	11			3,035	68,600	990	1,990	3
Total Ward	45,034	86,229	3,528		51		13	39			43		3,471	69,596	1,106	2,214	

MASASI DISTRICT Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m³/d	Existing W/S Systems	Existing W/S No of suff. Hp-wells	Future Development 1986 - 1991 Systems	1986 - 1991 New hand-pumps	1986 - 1991 Hand-pumps to be deepe-ned	1986 - 1991 Piped W/S rehab. %	1992 - 2001 Systems	1992 - 2001 New hand-pumps	1992 - 2001 Piped W/S rehab. %	Development costs TAS 1,000 1986-1991	Development costs TAS 1,000 1992-2001	Operation and maintenance costs TAS 1,000/yr 1986	Operation and maintenance costs TAS 1,000/yr 2001	Priority
LISEKESE DIVISION																	
NANDETE Code: 110306																	
NANDETE - KALOLENI - NAKOPWITI	1,760	2,305	59	6 1	13				10				100	0	90	100	2
CHAKAMA	1,656	2,169	56	2 6	7					21	2		0	43	18	24	4
NAVAI - MKANGARA	1,219	1,597		6 7		21 23	2			21	5		66	108		16	1
MTALIKACHAU - MTENDACHI	990	1,297	41	6		21 23	2			21	4		66	86		16	1
ULANGA - SEMENI	1,468	1,923	50	6		21 23	3			21 23	5		88	131		21	1
CHIVIRIKITI - MZALENDO	1,045	1,369	34	6 7		21 23	2			21	4		66	86		16	1
NAKOLE - MKARAKATE - CHITUKANI	1,020	1,336	33	6 1		13			10								
Total Ward	9,150	11,995	225		7		9				20		386	454	108	193	
MPINDIMBI Code: 110307																	
CHANIKANGUO - NAMAKONGWA	1,920	2,515	69	1 2	4	13			5						10	10	2
KANYIMBI - MUUNGANO - NAMAHAMBA	1,497	1,961	55	6		21 23	3			21 23	6		88	152		24	1
CHISEGU - MKAJAMILA - MKATIOKA	1,280	1,677	42	1 2 6	2	13			5				350	0	150	170	2
KACHEPA - MINJALE	1,502	1,967	52	1 2	3	13			5						8	8	
SHAURI MOYO	1,266	1,658	50	1 6		13			5								
MPINDIMBI - MAPALE	2,839	3,718	97	1 2 6	3	13			5						10	10	
Total Ward	10,304	13,496	146		12		3				6		438	152	178	222	
MARIKA Code: 110308																	
MARIKA - SAUTIMOJA - KAZAMOYO	1,423	1,864	51	6		21 24	3			21 23	5		88	131	8	21	1
NAMATUNU - IPIHO - NAZARETI - MSAKALA	1,080	1,415	38	2 6	1	21	1			21	4		22	86	5	16	1
MLUNDELUNDE - MCHAKA - MPOTA	1,915	2,508	39	2 3 4	1	21	3			21	7		65	151	10	29	1
NAMIKUNDA - CHIPOLE	1,923	2,619	66	6		21 23	4			21 23	7		109	174	10	29	1
MUMBAKA - MAJENGO - NAKWANDE - MACHOMBE - KILIMANI- HEWA - MIPAKANI	2,452	3,212	85	2 3	2	21 24	1	2		21	9		31	194	5	34	1
Total Ward	8,793	11,517	306		4		12	2			32		315	736	38	129	
TOTAL DIVISION	124,150	189,864	6,084		137		73	85			196		6,366	77,841	2,260	3,953	

MASASI DISTRICT

Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m³/d	Existing W/S Systems	Existing W/S No of suff. Hp-wells	Future Development 1986 - 1991 Systems	1986 - 1991 New hand-pumps	1986 - 1991 Hand-pumps to be deepened	1986 - 1991 Piped W/S rehab. %	1992 - 2001 Systems	1992 - 2001 New hand-pumps	1992 - 2001 Piped W/S rehab. %	Development costs TAS 1,000 1986-1991	Development costs TAS 1,000 1992-2001	Operation and maintenance costs TAS 1,000/yr 1986	Operation and maintenance costs TAS 1,000/yr 2001	Priority
CHIUNGUTWA DIVISION																	
NANJOTA Code: 110401																	
NANJOTA - MIGONGO	1,296	3,137	80	2 3		24		12		21 23	7		54	197	31	34	1
NAMBUNDA - MPWAPWA JUU - TUPENDANE	2,716	3,557	93	6 2	6					21	9		0	194	16	39	4
MIJELEJELE - TULEANE-MPUTENI - MTENGULA - MPWAPWA	1,606	2,103	56	2 3 4	5					21	4		0	86	13	24	4
NAIROMBO	987	1,293	34	6 2 4	3	24		3		21	2		13	43	16	16	2
Total Ward	7,704	10,090	266		14		0	15			22		67	520	76	113	
CHIUNGUTWA Code: 110402																	
CHIUNGUTWA - KALIPINDE CHINI	2,700	3,536	94	1 6		13			20	13		30					1
MISECHELA - LUKONDESI - CHILIMBA - LISANJE	1,992	2,609	75	6		21 23	4			21	7		132	151		29	1
MAUGURA - MASUGURU - NGALINJE - MNELAWINA	2,208	2,892	74	2 4 1	6	13			20	13		30			18	18	1
HUWE	679	889	24	6		21 23	2			21	2		66	43		10	1
- CHANIKA	300	393	10	2 6	2								0	0	5	5	
- MAKANYAMA - PACHOTO	789	1,034	26	1		21 23	2			21	2		66	43	0	10	2
MIPANDE - KALIPINDE - MTENGA	814	1,066	30	2 4	2	24		4		21	1		18	22	16	16	4
MPETA - MRASHI	1,913	2,506	64	2 3 1		24		17		21	3		77	65	45	29	1
Total Ward	11,395	14,925	396		10		6	21			13		293	281	84	107	
LIPUMBURU Code: 110403																	
LIPUMBURU - NAMBUNJU - NAKACHERE	776	1,016	26	6 3		21 23	2			21	3		66	65		13	1
MTOJO - LUPASO	1,008	1,320	35	6 4		21 23	2			21	4		66	86		16	1
MCHOTI - MBANGARA-MBUYUNI - NAMAJANI - NANDEMBO - NAMTONA	1,416	1,855	46	4 6		21 23	3			21 23	5		88	131		21	1
UTIMBE	906	1,187	30	6		21 23	2			21	3		66	65		13	1
MBANGARA MIESI	463	606	15	6		21	1			21 22	2		22	66		8	1
Total Ward	4,569	6,984	153		0		10	0			17		308	413	0	71	
MBUYUNI Code: 110404																	
MDIBWA - MATOGORO	1,798	2,355	61	1 6		13			20	13		50					1
MIUNGO - CHIPINDIMBI	1,325	1,735	46	4 2		21 24	1	4		21 23	4		40	109	10	16	1
MPULIMA - MAJEMBE NDAGO - LIKONGA JUU - LILAWA	1,644	2,153	57	6 2	1	24		6		21 23	5		27	131	18	24	1
MITONJI - MNONJINI	701	918	25	4 6		21 24	2			21	1		68	22		8	1
MBUYUNI - NAMBARAPI - LUCHELEWA	1,385	1,814	48	1 6		13			20			50					1
Total Ward	6,853	8,976	236		1		3	10			10		133	262	28	48	
TOTAL DIVISION	30,521	39,975	1,051		25		19	46			62		801	1,476	188	339	

MASASI DISTRICT Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m³/d	Existing W/S Systems	Existing W/S No of suff. Hp-wells	Future Development 1986 - 1991 Systems	1986 - 1991 New hand-pumps	1986 - 1991 Hand-pumps to be deepened	1986 - 1991 Piped W/S rehab. %	1992 - 2001 Systems	1992 - 2001 New hand-pumps	1992 - 2001 Piped W/S rehab. %	Development costs TAS 1,000 1986-1991	Development costs TAS 1,000 1992-2001	Operation and maintenance costs TAS 1,000/yr 1986	Operation and maintenance costs TAS 1,000/yr 2001	Priority
MCHAURU DIVISION																	
SINDANO Code: 110501																	
LUATALA - LULEMBA - NDENDEMAMA	2,177	2,851	78	1 6		13			20	13		50	0	0			1
SINDANO - SINDANO A - SINDANO B	1,668	2,185	57	1 4 6		13			20	21	4		120	86	95	105	2
LICHEHE - MGWAGULE - MITANDAWALA	729	955	25	1 4 6		13			20	2	2			43		5	2
ULUNGU - MSIKISI - NDOMONI - NG'UNI(ULUNGU)	908	1,189	30	6 4		21 23	2			21	3		66	65		13	1
Total Ward	5,482	7,180	190		0		2				9		186	194	95	123	
MCHAURU **Code: 110502**																	
RIVANGO - RIVANGO A - RIVANGO B	1,380	1,807	46	1 4 6		13			30			30		0			2
NAMOMBWE - MKUMBULULU - MWITIKA	1,751	2,293	57	1 6		13			30			30		0			2
MIREWE - TAPUTA - NANGANGA	1,387	1,817	52	4 6		21 23	3			21 23	5		88	131		21	1
MCHAURU JUU - MTOTA - MAKOCHI	1,836	2,405	68	4 6		21 23	3			21 23	7		88	174		26	1
NANGOMWA	387	507	13	4 6		21	1			23	1		22	45		5	1
MAPARAWE	826	1,082	30	4		21 23	2			21	3		66	65		13	1
MKWO - NALIMBUDI	1,733	2,270	57	4 6		21 23	3			21 23	6		88	152		24	1
Total Ward	9.300	12.181	325		0		12				22		352	567	0	89	
MNAVIRA **Code: 110503**																	
NAKARARA	1,493	1,955	51	1 6 4		13			30			30					
MAPILI - RAHALEO	111	145	9	1 4 6		13			30			30					
MANYULI	407	533	16	1 4 6		13			30			30					
MNAVIRA	821	1,075	31	1 4 6		13			30			30					
MKACHIMA - CHIPINGO - MKALIWATA	1,599	2,094	58	1 4													
MAKONGONDA - MKWAYA - MAKONGONDA CHINI	2,005	2,626	68	1 4 6		13			30	13		30	700	700	130	150	1
GEUZA - NALIONGOLO - MDUHE - NAMUTEMA	569	745	20	4		21	1			21 23	2		22	66		8	
NAMYOMO	665	871	26	4 6		21 23	2			21	2		66	43		10	
CHIKOROPOLA	1,650	2,161	55	1 4 6		13			30								
Total Ward	9,320	12,207	334		0		3				4		788	809	130	168	
TOTAL DIVISION	**24,102**	**31,568**	**849**		**0**		**17**	**0**			**35**		**1,326**	**1,570**	**225**	**380**	

MASASI DISTRICT Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m³/d	Existing W/S Systems	Existing W/S No of suff. Hp-wells	Future Development 1986 - 1991 Systems	1986 - 1991 New hand-pumps	1986 - 1991 Hand-pumps to be deepe-ned	1986 - 1991 Piped W/S rehab. %	1992 - 2001 Systems	1992 - 2001 New hand-pumps	1992 - 2001 Piped W/S rehab. %	Development costs TAS 1,000 1986-1991	Development costs TAS 1,000 1992-2001	Operation and maintenance costs TAS 1,000/yr 1986	Operation and maintenance costs TAS 1,000/yr 2001	Priority
LULINDI DIVISION																	
NAMALENGA **Code: 110601**																	
NAMALENGA	2,043	2,676	68	1 6		13			20	13		50					
NAGAGA	1,490	1,952	56	1 6		13			20	13		50					
MPILIPILI	1,347	1,764	55	1 4 6		13			20	13		50					
MVITA	767	1,005	29	1 6		13			20	13		50					
- CHIGEWA																	
- MAJENGO																	
MITESA	940	1,231	31	1 6 4		13			20	13		50					
MSANGA	840	1,100	30	1 6 4		13			20	13		50					
- MAPINDUZI																	
- JUHUDI																	
- KATUNDU																	
MSOKOSELA	589	771	24	4 6		21	1			21 22	2		22	66		8	1
- MBURUSA																	
- LISIMALYAO																	
Total Ward	8,016	10,499	292		0		1	0			2		22	66	0	8	
LULINDI **Code: 110602**																	
LULINDI	2,070	2,711	86	1 4 6		13			20	13		50	360	1,000	350	400	1
MKASEKA	783	1,026	26	1 4		13			20	13		50					
CHIWAMBO	1,040	1,362	38	1 4		13			20	13		50					
- NAMAJANI																	
- KISIWANI																	
KIVUKONI	1,351	1,769	45	1 6		13			20	13		50					
- MTAKUJA																	
- MNOPWE																	
- RAHALEO																	
LUAGALA	1,315	1,722	45	1 4		13			20	13		50					
Total Ward	6,559	8.591	241		0		0	0			0		360	1,000	350	400	
MKULULU **Code: 110603**																	
MKULULU	1,382	1,810	47	1		13			30				240	0	80	170	1
MFUTO	1,185	1,552	39	2 6	9								0	0	26	26	
- MNOLELA																	
- LUSONJE																	
- CHINOLO																	
NAKACHINDU	893	1,170	31	2 6	1	21 24	1	1		21	3		26	65	5	13	1
MIBA	1,145	1,500	45	1 4 6		13			30								1
- MBUGO																	
- MKWAYA																	
MPOPO	918	1,202	32	6		21 23	2			21	4		66	86		16	1
- MKONDE																	
- MBALICHILA																	
Total Ward	5,523	7,234	198		10		3	1			7		332	151	111	225	
MKUNDI **Code: 110604**																	
MKUNDI	1,594	2,088	56	4 6		21 23	3			21 23	6		88	152		24	1
MKOROPOLA	1,454	1,904	58	6		21 23	3			21 23	6		88	152		24	1
- NANGWALE																	
- MKOROPOLA CHINI																	
- NAKALOLA CHINI																	
NAKALOLA	1,114	1,459	47	6 4		21 23	2			21 26	5		66	131		18	1
MAJEMBE	1,647	2,157	58	1 4 6									0	0			
- KITUNDA																	
- MAJEMBE KATI																	
MIWALE	810	1,061	30	1 4 6									0	0	60	65	
CHIPANGO	751	984	29	4 6		21 23	2			21	2		66	43		10	1
- NJECHELE																	
Total Ward	7,370	9,653	278		0		10	0			19		308	478	60	141	
TOTAL DIVISION	27,468	35,977	1,009		10		14	1			28		1,022	1,695	521	774	

MASASI DISTRICT				Existing W/S		Future Development							Development costs		Operation and maintenance costs		Priority
						1986 - 1991				1992 - 2001							
Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m³/d	Systems	No of suff. Hp-wells	Systems	New hand-pumps	Hand-pumps to be deepened	Piped W/S rehab. %	Systems	New hand-pumps	Piped W/S rehab. %	TAS 1,000 1986-1991	TAS 1,000 1992-2001	TAS 1,000/yr 1986	TAS 1,000/yr 2001	
CHIKUNDI DIVISION																	
CHIWATA Code: 110701																	
CHIWATA	2,301	3,014	79	6		21	4			21	9		86	194		34	1
CHIDYA	1,542	2,020	124	6		21	3			21	5		65	108		21	1
- NAMAUNYA																	
- ZINGATIA																	
- NGALINJE																	
SAUTIMOJA	1,037	1,358	38	4 6		21	2			21	4		43	86		16	1
- NANGOLOLO JUU																	
- NANGOLOLO CHINI																	
- MPANGULE																	
Total Ward	4,880	6,392	221		0		9	0			18		194	388	0	71	
CHIGUGU Code: 110702																	
MBEMBA	1,285	1,683	43	1 6		13			20								
CHIGUGU	1,905	2,495	70	1		13			20								
LILOYA	1,150	1,506	39	1 2	2	13			20						5	5	
CHIKUKWE	3,172	4,155	108	1 2	4	13			20						10	10	
MAPARAGWE	750	982	25	2 6	2					21	2		0	43	5	10	4
MANDIWA	992	1,299	34	6 1 2	2	13			20						5	5	
- MIHURU																	
MBAJU	1,310	1,716	44	2 1	4	13			20						10	10	
- RAHALEO																	
Total Ward	10,564	13,836	363		14		0	0			2		0	43	35	40	
MWENA Code: 110703																	
CHIKUNDI	4,665	6,110	159	1		13			20								
MKALAPA	2,208	2,892	78	1 2	2	13			20						5	5	
- MKALEKA																	
MWENA	2,050	2,685	62	1		13			20				150	0	70	70	
MPOWORA	3,576	4,684	427	1		13			20								
LIPUTU	2,100	2,751	70	1 6		13			20				130	0	60	60	
- TUUNGANE																	
- NJENGA																	
RUKOHE	841	1,102	28	6		21	2			21	3		43	65		13	1
Total Ward	15,440	20,223	843		2		2	0			3		323	65	135	148	
NANGANGA Code: 110704																	
MKUNG'U	1,382	1,810	48	2 4 1	1	13			20						3	3	
NAMIHUNGO	1,620	2,122	55	6 1		13			20								
MIHIMA	780	1,022	30	6		21	2			21	3		43	65		13	1
- MIHIMA JUU																	
- MIHIMA CHINI																	
MUMBURU	1,403	1,838	47	1 3		13			20								
- RUTAMBA																	
- DODOMA																	
- MWENA																	
- MTAKUJA																	
MKAMI	933	1,222	31	6		21	2			21	3		43	65		13	1
MPANYANI	480	629	17	6		21	1			21	2		22	43		8	1
NANGOO	1,642	2,150	59	1		13			20								
MWONGOZO	1,519	1,990	55	1 2 7	1	13			20						5	5	
NANGANGA	1,600	2,095	54	1 4 2	2	13			20						10	10	
MKANGU	1,000	1,310		6		21	2			21	4		43	86		16	1
Total Ward	12,359	16,187	428		4		7	0			12		151	259	18	68	
TOTAL DIVISION	43,243	57,638	1,855		20		18	0			35		668	755	188	327	
TOTAL DISTRICT	307,369	430,548	12,792		255		205	135			511		12,047	87,846	3,796	6,871	

12 MTWARA DISTRICT

Divisions		Wards	
01	Dihimba	01	Dihimba
		02	Mnima
02	Kitaya	01	Kiromba
		02	Kitaya
		03	Mahurunga
03	Mayanga	01	Mayanga
		02	Naumbu
04	Mpapura	01	Kitere
		02	Mbuo
05	Nanyamba	01	Mtiniko
		02	Nanyamba
		03	Nitekela
		04	Njengwa
06	Ziwani	01	Nalingu
		02	Nanguruwe
		03	Ziwani

MTWARA DISTRICT

Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m³/d	Existing W/S Systems	Existing W/S No of suff. Hp-wells	Future Development 1986 - 1991 Systems	1986 - 1991 New hand-pumps	1986 - 1991 Hand-pumps to be deepened	1986 - 1991 Piped W/S rehab. %	1992 - 2001 Systems	1992 - 2001 New hand-pumps	1992 - 2001 Piped W/S rehab. %	Development costs TAS 1,000 1986-1991	Development costs TAS 1,000 1992-2001	Operation and maintenance costs TAS 1,000/yr 1986	Operation and maintenance costs TAS 1,000/yr 2001	Priority
DIHIMBA DIVISION																	
DIHIMBA Code: 120101																	
NJUMBULI	752	1,036	26	2 3	8								0	0	26	26	
- NAMANJELE	300	413	10	2 3	2								0	0	5	5	
- MIUTA	300	413	10	3		21	1			21	1		22	22		5	1
MPONDOMO (DIHIMBA)	1,227	1,690	45	1 3		13			20								
DIHIMBA	2,000	2,754	71	2 1 3	5	13			20				200	0	110	120	
MKWAJUNI	733	1,009	28	3		21	2			21	3		43	65		13	1
MWEMBE TONGWA	427	588	15	3		21	1			21	3		22	65		10	1
MUUNGANO	946	1,303	35	3		22	2			22	4		43	86		16	1
LYOWA	746	1,027	26	3		21	2			21	2		43	43		10	1
- MANAMAWA	300	413	10	3		21	1			21	1		22	22		5	1
Total Ward	7,731	10,646	277		15		9	0			14		395	303	141	210	
MNIMA Code: 120102																	
MKUTIMANGO	699	963	27	3		22	2			22	2		32	32		10	1
- NAMALOMBE	300	413	10	3		22	1			22	1		16	16		5	1
MNIMA	3,168	4,363	113	2 3	7					21	11		0	237	18	47	3
- KILIMA-HEWA	400	551	14	3		21	1			21	2		22	43		5	1
- NAMAMBI JUU	400	551	14	3 2	1	21	1			21	2		22	43	3	5	1
- MALAMBWANJI																	
MTAMA	513	706	18	3		23	1			23	2		45	89		8	1
- LILALA	200	275	7	3		23	1						45	0		3	1
- MTALALA	200	275	7	3 2	1	23	1						45	0	3	3	1
- NAMBELA																	
LIPWIDI	1,333	1,836	47	3 2	2	22	3			22	5				5	21	1
MANGO PACHANNE	1,313	1,808	47	2 3	4					22	4		0	86	10	21	1
Total Ward	8,526	11,741	302		15		11	0			29		227	546	39	128	
TOTAL DIVISION	16,257	22,387	579		30		20	0			43		622	849	180	338	
KITAYA DIVISION																	
KIROMBA Code: 120201																	
KIROMBA JUU	1,285	1,770	46	1 3		13			30								2
- KIROMBA CHINI																	
- MIKUMBI	300	413	10	3		22	1			22	1		16	16		5	1
KIYANGA	962	1,325	35	2 3 5	5					22	1		0	22	13	16	1
- MYAMBO	300	413	10	3		11											1
- MKAHARA	300	413	10	3		11											1
MISUFINI	1,211	1,668	42	3		23	2			23	3		89	134		13	1
- NACHUMA	400	551	14	3		23	1			23	1		45	45		5	1
MAYEMBE	2,275	3,133	84	1		13			30								2
MPAYANI	750	1,033	27	4 7		11											1
Total Ward	7,783	10,718	279		5		4				6		150	217	13	39	
KITAYA Code: 120202																	
ARUSHA CHINI	630	866	24	1 3									0	0			
- KIHAMA	200	275	7	2 4	2								0	0	5	5	
- ARUSHA JUU	830	1,143	29	1 3									0	0			
- NGONJA	344	474	12	3		22	1			22	1		16	16		5	1
CHAWI	747	1,029	28	3 5		23	2			23	2		89	89		10	1
- NAVIKOLE	451	621	16	3		23	1			23	2		45	89		8	1
- NGORONGORO	373	514	13	3		23	1			23	1		45	45		5	1
- MKOMA	495	682	17	3		23	1			23	2		45	89		8	1
KITAYA	3,859	5,314	140	1 2	3	13			30				420	0	180	225	2
- MCHANJE	356	490	12	4 7		21	1			21	1		22	22		5	1
Total Ward	8,285	11,409	296		5		7				9		682	350	185	271	
MAHURUNGA Code: 120203																	
TANGAZO	2,337	3,218	86	2	9	24		2		21	3		9	65	31	34	3
- MAGOMENI																	
- KILAMBO	300	413	10	2	5								0		13	13	
KILOMBERO	985	1,356	34	2 7	2	24		3		21	3		13	65	13	16	3
KITUNGULI	1,101	1,516	38	1 2	4	24		1		21	2		5	43	13	16	4
MAHURUNGA	2,085	2,871	134	1 2	2	24 13		4		21	4		98	86	66	71	2
- KIYONGO																	
KIHIMIKA	788	1,085	28	5 2	1	21 24	1	3		21	2		34	43	10	13	2
Total Ward	7,596	10,460	326		23		1	13			14		159	302	146	163	
TOTAL DIVISION	23,669	32,587	903		33		12	13			29		991	869	344	473	

MTWARA DISTRICT Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m³/d	Existing W/S Systems	Existing W/S No of suff. Hp-wells	Future Development 1986 - 1991 Systems	1986 - 1991 New hand-pumps	1986 - 1991 Hand-pumps to be deepened	1986 - 1991 Piped W/S rehab. %	Future Development 1992 - 2001 Systems	1992 - 2001 New hand-pumps	1992 - 2001 Piped W/S rehab. %	Development costs TAS 1,000 1986-1991	Development costs TAS 1,000 1992-2001	Operation and maintenance costs TAS 1,000/yr 1986	Operation and maintenance costs TAS 1,000/yr 2001	Priority
MAYANGA DIVISION																	
MAYANGA Code: 120301																	
KAWAWA	816	1,124	30	1 3									0	0			
- MBAWALA-CHINI	300	413	10	1 3									0	0	140	170	
- NANYATI	200	275	7	1 3									0	0			
- NYENGEDI	300	413	10	1 3 5									0	0			
MKUNWA	1,160	1,597	43	6 5 1		22	2			22	5		43	108		18	1
LIKONDE	675	930	25	6		22	2			22	2		43	43		10	1
- LIKONDE GODAUNI																	
MSIJUTE	1,165	1,604	44	2	1	22	2			22	5		43	108	3	18	1
Total Ward	4,616	6,357	168		1		6				12		129	259	143	216	
NAUMBU Code: 120302																	
IMEKUWA	2,029	2,794	71	6 5 1		21	4			21	8		86	172		31	1
- KISIWAMBE																	
- MAWILO																	
- NACHIEMBE																	
NAMGOGOLI	1,100	1,515	40	6 1		21	2			21	5		43	108		18	1
- LISOHO																	
- KISIWA	400	551	15	2 6 1	2	21	1			21	2		22	43	5	8	1
NAUMBU	1,699	2,340	73	6 1		13			40				360	0	80	90	2
- KITOPE																	
- SANGWANGE																	
- MWITA PWANI																	
- PEMBA PWANI																	
- MKUNGU																	
- KABISELA	600	826	69	1		13			40								
MGAO	906	1,248	40	1		21	2			21	3		43	65		13	1
Total Ward	6,734	9,274	466		2		9				18		554	388	85	160	
TOTAL DIVISION	11,350	15,631	536		3		15	0			30		683	647	228	376	
MPAPURA DIVISION																	
KITERE Code: 120401																	
LIBOBE	845	1,164	34	2 4 1	7					13		30			18	34	3
- MING'WENA	907	1,249	36	5 2		22 24	2	1		22	4		37	65	3	16	1
- MITUPA	486	669	17	7		21	1			21	2		22	43		8	1
NAMUHI	2,298	3,165	85	4 1		22	4			13		30	65	330		140	2
- MNYIJA			3	6		22	1						16			3	1
CHEMCHEM	1,509	2,078	125	1 5 4		13			20				240	0	140	170	2
- LILIDO																	
- KITUNGURU	352	485	12	6 1		13			20								
- HAMBONI	485	668	17	6		21	1		23	1			22	45		5	1
CHEKELENI	2,418	3,330	88	7 4 1		13			20								
- NAKADA	700	964	26	5 1		13			20								
- MKONYE	850	1,171	30	5		21	2			21	3		43	65		13	1
Total Ward	10,850	14,941	474		7		11	1			9		445	548	161	389	
MPAPURA Code: 120402																	
MBUO	1,589	2,188	59	3 1 4	1	22	2			16	6		32	97	3	24	1
- CHANGARAWE																	
NDUMBWE	2,525	3,477	91	2 3 1	1								0	0	83	93	
- NDAMBI																	
UTENDE	926	1,275	34	1 2	7					13		30			18	18	3
- NANYANI	121	167	5	6		22	1						16	0		3	1
- MABATINI																	
MPAPURA	2,018	2,779	71	4 6 1		22	4			13		30	65	240		80	1
- MNANJE	1,000	1,377	34	2	6								0		16	16	
MWETEHI	1,161	1,599	41	2	10								0		26	26	
- MNYUNDO																	
Total Ward	9,340	12,862	334		25		7	0			6		113	337	146	260	
TOTAL DIVISION	20,190	27,803	804		32		18	1			15		558	885	307	649	

MTWARA DISTRICT Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m³/d	Existing W/S Systems	Existing W/S No of suff. Hp-wells	Future Development 1986 - 1991 Systems	1986 - 1991 New hand-pumps	1986 - 1991 Hand-pumps to be deepened	1986 - 1991 Piped W/S rehab. %	1992 - 2001 Systems	1992 - 2001 New hand-pumps	1992 - 2001 Piped W/S rehab. %	Development costs TAS 1,000 1986-1991	Development costs TAS 1,000 1992-2001	Operation and maintenance costs TAS 1,000/yr 1986	Operation and maintenance costs TAS 1,000/yr 2001	Priority
NANYAMBA DIVISION																	
MTINIKO **Code: 120501**																	
MISANJE - NANYENDYA	1,050	1,446	37	6 8		22	2			4			32	65		16	1
MARANJE	1,383	1,906	50	3		22	3			22	5		48	81		21	1
MTINIKO	2,130	2,933	76	3 1		22	4			13		50	65	400		90	1
- MALAMBA	300	413	10	6		22	1			22	1		16	32		5	1
MBAMBA KOFI	1,360	1,873	47	3		11											
- MNIVATA	300	413	12	3		11											
MTIMBWILIMBWI	2,752	3,790	96	5 3		11											
- MTOPWA	300	413	11	3		11											
- PACHANI	300	413	10	3		11											
Total Ward	9,875	13,599	350		0		10	0			6		161	578	0	132	
NANYAMBA **Code: 120502**																	
MINONGODI	1,223	1,684	69	1 3 4									0	0			
- KIWENGURU	389	536	13	3 4		12							130	0			
- LIKWAYA	388	534	13	1 3									0	0			
MNYAHI	783	1,078	29	1 3									0	0			
MILANGOMINNE	1,376	1,895	49	1									0	0			
MNYAWI SOKONI	750	1,033	28	1 3									0	0			
- MNYAWI BARABARANI	414	570	14	1 3									0	0			
- MNYAWI SHULENI	334	460	12	1 3									0	0			
MWANGANGA	776	1,069	27	3		11											
- MAGOMENI	300	413	10	3		11											
MBEMBA LEO	1,103	1,519	39	3		11							4,000	0	0	320	1
- MILAMBA	300	413	11	3		11											
NANYAMBA	1,522	2,096	66	1 5									0	0	410	540	
- MIBOBO	300	413	11	1 3 2	1								0	0	3	3	
DINYECHA	4,292	5,910	150	1 5									0	0			
NAMAKUKU	1,841	2,535	67	1 2 5	3								0	0	8	8	
- NAMAYANDA	300	413	14	2	2					21	1		0	22	5	5	
CHIKWAYA	999	1,376	36	1 3									0	0			
- MITANGANI	300	413	12	1 5									0	0			
NAMTUMBUKA SOKONI	2,678	3,688	98	1 3									0	0			
- KILIMA-HEWA	242	333	8	3 4		23	1			23	1		49	49		5	1
- MACHEHE	215	296	74	1 3									0	0			
- NAMTUMBUKA SUHELENI	478	658	16	1 3													
Total Ward	21,303	29,336	775		6		1	0			2		4,179	71	426	881	
NITEKELA **Code: 120503**																	
NITEKELA	1,273	1,753	48	2 3	5					22	3		0	49	13	21	4
- MIULE	270	372	9	2 5	1					22	1		0	16	3	5	4
- CHIWILA	300	413	10	6		22	1			22	1		16	16		5	1
NYUNDO	1,701	2,342	62	2 3 5	2	24		3		22	7		13	113	13	26	1
- MIYUMBA	300	413	11	3 5		22	1			22	1		16	16		5	1
KITAMA BONDENI	915	1,260	33	6		21	2			21	4		43	86		16	1
MIGOMBANA	701	965	24	2 3 5	3					22	1		0	16	8	10	4
Total Ward	5,460	7,519	198		11		4	3			18		88	312	37	88	
NJENGWA **Code: 120504**																	
CHIWINDI	840	1,157	29	6		23	2			23	2		89	89		10	1
NARUNGA	861	1,186	31	3		23	2			23	2		89	89		10	1
NJENGWA	1,521	2,095	55	2 3	1	21 24	1	3		21	6		35	129	10	24	1
- MAJENGO	550	754	19	2 3	5								0	0	13	13	
NANGAWANGA	498	686	17	3 2	2					22	1		0	16	5	8	4
- MALONGO	402	554	31	2 3	1					22	2		0	32	3	8	4
HINJU	1,600	2,203	56	2 3	2	22	1			22	6		16	97	5	24	1
- MTULI NJENGWA	211	291	7	2 5	2								0	0	5	5	
Total Ward	6,483	8,928	228		13		6	3			19		229	452	41	102	
TOTAL DIVISION	43,131	59,402	1,551		30		21	6			45		4,657	1,413	504	1,203	

MTWARA DISTRICT Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m³/d	Existing W/S Systems	Existing W/S No of suff. Hp-wells	Future Development 1986 - 1991 Systems	1986 - 1991 New hand-pumps	1986 - 1991 Hand-pumps to be deepe-ned	1986 - 1991 Piped W/S rehab. %	1992 - 2001 Systems	1992 - 2001 New hand-pumps	1992 - 2001 Piped W/S rehab. %	Development costs TAS 1,000 1986-1991	Development costs TAS 1,000 1992-2001	Operation and maintenance costs TAS 1,000/yr 1986	Operation and maintenance costs TAS 1,000/yr 2001	Priority
ZIWANI DIVISION																	
NALINGU Code: 120601																	
NALINGU	923	1,271	38	2 3	5								0	0	13	13	
- MNAZI	300	413	10	6 2		24		2		22	1		9	16	5	5	1
- MNETE	482	664	17	6 2		24		2		22	2		9	32	5	8	1
MNAWENE	1,160	1,597	40	2 6	4					22	3		0	49	10	18	4
MSIMBATI - RUVULA	2,161	2,976	78	2	8					21	4		0	86	21	31	4
MSANGAMKUU - NNOMO - NAMELA - MAPUNJE	2,217	3,053	78	3 6 1		13			20	21	5		200	108	90	103	2
SINDE - NG'WALE	1,077	1,483	41	6 3 1		13			20	21	3			65		8	2
KILIMBI	558	768	19	6		21	1			21	2		22	43		8	1
- MKUBIRU	300	413	10	6 2		21	1			21	1		22	22		5	1
MNGOJI	693	954	29	2 1	2										3	3	
- HYUVI	250	344	38	3		21	1			21	1		22	22		5	1
Total Ward	10,121	13,937	361		19		3	4			22		284	443	147	207	
NANGURUWE Code: 120602																	
MAKONJELE	676	931	24	5 2 1	5								0	0	13	13	
- NACHENJELE	300	413	10	2	5								0	0	13	13	
- CHIMBINDU	117	161	4	2	1								0	0	3	3	
- MAKOME A	190	262	7	2	3								0	0	8	8	
- MAKOME B	117	161	4	2	2								0	0	5	5	
MBAWALA	1,550	2,134	117	2 5 1	8								0	0	21	21	
NAMAYAKATA	1,654	2,278	59	6		21	3			21	7		65	151		26	1
NANGURUWE	2,090	2,878	84	2 6 5 1	5	24	2			21	6		9	129	13	31	2
MDUWI	744	1,025	26	1 3									0	0			
- MAILI-KUMI	300	413	10	1 3									0	0			
Total Ward	7,738	10,656	346		29		5	0			13		74	280	76	120	
ZIWANI Code: 120603																	
ZIWANI - NAMBELETEKELA - MSAKALA	2,470	3,402	87	2 1 5	10					13		20		180	26	106	4
MNYEMBE	1,320	1,818	49	2	14								0	0	31	31	
- MOMA	500	689	17	2	7								0	0	18	18	
- DING'WIDA	300	413	10	2	3								0	0	8	8	
- MIHURU	300	413	10	2	6								0	0	16	16	
LITEMBE - LITEMBE PACHANI - MITAMBO PATAKUWA	1,774	2,443	64	2	4					21	6		0	129	10	26	3
MADIMBA - MCHEPA	1,565	2,155	55	2 1	6					13		20	0		16	16	
MTENDACHI	1,120	1,542	39	1 2	2					13		20			5	5	
- NAMINDONDI	300	413	10	2 1	1					13		20			3	3	
Total Ward	9,649	13,288	342		53		0	0			6		0	309	133	229	
TOTAL DIVISION	27,508	37,881	1,049		101		8	4			41		358	1,032	356	556	
TOTAL DISTRICT	142,105	195,942	5,422		229		94	24			203		7,869	5,595	1,919	3,595	

13 NEWALA DISTRICT

Divisions		Wards	
01	Newala	01	Luchingu
		02	Makote
		03	Nanguruwe
		04	Mkunya
		05	Mcholi
		06	Namiyonga
		07	Mnekachi
		08	Chitekete
02	Chilangala	01	Mnyamba
		02	Chilangala
		03	Mkoma II
03	Kitangari	01	Kitangari
		02	Malatu
		03	Mchema
		04	Mtopwa
		05	Chiwonga
04	Litehu	01	Luagala
		02	Ngunja
		03	Mkwiti
		04	Mkonjowano
05	Mahuta	01	Mahuta
		02	Mcholi II
		03	Mkundi
		04	Mnyawa
		05	Lukokoda
		06	Nanhyanga
		07	Mdimba
		08	Chingungwe
		09	Makukwe
		10	Mkwedu
06	Namikupa	01	Namikupa
		02	Tandahimba
		03	Kitama
		04	Mihambwe
		05	Michenjele
		06	Mkoreha
		07	Naputa
		08	Maundo

NEWALA DISTRICT Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m³/d	Existing W/S Systems	Existing W/S No of suff. Hp-wells	Future Development 1986 - 1991 Systems	1986 - 1991 New hand-pumps	1986 - 1991 Hand-pumps to be deepe-ned	1986 - 1991 Piped W/S rehab. %	1992 - 2001 Systems	1992 - 2001 New hand-pumps	1992 - 2001 Piped W/S rehab. %	Development costs TAS 1,000 1986-1991	Development costs TAS 1,000 1992-2001	Operation and maintenance costs TAS 1,000/yr 1986	Operation and maintenance costs TAS 1,000/yr 2001	Priority
NEWALA DIVISION																	
LUCHINGU **Code: 130101**																	
NEWALA TOWN	0	0	47	1 3 8		13				12			9,240	3,250			1
- LUCHINGU	2,600	6,065	253	1 3 8		13				12							
- MAJENGO	4,600	8,960	448	1 3 8		13				12							
- NANGAWALA	5,370	10,460	523	1 3 8		13				12							
- JULIA	1,475	2,873	144	1 3 8		13				12							
- KILIMAHEWA	610	1,188	59	1 3 8		13				12							
- LINGANA	0	0	4	1 3 8		13				12							
- LIKUNA	2,225	4,334	217	1 3 8		13				12							
- LEKANELO	0	0	0	1 3 8		13				12							
- KIDUNI	654	1,274	64	1 3 8		13				12							
- LEGEZA	554	1,079	55	1 3 8		13				12							
- TUPENDANE	0	0	0	1 7 6 8		13				12							
- AMKENI	1,700	3,311	168	1 7 6 8		13				12							
- TWENDEPAMMOJA	3,620	7,051	352	7 3 1 8		13				12							
MONEKA	1,058	1,191	31	3 8 1		13				12							
- MWANONA	293	330	9	7 6		21	1			21	1		22	22		5	1
CHITANDI	919	1,035	26	7 6 8		12											
Total Ward	25,678	48,152	2 401		0		1				1		9,262	3,272	0	5	
MAKOTE **Code: 130102**																	
KIPIMI	1,036	1,166	29	1 7 8		13				12							
CHIKWAYA	1,255	1,413	40	3 8 1		13				12							
KIKUYU	0	0															
- MNAZIMMOJA	1,002	1,128	31	1 3 8		13				12							
- TEMEKE	766	862	23	1 3 8		13				12							
MAKONDEKO	2,307	2,597	71	1 7		13				12							
MAHUMBIKA	1,439	1,620	44	3 1 8		13				12							
MAKOTE	2,135	2,404	66	7 1		13				12							
Total Ward	9,940	11,191	304		0												
NANGURUWE **Code: 130103**																	
MAPILI	550	619	17	6 1		13				12							
MNANJE	1,034	1,164	32	7 8		12				12							
MTAWE A	901	1,014	28	7 3 3		12				12							
- MTAWE B	600	676	19	7 3 8 1		13				12							
SAMORA JUU	1,000	1,126	32	7 8 1		13				12							
- SAMORA CHINI	170	191	5	7 8 1		13				12							
NANGURUWE	1,235	1,390	40	7 8 1		13				12							
- SONGAMBELE	225	253	7	7 8 1		13				12							
MAGUMCHILA	1,300	1,464	40	7 1		13				12							
Total Ward	7,015	7,898	220		0												
MKUNYA **Code: 130104**																	
KIUTA	1,100	1,238	33	3 8 1		13											
MKUNYA	1,300	1,464	42	7 1		13											
RAHALEO	1,700	1,914	51	7 1		13											
MATOKEO	0	0															
- TUVENE	1,012	1,139	33	7 8 1		13											
CHIHANGA	1,255	1,413	39	7		21	3			21	3		65	65		16	1
Total Ward	6,367	7,169	199		0		3				3		65	65	0	16	
MCHOLI **Code: 130105**																	
CHIUNJILA	500	563	16	7		21	1			21	2		22	45		8	1
- MPILIPILI	621	699	21	7		21	1			21	2		22	45		8	1
- CHIKWEDU	402	453	13	7		21	1			21	1		22	22		5	1
CHIHWINDI	2,660	2,995	85	3 8 1		13				12							
MCHOLI GODAUNI	2,690	3,029	81	7 8 1		13				12							
AMANI-MCHOLI	1,794	2,020	52	7 1		13				12							
- MNALALE	520	585	20	7 1		13				12							
PACHOTO	1,700	1,914	49	7 1		13				12							
Total Ward	10,887	12,258	336		0		3				5		66	112	0	21	
NAMIYONGA **Code: 130106**																	
MANDUMBA	1,000	1,126	34	3 8		12											
- LONDO	499	562	21	3 8		12											
NAMIYONGA	1,737	1,956	52	3 1 8		13											
NAKACHELA	1,500	1,689	47	3 8		12											
MAGOMBO SHULENI	1,512	1,702	46	3 8		12											
- MAGONBO BARABANI	870	980	30	3 8 1		13											
Total Ward	7,118	8,014	229		0												

NEWALA DISTRICT Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m³/d	Existing W/S Systems	Existing W/S No of suff. Hp-wells	Future Development 1986 - 1991 Systems	1986 - 1991 New hand-pumps	1986 - 1991 Hand-pumps to be deepened	1986 - 1991 Piped W/S rehab. %	1992 - 2001 Systems	1992 - 2001 New hand-pumps	1992 - 2001 Piped W/S rehab. %	Development costs TAS 1,000 1986-1991	Development costs TAS 1,000 1992-2001	Operation and maintenance costs TAS 1,000/yr 1986	Operation and maintenance costs TAS 1,000/yr 2001	Priority
NEWALA DIVISION																	
MNEKACHI **Code: 130107**																	
MNAKWEMBE	0	0															
- NAMBUNGA	1,212	1,365	37	7 8		12											
- MNAMBE	267	301	8	6 8		12											
- CHIWAMBO	1,000	1,126	28	7 8 1		13											
NANYONDA	933	1,050	26	2 8		12											
- NANYUWILA	158	178	4	2 8		12											
KILIDU	945	1,064	27	2 8		12											
MKOMA I	2,541	2,861	82	7 8 1		13											
MTANGALANGA	1,117	1,258	34	7 8 1		13											
MAKONGA	1,968	2,216	58	1 8 3		13											
JUHUDI	3,162	3,560	91	7 8 3 1		13											
Total Ward	13,303	14,978	395		0												
CHITEKETE **Code: 130108**																	
MITAHU	982	1,106	31	7 8 1		13											
MPALU	544	612	18	6 8		12											
- LUKOHE	131	147	4	7 8 1		13											
- MCHAURU	147	166	4	6 8 1		13											
MNAUKE VIJAMA	460	518	13	7 8 1		13											
CHITEKETE	1,200	1,351	37	2 8 1	4	13									10	10	
- NANKONDA	600	676	18	2 8		12											
NAMBUDI	509	573	19	2 8	4	12									10	10	
- MCHANGANI	437	492	15	2 8	4	12									10	10	
NAKAHAKO	1,328	1,495	60	6 8 1		13											
Total Ward	6,338	7,136	201		0												
TOTAL DIVISION	86,643	116,796	4,285		12		7	0			9		9,393	3,449	30	42	
CHILANGALA DIVISION																	
MNYAMBE **Code: 130201**																	
IDAMNOLE	1,892	2,130	56	7 8		12											
HANGAPANO	495	557	14	7 8		12											
- NANGUKU	559	629	16	7 8		12											
- NACHIPOME	275	310	8	6 8		12											
MNYAMBE	1,913	2,154	54	7 8 1		13											
MNAYOPE	2,001	2,253	59	7 8 1		13											
MNIMA	1,100	1,238	71	7 8 1		13											
CHIHANGU	2,231	2,512	66	1 8		13											
LIKANGARA	15	17	1	1 2 8		13											
BAHATI	449	506	13	1 2 8		13											
MAJEMBE JUU	422	518	13	7 6 8		12											
Total Ward	11,390	12,824	369		0												
CHILANGALA **Code: 130202**																	
NANYAMBA	100	113	3	7 8 1		13				12							
- MKUDUMBA	493	555	13	7 8 1		13				12							
- NANDIMBA	717	807	22	7 8 1		13				12							
- MNYENGACHI	191	215	6	7 8 1		13				12							
MIYUYU	547	616	16	6 4 8 1		13				12							
CHILANGALA																	
SHULENI	1,018	1,146	62	6 8 1		13				12							
- NAWANGA	406	457	12	7 8 1		13				12							
MKONGI	2,402	2,704	69	6 8 1		13				12							
NAMANGUDU	490	552	14	6 8		12				12							
MIKUMBI	1,600	1,801	47	7 8 1		13				12							
Total Ward	7,964	8,967	249		0												
MKOMA II **Code: 130203**																	
MLINGANE - NANGUDYANE - MKOMA SOKONI - LIHANGA	1,800	2,027	53	6 8		12											
MMALACHI - MKOMA SHULENI - CHILENDE - MAHOHA	2,085	2,348	60	6 8		12											
LOACHINU - NAMIHONGA - LUKUNGU - CHIKALULE	*1,000*	*1,126*	*30*	*6 8*		21 23	2			21	3		66	65	13		1
NAMBALI	1,598	1,799	45	6 8		21 23	3			21 23	5		88	131	21		1
Total Ward	6,483	7,299	75		0		5				8		154	196	0	34	
TOTAL DIVISION	25,837	29,090	713		0		5	0			8		154	196	0	34	

NEWALA DISTRICT Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m³/d	Existing W/S Systems	Existing W/S No of suff. Hp-wells	Future Development 1986 - 1991 Systems	1986 - 1991 New hand-pumps	1986 - 1991 Hand-pumps to be deepened	1986 - 1991 Piped W/S rehab. %	1992 - 2001 Systems	1992 - 2001 New hand-pumps	1992 - 2001 Piped W/S rehab. %	Development costs TAS 1,000 1986-1991	Development costs TAS 1,000 1992-2001	Operation and maintenance costs TAS 1,000/yr 1986	Operation and maintenance costs TAS 1,000/yr 2001	Priority
KITANGARI DIVISION																	
KITANGARI Code: 130301																	
MMOVO	800	901	29	1 6 8									0	0			
NANDA	923	1,039	444	1 8									0	0			
MIKWANGA	0	0															
- MITANGA	400	450	13	3 8		12											
- LIKWAYA	299	337	9	3 8		12											
MANDALA	1,151	1,296	40	1 8		13											
- MITEMA																	
- NANKONDA																	
- MTOPOLA																	
MAPUTI	1,500	1,689	50	1 3 8									0	0			
NIAMOJA	700	788	24	1 6 8		12											
- MINGALIE	337	379	9	1 6 8		12											
KITANGARI (MAJENGO)	1,787	2,012	57	1 2	7	12				12			20,600	93,300	13,400	26,280	1 (1)
MTONGWELE	1,400	1,576	46	1													
MNAUYA	713	803	24	6		12											
KADENGWA	552	622	19	1 6													
Total Ward	10,562	11,892	763		7		0						20,600	93,300	13,400	26,280	
MALATU Code: 130302																	
MKUNJO	0	0	3														
- MALATU SHULENI	761	857	25	2 3 8		21	2			21	2		43	43		10	1
- DODOMA	520	585	15	2 3 8		21	1			21	2		22	43		8	1
- MTANDA	476	536	14	2 3 8		21	1			21	2		22	43		8	1
MALATU	1,500	1,689	46	2	5					21	1		0	22	13	16	4
MNOLELA CHINI	1,209	1,361	37	2	6								0	0	16	16	
- MNOLELA JUU	216	243	6														
Total Ward	4,682	5,271	145		11		4				7		87	151	29	58	
MCHEMO Code: 130303																	
MCHEDEBWA	1,300	1,464	39	1 8		12											
- MKUPETE	286	322	9	1 8		12											
CHIULE	1,104	1,243	37	1 8		12											
- MCHEMO A	1,118	1,259	31	1 8		12											
LENGO	1,370	1,542	42	1 8		12											
MPWAPWA	927	1,044	26	2 1	5	12									13	13	
SONGAMBELE CHINI	667	751	19	1 8		12											
- SONGAMBELE JUU	320	360	9	1													
MCHEMO	983	1,107	28	2 1		13											
MDIMBA	680	766	23	6 8 1		13											
- NGALU	568	640	16	1		13											
MINJALE B	509	573	14	2 1	2	13									5	5	
- MINJALE A	223	251	6	1		13											
CHITENDA	989	1,114	28	2	2	12									5	5	
Total Ward	11,044	12,435	327		9		0								23	23	
MTOPWA Code: 130304																	
MNYEU	1,850	2,083	55	1 8 5									0	0			
- CHIKWAYA																	
CHILONDOLO	702	790	23	1 8 6									0	0			
CHIKUNDA	473	533	19	1 8 6									0	0			
MTOPWA	2,210	2,488	72	1 6									0	0			
Total Ward	5,235	5,894	157		0								0	0			
CHIWONGA Code: 130305																	
MZUNGUKA	300	338	10	1									0	0			
- CHIKUNDA LUBEBO	359	404	11	1 7 6 8									0	0			
- MPILANI	347	391	11	1 6 8									0	0			
- VIHOKOLI	411	463	13	1 6 8									0	0			
NANDWAHI	1,467	1,652	52	1 6 8		13							0	0			
CHIWONGA	698	786	27	6 8		12											
- PACHANNE	739	832	22	6 8		12											
- CHIWINDI	430	484	12	6 8		12											
- CHIKUTI	548	617	16	6 8		12											
MMULUGA	776	874	26	1 8 6		13											
- ZIARANI	577	650	18	1 6 8		13											
MZALENDO	1,036	1,166	31	1 8 6									0	0			
- MBEMBERE	334	376	13	1 6		13											
- CHIPITO	320	360	11	1		13											
Total Ward	8,342	9,392	274		0												
TOTAL DIVISION	39,865	44,884	1,666		27		4	0			7		20,687	93,451	13 452	26,361	

(1) All O & M cost of Makonde Plateau W/S are shown here.

NEWALA DISTRICT Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m³/d	Existing W/S Systems	Existing W/S No of suff. Hp-wells	Future Development 1986 - 1991 Systems	1986 - 1991 New hand-pumps	1986 - 1991 Hand-pumps to be deepened	1986 - 1991 Piped W/S rehab. %	1992 - 2001 Systems	1992 - 2001 New hand-pumps	1992 - 2001 Piped W/S rehab. %	Development costs TAS 1,000 1986-1991	Development costs TAS 1,000 1992-2001	Operation and maintenance costs TAS 1,000/yr 1986	Operation and maintenance costs TAS 1,000/yr 2001	Priority
LITEHU DIVISION																	
LUAGALA **Code: 130401**																	
MONGOMONGO	659	742	21	1 6													
- MKWEDU	504	567	14	1 5													
- MACHEDI	413	465	14	1 5													
CHAUME A	1,602	1,804	49	1 8													
- CHAUME B	190	214	6	1 8		12											
- LIPONDE	423	476	12	1													
MWERU	1,075	1,210	34	1 5													
MICHINJI	1,949	2,194	73	1 8 6													
LITEHU	1,388	1,563	43	1 5													
MKOLA	1,417	1,595	47	1													
KULYENDA	1,284	1,446	41	1		13											
- MABETI																	
- CHIDEDE																	
MMEDA	884	995	25	1		12											
LIBOBE	465	524	13	1 6		13											
Total Ward	12,253	13,796	392		0												
NGUNJA **Code: 130402**																	
NAMINDONDI JUU	1,201	1,352	75	2 3 1		13									5	5	
- NAMINDONDI CHINI	500	563	14	2 1 3	1	13									5	5	
MKUNJANGO	0	0															
- MANGOMBAYA	650	732	22	7 8 1		13											
- NANJANGA	332	374	11	7 8		12											
- MKUTI	856	964	27	1 8		12											
NGUNJA	1,676	1,887	52	8 7 1		13											
NANNALA	754	849	27	8 5		12											
Total Ward	5,969	6,721	227		1										10	10	
MKWITI **Code: 130403**																	
LIKOLOMBE CHINI	1,891	2,129	92	6		21	4			21	6		86	129		26	1
- KIDOO	340	383	10	6		21	1			21	1		22	22		6	1
- LIKOLOMBE JUU	226	263	6	6		21	1						22	0		3	1
MKWITI A	1,180	1,329	40	4 8		21	2			21	4		43	86		16	1
- MKWITI B	508	572	18	4 8		21	1			21	2		22	43		8	1
Total Ward	4,144	4,666	166		0		9				13		195	280	0	59	
MKONJOWANO **Code: 130404**																	
MKONJOWANO	485	546	14	1 5 8													
- ULODA LEO	424	477	13	1 8 6		12											
- NAMBUTUKA	263	296	9	1 8		12											
NACHUNYU	728	820	28	1 5 8													
MKULA	420	473	10	1 6 8		12											
- MIKUYU	388	437	13	1 6 8		12											
CHIMBUKO	751	846	25	1 8 5													
- CHIWONDA	214	241	7	1 5 8													
NAMBAHU	1,126	1,268	41	1 8 6													
- MAHOHA	293	330	11	1 8 6		12											
MIVANGA	565	636	17	1 6 8													
- MNAIDA	126	142	4	6 1		12											
MWEMBEMMOJA	791	891	23	1 5 8													
LYENJE	748	842	22	1 5													
Total Ward	7,322	8,244	244		0												
TOTAL DIVISION	29,688	33,427	1,029		1		9	0			13		195	280	10	69	

NEWALA DISTRICT

Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m³/d	Existing W/S Systems	Existing W/S No of suff. Hp-wells	Future Development 1986 - 1991 Systems	1986 - 1991 New hand-pumps	1986 - 1991 Hand-pumps to be deepened	1986 - 1991 Piped W/S rehab. %	1992 - 2001 Systems	1992 - 2001 New hand-pumps	1992 - 2001 Piped W/S rehab. %	Development costs TAS 1,000 1986-1991	Development costs TAS 1,000 1992-2001	Operation and maintenance costs TAS 1,000/yr 1986	Operation and maintenance costs TAS 1,000/yr 2001	Priority
MAHUTA DIVISION																	
MAHUTA Code: 130501																	
MAHUTA	15,760	30,699	1,545	7 8 1		13											
- MKULUNGULU																	
- CHIKONGOLA																	
- BONDENI																	
LIDUMBE-MTONI	848	955	28	7 1		13											
MILUMBA (JUU)	801	902	26	1 8		12											
- MILUMBA CHINI	103	116	3	3 1 8		12											
NAKAYAKA A	407	458	16	1 6													
- NAKAYAKA B	323	364	9	1 6													
- NAKAYAKA C	201	226	6	1 6													
LUBANGALA	1,523	1,715	55	1 3 6													
Total Ward	19,966	35,435	1,688		0												
MCHOLI II Code: 130502																	
LIDUMBE SHULENI	1,477	1,663	51	3 8 1		12											
MNAIDA	1,167	1,314	35	3 8 1		12											
MSILILI	1,900	2,139	58	7 8 1		12											
- MITUMBATI	600	676	24	7 8 1		12											
TAWALA	1,979	2,228	63	3 8 1		12											
Total Ward	7,123	8,020	230		0												
MKUNDI Code: 130503																	
MIKUNDA	2,327	2,620	69	1 3 6													
CHITOHOLI	1,198	1,349	37	1 3 7													
DINEMBO	1,343	1,612	40	1 3 4													
LIPALWE	1,475	1,661	44	6 5		21	3			21	4		65	86		18	1
- LIPALWE II	1,117	1,258	34	5		21	2			21	4		43	86		16	1
Total Ward	7,460	8,399	225		0		5				8		108	172	0	34	
MNYAWA Code: 130504																	
MAHEHA	999	1,125	31	1 3 4													
PACHANI	805	906	25	6		21	2			21	2		43	43	0	10	1
MCHICHIRA	2,352	2,648	71	1 3 8													
MNYAWA	1,472	1,657	45	1 3 4													
SHANGANI	1,633	1,839	48	1 3 4													
JANGWANI	2,216	2,495	65	1 3 4													
MUNDAMKULU	1,553	1,749	46	1													
Total Ward	11,030	12,419	332		0		2				2		43	43	0	10	
LUKOKODA Code: 130505																	
GHANA	1,450	1,633	43	1 3 6													
LUKOKODA	1,800	2,027	5	1 3 6													
MNAZIMMOJA	1,620	1,824	48	1 3 6													
Total Ward	4,870	5,483	146		0												
NANYANGA Code: 130506																	
NANYANGA	3,329	3,748	102	1 8 5													
NAMDOWOLA	347	390	12	6 8 5		12											
DINDUMA																	
BARABARANI	502	565	20	1 8													
- TANDIKA	243	274	10	1 8													
- DINDUMA SHULENI	241	271	10	1 8		12											
MITENE	1,400	1,576	58	1 8													
- MNALWAYO	173	195	8	8 1													
NANYUWILA	816	919	28	1													
MIULE	1,826	2,056	59	1													
Total Ward	8,877	9,995	299		0												
MDIMBA-MNYOMA Code: 130507																	
TUKURU JUU	1,727	1,944	55	1 8													
- TUKURU CHINI	289	325	10	1 8													
MNYOMA	2,345	2,640	71	1 8													
MAMBAMBA	1,604	1,806	50	1 5 8													
MTANDAVALA	642	723	22	1 8 5													
- MNAUYA	383	431	14	1 5 8													
MNDUMBWE	1,179	1,327	39	1 8													
- MTYATULA	169	190	8	1 8													
MTEGU	1,242	1,398	42	1													
Total Ward	9,580	10,786	311		0												
CHINGUNGWE Code: 130508																	
MKUPETE	1,550	1,745	50	1 8													
MTENDA	978	1,101	33	8 1		12											
SALAMA	100	113	3	1													
- CHIKUNDA	496	558	18	1 8													
- MALANJE	323	364	13	1 8													
- KIULE	450	507	15	1 8													
CHINGUNGWE	2,555	2,877	81	1 8													
Total Ward	6,452	7,264	212		0												

NEWALA DISTRICT Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m³/d	Existing W/S Systems	Existing W/S No of suff. Hp-wells	Future Development 1986 - 1991 Systems	1986 - 1991 New hand-pumps	1986 - 1991 Hand-pumps to be deepened	1986 - 1991 Piped W/S rehab. %	1992 - 2001 Systems	1992 - 2001 New hand-pumps	1992 - 2001 Piped W/S rehab. %	Development costs TAS 1,000 1986-1991	Development costs TAS 1,000 1992-2001	Operation and maintenance costs TAS 1,000/yr 1986	Operation and maintenance costs TAS 1,000/yr 2001	Priority
MAHUTA DIVISION																	
MAKUKWE Code: 130509																	
MNACHI	100	113	3	1		13											
- MTENDACHI	809	911	23	1 8 1		12											
- MNAUJA	774	871	26	1 8 1		12											
MTUNGURU	3,721	4,189	139	1 8 1		12											
MMONGO	0	0															
- MINJALE	292	329	9	8 1		12											
- MBUYUNI	692	779	23	8 1		12											
MANGO	0	0															
- MAKUKWE I	983	1,107	36	8 1		12											
- NGONGO	744	838	27	1 8													
MAKUKWE	1,547	1,742	49	3 8 1		13											
MNAMUNJELELE	1,610	1,813	53	3 8 1		13											
Total Ward	11,272	12,691	386		0												
MKWEDU Code: 130510																	
MNYAMBACHI	1,837	2,068	61	3 8		12											
MKWEDU	1,405	1,582	47	1 8 1		13											
- CHIUTA	629	708	21	1 8 1		13											
TENGULENGU	1,328	1,495	46	3 8		12											
- MAKULE	301	339	9	8 3		12											
Total Ward	5,500	6,192	184		0												
TOTAL DIVISION	**92,130**	**116,684**	**4,013**		**0**		**7**	**0**			**10**		**151**	**215**	**0**	**44**	
NAMIKUPA DIVISION																	
NAMIKUPA Code: 130601																	
NAMIKUPA	2,229	2,510	74	7 1		13											
PEMBA	1,372	1,545	42	6 8 1		13											
- SINYANGI	105	118	3	6		12											
CHINGATI	1,425	1,604	42	1 6 8													
HURUMA	597	672	19	1 3													
MILIDU	1,173	1,321	37	1 3													
KWANYAMA	1,313	1,478	40	3 4		12											
NANJALAHU	227	256	7	3 5 4		12											
Total Ward	8,441	9,504	264		0												
TANDAHIMBA Code: 130602																	
MAPUNJU	969	1,091	31	1 6 8													
- TINGIDA A																	
- TINGIDA B																	
MBALALA	635	714	18	1 6													
MAROPOKELO	776	874	25	1 6													
- MILEDI	221	249	7	1 6													
NANGOTI	147	166	5	1 6													
MADABA A	1,530	1,723	47	1 6 8													
- MADABA B	60	68	2	1 6													
MALAMBA	1,426	1,606	46	1 6 8													
TANDAHIMBA	3,595	4,048	119	1 6													
NAMKOMOLELA	639	719	18	1 8 5													
MILONGOOI	1,283	1,445	37	1 5													
- MWINDI	400	450	12	1 8													
- NALYAMBA	123	138	3	1 8													
Total Ward	11,804	13,290	373		0												
KITAMA Code: 130603																	
NG'ONGOLO	985	1,109	33	1 3 6													
- NG'ONGOLO CHINI	182	205	5	1 6													
MIUTA	1,336	1,504	43	1 6 3													
KITAMA	2,345	2,640	70	1 6 8													
MWENGE	1,859	2,093	55	1 6 8													
MITONDI A	985	1,109	30	1 5 8													
- MITONDI C	140	158	4	8		12											
- MITONDI B	282	318	10	5		12											
Total Ward	8,114	9,136	252		0												

NEWALA DISTRICT Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m³/d	Existing W/S Systems	No of suff. Hp-wells	Future Development 1986 - 1991 Systems	New hand-pumps	Hand-pumps to be deepe-ned	Piped W/S rehab. %	1992 - 2001 Systems	New hand-pumps	Piped W/S rehab. %	Development costs TAS 1,000 1986-1991	1992-2001	Operation and maintenance costs TAS 1,000/yr 1986	2001	Priority
NAMIKUPA DIVISION																	
MIHAMBWE **Code: 130604**																	
MIHAMBWE	1,437	1,618	46	1 4 3													
RUVUMA	1,738	1,957	53	1 3 4													
LEMBELA	0	0															
- NAKALE	250	281	7	1 3 6													
- MNYAHI	735	828	23	1 3 6													
KISAGANI	0	0		1													
- MKAHA	653	735	21	1 3 4													
- MATENDE	505	569	14	1 3 4													
- MITUMBATI	378	426	11	1 3 4													
Total Ward	5,696	6,413	176		0												
MICHENJELE **Code: 130605**																	
SHIRIKISHO	200	225	6	1 3 4													
- MPUNDA	416	468	14	1 3 4													
- MMALALA	480	540	14	1 3 5													
NGONGO	855	963	28	1 4													
MICHENJELE JUU	1,620	1,711	47	1 3 4													
- MICHENJELE CHINI	74	83	2	1													
Total Ward	3,545	3,991	111		0												
MKOREHA **Code: 130606**																	
DINYEKE	430	484	12	1 3 6													
- DINYEKE II	390	439	11	6 1													
NAMUNDA	2,010	2,263	61	1 3 6													
- MISUFINI	1,100	1,238	35	1 3 6													
MCHANGANI	1,150	1,295	32	1 3 6													
CHIKONGO	1,178	1,326	36	1 3 4													
Total Ward	6,258	7,046	188		0												
NAPUTA **Code: 130607**																	
MWANGAZA	1,021	1,150	32	1 3 6													
- MPIKULA	340	383	10	1 3 8													
NAMDWANI	727	819	20	1 3 6													
NAPUTA	1,662	1,871	51	1 3 6													
Total Ward	3,750	4,222	113		0												
MAUNDO **Code: 130608**																	
KUNANDUNDU	1,510	1,700	46	1 3 4													
CHIUMO	100	113	3	1													
- MAKOMBO	700	788	20	1 3 6													
- MBUYUNI	262	295	7	6		21	1			21	1		22	22	5		1
- MAUNDO CHINI	300	338	8	6		21	1			21	1		22	22	5		1
NAMAHONGA	2,193	2,469	65	1 3 4													
MAUNDO	1,370	1,542	39	1 3 6													
Total Ward	6,435	7,245	188		0		2				2						
TOTAL DIVISION	54,043	60,447	1,675		0		2				2		44	44	0	10	
TOTAL DISTRICT	328,206	401,328	13,381		40		34	0			49		30,624	97,635	13,482	26,560	

14 MTWARA-MIKINDANI TOWN

Division

01 Mtwara

02 Mikindani

MTWARA-MIKINDANI TOWN				Existing W/S		Future Development 1986 - 1991				1992 - 2001			Development costs TAS 1,000		Operation and maintenance costs TAS 1,000/yr		Priority
Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m³/d	Systems	No of suff. Hp-wells	Systems	New hand-pumps	Hand-pumps to be deepened	Piped W/S rehab. %	Systems	New hand-pumps	Piped W/S rehab. %	1986-1991	1992-2001	1986	2001	
MTWARA MJINI DIVISION																	
Code: 140100																	
MAGOMENI	6,000	8,263	207	2 3 1	1					21	23		0	495	26	86	2
MANGOMBA	1,200	1,653	41	2	3					21	4		0	86	8	18	3
NALINDELE	4,100	5,646	141	1									0	0			
OMKANGALA	3,150	4,338	108	2	1	21 23	5			21 23	12		154	304	16	47	
MBAE	1,100	1,515	38	2	4					21	2		0	43	10	16	4
MTWARA TOWN	61,300	165,067	8,280	1 2 3	30	12				12			45,000	66,000	2,200	6,400	1
Total Ward	76,850	186,481	8,815		39		5				41		45,154	66,928	2,260	6,567	
MIKINDANI DIVISION																	
Code: 140200																	
MIKINDANI TOWN	11,300	30,428	1,520	1 2	20	13				12			1,300	5,000	400	900	2
RWELU	1,150	1,584	41	2	2					21	5		0	108	8	18	2
Total Ward	12,450	32,012	1,561		22						5		1,300	5,108	408	918	
LIKOMBE DIVISION																	
Code: 140300																	
MTAWANYA	1,300	1,790	49	2 1 3	1	12				12			0	0	8	8	
Total Ward	1,300	1,790	49		1								0	0	8	8	
TOTAL DISTRICT	90,600	220,283	10,425		62		5	0			46		46,454	72,036	2,676	7,493	
TOTAL REGION	868,280	1248,101	42,020		586		338	159			809		96,994	263,212	21,673	44,519	

21 KILWA DISTRICT

Divisions		Wards	
01	Kipatimu	01	Kipatimu
		02	Kandawale
		03	Chumo
02	Njinjo	01	Miguruwe
		02	Mitole
		03	Njinjo
03	Nanjirinji	01	Nanjirinji
		02	Likawage
04	Miteja	01	Kinjumbi
		02	Miteja
		03	Tingi
		04	Mingumbi
05	Pwani	01	Kivinje
		02	Masoko
		03	Songosongo
		04	Kikole
06	Pande	01	Pande-Mikoma
		02	Lihimalyao
		03	Mtandi
		04	Mandawa

KILWA DISTRICT

Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m³/d	Existing W/S Systems	Existing W/S No of suff. Hp-wells	Future Development 1986 - 1991 Systems	1986 - 1991 New hand-pumps	1986 - 1991 Hand-pumps to be deepened	1986 - 1991 Piped W/S rehab. %	1992 - 2001 Systems	1992 - 2001 New hand-pumps	1992 - 2001 Piped W/S rehab. %	Development costs TAS 1,000 1986-1991	Development costs TAS 1,000 1992-2001	Operation and maintenance costs TAS 1,000/yr 1986	Operation and maintenance costs TAS 1,000/yr 2001	Priority
KIPATIMU DIVISION																	
KIPATIMU Code: 210101																	
HANGA	964	1,306	33	2 3 6	2					21	4		0	86	5	16	3
KIPATIMU	4,002	5,420	156	2 3 1	14					21	8		0	172	37	58	3
KIBATA	1,143	1,548	39	6		21	2			21	5		43	108	0	18	1
MTONDO WA KIMWAGA	1,662	2,251	56	2 6	7					21	2			43	18	24	4
- MKONGO	300	406	10	2	3								0	0	8	8	
MWENGEI	827	1,134	28	6		21	2			21	3		43	65	0	13	1
NANDEMBO	1,046	1,417	35	6		21	2			21	4		43	86	0	16	1
NANDETE	1,907	2,583	65	2 6	9					21	1			22	24	26	4
MKANRANGO	1,000	1,354	34	2 6	4					21	2			43	10	16	4
Total Ward	12,861	17,418	455		39		6				29		129	624	102	195	
KANDAWALE Code: 210102																	
NAMATEWA	700	948	24	6		21	2			21	2		43	43	0	10	1
NGARAMBI	1,750	2,370	59	3 6		21	3			21	7		65	151	0	26	1
MTUMBEI-MPOPERA	1,256	1,701	43	4 3		21	3			21	6		65	129	0	24	1
KANDAWALE	1,731	2,424	58	3 6		21	3			21	7		65	151	0	26	
Total Ward	5,437	7,363	184		0		11				22		237	473	0	86	
CHUMO Code: 210103																	
CHUMO	3,000	4,063	102	2 3	6	24		4		21	9		24	194	26	45	2
NAMAYUNI	2,514	3,405	85	2 3	3	24 21	1	1		21	10		28	215	8	34	1
KINYWANYU	1,716	2,324	38	2 3 7	8	24		2		21	1		24	22	26	31	2
INGIRITO	1,400	1,896	47	3		21	3			21	5		65	108	0	21	1
Total Ward	8,630	11,688	292		17		4	7			25		140	538	60	131	
TOTAL DIVISION	26,928	36,469	931		56		21	7			76		506	1,635	162	412	
NJINJO DIVISION																	
MIGURUWE Code: 210201																	
MIGURUWE	1,541	2,087	52	2 6 3		24		7		21	6		42	129	18	24	1
NAKINGOMBE	1,220	1,652	41	2 3	4					21	3		0	65	10	18	4
ZINGA KIBAONI	600	813	20	2 3	3					21	1		0	22	8	10	4
Total Ward	3,361	4,552	114		7			7			10		42	215	36	52	
MITOLE Code: 210202																	
MITOLE	1,250	1,693	42	3 4		21	3			21	4		65	86	0	18	1
NGEA	620	840	21	3 6		21	1			21	3		22	65	0	10	1
MKOMA	520	704	18	3 6		21	1			21	2		22	43	0	8	1
Total Ward	2,390	3,237	81		0		5				9		108	194	0	37	
NJINJO Code: 210203																	
NJINJO	3,400	4,605	125	2 1	16					21	3		0	65	42	50	1
KIPINDIMPI	2,015	2,729	68	2 3		24		5		21	9		30	194	13	29	1
KISIMA-MKIKA	1,400	1,896	47	3 1		21	3			21	5		65	108	0	21	1
Total Ward	6,815	9,230	241		16		3	5			17		95	366	55	100	
TOTAL DIVISION	12,455	17,019	436		23		8	12			36		245	775	91	189	

KILWA DISTRICT Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m³/d	Existing W/S Systems	Existing W/S No of suff. Hp-wells	Future Development 1986 - 1991 Systems	1986 - 1991 New hand-pumps	1986 - 1991 Hand-pumps to be deepened	1986 - 1991 Piped W/S rehab. %	1992 - 2001 Systems	1992 - 2001 New hand-pumps	1992 - 2001 Piped W/S rehab. %	Development costs TAS 1,000 1986-1991	Development costs TAS 1,000 1992-2001	Operation and maintenance costs TAS 1,000/yr 1986	Operation and maintenance costs TAS 1,000/yr 2001	Priority
NANJIRINJI DIVISION																	
NANJIRINJI Code: 210301																	
NANJIRINJI B	1,500	2,031	51	6 1		21	3			21	6		65	129	0		1
NANJIRINJI A	1,200	1,625	41	3 3 1						12			0	40	70	90	3
NAKIU	2,600	3,521	88	3 4		21	5			21	9		108	194	0	37	1
Total Ward	5,300	7.178	179		0		8				15		172	363	70	127	
LIKAWAGE Code: 210302																	
LIKAWAGE	2,200	2,979	74	3 1		13			30	21	5		150	108	70	80	2
- MBUNJU	370	501	13	3 6		21	1			21	1		22	22	0	5	1
NAINOKWE	485	657	16	3		21	1			21	2		22	43	0	8	1
LIWITI	1,000	1,354	34	4		21	2			21	4		43	86	0	16	1
Total Ward	4,055	5,492	137		0		4				12		236	258	70	109	
TOTAL DIVISION	9,355	12,670	317		0		12				27		408	621	140	236	
MITEJA DIVISION																	
KINJUMBI Code: 210401																	
KIHEMA (KINJUMBI)	3,400	4,605	116	2 3	8					21	11		0	237	21	50	3
MALENDEGO	800	1,083	27	2 3	4					21	1		0	22	10	13	4
SOMANGA NDUMBO	1,793	2,428	61	2 3	10								0	0	29	29	
SOMANGA SIMU	810	1,097	28	2 3	2	24		2		21	2		12	43	13	16	2
MTYALAMBUKO	1,506	2,040	51	3 4		21	3			21	6		65	129	0	24	1
Total Ward	8,309	11,253	284		24		3	2			20		77	430	73	132	
MITEJA Code: 210402																	
MITEJA	2,900	3,927	98	2 3	6					21	10		0	215	16	42	4
MTONI	1,710	2,316	58	3 6		21	3			21	7		65	151	0	26	1
MTUKWAO	810	1,097	27	3 6		21	2			21	3		43	65	0	13	1
TILAWANDU	500	677	17	3		21	1			21	2		22	43	0	10	1
Total Ward	5,920	8,017	201		6		6				22		129	473	16	91	
TINGI Code: 210403																	
TINGI	2,000	2,709	78	1 2 3		13			15				80	0	95	110	1
MTANDANGO	683	925	24	2 3	5								0	0	13	13	
NJIANNE	1,300	1,761	44	1 6		13			15					0			1
- MATAPATAPA	200	271	7	6		21	1						22	0	3	3	1
Total Ward	4,183	5,665	153		5		1						102	0	111	126	
MINGUMBI Code: 210404																	
MINGUMBI	2,600	3,521	89	2 3	11	24		9					36	0	39	39	2
KILILIMA	2,100	2,844	72	2 3		21 24	4	1		21	8		92	172	3	26	1
CHAPITA	1,400	1,896	48	2 3		21 24	2	2		21	5		55	108	5	21	1
Total Ward	6,100	8,261	208		11		6	12			13		183	280	47	86	
TOTAL DIVISION	24,512	33,196	846		46		16	14			55		491	1,183	247	435	

KILWA DISTRICT Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m³/d	Existing W/S Systems	Existing W/S No of suff. Hp-wells	Future Development 1986 - 1991 Systems	1986 - 1991 New hand-pumps	1986 - 1991 Hand-pumps to be deepe-ned	1986 - 1991 Piped W/S rehab. %	1992 - 2001 Systems	1992 - 2001 New hand-pumps	1992 - 2001 Piped W/S rehab. %	Development costs TAS 1,000 1986-1991	Development costs TAS 1,000 1992-2001	Operation and maintenance costs TAS 1,000/yr 1986	Operation and maintenance costs TAS 1,000/yr 2001	Priority
PWANI DIVISION																	
KIVINJE Code: 210501																	
KILWA KIVINJE																	
TOWN	6,161	14,121	418	1 3		13			20	12			940	3,400	100	130	2
SINGINO	3,300	4,469	114	4 1		13			20				130	0	85	95	1
- NANKURUKURU	200	500	13	3 1		13			30				80	0	40	50	1
- MATANDU	200	271	7	4		21	1						22	0	0	3	1
Total Ward	9,861	19,361	552		0		1						1,172	3,400	225	278	
MASOKO Code: 210502																	
KILWA-MASOKO																	
TOWN	7,000	22,112	4,000	1 2	4	12				12			30,000	47,000	400	4,000	1
MKAWANYULE	713	966	25	1		12											1
KISIWANI	600	813	20	3		21	1			21 8	1		22	22	0	7	1
MPARA	600	813	20	2	1	12									3	3	2
- BSANGWE	200	271	7	3		21	1						22		0	0	1
- LIPINDI	200	271	7	3		21	1						22		0	0	1
- MTANGA	200	271	29	1 3		12									0		1
Total Ward	9,513	25,517	4,108		5		3				1		30,066	47,022	403	4,010	
SONGOSONGO Code: 210503																	
SONGOSONGO	1,300	1,761	44	1 3		13			20				80	0	60	70	2
Total Ward	1,300	1,761	44		0								80	0	60	70	
KIKOLE Code: 210504																	
RUHATWE - KISANGI- KIMBAGAMBARA	1,701	2,304	59	1 4		21	3			13		20	65	80	95	118	2
MIGEREGERE	1,132	1,533	40	1 3						13		20	0	80	60	70	2
KIKOLE	1,600	2,167	55	4 3 1		21	3			13		20	65				2
Total Ward	4,433	6,004	153		0		6						130	160	155	188	
TOTAL DIVISION	25,107	52,643	4,857		5		10				1		31,448	50,582	843	4,546	

KILWA DISTRICT Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m³/d	Existing W/S Systems	Existing W/S No of suff. Hp-wells	Future Development 1986 - 1991 Systems	1986 - 1991 New hand-pumps	1986 - 1991 Hand-pumps to be deepened	1986 - 1991 Piped W/S rehab. %	1992 - 2001 Systems	1992 - 2001 New hand-pumps	1992 - 2001 Piped W/S rehab. %	Development costs TAS 1,000 1986-1991	Development costs TAS 1,000 1992-2001	Operation and maintenance costs TAS 1,000/yr 1986	Operation and maintenance costs TAS 1,000/yr 2001	Priority
PANDE DIVISION																	
PANDE MIKOMA **Code: 210601**																	
MIKOMA	2,500	3,386	86	3		21 8	5			21 8	1		535	173	0	45	1
- NAKIMWERA																	
MALALANI	1,200	1,625	42	3 2		21 24	2	1		21 8	1		49	297	3	24	1
- CHASI																	
- SANJAKATI				8													
PANDE PLOT	4,000	5,417	142	2 3 1						21	10		0	215	29	55	3
- MBILINDINYI				6													
- KIHIVA				6													
- MPOTOLA				6													
- MSITETEME				6													
NAMWEDO	1,220	1,652	43	2 3	2					21	5		0	108	5	18	3
- MAKOTE																	
- NJENGA				6													
MTITIMIRA	1,310	1,774	45	6		21 8	2			21 8	1		267	101	0	23	1
NANGOO-KIWALA	1,000	1,354	34	6		21 8	2			21 8	1		213	82	0	19	1
Total Ward	11,230	15,209	392		2		11	1			19		1,664	976	37	184	
LIHIMALYOAO **Code: 210602**																	
KISONGO	1,600	2,167	65	3 3		21 8	2			21 8	3		316	162	0	32	1
LIHIMALYOAO	3,120	4,225	107	1 3		13			25	21	7		100	151	90	123	1
- NGALWE																	
- NAMDALOMBE																	
- MWEMBE MTUNGI																	
RUAYAYA	800	1,083	28	3 7		21 8	1			21 8	2		158	91	0	17	1
- MKALA																	
RUSHUNGI	1,000	1,354	36	3		21 8	1			21 8	2		192	103	0	20	1
NAMAKONGORO	600	813	2	1 3		21	1			8			22	60	50	53	1
Total Ward	7,120	9,643	255		0		5				14		788	567	140	245	
MTANDI **Code: 210603**																	
MAKANGAGA	1,290	1,747	43	3	3					21	4			86	8	18	1
KIRANJERANJE	2,660	3,602	92	1 3						21	4		0	86		10	4
MBWEMKURU	1,565	2,119	54	2 3	1	21 24	1	3		21	6		40	129	8	21	1
KISWERE	910	1,232	31	3		21	2			21	3		43	65	0	13	1
MTANDI	1,300	1,761	44	1 2		23		3					18	0	100	120	1
Total Ward	7,725	10,462	265		4		3	6			17		100	366	116	182	
MANDAWA **Code: 210604**																	
HOTELITATU	500	677	17	3		21	1			21	2		22	43	0	8	1
MAVUJI	1,614	2,186	55	4		21	3			21	6		65	129	0	24	1
- MCHAKAMA				4													
MANDAWA	2,250	3,047	77	4		21	4			21	9		86	194	0	34	1
KIWAWA	1,600	2,167	54	1 2	4	13			10				40	0	70	80	1
KINGONGO	500	677	17	3		21	1			21	2		22	43	0	8	1
Total Ward	6,464	8,756	220		4		9				19		234	409	70	154	
TOTAL DIVISION	32,539	44,070	1,132		10		28	7			69		2,186	2 318	453	765	
TOTAL DISTRICT	130,500	196,100	8,519		140		95	40			264		35,324	57,114	1,936	6,583	

22 LINDI DISTRICT

Divisions		Wards	
01	Ruangwa	01	Ruangwa
		02	Mbekenyera
		03	Makanjiro
		04	Likunja
		05	Narungombe
		06	Namichiga
02	Mnacho	01	Malolo
		02	Mnacho
		03	Nkowe
		04	Luchelegwa
03	Mandawa	01	Mandawa
		02	Nambilanje
		03	Mtondo
04	Mtama	01	Mtua
		02	Mtama
		03	Nyengedi
		04	Nyangao
		05	Namupa
05	Mipingo	01	Mipingo
		02	Kitomanga
06	Nangaru	01	Nangaru
		02	Chikonji
		03	Matimba
07	Milola	01	Milola
		02	Kiwawa
		03	Rutamba
08	Rondo	01	Chiponde
		02	Mnara
09	Mhinga	01	Mbanja
		02	Mchinga
		03	Kilolambwani
10	Ngapa	01	Ngapa
		02	Tandangongoro
11	Mingoyo	01	Mingoyo
		02	Mnolela
		03	Kiwalala
12	Nyangamara	01	Nyangamara
		02	Nahukahuka
		03	Mandwanga
13	Sudi	01	Sudi
		02	Nachunyu

LINDI DISTRICT Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m³/d	Existing W/S Systems	Existing W/S No of suff. Hp-wells	Future Development 1986 - 1991 Systems	1986 - 1991 New hand-pumps	1986 - 1991 Hand-pumps to be deepened	1986 - 1991 Piped W/S rehab. %	1992 - 2001 Systems	1992 - 2001 New hand-pumps	1992 - 2001 Piped W/S rehab. %	Development costs TAS 1,000 1986-1991	Development costs TAS 1,000 1992-2001	Operation and maintenance costs TAS 1,000/yr 1986	Operation and maintenance costs TAS 1,000/yr 2001	Priority
RUANGWA DIVISION																	
RUANGWA **Code: 220101**																	
RUANGWA	0	0	15	2 1 3									0	0	140	155	
- KILIMAHEWA	1,255	1,486	38	1 3									0	0			
- NACHINGWEA	1,196	1,416	37	2 1 3	6								0	0	16	16	
- DODOMA	1,382	1,637	42	2 1 3	4								0	0	10	10	
- LIPANDE	300	355	9	2 3	3								0	0	8	8	
- MCHANGANI	1,255	1,486	41	2 1 3	3	24		3					12	0	16	10	2
MANDARAWE	990	1,172	30	2 3	6								0	0	16	16	
NACHINYIMBA	888	1,052	28	2 3	3					21	2		0	43	8	13	4
LIKANGARA	1,223	1,448	45	1 3									0	0			
NANDENJE	870	1,030	32	2 3	4	24		1		21	1		6	22	13	13	2
Total Ward	9,359	11,084	362		29			4			3		18	65	227	241	
MBEKENYERA **Code: 220102**																	
NAUNAMBE	2,196	2,601	67	3 3		21	4			21	7		86	151	0	29	1
MKUTINGOME	1,287	1,524	40	3 2	3					21	3		0	65	8	16	3
NAMIKULO	1,739	2,060	53	3 2	7					21	2		0	43	18	24	4
MBEKENYERA	2,450	2,902	76	2 3	12								0	0	31	31	
CHUNYU	1,585	1,877	49	2 3	9								0	0	24	24	
NAMILEMA	972	1,151	29	3 2	8								0	0	21	21	
Total Ward	10,229	12,114	315		39		4				12		86	259	102	145	
MAKANJIRO **Code: 220103**																	
CHIKOKO	500	592	15	2	2					21	1		0	0	5	8	4
MAKANJIRO	900	1,066	28	2 3	4					21	1		0	0	10	13	4
- CHINOKOLE	303	359	9	3		21	1			21	1		22	22		5	1
- MBANGARA	394	467	12	3		21	1			21	1		22	22		5	1
Total Ward	2,097	2,483	63		6		2				4		43	43	15	31	
LIKUNJA **Code: 220104**																	
KITANDI	1,926	2,281	59	2 3	10								0	0	26	26	
LIKUNJA	1,235	1,463	39	2 3	10								0	0	26	26	
- MPARA	300	355	9	2 3	4								0	0	10	10	
- MNAWA	488	578	14	2 3	2					21	1		0	22	5	8	4
CHILANGALILE	1,160	1,374	36	3 1						13			0	150	60	65	3
- MTIMBO-LINDI	309	366	9	2 3	3								0	0	8	8	
MITOPE	1,063	1,259	33	2 3 1	4					21	1		0	22	10	10	4
Total Ward	6,481	7,675	198		33						2		0	193	145	153	
NARUNG'OMBE **Code: 220105**																	
NARUN'GOMBE	1,770	2,096	54	2 4	1	21 24	1	2		21	6		35	129	8	21	2
- NACHIUNGO	500	592	15	3		21	1			21	1		22	22		5	1
LIUGURU	1,557	1,844	48	1 2 3	3										8	8	
MACHANGANJA	946	1,120	29	3		21	2			21	3		43	65		13	1
Total Ward	4,773	5,653	145		4		4	2			10		100	216	16	47	
NAMICHIGA **Code: 220106**																	
MIHEWE	855	1,013	26	2 3	3	24		2		21	1		9	23	13	13	2
MATAMBALALE	1,440	1,705	43	3		21	3			21	4		65	86	0	18	1
NANDANDARA	761	901	23	3		21	2			21	1		43	22	0	8	1
NAMICHIGA	2,447	2,898	75	2 3 1	3					13		30	0	250	110	120	3
Total Ward	5,503	6,517	166		6		5	2			6		117	381	123	159	
TOTAL DIVISION	33,442	45,526	1,249		117		15	8			37		364	1 157	628	776	

LINDI DISTRICT Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m³/d	Existing W/S Systems	Existing W/S No of suff. Hp-wells	Future Development 1986 - 1991 Systems	1986 - 1991 New hand-pumps	1986 - 1991 Hand-pumps to be deepened	1986 - 1991 Piped W/S rehab. %	1992 - 2001 Systems	1992 - 2001 New hand-pumps	1992 - 2001 Piped W/S rehab. %	Development costs TAS 1,000 1986-1991	Development costs TAS 1,000 1992-2001	Operation and maintenance costs TAS 1,000/yr 1986	Operation and maintenance costs TAS 1,000/yr 2001	Priority
MNACHO DIVISION																	
MALOLO **Code: 220201**																	
MICHENGA	1,996	2,364	59	2 3	8	24		1		21	2		5	43	24	26	4
NANGANGA	959	1,136	31	1 2 4	2								0	0	10	10	
NANGUMBU	4,223	5,001	127	2	19					22	1		0	16	50	52	4
MALOLO	1,240	1,469	42	2 6	5	24		1		21	1		5	22	3	5	4
Total Ward	8,418	9,969	259		34		0	2			4		10	81	87	93	
MNACHO **Code: 220202**																	
NGAU	1,750	2,073	52	1 3		13			20				70	0	35	40	2
NAMAHEWA	1,313	1,555	40	3		21	3			21	4		65	86	0	18	1
NANDAGALA	2,957	3,384	86	1 3		13			20				0	0			
CHIMBILA A	2,375	2,813	71	1 2 3	4	13							0				
- CHIMBILA B	400	474	12	3		21	1		20	21	1		22	22	0	5	1
MANOKWE		0		3													
Total Ward	8,695	10,298	261		4		4				5		157	108	35	63	
NKOWE **Code: 220203**																	
NKOWE	2,691	3,187	91	2 3 1	5					13		10	0	40	90	100	3
KIPINDIMBI	814	964	25	3 2	4								0	0	10	10	
CHIENJELE	1,658	1,964	50	5 3 1		21	3			21	5		65	108	0	21	1
MIBURE	2,064	2,444	63	6		21	4			21	6		86	129	0	26	1
NGIMBWA	507	600	15	6		21	1			21	2		22	43		8	1
NAMAKUKU	893	1,058	27	2 1	1	21	1			21	2		22	43	3	8	2
Total Ward	8,627	10,217	271		10		9				15		195	363	103	173	
LUCHELEGWA **Code: 220204**																	
NANDANGA	1,071	1,268	33	4 6		22	2			22	4		32	65	5	16	1
CHINONGWE	2,313	2,739	74	4 2	5	24		1		22	7		5	113	16	31	3
LITAMA	814	964	32	4 2	3					22	2		0	32	8	13	4
LUCHELEGWA	850	1,007	27	6		22	2			22	3		32	49	5	13	1
Total Ward	5,048	5,978	166		8		4	1			16		69	259	34	73	
TOTAL DIVISION	30,788	36,462	957		56		17	3			40		431	811	259	402	
MANDAWA DIVISION																	
MANDAWA **Code: 220301**																	
CHIBULA	1,242	1,471	38	1 3		13			10	13		10					2
MCHICHILI (MANDAWA)	2,916	3,453	100	1 3									0	0	40	45	
NAHANGA	1,812	2,146	55	1 3									0	0			
CHIKUNDI	647	766	20	1 3									0	0			
LICHWACHWA	366	433	12	4 3 1		13			10	13		10	50	50	70	80	2
Total Ward	6,983	8,270	225		0								50	50	110	125	
NAMBILANJE **Code: 220302**																	
MKARANGA	908	1,075	29	2 3	2	24		4		21	1		18	23	16	16	2
NAMBILANJE	878	1,040	27	3		21	2			21	3		43	65	0	13	1
NANJURU	789	934	25	3		21	2			21	2		43	43	0	10	1
Total Ward	2,575	3,050	80		2		4	4			6		104	131	16	39	
MTONDO **Code: 220303**																	
MTONDO	1,147	1,358	36	1 3									0	0			
MUHURU	300	355	9	3 1		13			10	13		10					
Total Ward	1,447	1,714	44		0								0	0			
TOTAL DIVISION	11,005	13,034	349		2		4	4			6		154	181	126	164	

LINDI DISTRICT Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m^3/d	Existing W/S Systems	Existing W/S No of suff. Hp-wells	Future Development 1986 - 1991 Systems	1986 - 1991 New hand-pumps	1986 - 1991 Hand-pumps to be deepe-ned	1986 - 1991 Piped W/S rehab. %	1992 - 2001 Systems	1992 - 2001 New hand-pumps	1992 - 2001 Piped W/S rehab. %	Development costs TAS 1,000 1986-1991	Development costs TAS 1,000 1992-2001	Operation and maintenance costs TAS 1,000/yr 1986	Operation and maintenance costs TAS 1,000/yr 2001	Priority
MTAMA DIVISION																	
MTUA Code: 220401																	
LONGA	2,053	2,431	61	4 1						12			0	0	0	0	1
MTUA	3,512	4,159	105	2 1 4	10					12			0	750	70	90	4
Total Ward	5,565	6,591	167		10								0	750	70	90	
MTAMA Code: 220402																	
MPENDA	1,105	1,309	33	2 3	1	24		3		21	4		13	86	10	16	2
MTAMA	0	0	120			11							1,800	0	0	380	2
- MIHOGENI	2,380	2,819	70	2 1	5	11									13	13	2
- MAKONDE	2,813	3,331	84	2 1	5	11									13	13	2
- MAJENGO	4,313	5,108	128	2 1	4	11									10	10	2
- MASASI	1,517	1,797	45	2 1	2	11									5	5	2
NANGAKA - CHIGURUWE	947	1,122	28	3		21	2			21	3		43	65	0	13	1
MBALALA	832	985	25	4 1		21	2			12			43	720	0	5	2
Total Ward	13,907	16,470	535		17		4	3			7		1,899	871	51	450	
NYENGEDI Code: 220403																	
MTUMBYA	1,326	1,570	39	6		22	3			22	4		49	65	0	18	1
KILIMANJARO	1,235	1,463	37	6		22	3			22	3		49	49	0	16	1
LUWALE	870	1,030	26	4 3 1		13				30			0		0	0	1
NYENGEDI	3,252	3,851	96	2 4 1	1	13				30			500	0	73	130	1
Total Ward	6,683	7,915	199		1		6				7		598	114	73	164	
NYANGAO Code: 220404																	
NAMANGALE	2,414	2,859	75	2 6	6					21	6		0	129	16	31	3
NYANGAO	3,201	3,791	150	4 2	16	24		2					9	0	47	47	2
MNAMBA	379	449	15	4		23	1			23	1		45	45	0	5	1
CHIWERERE	674	798	23	4 2	1	24		2		22	2		9	32	8	10	2
MAHIWA	1,270	1,504	38	4 6 1		21	2			13		30	43	100	0	75	2
MAWILO	365	432	14	2	2												
Total Ward	8,303	9,833	433		25		3	4			9		106	306	71	168	
NAMUPA Code: 220405																	
NDAWA	412	488	12	4		23	1			23	1		45		0	5	1
MIHIMA	1,012	1,199	30	4		21 22	2			21 23	3		66	88	0	13	1
NAMUPA	1,451	1,718	46	4 2 7	3					21	5		0	108	8	21	1
Total Ward	2,875	3,405	891		3		3				9		111	196	8	39	
TOTAL DIVISION	37,333	44,214	1,303		56		16	7			32		2,714	2,237	273	911	
MIPINGO DIVISION																	
MIPINGO Code: 220501																	
MNYANGARA	1,245	1,474	37	4 6		21	3			21	3		65	65	0	16	1
MATAPWA	1,000	1,184	32	2	12								0	0	31	31	
MIPINGO	1,410	1,670	43	3 1		21	2			13		30	43	200	0	80	1
NAMKONGO	908	1,075	27	6 1		21	1			13		30	22	150	0	65	2
LIHIMILO	658	799	20	6 4		21	1			21	2		22	43	0	8	1
Total Ward	5,221	6,183	158		12		7				5		152	458	31	200	
KITOMANGA Code: 220502																	
MKWAJUNI	1,443	1,709	43	2 6	1	21	2			21	4		43	86	3	18	2
KITOMANGA	3,981	4,715	128	1 2	3	13			10				100	0	100	110	2
Total Ward	5,424	6,424	171		4		2				4		143	86	103	128	
TOTAL DIVISION	10,645	12,607	329		16		9	0			9		295	544	134	328	

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NANGARU DIVISION																	
NANGARU Code: 220601																	
MAKUMBA	420	497	13	6		23	1			23	1		45	45	0	5	1
MKUMBAMOSI	1,984	2,219	57	6 4		21 24	3			21 23	6		88	175	0	24	1
MUUNGANO	1,474	1,746	45	6		21 24	3			21 23	5		88	13	0	21	1
NANGARU	1,329	1,574	41	3		21 24	3			21 23	4		88	110	0	18	1
Total Ward	5,097	6,036	157		0		10				16		309	393	0	68	
CHIKONJI Code: 220602																	
CHIKONJI - MWIWI	2,753	3,260	83	2 1	12					21	2		0	43	31	37	4
NANYANJE	1,217	1,441	37	6 1		21	2			21	4		43	86	0	16	2
JANGWANI	412	488	19	6		21	1			21	2		22	43	0	8	1
Total Ward	4,382	5,190	139		12		3				8		65	172	31	61	
MATIMBA Code: 220603																	
LIKWAYA	1,096	1,298	33	5		21	2			21	3		43	65	0	13	1
KIKOMOLELA	1,600	1,895	48	2	10								0	0	26	26	
MOKA	869	1,029	28	2 6		24		5		21	3		23	65	13	13	1
MATIMBA	442	523	13	2	2								0	0	5	5	
Total Ward	4,007	4,746	123		12		2	5			6		66	130	43	57	
TOTAL DIVISION	13,486	15,972	419		24		15	5			30		440	695	74	186	
MILOLA DIVISION																	
MILOLA Code: 220701																	
NAMTAMBA MILOLA	926	1,097	28	4 1		13			30				150		65	70	2
MACHARIKI	2,634	3,119	84	2 1	2								0	0	120	130	
CHIKWIKWI	2,530	2,996	82	2 1									0	0			
LEGAZAMWENDO	718	850	21	4 1									0	0			
Total Ward	6,808	8,063	216		2								150		185	200	
KIWAWA Code: 220702																	
KIWAWA	1,354	1,604	40	6		21	3			21	4		65	86	8	18	1
MPUTWA	983	1,164	33	4		21	2			21	3		43	65	5	13	1
Total Ward	2,337	2,768	73		0		5				7		108	151	13	31	
RUTAMBA Code: 220703																	
RUTAMBA	2,122	2,513	74	2 1	14								0	0	110	120	
RUTAMBA YASASA	3,600	4,264	108	2 1	20								0	0			
KINYOPE	1,581	1,872	47	2 4 1	4								0	0			
MAKANGARA	1,186	1,405	36	6		22	2			22	4		32	65	0	16	1
RUHOMA	758	854	21	4		21	2			21	2		43	43	0	10	1
RUCHEMI	721	854	21	4		21	2			21	2		43	43	0	10	1
CHITONJI	1,003	1,188	30	2 1	12								0	0	31	31	
Total Ward	10,971	12,993	338		50		6				8		118	151	141	187	
TOTAL DIVISION	20,116	23 824	627		52		11	0			15		376	302	339	418	

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RONDO DIVISION																	
CHIPONDA Code: 220801																	
CHIODYA	1,217	1,441	36	6 1		13 8			10	13 8		20	208	38	0	12	3
MIHANGA	898	1,064	27	6 1		13 8			10	13 8		20	153	28	0	9	3
NTAUNA	974	1,154	29	4 1		13 8			10	13 8		20	166	31	0	10	3
RONDO-CHIPONDA	1,067	1,264	32	4 1		13 8			10	13 8		20	491	540	320	371	3
Total Ward	4,156	4,922	123		0								1,018	637	320	402	
MNARA Code: 220802																	
MKANGA	1,760	2,084	52	4 1		13			20				160	0	85	90	1
MNARA - RONDO ANGLICAN COLLEGE	2,316	2,743	70	4 1		13 8			10	13 8		20	396	73	0	24	3
MTAKUJA	1,273	1,508	38	4 1		13 8			10	13 8		20	217	40	0	13	3
NTENE	1,742	2,063	52	4 1		13 8			10	13 8		20	298	55	0	18	3
Total Ward	7,091	8,398	212		0								1 071	168	85	145	
TOTAL DIVISION	11,247	13,320	335		0		0	0			0		2,089	805	405	547	
MCHINGA DIVISION																	
MBANJA Code: 220901																	
MBANJA - KIKWETU	3,162	3,745	130	1 2	2								0	0	80	90	
LIKONGO - MITOTO	1,304	1,544	42	1									0	0	60	65	
MITWERO	1,424	1,686	48	1		13			20				150	0	200	220	
Total Ward	5,890	6,976	219		2								150	0	340	375	
MCHINGA Code: 220902																	
MCHINGA I	1,622	1,921	60	2 3	5	24		4		21	1		18	22	24	24	1
MCHINGA II	2,190	2,594	66	2 6	14								0	0	37	37	
MNIMBILA - LIKAHAKU	600	711	24	2 6	1					21	3		0	65	3	10	3
RUVU	1,007	1,193	31	2 6	2					21	3		0	65	5	13	3
KITOMANGA (KILANGALA)	2,700	3,198	95	2 6	1	21 24	3	2		21	9		74	194	3	37	1
MTUMBIKILE	793	927	29	3		21	2			21	3		43	65	0	13	1
Total Ward	8,902	10,523	307		23		5	6			19		135	411	72	134	
KILOLAMBWANI Code: 220903																	
MNANGOLE	589	698	24	5 6		21	1			21	3		22	65	0	10	1
KILOLAMBWANI	940	1,113	29	2 6	2					21	3		0	65	5	13	4
MVULENI	2,058	2,437	64	2 6	8	24		1		21	2		5	43	24	29	4
DIMBA	1,186	1,405	36	6		21	2			21	4		43	86	0	16	1
KIJIWENI	1,769	2,095	55	2	1	24		5		21	6		23	129	3	18	1
Total Ward	6,542	7,748	210		11		3	6			18		93	388	32	86	
TOTAL DIVISION	21,334	25,247	736		36		8	12			37		378	799	444	595	

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NGAPA DIVISION																	
NGAPA **Code: 221001**																	
KINENGENE	1,600	1,895	48	2 1	2	24		3		13		30	14	300	13	110	2
MKUPAMA	1,650	1,954	67	2	9					22	1		0	16	24	26	4
NGAPA	2,500	2,961	76	2	6					22	6		0	97	18	31	4
MBUYUNI	2,010	2,380	181	2	8					22	2		0	32	21	26	4
Total Ward	7,760	9,190	255		25			3			9		14	445	76	193	
TANDANGONGORO **Code: 221002**																	
TANDANGONGORO	800	947	25	2	3					22	1		0	16	8	10	4
NANDAMBI	534	632	20	6		21	1			21	2		22	43	0	8	1
NARUNYU	1,000	1,184	30	2	3	24		1		21	2		5	43	10	13	4
MKANGA	573	679	17	6		21	1			21	2		22	65	0	8	1
Total Ward	2,907	3,443	94		6		2	1			7		49	167	18	39	
TOTAL DIVISION	10,667	12,633	349		31		2	4			16		63	612	94	232	
MINGOYO DIVISION																	
MINGOYO **Code: 221101**																	
TULIENI	1,109	1,313	35	6		21	2			21	4		43	86	0	16	1
MNAZIMMOJA	3,700	4,382	123	1 2	2								0	0	340	400	
RUAHA	500	592	17	4		21	1			21	2		22	43	0	8	1
MKWAYA	1,360	1,611	42	6 1									0	0			
MINGOYO	1,893	2,242	89	1									0	0			
Total Ward	8,562	10,140	307		2		3				6		65	129	340	424	
MNOLELA **Code: 221102**																	
MNOLELA	3,434	4,067	107	2 1	4								0	0			
RUHOKWE	1,034	1,225	31	1									0	0			
SIMANA	1,020	1,208	32	1 6						13		10	0	60	65	70	3
NAMUNDA	828	981	26	1 6									0	0			
ZINGATIA	1,121	1,328	34	6 1									0	0			
Total Ward	7,437	8,808	229		4								0	60	65	70	
KIWALALA **Code: 221103**																	
KIWALALA	1,772	2,099	53	4 2 1	1	21	2			21	6		43	129	3	24	1
RUO	818	969	40	2 3	2	24		1		21	2		5	43	8	10	3
MNANGAWANGA	1,377	1,631	42	2		21	3			21	4		65	86	0	18	1
NARUNYU	1,807	2,140	54	2	11								0	0	29	29	
MAHUMBIKA	2,300	2,724	69	3 1									0	0			
MPEMBE	510	604	16	3		21	1			21	2		22	43		8	1
Total Ward	8,584	10,166	274		14		6	1			14		135	301	40	89	
TOTAL DIVISION	24,583	29,114	810		20		9	1			20		200	490	445	583	

LINDI DISTRICT

Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m³/d	Existing W/S Systems	Existing W/S No of suff. Hp-wells	Future Development 1986 - 1991 Systems	1986 - 1991 New hand-pumps	1986 - 1991 Hand-pumps to be deepened	1986 - 1991 Piped W/S rehab. %	1992 - 2001 Systems	1992 - 2001 New hand-pumps	1992 - 2001 Piped W/S rehab. %	Development costs TAS 1,000 1986-1991	Development costs TAS 1,000 1992-2001	Operation and maintenance costs TAS 1,000/yr 1986	Operation and maintenance costs TAS 1,000/yr 2001	Priority
NYANGAMARA DIVISION																	
NYANGAMARA Code: 221201																	
LITIPU	881	1,043	28	2 3 1		13							0	0			
MADINGO	1,452	1,720	45	3 1		13			20				120	0	65	70	1
NYANGAMARA	2,264	2,681	85	3 1									0	0	215	250	
Total Ward	4,597	5,444	158		0								120	0	280	320	
NAHUKAHUKA Code: 221202																	
LINOHA	725	859	23	2 6 1	1	24		3					14	0	10	10	
NAHUKAHUKA	1,153	1,366	36	2 1		24		5					23	0	13	13	
LIPOME	721	854	22	6 1									0	0			
MBAWALA	255	302	19	6 1									0	0			
Total Ward	2,854	3,380	89		1			8					37	0	23	23	
MANDWANGA Code: 221203																	
MANDWANGA	875	1,036	26	6		21	2			21	3		43	65	0	13	1
NAMBAHU	1,800	2,132	55	5		21 23	3			21 23	6		88	175	0	24	1
MALUNGO	1,054	1,248	32	5		21 23	2			21 23	3		66	88	0	13	1
CHIUTA	1,857	2,119	54	6		21 23	3			21 23	6		88	175	0	24	1
LINDWANDWALI	625	740	19	6		21	1			21	2		22	43	0	8	1
Total Ward	6,211	7,356	187		0		11	8			20		307	546	0	82	
TOTAL DIVISION	13,662	16,180	434		1		11	8			20		464	546	303	425	
SUDI DIVISION																	
SUDI Code: 221301																	
SUDI	1,648	1,964	50	3		21	3			21	5		65	108	0	21	1
MTEGU	769	911	27	2 1	2	24	1			13		30	5	0	8	8	3
HINGAWALI	1,806	2,139	54	2 6	3					22	6		0	97	8	24	3
MADANGWA	2,000	2,369	60	6 1		13			30				180	0	70	80	2
NJONJO	740	876	24	2 6						21	2		0	43	8	10	4
PANGATENA	1,500	1,776	45	2 6	2	21	1			21	4		22	86	5	18	2
Total Ward	8,473	10,035	260		7		5				17		272	334	99	161	
NACHUNYU Code: 221302																	
PANGABOI	900	1,066	29	3 1		13			10				50		60	60	2
MSANGI	480	568	15	2 6		22 24	1	1		22	1		21	16	3	5	1
KITUMBIKWELA	1,251	1,482	39	3		22 23	2			22 23	3		61	77	0	13	1
NACHUNYU	1,852	2,193	56	2 1		22 23	3			22 23	6		77	109	0	24	1
MMUMBU	712	843	23	6		22	1			22 23	2		16	61	0	8	1
SHUKA	468	554	15	5		22	1			23	1		16	45	0	5	1
MNALI	1,260	1,492	39	6		22 23	2			22 23	3		61	77	0	13	1
NAVANGA - MONGOMONGO	837	991	26	6		22 23	2			22	2		61	49	0	10	1
NAMPUNGA	441	522	14	3 1									0	0			
Total Ward	8,201	9,712	255		0		12	1			18		363	434	63	138	
TOTAL DIVISION	16,674	19,747	515		7		17	1			35		635	768	162	299	
TOTAL DISTRICT	259,982	307,880	8,412		418		134	53			297		8,603	9,947	3 686	5 866	

23 LIWALE DISTRICT

Divisions		Wards	
01	Kibutuka	01	Nangano
		02	Kibutuka
		03	Kiangara
		04	Mirui
02	Liwale	01	Liwale
		02	Mihumo
		03	Ngongowele
		04	Mbaya
		05	Mpigamiti
		06	Kimambi
		07	Liwale Mjini
03	Makata	01	Barikiwa
		02	Makata
		03	Mkutano
		04	Mlembwe

.IWALE DISTRICT Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m^3/d	Existing W/S Systems	Existing W/S No of suff. Hp-wells	Future Development 1986 - 1991 Systems	1986 - 1991 New hand-pumps	1986 - 1991 Hand-pumps to be deepened	1986 - 1991 Piped W/S rehab. %	1992 - 2001 Systems	1992 - 2001 New hand-pumps	1992 - 2001 Piped W/S rehab. %	Development costs TAS 1,000 1986-1991	Development costs TAS 1,000 1992-2001	Operation and maintenance costs TAS 1,000/yr 1986	Operation and maintenance costs TAS 1,000/yr 2001	Priority
KIBUTUKA DIVISION																	
NANGANO **Code: 230101**																	
NANGANO - NAMATULA	881	1,661	42	4		21	2			21	5		43	108	0	18	1
NAHORO	1,066	2,010	50	6		21	2			21	6		43	129	0	21	1
Total Ward	1,947	3,670	92		0		4				11		86	237	0	39	
KIBUTUKA **Code: 230102**																	
KIBUTUKA - KIBUTUKA A - KIBUTUKA B	1,309	2,468	62	1 6		21	2			13		40	43	400		75	2
NGUMBU	1,344	2,534	63	6		21	3			21	7		65	151		26	1
Total Ward	2,653	5,001	125		0		5				7		108	551	0	101	
KIANGARA **Code: 230103**																	
NAUJOMBO	1,115	2,102	53	6		21	2			21	7		43	151	0	24	1
KIPELELE	667	1,257	31	6 1		21	1			13		10	22	80	65	70	1
KIANGARA	1,391	2,622	66	2 1	4	13			10				100	0	75	85	2
KITOGORO	871	1,642	41	6		21	2			21	5		43	108	0	18	1
Total Ward	4,044	7,624	191		4		5				12		208	339	140	197	
MIRUI **Code: 230104**																	
MIRUI	1,634	3,080	77	6		21	3			21	10		65	215	0	34	
Total Ward	1,634	3,080	77		0		3				10		65	215	0	34	
TOTAL DIVISION	10,278	19,375	485		4		17				40		467	1,342	140	371	
LIWALE DIVISION																	
LIWALE B **Code: 230201**																	
LIWALE B	1,337	2,521	64	1 4		13											1
MIKUNYA	1,644	3,099	78	6 1		13			20	21	3		200	65	70	95	1
Total Ward	2,981	5,620	141		0						3		200	65	70	95	
MIHUMO **Code: 230202**																	
LIKOMBORA	678	1,278	33	2 4 1	3					21	2		0	43	8	13	4
MIHUMO	2,191	4,130	103	2 6 4	7					21	10		0	215	18	45	3
Total Ward	2,869	5,409	136		10						12		0	258	26	58	
NGONGOWELE **Code: 230203**																	
NGONGOWELE	1,730	3,261	82	1 6		21	3			21	10		65	215	0	34	1
NGUNJA	790	1,489	37	1 6		13			10				80	0	80	100	2
LILOMBE	1,650	3,111	78	6		21	3			21	10		65	215	0	34	1
Total Ward	4,170	7,861	197		0		6				20		210	430	80	168	
MBAYA **Code: 230204**																	
MBAYA	1,058	1,995	50	2 1	5	13			5				50	0	75	100	
NDURUKA	887	1,672	42	2	5					21	2		0	43	13	18	
KICHONDA	373	703	18	1 3		13			5								
NAMIHU	822	1,550	40	6		21	2			21	4		43	86	0	10	
Total Ward	3,140	5,919	149		10		2				6		93	129	88	128	
MPIGAMITI **Code: 230205**																	
MPIGAMITI - MPIGAMITI A - MPIGAMITI B - MPIGAMITI C	1,878	3,540	92	4 6 1		21	3			21	11		65	237	0	37	
Total Ward	1,878	3,540	92		0		3				11		65	237	0	37	
KIMAMBI **Code: 230206**																	
KIMAMBI	1,233	2,324	58	2 6	4					21	6		0	129	10	26	3
Total Ward	1,233	2,324	58		4						6		0	129	10	26	

LIWALE DISTRICT Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m³/d	Existing W/S Systems	Existing W/S No of suff. Hp-wells	Future Development 1986 - 1991 Systems	1986 - 1991 New hand-pumps	1986 - 1991 Hand-pumps to be deepened	1986 - 1991 Piped W/S rehab. %	Future Development 1992 - 2001 Systems	1992 - 2001 New hand-pumps	1992 - 2001 Piped W/S rehab. %	Development costs TAS 1,000 1986-1991	Development costs TAS 1,000 1992-2001	Operation and maintenance costs TAS 1,000/yr 1986	Operation and maintenance costs TAS 1,000/yr 2001	Priority
LIWALE DIVISION																	
LIWALE MJINI **Code: 230207**																	
LIWALE TOWN	0	0			7								4,100	7,000	518	918	1
- NALULEO	723	1,647	84	4 2 1		13			30	12							
- MUNGURUMO	3,043	6,975	350	1 4 2		13			30	12							1
- LIKONGOWELE	2,111	4,838	243	1 4 2		13			30	12							
- MAKONJIANGA	1,539	3,527	179	1 2 4		13			30	12							
- NANGANDO	2,284	5,235	262	1 4 2		13			30	12							
MANGIRIKITI	973	1,834	47	1 4		21	2				6		43	129	0	21	
KIPULE	1,644	3,099	78	1 4		21	3				10		65	215	0	34	
Total Ward	12,317	27,166	1,243		7		5				16		4,208	7,344	518	973	
TOTAL DIVISION	28,588	57,839	2,016		31		16				74		4,776	8,592	792	1,485	
BARIKIWA DIVISION																	
BARIKIWA **Code: 230301**																	
BARIKIWA	1,260	2,375	60	2 6 1	4					21	6		0	129	10	26	4
NDUNYUNGU	513	967	24	2	5								0	0	13	13	
CHIUMBUKO	1,652	3,114	78	6		21	3			21	8		65	172		29	1
Total Ward	3,425	6,457	162		9		3	0			14		65	301	23	68	
MAKATA **Code: 230302**																	
MPENGERE	796	1,501	38	6		21	2			21	4		43	86		10	1
MAKATA	1,260	2,375	64	2 1	7								0				
MKUNDI	997	1,880	47	2	5					21	3		0	65	13	21	4
Total Ward	3,053	5,755	150		12		2	0			7		43	151	13	31	
MKUTANO **Code: 230303**																	
MKUTANO	687	1,295	32	2	5								0	0	13	13	4
KIKULYUNGU	835	1,574	39	2	2	24		3		21	4		13	86	13	18	2
Total Ward	1,522	2,869	72		7		0	3			4		13	86	26	31	
MLEMBWE **Code: 230304**																	
NDAPATA	996	1,878	47	6 1		21	2			21	6		43	129	0	21	1
MLEMBWE	2,037	3,840	96	6		21	4			21	12		86	258	0	42	1
Total Ward	3,033	5,718	143		0		6				18		129	387		63	
TOTAL DIVISION	11,033	20,799	527		28		11	3			43		250	925	62	193	
TOTAL DISTRICT	49,895	98,013	3,028		63		40	3			161		5,493	10,859	994	2,049	

24 NACHINGWEA DISTRICT

Divisions		Wards	
01	Kilimarondo	01	Kilimarondo
		02	Matekwe
		03	Mbondo
		04	Kiegei
02	Lionja	01	Lionja
		02	Nditi
		03	Namikango
03	Mnero	01	Mnero Miembeni
		02	Mnero Ngongo
		03	Kipara
		04	Namapwia
04	Ruponda	01	Ruponda
		02	Marambo
		03	Chiola
		04	Mkoka
05	Nambambo	01	Naipanga
		02	Ndomoni
		03	Mkotokwyana
		04	Mpiruka
		05	Naipingo
		06	Mtua
06	Nambambo Mjini	01	Nambambo
		02	Kilimani Hewa
		03	Nangowe
		04	Stesheni
		05	Namatula

NACHINGWEA DISTRICT Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m^3/d	Existing W/S Systems	Existing W/S No of suff. Hp-wells	Future Development 1986 - 1991 Systems	1986 - 1991 New hand-pumps	1986 - 1991 Hand-pumps to be deepened	1986 - 1991 Piped W/S rehab. %	1992 - 2001 Systems	1992 - 2001 New hand-pumps	1992 - 2001 Piped W/S rehab. %	Development costs TAS 1,000 1986-1991	Development costs TAS 1,000 1992-2001	Operation and maintenance costs TAS 1,000/yr 1986	Operation and maintenance costs TAS 1,000/yr 2001	Priority
KILIMARONDO DIVISION																	
KILIMARONDO **Code: 240101**																	
KILIMARONDO - SEBULENI - NJAPEJE - NAMAKONO - ANURU	1,100	1,566	49	1 2	10					13		40	0	400	26	80	4
NAMATUNU	1,320	1,879	47	2 6	3					21	5		0	108	5	21	3
NANJIHI	1,320	1,879	47	2 3	2	21	1			21	5		22	108	8	21	1
Total Ward	3,740	5,325	143		15		1	0			10		22	616	39	122	
MATEKWE **Code: 240102**																	
MATEKWE - MAJONANGA	3,085	4,392	102	1 2	3	21	3			21	12		65	258	8	47	2
Total Ward	3,085	4,392	102		3		3	0			12		65	258	8	47	
MBONDO **Code: 240103**																	
MBONDO	1,299	1,849	46	1 2	6					21	2		0	43	16	21	4
CHIMBENDENGA	1,062	1,512	38	1 2	6					13		20	0	160	66	70	4
NAKALONJI	992	1,412	35	6 1		13			20								
NAHIMBA	749	1,066	27	1 2	4	13			20				200	0	80	85	2
Total Ward	4,102	5,840	173		16		0	0			2		200	203	162	176	
KIEGEI **Code: 240104**																	
KIEGEI - ITULA - NAMANGA	1,870	2,662	67	2 4	7					21	4		0	86	18	29	4
Total Ward	1,870	2,662	67		7		0	0			4		0	86	18	29	
TOTAL DIVISION	12,797	18,219	485		41		4	0			28		287	1,163	227	374	
LIONJA DIVISION																	
LIONJA **Code: 240201**																	
LIONJA A	3,108	4,425	112	2 3 1	7	13			20				120	0	98	113	2
LIONJA B	1,670	2,378	59	3		21	3			21	7		65	151	0	26	1
NGUNICHILE	2,568	3,656	93	2 3	2	21	3			21	10		65	215	5	39	1
Total Ward	7,346	10,459	264		9		6	0			17		250	366	103	178	
NDITI **Code: 240202**																	
NDITI - MIANZINI - MTAMAILULU	1,578	2,247	56	3 4		21	3			21	6		65	129	0	24	1
NAMANJA	1,095	1,559	39	4 6		21	2			21	5		43	108	0	18	1
Total Ward	2,673	3,806	95		0		5	0			11		108	237	0	42	
NAMIKANGO **Code: 240203**																	
NAMIKANGO	1,548	2,204	56	1 6		13			30				330	0	120	135	1
NANGUNDE	2,105	2,997	76	1 3		13			30								
Total Ward	3,653	5,201	131		0		0	0			0		330	0	120	135	
TOTAL DIVISION	13,673	19,466	490		9		11	0			28		688	603	223	355	

NACHINGWEA DISTRICT Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m^3/d	Existing W/S Systems	Existing W/S No of suff. Hp-wells	Future Development 1986 - 1991 Systems	1986 - 1991 New hand-pumps	1986 - 1991 Hand-pumps to be deepened	1986 - 1991 Piped W/S rehab. %	1992 - 2001 Systems	1992 - 2001 New hand-pumps	1992 - 2001 Piped W/S rehab. %	Development costs TAS 1,000 1986-1991	Development costs TAS 1,000 1992-2001	Operation and maintenance costs TAS 1,000/yr 1986	Operation and maintenance costs TAS 1,000/yr 2001	Priority
MNERO DIVISION																	
MNERO MIEMBENI **Code: 240301**																	
MNERO MIEMBENI	1,583	2,254	82	2 1	4					13		40	0	400	10	110	3
MKONJELA	1,490	2,121	54	2 1	5					13		40			13	13	
NTILA	920	1,310	34	2 1 6	9					13			0		26	26	
NAMKULA	840	1,196	30	6		21	2			21	3		43	65	0	13	1
Total Ward	4,833	6,881	201		18		2				3		43	465	49	162	
MNERO NGONGO **Code: 240302**																	
MPUTE	1,169	1,664	42	2	1	21	1			21	5		22	108	3	18	1
KITANDI	834	1,187	30	6 1		13			20				160	0	60	65	2
NGONGO	2,400	3,417	91	2 1	10					21	4		0	86	26	37	4
Total Ward	4,403	6,269	162		11		1	0			9		182	194	88	120	
KIPARA **Code: 240303**																	
MWANDILA	872	1,242	31	2	5								0	0	13	13	
KIPARA-MNERO	623	887	22	6 1		21 23	2			21	2		66	43	0	10	1
NAMBALAPALA - LIBUNDU	1,338	1,905	48	6 1		21 23	3			21 23	5		88	131	0	21	1
Total Ward	2,833	4,034	101		5		5	0			7		154	174	13	44	
NAMAPWIA **Code: 240304**																	
NAMAPWIA	1,400	1,993	50	2	5					21	3		0	65	13	21	4
LIKONGOWELE	1,300	1,851	46	3		21	3			21	5		65	108	0	21	1
Total Ward	2,700	3,844	96		5		3	0			8		65	173	13	42	
TOTAL DIVISION	**14,769**	**21,028**	**550**		**39**		**11**	**0**			**27**		**444**	**1,006**	**163**	**368**	
RUPONDA DIVISION																	
RUPONDA **Code: 240401**																	
RUPONDA	1,515	2,157	57	2 1	6					13		50	0	450	16	170	3
MANDAWA	791	1,126	28	6 1		21	2			13		50	43		0	5	1
NAMANGA	1,666	2,372	61	2 1	7					13		50			18	18	
Total Ward	3,972	5,655	145		13		2	0			0		43	450	34	193	
MARAMBO **Code: 240402**																	
IKUNGU	733	1,044	27	6		21	2			21	3		43	65	0	13	1
RUPOTA	1,039	1,479	37	6 2	2					21	4		0	86	5	16	3
MARAMBO	2,483	3,535	91	6 1		21	4			13		50	86		0	10	1
LITULA - NANDILE - MTAAWA CHINGUNDULI - CHANIKA - MCHANAMO	954	1,358	36	3 6 1		21	2			13		50	43		0	5	1
Total Ward	5,209	7,416	191		2		8	0			7		172	151	5	44	
CHIOLA **Code: 240403**																	
MTIMBO NACHINGWEA	1,057	1,505	39	4 1											90	105	
CHIOLA	1,828	2,603	67	2 3	1												
CHINGUNDULI	1,009	1,437	38	4 1		21	2			13		50	43	0	0	5	1
Total Ward	3,894	5,544	144		1		2	0					43	0	90	110	
MKOKA **Code: 240404**																	
RWEJE	1,100	1,566	39	6 1		13			50				400	0	65	70	3
MKOKA	1,520	2,164	56	1		13			50				400	0	70	75	3
LIKWELA	495	705	18	6		21	1			21	2		22	43	0	8	1
Total Ward	3,115	4,435	113		0		1				2		822	43	135	153	
TOTAL DIVISION	**16,190**	**23,050**	**593**		**16**		**13**	**0**			**9**		1,080	644	264	500	

NACHINGWEA DISTRICT Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m³/d	Existing W/S Systems	Existing W/S No of suff. Hp-wells	Future Development 1986 - 1991 Systems	1986 - 1991 New hand-pumps	1986 - 1991 Hand-pumps to be deepened	1986 - 1991 Piped W/S rehab. %	1992 - 2001 Systems	1992 - 2001 New hand-pumps	1992 - 2001 Piped W/S rehab. %	Development costs TAS 1,000 1986-1991	Development costs TAS 1,000 1992-2001	Operation and maintenance costs TAS 1,000/yr 1986	Operation and maintenance costs TAS 1,000/yr 2001	Priority
NAMBAMBO DIVISION																	
NAIPANGA Code: 240501																	
NAIPANGA	3,849	5,480	158	1 6						12				450	100	120	4
CHIUMBATI SHULENI	967	1,377	40	6		21 23	2			21	3		66	65	0	13	1
CHIUMBATI MIEMBENI	899	1,280	33	6		21 23	2			21	3		66	65	0	13	1
Total Ward	5,715	8,137	214		0		4	0			6		132	580	100	146	
NDOMONI Code: 240502																	
NDOMONDO	1,800	2,563	75	6 1											110	120	
NDOMONI	1,134	1,615	41	6 5		12							400	0			1
Total Ward	2,934	4,177	116		0		0	0			0		400	0	110	120	
MKOTOKWYANA Code: 240503																	
MKOTOKWYANA	518	738	20	1 6		13			50				450	0	60	65	2
MANDAI	1,150	1,637	36	1 6		13			50								
Total Ward	1,668	2,375	62		0		0	0			0		450	0	60	65	
MPIRUKA Code: 240504																	
MKUMBA	1,768	2,517	66	1 6		21	3			13			65	0	0	8	1
MPIRUKA	1,728	2,460	66	6 1		13			20				160	0	60	65	2
Total Ward	3,496	4,977	132		0		3	0			0		225	0	60	73	
NAIPINGO Code: 240505																	
MCHANGANI	1,800	2,563	96	6 1		21 23	3			21 23	7		88	174	0	26	1
NAIPINGO	4,499	6,460	192	2 1	10	13			60				650	0	100	120	1
Total Ward	6,299	8,968	289		10		3	0			7		738	174	100	146	
MTUA Code: 240506																	
KIPARA MTUA	1,774	2,526	63	5 6		21 23	3			21 23	7		88	174	0	26	1
NALENGWE - NANDONDO	816	1,162	29	1 6						13		20	0	160	55	60	3
MTUA	2,488	3,485	87	1 6		13			30				270		70	80	2
Total Ward	5,038	7,173	180		0		3	0			7		358	334	125	166	
TOTAL DIVISION	25,150	35,807	993		10		13	0			20		2,303	1,088	555	716	
NAMBAMBO MJINI DIVISION																	
NAMBAMBO Code:240601																	
NAMBAMBO (URBAN)	8,656	19,840	1,000	1 2	24	13				12			9,700	9,200	1,270	2,070	1
Total Ward	8,656	19,840	1,000		24		0	0			0		9,700	9,200	1,270	2,070	
KILIMANI HEWA Code: 240602																	
KILIMANI HEWA (URBAN) - SUNGURA	3,444	7,894	397	1 6		13				12							1
Total Ward	3,444	7,894	397		0		0	0			0						
NANGOWE Code: 240603																	
MWENGE	452	644	17	6 1		21	1			21	2		22	43	0	8	1
MITUMBATI	1,944	2,768	71	6 1		21	4			21	7		86	151	0	29	1
NANGOWE SHULENI	1,540	2,193	56	6		21	3			21	6		65	129	0	24	1
NANGOWE MATANKINI	2,189	3,117	78	6		21	4			21	9		86	194	0	34	1
Total Ward	6,125	8,721	222		0		12	0			24		259	517	0	95	
STESHENI Code: 240604																	
SONGAMBELE	2,331	3,319	85	6		21 23	4			21 23	10		109	261	0	37	1
CHEMCHEM	1,965	2,798	78	2	3	21	1			21	6		22	129	8	26	1
STESHENI	8,896	12,666	321	1 2		13				12							
Total Ward	13,192	18,782	484		3		5	0			16		131	390	8	63	
NAMATULA Code: 240605																	
NAMATULA	3,328	4,738	120	2 1		13				12					26	26	
Total Ward	3,328	4,738	120		0		0	0			0				26	26	
TOTAL DIVISION	34,745	59,975	2,223		27		17	0			40		10,090	10,107	1,304	2,254	
TOTAL DISTRICT	117,414	177,545	5,334		142		69	0			152		14,892	14,611	2,736	4,567	

25 LINDI TOWN

LINDI TOWN				Existing W/S		Future Development 1986 - 1991				1992 - 2001			Development costs TAS 1,000		Operation and maintenance costs TAS 1,000/yr		Priority
Name of village	Popul. 1984	Popul. 2001	Water Demand 2001 m³/d	Systems	No of suff. Hp-wells	Systems	New hand-pumps	Hand-pumps to be deepe-ned	Piped W/S rehab. %	Systems	New hand-pumps	Piped W/S rehab. %	1986-1991	1992-2001	1986	2001	
Code: 2501																	
LINDI TOWN	36,600	83,888	4,194	1	3	13				12			10,600	49,500	1,020	3,230	
TOTAL DISTRICT	36,600	83,888	4,194		0		0	0			0		10,600	49,500	1,020	3,230	
TOTAL REGION	594,391	863,426	29,487		763		342	96			870		74912	142031	10372	22295	