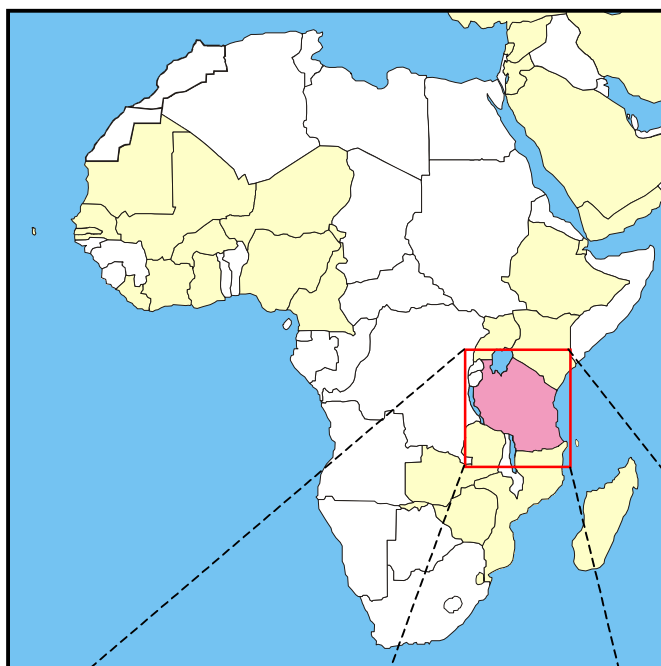
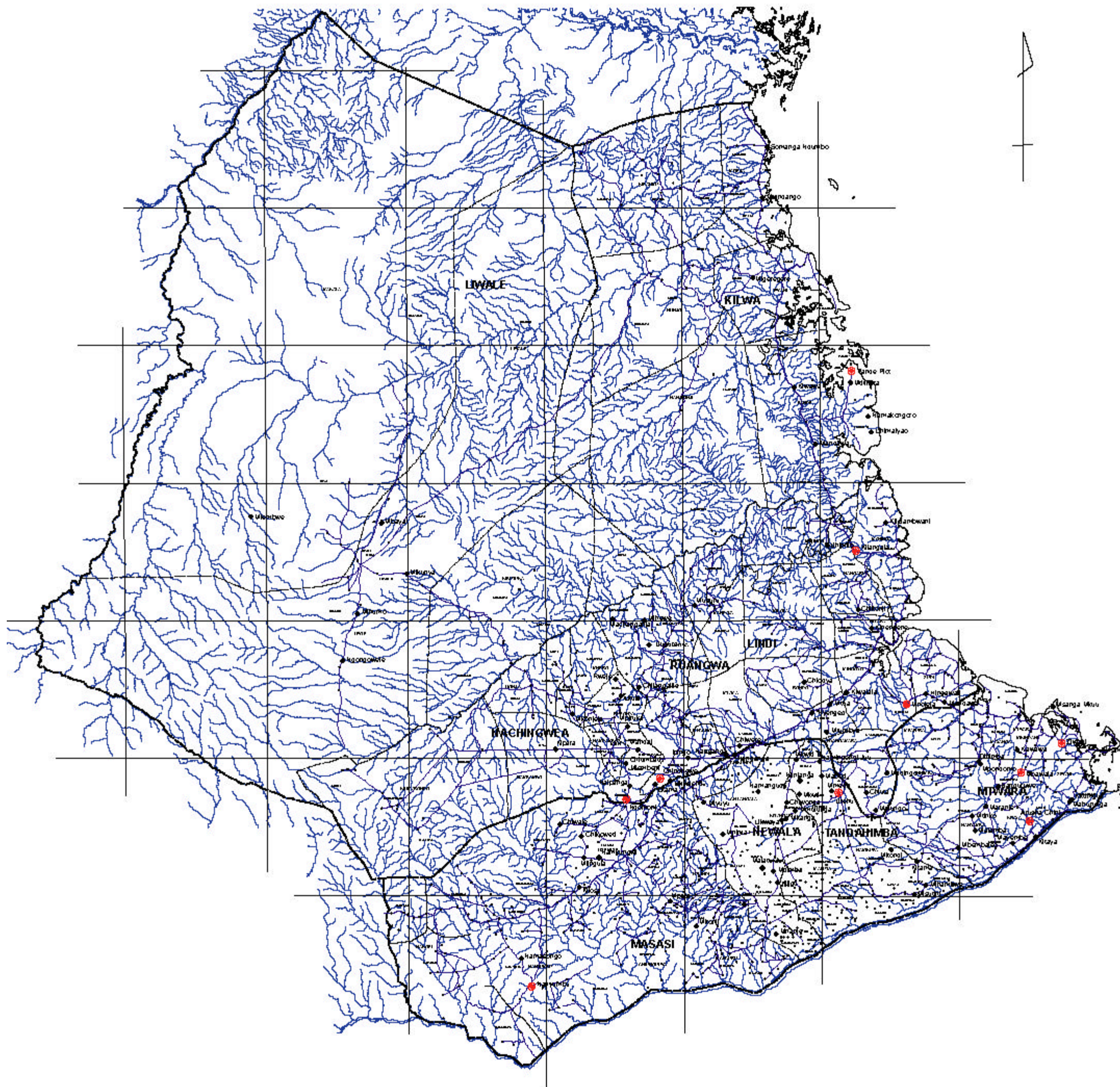


Location Map of Study Area





Legend (S=1:700,000)

- | | |
|---|--|
|  national boundary |  river |
|  regional boundary |  village |
|  district boundary |  Test Drilling Site |
|  road | |

Village Location Map

Acronyms and Abbreviations

DAS	District Administrative Secretary
DC	District Commissioner
DWE	District Water Engineer
ESA	External Supporting Agency
JICA	Japan International Cooperation Agency
LUWASA	Lindi Urban Water and Sewerage Authority
MoW	Ministry of Water
MRALG	Ministry of Regional Administration and Local Government
MTUWASA	Mtwara Urban Water and Sewerage Authority
MWLD	Ministry of Water and Livestock Development
NGO	Non-Governmental Organization
RAS	Regional Administrative Secretary
RC	Regional Commissioner
RCC	Regional Consultative Committee
RWE	Regional Water Engineer
UNICEF	United Nations Children's Fund
VWC	Village Water Committee
WHO	World Health Organization
WMP	Water Master Plan
BGS	Below Ground Surface
DO	Dissolved Oxygen
DWL	Dynamic Water Level
EC	Electricity Conductivity
L/C/D, ℓ/c/d	Litres per Capita per Day (litres per person per day)
O&M	Operation and Maintenance
RWS	Rural Water Supply
STDWHO	WHO guideline value (water quality standard)
SWL	Static Water Level
TDS	Total Dissolved Solid

Executive Summary

1) Background of the Study

The United Republic of Tanzania is an agricultural nation rich in natural resources. However, as productivity in agriculture is low and most of the mineral resources are undeveloped, Tanzania remains one of the least developed countries, with an annual GDP not exceeding US\$300 per capita since its independence from the United Kingdom in 1961.

The Study Area is composed of the Lindi and Mtwara Regions, which lie in the south-eastern corner of Tanzania. It occupies about 9% of the nation's land and is a particularly undeveloped part of the nation. This is mainly due to the area's reliance on income from cashew nuts, which has hindered the development of other industries, as well as the periodic influx of refugees from the neighbouring country, Mozambique.

The social infrastructure in this area is also far behind other regions, except for its water supply works. The water supply coverage in the rural area of these two regions was once among the best in the nation, attaining over 75% coverage. The Master Plan of the water supply for the two regions was compiled in 1976, and updated once in 1986. During preparation and revision of the Master Plan, significant developments in the water supply system took place, owing much to financial support from the Republic of Finland.

However, after the suspension of aid from Finland in 1991, no further foreign financial support was extended to these regions. Few water supply projects have been carried out since then, and facility maintenance has been inadequate, resulting in the dilapidation of many of the constructed facilities. Accordingly, the supply service coverage has rapidly been reduced in recent years, declining to more or less 35%, which may be among the lowest in the nation.

2) Socio-economic Features of the Area

The main industry in the area is agriculture (over 85% of income), followed by fishery, the service industry and forestry. Most of the crop farms are individual smallholdings, which are irrigated by rainwater and cultivated using only hand hoes and machetes. Food products are sold locally. The major cash crops in the area are cashew nuts, sesame, coconuts and groundnuts, overwhelmingly led by cashew nuts. The farmers' wealth and prestige seem to be determined by the number of cashew nut trees owned. Since both regions are heavily dependent on cashew nut income, the financial status of the local government fluctuates according to the international cashew nut price. The revenues of villages, districts and the regional government decreased in 2000 and 2001 to nearly half of those in an average year due to the drastic decline in the international price of cashew nuts.

The annual income of an individual household in an average year ranges from Tsh 10

thousand to Tsh 1.5 million, averaging Tsh 240, 000 per year,.

3) Natural Conditions and Water Resources Development Potential

The area has two rainy seasons, from November-December and March-May, with an average annual precipitation of 800-1000 mm. Groundwater development is, therefore, possible everywhere, although difficulty of development differs from place to place. Development of surface water is also possible, but it is not stable throughout the year. All but the four major rivers of Ruvuma, Lukuledi, Mbwemkuru and Mavuji are seasonal.

Groundwater as a source for rural water supply has advantages, when compared with surface water, in that it is stable throughout the year and safe (not contaminated with bacteria) so that it can be distributed without any treatment.

Groundwater development is, however, difficult in the plateau area, which consists of metamorphic basement rock from the Pre-Cambrian Era and older formations from the Mesozoic Era, because, in addition to the very deep water table, the high potential zone is limited to the fissures in the rocks (unlike bedded aquifer in the young sedimentary formations). The cost of pumping water from a deep well is high, and drilling must be done based on trial-and-error to hit groundwater-abundant fissures.

Another problem with groundwater in some areas is excessive concentrations of dissolved sulphate and/or carbonate, which are probably the effect of the mineralization of the rocks during metamorphism, especially in the upper reaches of the Lukled River Basin, where many of the candidate villages are located.

The success rate of hitting water-abundant fissures may be about 60% in the plateau area, and that of good-quality water is more or less 30%, whereas that of hitting good aquifers in the young sedimentary formations is over 90%. These matters have been duly considered in the planning of groundwater development.

4) Type and Condition of Existing Water Supply Facilities

Out of the 913 villages in the two regions, public water supply systems have been constructed in 675 of the villages, which is over 70%. However, the facilities in 273 of those villages are not working and have been abandoned for many years. The facilities in the remaining 384 villages are still utilized, but under unsatisfactory conditions such as “water transmission to the village is once a week or only 1 hour in 3 days”, “8 out of 10 taps are out of order”, “3 out of 5 wells have dried up”, etc. Accordingly, although the service coverage should be 42%, the actual served population is about 35% or less.

The Ministry of Water was responsible for the operation and maintenance of all water schemes until the National Water Policy 1992 was announced. However, it was difficult for the Ministry to handle the O&M services for the large number of facilities rushed into construction

during the period from 1976-1987, due to tight financial circumstances and a shortage of manpower. As facilities were constructed in a rush, users' participation in operation of the water schemes was not taken into consideration. These are the reasons why many of the schemes did not last or are in poor condition. Since the users and the local government do not have the necessary skills or knowledge for operation and maintenance work, the existing schemes are still deteriorating, resulting in a continual decrease in service coverage.

Two types of facilities have been provided in the area. One is a Level-1 facility, which consists of several wells in one village, mostly protected shallow dug wells equipped with hand-pumps. The other is a Level-2 facility (a piped scheme), which supplies water through public taps. The Level-2 facility has two types: 1) an independent system, that has one water source and supplies one village, and 2) a system that has one source and supplies several villages.

The area, especially on the plateau, is characterized by large-scale piped schemes, represented by the Kitangali scheme, which covers 130 villages with a 450km long transmission/distribution pipeline. The Mtwara Region is provided with 12 large-scale schemes (that cover over five villages), and the Lindi Region has seven such schemes. One of the probable reasons for the large-scale schemes in the area is the difficulty in developing the supply-source.

Under the new National Policy, which recommends community-based management, however, it is difficult to operate and maintain the large-scale piped schemes.

5) Facility Planning for Selected 100 Villages

The water supply facilities planned for 100 villages (50 villages in each of the two regions) have been based on the following two basic concepts:

- (1) Following the revision of the National Policy, which stipulates a transfer of responsibility for management of water schemes from the central government to the co-operative bodies of the local government and the users themselves, the schemes should be independent at village level to make autonomous management of it easier.
- (2) Considering the critical financial condition of the local people and their lack of experience in facility O&M, the facility should be as cheap and simple as possible.

The design of the facilities was, for the most part, based on the national design manual and the unit supply amount of 20 litres/capita/day. However, in consideration of the above mentioned concepts. The following limitations in scale were put on the design: 1) maximum of five wells in one village for Level-1 schemes, and 2) maximum length of 500m of distribution pipe and five public faucet bases for Level-2 schemes,

The amount and type designed for 100 villages are as follows:

- Level-1 facility: 78 borehole wells equipped with a hand-pump for 18 villages;
- Level-2 facility: 75 borehole wells with a motorized pump and 5 sets of spring boxes equipped with a motorized pump for transmission as the sources for 82 villages, and the following pumping and distribution facilities (2 sets for schemes covering two villages are included):
 - 1) 80 sets of elevated distribution tank with varying volumes [20m³ (49), 30m³ (10), 40m³ (9) and 50m³ (12)]
 - 2) 262 sets of public standpipes with 2 taps each
 - 3) 40,000m of transmission/distribution pipes (total length)
 - 4) Power sources: 62 sets of diesel engine generators in generator house for submersible motor pump, 13 sets of solar energizing batteries for submersible motor pump, 5 sets of diesel engine generators for centrifugal pump.

Breakdown of the sources is as follows;

- Wells for Level-1 system: 4" diameter, 76 wells with 6370m total drilling length
- Wells for Level-2 system: 4" diameter, 39 wells with 6210m total drilling length
6" diameter, 34 wells with 3980m total drilling length
- Spring development for Level-2 system: 5 places.

6) Cost of the Project

The construction cost of the facilities for 100 villages is estimated at 15.79 million US Dollars (\$15,790,000), including 11.73 million US Dollars (\$11,730,000) for direct construction cost and engineering fees, and 4.06 million US Dollars (\$4,060,000) for the cost required for equipment provision for execution of construction works.

Necessary equipment comprises a drilling machine capable of drilling deeper than 200m, drilling tools and parts, supporting vehicles, as well as vehicles for O&M services, geophysical survey equipment, pumping test equipment, etc.

Since the drilling machines available in Tanzania have a limited capacity (130m), and there are over 40 deep wells over 150m (20 wells are estimated as over 200m depth) to be drilled in this project, procurement of a high capacity machine is essential.

The cost for operation and maintenance is to be shouldered partially by the local government but mostly by the users. The increase in the annual budget to the District Water Department is estimated at TShs 3,600,000/year for an additional staff member and periodical patrol services. Budgetary measures amounting to TShs 1,500,000/year also need to be taken for the Regional Water Departments, for better maintenance of the equipment to be used for facility maintenance work, and for strengthening the training programmes for district level staff.

The O&M cost to be covered by the users of the 100 villages totals TShs 3,600,000/year,

including running costs, the cost for repair/replacement of pumping facilities and the cost for rehabilitation of water sources and distribution facilities. Breakdown by facility type, and average amount to be shared by one household are as follows:

- 1) For Level-1 facilities(18 villages with 6540 households):
TShs170,000/well/year x 76 wells = TShs12,920,000/year
Share per household is TShs 2000/year/household
- 2) For Level-2 facilities using diesel engine generator (69 villages with 44,800 hhs):
TShs 4,660,000/village/year x 69 villages = TShs 321,540,000/year
Share per household averages TShs7,200/year, and ranges from TShs5,000 to 29,000/year (the larger the household, the smaller the share).
- 3) For Level-2 facilities using solar-powered system (13 villages with 3300 hhs):
TShs 1,180,000/village/year x 13 villages = TShs 15,340,000/year
Share per household averages Tsh 4700 /year.

7) Project Effectiveness

The project has been designed to satisfy the basic human needs of the people residing in the rural area of the two regions. Implementation of the project is expected to yield various kinds of benefits. For example, as there will be about 30 thousand beneficiaries of the project in the two regions, the present low service coverage of 35% or less will increase to nearly 45%. The project will also make it possible to improve the health environment and to save time for more activities to promote rural community development. The present time required for water collection averages approximately one and a half hours in the 100 candidate villages. This extraordinary long wait will be reduced to 15 minutes or less. Furthermore, as women will have more time to spend on childcare, a reduction in morbidity and mortality of children can also be expected.

Since the service coverage in the two regions is rapidly declining, the increase in coverage to 44% by the project may fall to 40% or less, when the construction stage is complete. Therefore, implementation of this project should be given top priority (Phase 1) of the phased project.

8) Pilot study

As a part of the feasibility study, 6 pilot water supply schemes were constructed and the following activities took place:

- (a) A new village water committee (with water fund independent of village fund) was established;
- (b) The elected water committee members were trained in committee operation;
- (c) The villagers participated in facility planning, construction and operation; and

- (d) Educational activities were held for the villagers on improving sanitation focusing on the use of safe water throughout the year.

Four Level-2 systems and two Level-1 facilities were constructed, one facility in each of the six villages, and the test boreholes drilled for confirmation of the hydrogeological condition of the area were used as the supply sources (for practical purposes). The pilot schemes were monitored during construction and 6-months, 9-months and 1 year after completion of construction, by the joint Study Team of the JICA team and concerned officials of the regional and district water departments.

Although the facilities have been operating apparently in good condition for the past year, many problems discovered during the monitoring period have not been sufficiently seen to yet. The following matters should be duly considered before project implementation:

- The water consumption rate remains at more or less 10 litres/person/day, probably due to the collection method (per bucket).
- The water consumption rate drops to less than 1 litre/person/day during the height of the rainy season, implying that the majority of people return to traditional water sources.
- In many of the villages, the village council collects and manages the water fund intending to incorporate it into the village fund. That being so, the fund often will be spent for other purposes.

9) Conclusions and recommendation

The responsibility of managing the rural water schemes was transferred from the central government to the co-operative bodies of the local governments and water users in 1992 due to financial difficulties and a shortage in manpower. However, both the local governments and the residents are also in a tight situation and do not have the financial means to cover project implementation. Therefore, the use of the grant aid seems inevitable.

In consideration of the underdeveloped background of the area, the major concern in planning the schemes for the 100 villages was to make them simple and small-scale for easier and lower-costing operation. However, the natural conditions of the area (A very low water table, especially in the highland area) do not allow very low-cost operation, and people will probably prefer to consume less water or return to the traditional water sources during rainy seasons, to save money. This will go against the basic concept of the water supply – that is, the use of safe water throughout the year to improve sanitation.

Long-term educational activities to improve the resident's sense of hygiene are essential. In order to continue public education, the regional and district water departments need to be strengthened accompanied by budgetary measures for the departments. In addition, the introduction of a soft component is recommended, which will make it possible to continue the

educational activities until the sense of hygiene takes root in the area, along with the application of the grant aid for facility construction.