IDR RESEARCH REPORT

SOME SOCIO-ECONOMIC FACTORS RELATED TO RURAL WATER USE

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RESEARCH REPORT NO. 18

SOME SOCIO-ECONOMIC FACTORS RELATED TO RURAL WATER USE

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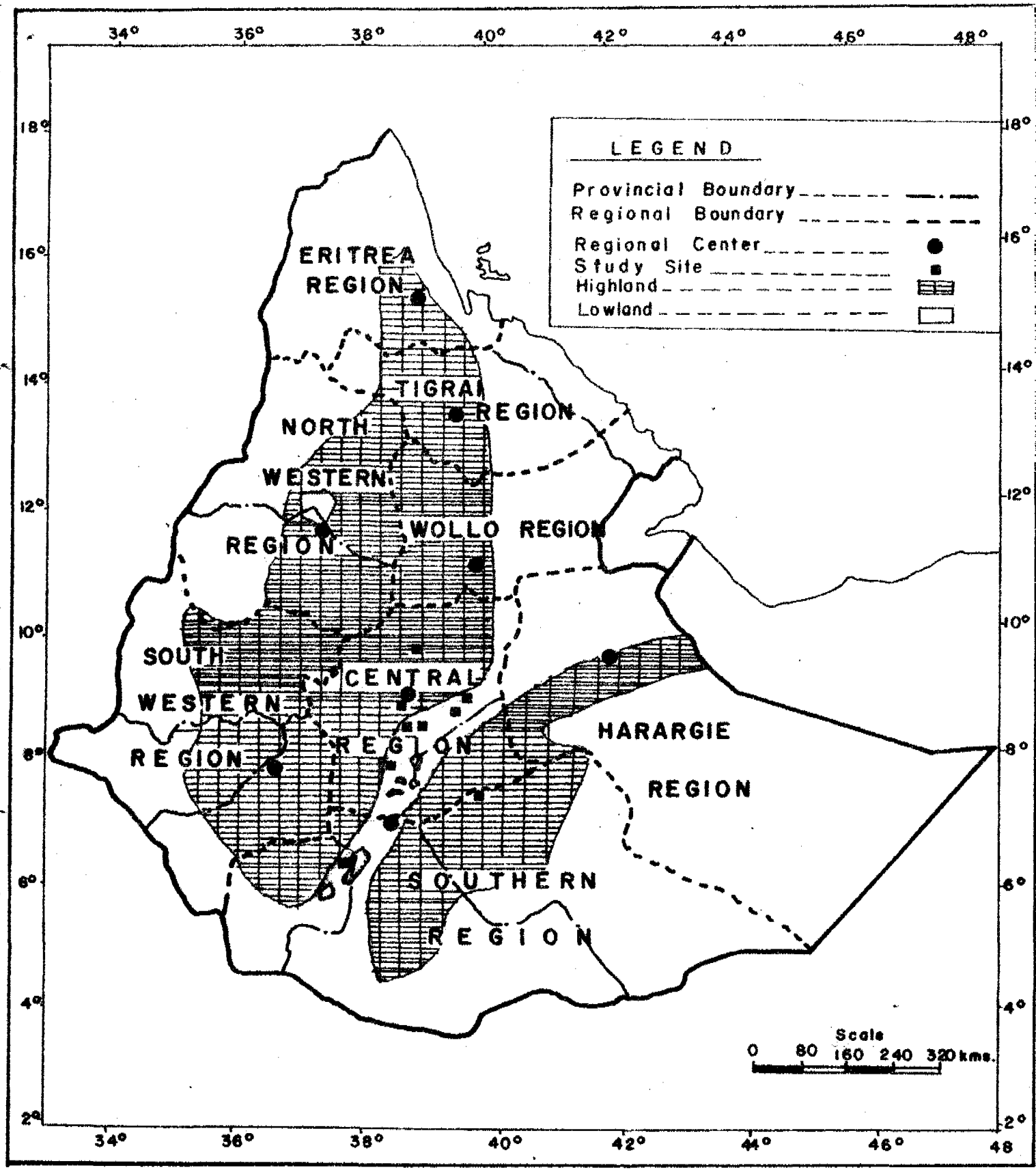
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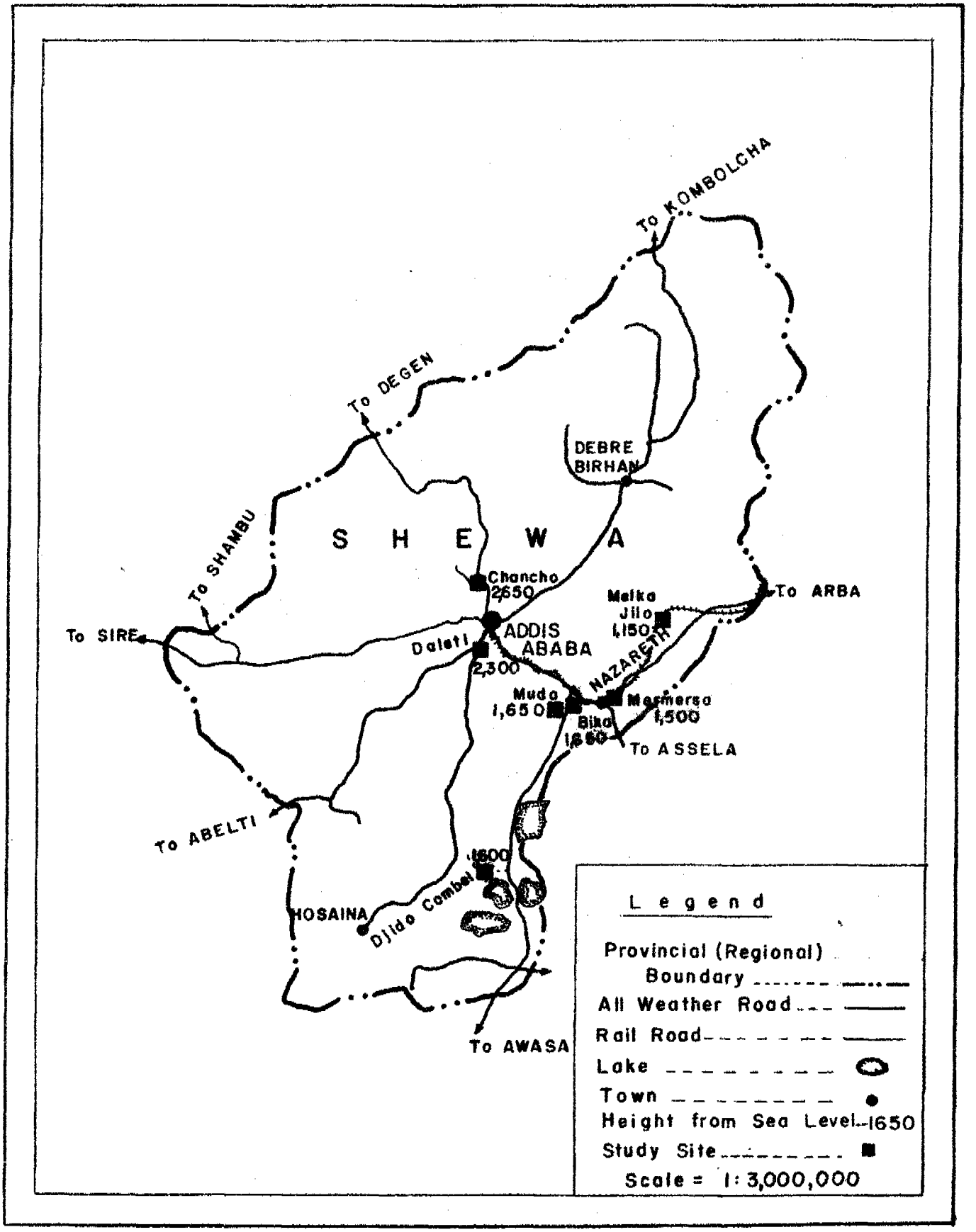
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Melka Jilo 1,150
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To ABELTI
1800
HOSAINA
Djido Combel
To AWASA
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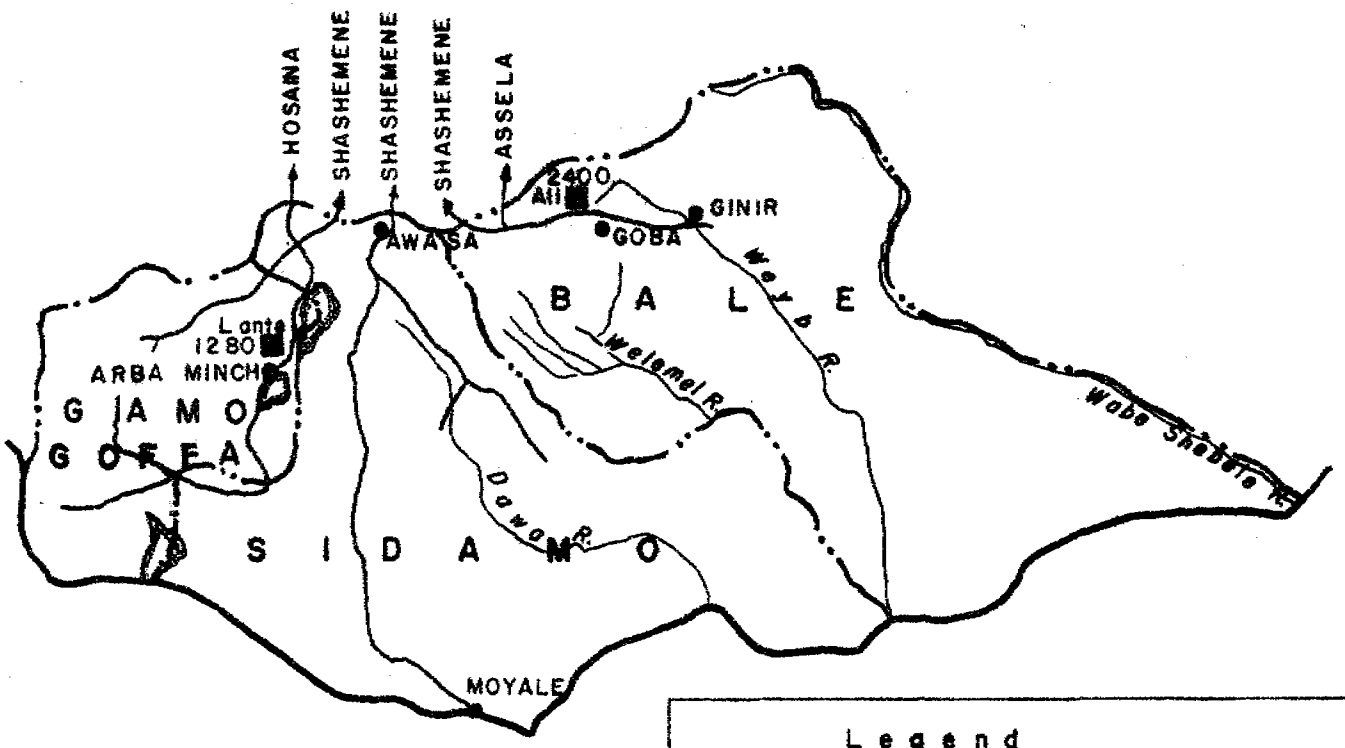
Provincial (Regional) Boundary
All Weather Road
Rail Road
Lake
Town
Height from Sea Level 1650
Study Site
Scale = 1: 3,000,000



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Provincial (Regional) Boundary

All Weather Road

Lake

Towns

Height from Sea Level 2400

Study Site

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Preface and Acknowledgements

This study on rural water use was conducted upon the request of the former Ethiopian Water Resources Authority (EWRA). The Institute of Development Research (IDR) agreed to carry out the study and funding was obtained from the International Development Research Centre (IDRC) of Ottowa, Canada.

Work on the study project was started towards the middle of February 1981 and the collection of data was completed at the end of March, 1982. The processing of the data and the writing of this report took some four and a half months.

The members of the research team would very much like to express their gratitude for the opportunity given them by the EWRA, the IDRC of Canada and the IDR of Addis Ababa University.

The team would like to make more specific acknowledgements of the special assistance and help given by Mr. Dekker, Ato Kefialew Achamyeleh and Ato Atnafe Beyene all of the National Water Works Commission. The enumerators and the people in the study sites have all been contributors to this study and the research team expresses its gratitude for and appreciation of this fact.

INTRODUCTION

1. The International Drinking Water and Sanitation Decade

In 1976, the United Nations Conference on Human Settlements recommended that "Safe water supply and hygienic waste disposal should receive priority with a view to achieving measurable qualitative and quantitative targets serving all the population (of the world) by a certain date." (UN, 1976). The following year, the United Nations Water Conference upheld this recommendation and appealed to governments to "adopt programmes with realistic standards for quality and quantity to provide water for urban and rural areas by 1990, if possible," (U.N. 1977).

This urgent call for planned action emanated from the realization that while drinking water "is essential both for life and full development" and, therefore, a basic human need and right, only some 14% of the rural and about 68% of the urban populations of 91 developing countries were said to have access to safe water in 1971 (WHO, 1973). On the basis of these findings, updated in 1975 for 75 developing countries, the World Health Organization had set the targets to supply drinking water for 1980 at 100% for the urban and 25% for the rural populations of these countries to have drinking water.

Given the scope and magnitude of the task, these recommendations and targets, especially those of the U.N. Water Conference, will undoubtedly have serious socio-economic and political implications for these countries. They will require political commitment and a considerable amount of persistent effort to mobilize the huge material, financial, and human resources

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that will be needed to attain the targets set. Those developing countries with better resources, commitment and lesser tasks will be able to attain these goals, while others will certainly require more time, resources, and explicit commitment. Perhaps with these latter group of developing countries in mind, the Plan of Action adopted by the United Nation's Water Conference mentioned above urges countries to "establish goals for 1990 which match as far as possible the global targets adopted," (U.N. 1976), (emphasis added).

2. Ethiopia and the Decade

With an estimated Gross National Product per capita of U.S. $100 (Ethiopian Water Resource Authority, 1978), Ethiopia is considered one of the 25 least developed countries in the world. The economy is dominated by subsistence agriculture which contributes some 50% of the Gross Domestic Product (GDP). This sector provides a livelihood for over 80% of the total population. The modern sector represents only a very small proportion of the GDP. The annual growth rate since the early 1970's has been less than 2% - thus showing a fall in the real per capita output (Ethiopian Water Resources Authority 1978).

The 1980 total population is estimated* at 30,825,400. At an estimated annual growth rate of 2.5%, the total population is expected to become 40,639,800 by 1990 (CSO, 1978). Using the Ethiopian Water Resources Authority's definition of rural communities (EWRA, 1980),

*This estimate is based on the National Sample Survey, Second Round of 1967-71 as no census has been taken so far.

on 10.12% of this total population is urban, and the rest lives in rural communities that may be either nucleated and "occupy a clearly delineated area and houses are generally very near to each other, individual compounds being generally adjacent and contiguous" or they may be scattered and "individual homesteads are on or near the farmed land and clearly separated by a certain distance from each other," (EWRA, 1980). This rural population is expected to be over 85% of the 1990 population.

These brief economic and demographic facts may point at the formidable task that confronts the country in its attempt to move towards meeting the targets set by the U.N. Water Conference. The task is made even more formidable by a complex set of natural and man-made conditions of which the topography, rock formations, climate (drought) and the politico-military situation in this part of Africa are some of the important ones. Moreover, in order to meet the Decade's targets, the country will have to start from virtually a scratch - a consequence of past indifference and neglect of the development needs of the country as a whole and of the rural areas in particular.

From the rather scanty and incomplete data available, it is estimated that out of the total population living in communities smaller than 10,000 (classified by EWRA as rural for the purposes of water supply only 3-4% were said to have access to safe water supply in 1978. Moreover, for the country as a whole, it was estimated that the nearest domestic water source was over 1 km. away for 45% of the communities in the dry seasons, and for 27% of the communities in the wet seasons. During the

dry seasons, 75% of the rural villages were said to be faced with rather serious shortages of water; more than 50% of the villages were also said to be faced with equally serious hazards associated with the unhealthy nature of the water to which they have access.

In a five-year indicative plan ending 1982, the EWRA had set a target to reach some 11% of the rural population with accessible, safe water supply (EWRA, 1978). The extent to which this goal has been attained is not known at the moment. The 1980 "Preliminary Proposals for a 10-year Plan for Rural Water Supply 1973-1982*" envisages a target of 35% of the 1990 rural population being provided with "protected safe water supply at a reasonable distance from the home" by the end of the plan period (EWRA, 1980).** This means that at an average annual increase of 24%, the total size of the rural population having access to safe water supply will come to about 12 million by 1990.

Although the final 10-year plan has as yet to be completed and approved, the proposal does nevertheless indicate the explicit commit-

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*This is roughly the same as the Decade period 1981-1990.

**The Preliminary Proposal defines an improved rural water supply as "a source which is protected and has one or more outlets such as hand pumps or public stand-posts of sanitary construction so as to provide reasonable safe water of acceptable quality and from which water can be obtained in sufficient quantity; which is reliable and provides water during all hours of day-light and all year round; the outlets of which are easily accessible and conveniently situated within 500 meters of the farthest user for whom it is intended; which can be operated and maintained, at least partly, by the community; and the water of which is actually used --- in a sufficient and appropriate way for domestic purposes (drinking, cooking, cleaning, washing, bathing, etc.)." (EWRA, 1980,p.5).

ment that is required. The resource implications of these proposed targets, though far from the global ones set by the UN Water Conference, are so huge for the country that they will of necessity, have, to develop the capacity to carefully plan, programme and implement the schemes that are envisioned. The gathering of relevant data on various aspects (technical, socio-economic, cultural practices, etc.) of water supply and use will no doubt be an important component of the effort to build that capacity.

It was with this intention that this study was requested by and conducted for the National Water Resources Commission (NWRC). The study is expected to contribute towards the successful implementation of the schemes by providing information regarding the socio-economic and cultural characteristics of the populations that are to be served by these planned schemes. It was assumed that these characteristics may influence the success of efforts to provide safe water supply. The success of projects is, in turn, measured by the extent to which users utilize and benefit from them (Saunders and Warford, 1976).

3. Objectives of the Study

The central objective of the study was to collect data on socio-economic and cultural factors that were thought to influence domestic water use in rural Ethiopia. The investigation of these factors was expected to enable the NWRC to better understand the rural communities' needs, preferences and capabilities in respect to domestic water supply so that it may use this understanding in its efforts to provide improved

domestic water supply to the rural population. In order to attain this principal objective, the following more specific tasks must be accomplished:

1. collection of baseline data on the social, economic and demographic characteristics of the selected rural communities,
2. identification of different types of water sources and assessment of their accessibility and suitability for local operation and maintenance,
3. studying the factors influencing consumer use of domestic water and the management of water points, including:
   a) methods of collecting, transporting and using water,
   b) water yard management practices, and
   c) the pattern of water demand for various activities and where these are carried out,
4. documentation of consumer needs and preferences with regard to the installation and management of water points.

4. Methods and Samples

The methods and the samples used in this study will be realized better if some basic information is given inadvance about the communities included in the study. The information specifically deals with the selection and description of the sites used.

4.1 Selection and Description of Sites

The study was conducted in 8 selected rural communities that have been provided with improved water supply. Initially, only 6 such communities were selected. Because of logistic problems that eventually led to the abandonment of one of the sites (to be discussed later) the number of the sites was reduced to 5. Finally 3 more communities were selected and included in order to broaden the scope and coverage of the study.

These 8 communities were selected with the intention of covering 3 of the 4 major geographic zones which were identified as:

a) the highland settled,
b) the lowland settled,
c) low pastural, and
d) low semi-sedentary regions.

These topographic variations coincide with the country's main climatic variations. Thus, the highlands are relatively temperate with ample to heavy rainfall at least twice per year, and the low-lands are often hot and sometimes arid with frequent and serious shortage of water. Three communities each from the highland (namely, Ali, Chancho and Dalete) and lowland (comprizing Lante, Mermersa, and Muda) settled regions and 2 communities from the low pasturalist regions (which included Djido Combel and Melkajilo) were selected. Communities from the fourth, low semi-sedentary regions could not be included due to various reasons of which the rather unsettled politico-military situation that had prevailed then as well as the scarcity of improved water supply in these parts were the most important ones. The limited

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number of improved water supply schemes even in the 3 zones covered made it difficult to use criteria other than the topographic and climatic ones in the selection of the communities.

Six of the 8 communities are found within the Administrative Region of Shoa and are under the jurisdiction of the Central Regional Office of the Ethiopian Water Works Construction Authority (EWWCA). Shoa happened to have not only comparatively more rural communities with improved water supply but also it has the 3 topographic and climatic zones used as the criteria for site selection. The remaining 2 communities are located in the two Administrative Regions of Gamo Goffa and Bale, and both are under the Southern Regional Office of the E.W. W.C.A.

The 6 communities in Shoa are Chancho,Daleti, Djido Combel, Melka Jilo, Mermersa, and Muda. While Lante is in Gamo Goffa, Ali is found in Bale. More specific description of these sites follow:

Ali

This is one of the many comparatively new settlement sites in the Administrative Region of Bale. It is located about 410 kms. from Addis Ababa and some 17 kms. to the left of the road to Goba, the region's administrative capital.

Ali has an altitude of about 2400 meters and a sub-humid climate with woodland and savanna vegetation. It receives rain twice per year in March, April and May and from July to October. Its average annual rainfall comes to about 926 mm. The land is flat plateau and very

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much suited to mechnized farming. The site is actually surrounded by large, mechanized state farms.

As a new settlement, it is nucleated. The settlers (predominantly Moslem Amharas) were brought from the drought striken regions of Wello and Tigrai in the north of the country by the Relief and Rehabilitation Commission which also helped to organize them into a Peasants' Association and provided them with shelter and with the assistance of E.W.W.C.A, with an improved water and other supplies.

It has an estimated population of 2800 and an average household size of about 4.7 persons. Subsistence farming is the main means of livelihood though a few are engaged in small, retail trade.

Its main water source is a borehole, fitted with a hand pump. Other water sources include a river, spring, pond and rain water.

Chancho

This nucleated community is located 44 kms. north-west of Addis Ababa and on the main highway leading from Addis to the northern and north-western regions of the country. As such it serves as a transition post for the numerous buses and lorries that pass daily to and from the grain producing regions of the north and north-west.

Located in the highlands of Sululta Woreda (district), Chancho has the highest altitude (2650 meters above sea level) among the study sites. It, therefore, has a humid climate with mountain savanna vegetation and ample rainfall twice per year between July and August, and from March to May. Its average annual rainfall is about 1098 mm.

With an estimated population of nearly 2900 (average household size of about 4 persons), Chancho is more of a roadside town than a rural community by Ethiopian standards (CSO, 1978). It is actually classified as such by the Ministry of Urban Development and Housing which has organized the population under an urban dwellers association. The population is predominantly Oromo, one of the largest nationality groups in the country, and is engaged in retail trade and subsistence agriculture. Some are salaried employees of the civil service.

Its main water source is the borehole, operated by a diesel generator, that was constructed by a private company some 10 years ago. It is now being managed by the town council (municipality). Other water sources used by the population for various purposes include a small river, an unimproved spring, and rain water.

Daleti

This small community is only 21 kms. from Addis Ababa on the road to the south-western and coffee producing region of Keffa. It occupies an area about 2 kms. to the south of the main highway to Keffa, but an all-weather, partly asphalted road passes through it to Butajira and Soddo in Shoa and Sidamo Administrative Regions respectively. Communication with Addis and, therefore, with other parts of the country is relatively easier from Daleti than most of the other sites.

With an altitude of about 2300 meters, Daleti is also in the highlands with a flatter topography than Chancho but with about the same humid climate and vegetation. It has adequate rainfall twice per year as in Chancho. Its average annual rainfall is about 867 mm.

It has an estimated population (mainly Oromo) of about 1700 (average household size 4.5) whose pattern of settlement is predominantly scattered. In this regard, the beginning of change is quite visible since a programme of villagization has been started by one of the Peasant's Associations (Daleti Newso Peasants' Producers' Cooperative). This is one of the very few associations in the country that has legally attained the second (i.e. Welba) of the three stages of cooperative development. The essential criteria in this process of cooperative development is the extent to which the means of production (land, oxen, tractors, etc.) have been collectivised, and members are remunerated on the basis of their respective labour and material contributions to the collective effort. As such there appears to be a much better organizational structure for community participation in development efforts. The Daleti Newso Peasants' Producers' Cooperative has actually taken over the responsibility for the management of the improved water source from the EWWCA.

In addition to the electric operated borehole, which is also occasionally used by another not-so-well organized peasants' association further down the road to Butajira (Selam Daleti Peasants' Association), the community also uses a couple of ponds, a river, a spring and some rain water.

The members of the two peasants' associations using the improved water source are essentially engaged in subsistence agriculture. However, the Daleti Peasants' Producers' Cooperative is gradually moving towards producing both crops and cattle for the Addis Ababa market.

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Lante

This is also a settlement in the sense that the population now living in it was recently brought down from the adjacent rugged highlands (to which they had been pushed by former feudal landlords) by the new government. As such it is nucleated and the population has been organized under a peasants' association which has, about 2 years ago, moved to the first stage (Malba) of cooperative development.

The village is located about 500 kms. on the main road from Addis Ababa and some 30 kms. from Arba Minch, the administrative seat of Gamo Goffa Region. Except for the surrounding mountains, the village lies low (altitude 1280 meters) and is flat. This, coupled with the existence of a river, a lake nearby and ample rainfall (average annual rainfall 734 mm.), has resulted in a warm and humid climate with relatively thick vegetation that is typical of these equatorial rain zones.

The large majority of the population are of the Gamo nationality group though there are some other minority groups represented. The estimated population is 3000 and the average household size comes to about 4.6 persons. These are well organized and they have now started, through their producers' cooperative, to take over the management of some of the services such as the community water supply system constructed with the help of Chinese experts and material.

Subsistence farming is the main means of livelihood, but cotton is also grown for cash.

In addition to the diesel operated borehole, the community also uses an old borehole fitted with a hand pump (provided by the EWRA

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some years ago and which apparently does not now have sufficient water) a river, a lake, and rain water.

Mermersa

Mermersa is a highly scattered community located in Yerer and Kereyu Awraja, Shoa Administration Region. It lies some 115 kms. from Addis Ababa, about 15 kms. past the town of Nazareth and on the main and busy road to Harar and Assab Regions. A rail line also passes close to the borehole provided by EWRA.

At an altitude of about 1500 meters, Mermersa has a dry sub-humid climate with savanna vegetation. The small rains come in March, April and May, while the big ones come between July and August. It appears that this and the surrounding areas have been seriously affected by the climatic changes that have occurred along the Sahelian belt across the continent and into Ethiopia's northern and north-eastern regions with both of which the region around Mermersa is physically joined. Consequently, the community has been affected by drought during the past few years and is now devoid of any vegetation except in the rainy seasons. Its average annual rainfall is said to be around 833 mm.

The large area served by the borehole has 4 peasants' associations and an estimated, combined population of 3900. This population is primarily engaged in subsistence farming and cattle raising. The population is predominantly Oromo. Organizationally, all four peasants' associations appear to be weaker, especially compared to those in Daleti and Lante, and often appeared to lack both the inititative and

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structural capability to do anything about the frequent malfunctioning of the water point.

Other than the borehole, people also use, particularly during the rainy seasons, small rivers, ponds and rain water.

Muda

Muda is also located in the same Yerer and Kereyu Awraja in Shoa and is about 92 kms. from Addis Ababa on the main road to the southern Administrative Region of Sidamo. It lies some 2 kms. off this main, asphalted road.

In almost all respects, Muda is very much like Mermersa which is only some 45 kms. away. The pattern of settlement is, however, not so scattered. Otherwise, its altitude (1650 meters), its small rainfall and savanna vegetation, its dry subhumid climate, and flat and open terrain are all similar to those of Mermersa.

The population (about 2200) is mainly Oromo and is engaged in subsistence farming and raising some cattle. Here too there are some 4 peasants' associations using the borehole at Muda. This and the borehole at Bika, about 2 to 3 kms. farther to the main road, were constructed by EWRA. Both boreholes have been frequently breaking down due to silt seeping into the pumps and, as a result, the one at Bika had to be closed down for good.

Other sources of water used by the population include a river (which is apparently highly polluted by refuse dumped from the Modjo tannery a few kms. away), an artificial lake, ponds, a spring and some rain water.

Djido Combel

On the same road to Sidamo Administrative Region and about 98 kms. from Muda (about 200 kms. from Addis Ababa) and on a flat terrain (altitude 1600 meters) lies Djido Combel. It is found some 17 kms. on the road to the Children's Village near Mito.

Though found at a higher altitude than Melka Jilo, Djido Combel is also semi-arid with savanna vegetation. Its population is engaged in both farming and cattle raising as in Melka Jilo. It is estimated that there are some 10 to 15 peasants' associations using the borehole at Djido Combel. The majority of this population is highly scattered though there is a small nucleated settlement at the water point.

A rather conservative estimation of the population using the improved water source puts it around 7000. This population is again predominantly Oromo.

The whole area is semi-arid with savanna vegetation and has been quite seriously affected by drought particularly during the past 2 to 3 years. It is believed that the area may be better suited for cattle raising, but the recent drought seems to have made even this a risky undertaking. It has an estimated average annual rainfall of 642 mm. Its rainy months are July, August and September (big rains) and April and May for the small ones.

Other than the borehole (constructed by the Japanese), people use a river, a spring, ponds, and rain water whenever this is available.

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Water is rather scarce particularly since the river that they have been using was diverted for use by the Children's Village.

Melka Jilo

This last site is located some 172 kms. from Addis Ababa on the Addis to Djibouti rail line. It is also accessible by road through Nazereth from which it is about 72 kms. away.

At an altitude of about 1150 meters, it has one of the hottest climates of all the study sites. Located in a valley partly surrounded by rugged mountains on the north, Melka Jilo is quite dry, dusty and very much windy at times.

Except for a small community at the railway station, the rest of the population (about 1800) is highly scattered. For most of the population, the chief means of livelihood is raising cattle (especially camels), and some farming. These are engaged in mainly for subsistence.

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TABLE 1. Names of Study Communities and Some of their Main Characteristics

Geographic Zone and Name of Community		COMMUNITY CHARACTERISTICS								
Zone	Name	Altitude in Meters	Average Rainfall in mm.	Temperature in C°	Estimated Population	Settlement Pattern	Livelihood	Economy	Water Sources	Distance from Addis (kms.)
Highland Settled	Ali	2400	926	15	2800	Nucleated	Agriculture some Trade	Subsistence	Borehole, River, Spring Rain Water	410
	Chancho	2650	1098	13	2900	Nucleated	Trade, Salary, Agriculture	Subsistence Trade, Services	Borehole, River, Spring, Rain Water	44
	Daleti	2300	867	16	1700	Scattered some Nucleated	Agriculture	Subsistence Some Cash	Borehole, River, Rain Water, Ponds	21
	Lante	1280	734	21	3000	Nucleated	Agriculture	Subsistence Some Cash	Boreholes, River, Lake, Rain Water	500
Lowland Settled	Mermersa	1500	833	21	3900	Scattered	Agriculture	Subsistence	Borehole, River, Pond, Rain Water	115
	Muda	1650	919	20	2200	Scattered	Agriculture	Subsistence	Borehole, River, Lake, Pond, Spring, Rain Water	92

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Table 1 Continued

Geographic Zone and Name of Community		COMMUNITY CHARACTERISTICS								
Zone	Name	Altitude in Meters	Average Rainfall in mm.	Temperature in C°	Estimated Population	Settlement Pattern	Livelihood	Economy	Water Sources	Estimated from Addis (kms.)
Low Pastoral	Djido Combel	1600	642	19	7000	Scattered some Nucleated	Cattle, Farming	Subsistence	Borehole, River, spring, Pond, Rain water	200
	Melka Jilo	1150	523	25	1800	Scattered some Nucleated	Cattle, Farming	Subsistence	Borehole, River, Spring, Pond, Rain Water	172

4.2 Methods of Data Collection and Sample Size

Both interview and observation were used as the methods of collecting data for the study. Both were conducted using two separate sets of questionnaires and observation schedules which were tested and, on the basis of these tests, modified and made ready to use.

Interviews

Using one set of the questionnaires, randomly selected households were interviewed. The second set of questionnaires was used to guide the discussions with the leaders of the peasants' and women's associations who were using the improved water source at each of the sites.

For the household interviews, which were conducted by trained enumerators, some 20% of the combined, total households using the improved water sources at the 8 sites were randomly selected from the records of the relevant peasants' associations. At the end of the interviews, 841 households (19.26% of the total number of households) were covered. As far as was possible both husband and wife were jointly interviewed. Since it was believed that women rather than men were responsible for carrying out most domestic activities related to water, efforts were made to interview particularly the women members of the selected households.

The goup interviews with the elected officers of the peasants' and women's associations were conducted by the research team from Addis Ababa. Each of these associations had 9 to 12 persons bearing various offices, and the officers of each association were interviewed as a group. For

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this purpose and in order to have as many of the individual officers attend these discussions, prior appointments were arranged through the enumerators. Finally a total of 23 such group discussions were held at the 8 sites.

Observations

Observations aimed at recording consumers' behaviour in relation to domestic water use both in the home and at the improved water points were made by the enumerators at 5 of the 8 selected sites. Separate observation guides were used for recording well-site and household overservations. The three sites which were not included were Ali, Lante and Djido Cambel (explanations are given under constraints).

At each of the 5 sites, three willing households, i.e., a total of 15 households, were selected for the household observations with the help of the water point operators. Each of these households was observed for a total of 2 to 3 times per season. The duration of these observations varied between half to a full day. All in all, 42 dry season and 43 wet season household observations were made.

Similarly, at each of these 5 sites 3 to 10 well-site observations were conducted. The observation periods in terms of hours per observation at the sites were on the average longer than those of the household observations. However, two of the water points (Ali and Djido Cambel) were virtually closed down during the rainy season (as people were using other more "accessible" sources) and observations could not be carried out. A total of 28 dry season and 16 wet season, well-site observations were made. The table below summarizes these figures.

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TABLE 2. Summary of Interviews and Observations Conducted Per Study Site

Name of Site	No. of Peasant Associations Using Improved Water Source	Estimated No. of Households Using Improved Water Source	No. of Households Interviewed	Percent of Households Interviewed	No. of Group Interviews Conducted	No. of Observations Conducted Per Season			
						Well-Site		Household	
						Dry	Wet	Wet	Dry
Ali	1	600	63	10.5	1	-	-	-	-
Chancho	1	740	140	18.92	2	4	4	9	9
Daleti	2	380	87	22.89	4	5	-	9	9
Lante	1	650	65	10.00	1	-	-	-	-
Mermersa	4	665	132	19.85	4	4	4	9	9
Muda	4	500	108	21.6	6	5	5	9	9
Djido Combel	11+	1600+	156	9.75	1	-	-	-	-
Melka Jido	3	398	90	22.61	4	10	3	9	9
Total	27+	5533+	841	19.26	23	28	16	45	45

+It was reported that these numbers are slightly low.

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Constraints

Initially, 6 enumerators were recruited from among high school graduates (with one exception) and given training on the objectives of the study and on the use of the data collection tools. One of these enumerators did not have that level of education but was the only one who could speak the language (Afar) of one of the sites (Awre Melka). He later withdrew for health reasons and as no replacement could be found, the site too had to be abandoned. The initial 6 sites and 6 enumerators had to be brought down to 5.

However, in order to make up for this loss as well as to broaden the scope of population coverage, 3 new sites were selected and included. These were Ali, Lante and Djido Combel. While the group and household interviews were conducted in all 8 sites, these new sites could not be included for the observations. These observations required staying at the sites, but finding accomodation for the enumerators was impossible.

One of the initial 5 sites (Bika) was not properly working for a long time and the research team had then intended to alternate between this and another improved water point (Muda) some 2 kms. away. Bika was finally closed down as a result of too frequent breakages of the pump due to silt seepage and Muda replaced Bika for this study. Nevertheless, some of the households from Bika who also shifted to Muda to draw domestic water, and which had been earlier included in the sample, were interviewed.

Attempts to conduct laboratory tests on water samples failed mainly because of technical problems. In order to carry out simple tests for

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fecal coliforms, the research team was told to transport the water samples to the laboratory in Addis Ababa within the shortest possible time. Even this would have been attempted had it not been for various extra assignments given to members of the research team. The teams' effort to engage one laboratory technician to conduct the tests at the sites did not work for similar reasons. Perhaps these tests could be taken up in a follow-up study.

All but the 3 newly selected water points have had at least one breakage or malfunctioning of pumps and/or generators during the period of this study. At some of the sites, this occurred upto 3 times and, more often than not, repair services were not readily available. These incidents affected the progress of the study and, particularly, the well-site observations which depended on the functioning of the points for at least parts of each season. These frequent incidents also influenced - though unable to say exactly to what extent - the research team's relationship with the people (and particularly the leaders of the peasants' associations) who began to question the value of the study since nothing could be done by the team to repair the breakages. An extra effort had to be made to explain that one of the objectives was to study how efficiently these maintenance services were provided.

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II. FINDINGS

1. Socio-demographic Characteristics of the Sample Population

As indicated earlier a total of 841 households were covered by the household interviews. Some very general information regarding the size of these households, the age and sex composition of the population and the marital status of the household heads were gathered with the objective of obtaining some baseline demogrphic data which may have a bearing on domestic water use. For similar purposes, basic information about levels of education, types of occupations, yearly income, and housing conditions were also gathered.

In general, responses were satisfactory. Answers to questions about age and income were, however, not so satisfactory. In relation to age, respondents appeared to be quite uncertain as is to be expected in rural, illiterate communities where concepts of time (and of space or distance) are quite vague. In respect to income too, this problem of reckoning appears to have contributed to the respondents' inability to state their yearly incomes which are almost wholly measured in crops produced primarily for domestic consumption. Our question on income assumed an ability, on the part of respondents, to convert their yearly crop production into a cash estimate. Not only did respondents lack this ability, but they also seemed reluctant to answer the question for various reasons of which fears about taxes and all sorts of levies could be other justifications.

Within these limitations, we can nevertheless attempt to describe the population covered by the study. Perhaps with the exception of one of the study sites (Chancho), the remaining 7 communities manifested similar rural characteristics in many aspects. The Chancho population however, manifests much more of the characteristics of Ethiopian road-side towns than the remaining communities and to that extent, its population could be considered quite different. Later, we shall try to see how far these characteristics may be related to domestic water use.

1.1 Age, Sex and Household Size

In the 841 households covered in this study, there are 4144 persons which would give an average household size of 4.93 persons. This is slightly above the 4.4 persons per household estimated for rural communities of the country as a whole (SCO, 1978). Although there are variations among the 8 communities, in most of them the number of persons per household lies around this average household size of 4.93. The extreme cases are Chancho, which has an average of 4.43 and Daleti and Djido Combel which respectively have 5.85 and 5.37 persons per household (see Table 3).

TABLE 3. Average Household Size by Community

Community	Average Household Size
Ali	4.78
Chancho	4.43
Daleti	5.85
Lante	4.91
Mermersa	4.72
Muda	4.81
Djido Combel	5.37
Melka Jilo	4.61

Out of the total population of 4144, 48.22% are females. This gives a male to female ratio of 107 to 100. This is again slightly higher than the ratio of 103 to 100 estimated for rural communities (CSO, 1978). While all 7 communities share this rural characteristic of male-female distribution, Chancho does not as it has a large proportion of women (55.16% or a male to female ratio of 81 to 100). This is one of the characteristics that renders Chancho to reflect more of an urban than a rural community picture. (The urban male to female proportion for the country is estimated to be 90 to 100 - see CSO, 1978).

On the whole, the sample population (i.e., 841 household heads and 667 spouses) is young, with an over all mean age of about 36.73. This breaks down into mean ages of 40.85 and 31.55 for household heads (predominantly men) and their spouses respectively (see Table 4 for details). While the age ranges for the household heads is from 15 to over 61, for their spouses the lower limit is less than 15 - thus

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indicating, to a limited extent, the fact that women in rural Ethiopia tend to marry at a very early age. In fact, the spouses are much younger than the household heads since over 80% are below 40 while only 55.65% of the household heads are below that age.

TABLE 4. Mean Age of Household Head and Spouse

Community	Mean (M) Ages and Number (N) of				
	Household Head		Spouse		Total
	M	N	M	N	
Ali	44.07	63	37.17	49	41.05
Chancho	45.89	140	37.14	73	42.89
Daleti	50.56	87	43.19	64	47.46
Lante	36.76	65	29.15	51	33.41
Mermersa	38.06	132	27.88	112	33.39
Muda	41.70	108	32.03	87	37.39
Djido Combel	34.35	156	27.63	151	31.04
Melka Jilo	38.68	90	27.30	91	33.29
Total	40.85	841	31.55		36.73

This age structure of the sample population may also indicate the existence, in these communities, of a large number of people (80.7%) who fall within the productive age group of below 50. However, these findings may be misleading if they are not related to the fact that the country's population as a whole is young and that the average life expectancy is around 40 (CSO, 1978). The apparent youthfulness of the sample population and its assumed productivity may not, however, mean much when the virtual absence of such basic services as education, health, nutrition and the like are taken into consideration.

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Except Chancho, in the case of the other 7 communities, the large majority (78.12%) of the total household heads are married (see Table 5) followed by those who are widowed (8.8%), separated (6.66%), single (4.28%), and those who are divorced (2.14%). In Chancho, however, the situation is conspicuously different as only 52.14% of the sample household heads are married.

Moreover, the majority of the household heads in Chancho are women. Roadside towns like Chancho do often serve as transition posts for women, often young, who run away from the drudgery and oppressive nature of the life in relatively backward, rural communities.

TABLE 5. Proportion of Household Heads that are Married

Community	Percentage of Household Heads that are Married
Ali	77.78
Chancho	52.14
Daleti	72.40
Lante	78.46
Mermersa	85.61
Muda	81.48
Djido Combel	89.10
Melka Jilo	90.00
Total	78.37

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1.2 Education, Occupation, Income and Housing Condition

The inavailability of educational programmes particularly in rural communities in the country has for long resulted in one of the highest illiteracy rates in the world. The communities covered by this study very much reflect this situation as the majority of all household members (76.26% of the 4144 persons) said they were illiterate (see Table 6). This is interesting in light of the fact that since the start of the National Literacy Campaign, an estimated 30-35% of the population is said to have become literate (National Literacy Campaign Coordinating Committee(NLCCC). Nevertheless, even a literacy rate of about 24% found in these communities is a considerable achievement in comparison to the less than 10% (NLCCC) that had prevailed before the revolution of 1974.

TABLE 6. Literacy Status of Household Members

Community	Proportions of Members that are	
	Illiterate	Literate
Ali	70.64	29.36
Chancho	67.44	32.56
Daleti	53.69	46.31
Lante	57.76	42.24
Mermersa	87.45	12.55
Muda	94.9	5.1
Djido Combel	74,49	25.51
Melka Jilo	88.24	11.76
Total	76.2	23.8

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Though some 60.32% of the total members of these households were not attending any educational programmes at the time of this study, the fact that nearly 40% are attending literacy and other programmes is also encouraging (see Table 7). For the majority of those not attending, lack of programmes, ill health and age (either too old or too young to attend) are the most frequently cited constraints.

TABLE 7. Current Attendance of Educational Programme

Community	Percentage Attending
Ali	60.80
Chancho	44.44
Daleti	60.29
Lante	63.49
Mermersa	4.46
Muda	63.69
Djido Combel	29.86
Melka Jilo	18.62
Total	39.68

It must here be pointed out that the success of any educational programme and particularly programmes such as the literacy campaign is to be judged not so much by the number of people who are enabled to read and write but more by their ability to impart basic, functional knowledge and skills that enable the population to lead a better and longer life. The question of whether or not education per se does lead to such a life is a complex one and no attempt has been made to

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establish causal relationships between education and the use of water. However, possible associations that may exist between this educational status of the sample population and its water related behaviour has been explored as much as the nature of the study permitted.

In response to the question about occupation, a few respondents gave more than one as their main means of livelihood and one respondent in Daleti declined to respond to the question. The majority (71.94% of the 841 household heads) gave farming as one of their main means of livelihood (see Table 8); 17.84% mentioned cattle raising; and 12.96% and 2.5% gave trade and crafts as their occupations respectively. Some 12% said they were engaged in a variety of occupations such as clerical, teaching, working in bars, and selling local drinks.

The exception to this over-all picture is again Chancho where the large majority of the sample population (95.95%) is engaged in occupations other than agriculture.

TABLE 8. Occupations of Household Heads by Site

Community	Percent of Household Heads Engaged In				
	Farming	Cattle Raising	Trade	Crafts	Other
Ali	53.97	-	9.52	6.35	30.16
Chancho	2.03	2.03	47.30	6.76	41.89
Daleti	54.65	2.33	26.74	2.33	13.95
Lante	95.38	-	1.54	-	3.08
Mermersa	52.85	47.15	-	-	-
Muda	100	-	-	-	-
Djido Combel	72.78	16.11	5	2.78	3.33
Melka Jilo	73.01	22	4.99	-	-
Total	71.94	17.84	12.96	2.5	12.01

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As shown in table 9 below, the combined yearly incomes of the households ranges between less than 100 birr to over 1,000. For the sample population as a whole, the mean yearly income is about 437.95 Birr.* While the lowest mean income is that of the population in Ali (265 Birr) which is a comparatively new settlement (for displaced persons from Wollo and Tigrai) the highest mean incomes are those of Mermersa (642.68 Birr) and Melka Jilo (526.67 Birr) both of which are more stable agricultural (farming and cattle raising) communities.

TABLE 9. Mean and Median Yearly Incomes of Households**

Community	Number	Income in Birr	
		Mean	Median
Ali	63	265.00	204.05
Chancho	148	493.58	438.96
Daleti	86	498.84	425.50
Lante	65	176.15	171.72
Mermersa	246	642.68	647.17
Muda	108	349.54	409.19
Djido Combel	180	333.89	291.99
Melka Jilo	90	526.67	509.59
Total		437.95	409.38

*1 Ethiopian Birr is approximately US$0.48.

**The median yearly incomes in the various sites reveal more clearly than the averages, the disparity of incomes prevailing among individuals in each site.

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Apparently, the incomes of those engaged in cattle raising are the highest with a mean yearly income of 602 Birr (six hundred two). This is followed by those engaged in various other occupations (567.17 Birr), trade (439.91 Birr), farming (409.4 Birr) and crafts (380.43 Birr).

With the exception of Chancho and, recently, of Daleti, houses in these communities are often circular in shape, built of wood plastered with mud and grass-thached roofs. Invariably there are no windows and whenever they are available they are rarely opened. In both Chancho and Daleti, houses have corrugated metal roofing which is better suited for collecting rain water, though this potential is not systematically exploited.

Tha majority of these houses have only one (49.66%) or two (37.10%) rooms. The rest have 3 (8.74%), 4 (2.8%) and 5 and above (1.69%) rooms. This comes to an over-all average of 1.52 persons per room. The situation at each of the sites shows variations with Chancho having more space per person (an average of only 0.98 persons per room). Mermersa and Melka Jilo have the most crowded housing situation with 2.23 persons and 2.21 persons per room respectively (see Table 10 below).

TABLE 10. Number of Persons Per Room

Community	No. of Persons Per Room
Ali	1.66
Chancho	0.98
Daleti	1.19
Lante	1.59
Mermersa	2.23
Muda	1.46
Djido Combel	1.82
Melka Jilo	2.21

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This situation is further compounded by the fact that in many of these houses living quarters are also used for a number of domestic activities including for keeping domestic animals. For instance, cooking is done in living quarters in 65.16% of the cases while animals are kept in the house with people (usually with inadequate partitions) in some 21.9% of the cases.

Similarly, the large majority of the houses (78.12%) have no toilet facilities and the people use the open field or woods. Needless to point out, this rather poor housing and sanitary condition must have a bearing on the people's health. The possible contributions of improved domestic water supply can be fully realized only when such provision is integrated with, among other things, improved health and sanitation practices and services (see Saunders and Warford, 1978; White, Bradely & White, 1972; Feacham, Burns, et.al. 1978).

Among the study sites, the situation in Ali, Daleti and Chancho appear to be better where the majority of the households use separate kitchens and pit latrines (see Table 11 below).

TABLE 11. Availability of Kitchen and Toilet Facilities

Community	Percentage of Household with	
	Separate Kitchens	Laterines
Ali	52.38	71.43
Chancho	86.43	57.86
Daleti	67.82	37.93
Lante	23.08	23.08
Mermersa	15.15	2.27
Muda	19.44	None
Djido Combel	9.62	6.41
Melka Jilo	10.00	1.11

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2. Sources, Quantities and Methods of Collecting Domestic Water

At least once every day women, children and sometimes men leave their homes carrying a variety of water containers to collect domestic water. In all of the study sites a number of water sources are available and used. Depending on the season and the choices they make, the people may travel distances as far as 10 to 15 kilometers or as near as a few meters to fetch water. In most of these sites, these choices get more and more narrowed with the approach of the long, dry months and, eventually, most of the traditional, unimproved sources dry up and the people are left with but the improved sources at the peak of the dry seasons.

On the average, respondents draw water at least once a day. Seasonal and site variations do exist. In all of the sites, frequencies of collection increase in the wet season. Among the sites too, there are differences in regard to the number of collections per day. Interestingly enough, however, these variations in frequency of water collection do not appear to make any significant differences in the amount of water collected per day in both the dry and wet seasons.

A variety of water containers with as varied shapes and sizes are used for collecting, transporting and storing domestic water. More often than not, these are vessels made and/or purchesed within the localities themselves. In some of the sites containers such as plastic and metal jerrycans, pails, and barrels, are used and these are often obtained from relatively more distant markets. Invariably, women and smaller children (often females) are assigned with the

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duty and responsibility of collecting domestic water (see pictures 1 and 2). One of the familiar sites in rural Ethiopia are these women drawers who often carry "ensiras" (clay pots) full of water on their backs, strapped to their chests with pieces of rope, and trudging along rough paths and difficult terrain. In a few cases donkeys are used to transport water in plastic bags, jerrycans or skin bags. In still other cases, water-filled barrels are pushed and rolled, often by men, on the ground to the home. No doubt a considerable amount of energy and time are expended every day on the collection and transportation of domestic water in the communities covered by this study.

The significance of water in household life needs no elaboration (see G.F. White, et.al, 1972). Both the quantity and quality of water for domestic use, i.e., consumption, hygiene and amenities, affect life in general and well-being and productivity in particular. Consequently, the provision of domestic water that is of acceptable quality and quantity to meet at least the basic needs of people becomes a prime responsibility of government as well as of the communities themselves. From the purely technical point of view, the provision of such improved water supply may simply be a matter of finance, but equally important, if not more so, is the question of utilization of these provisions. Past studies and experiences both in Africa and elsewhere have shown that a variety of social, economic and cultural factors influence people's water-use behaviour. This study too appears to confirm these past experiences.

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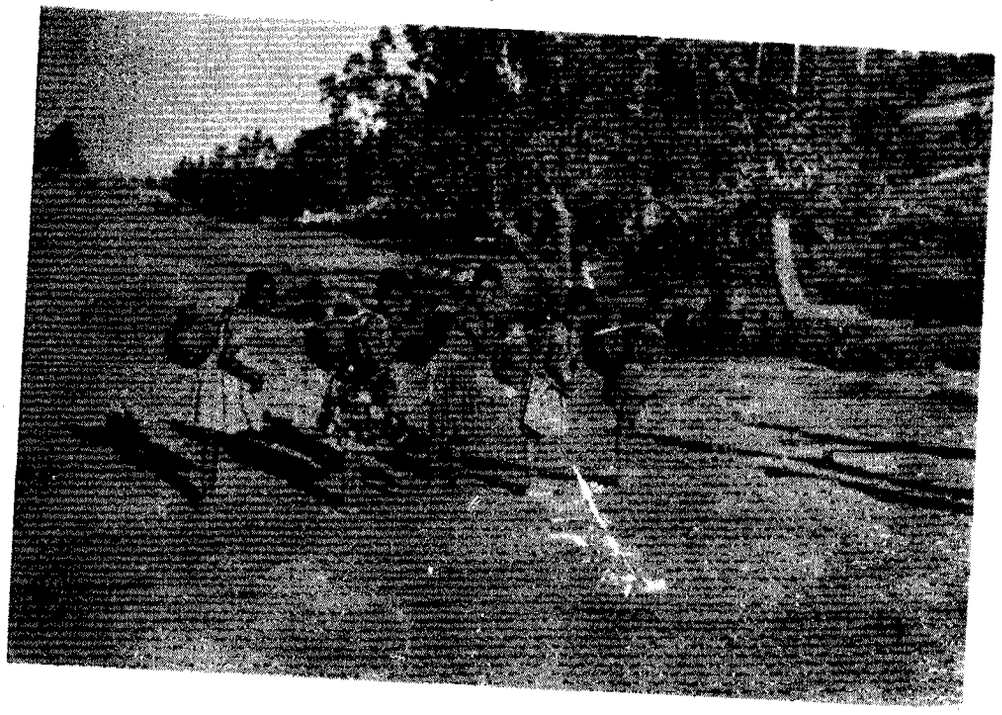
PICTURE 1. A Woman with "ensira" and men with jerrycans



PICTURE 2. "Ensira" and water collectors - compatible size

2.1 Sources Used

On the average respondents at each of the 8 study sites mentioned use between 4 and 5 different sources from which they draw domestic water. While the smallest number of sources (4) was given by respondents in Chancho, the largest number (7) was given by those in Djido Combel (see Table 12 below for details).

Although there are variations among the study sites, the improved sources and rivers appear to be more frequently used by larger number of households in the dry seasons (see picture 3). In the rainy months, ponds and rivers assume greater importance. The exceptions to this generalization are Ali, Chancho and Lante where the improved sources are used by relatively more households even in the wet seasons. All three sites are comparatively more nucleated with the improved water sources located in the midst of these communities. In the case of both Chancho and Lante, this proximity is supplemented by provisions of a number of public stand posts to which water is brought by pipes thereby minimizing queuing. Since there appears to be a relationship between the quantity and sources of water used and the time required to transport water (time required being largely a function of distance and queuing*), it is possible to conclude that the comparatively higher

*This conclusion is drawn with caution since factors such as mere socialization among water drawers may affect the time taken to collect water. Moreover, the respondents' estimation of time leaves a lot to be desired. Despite this, respondents said that on the average 91.07% of the time required is taken up by queuing (42.6%) and travelling to and from water sources (48.47%).

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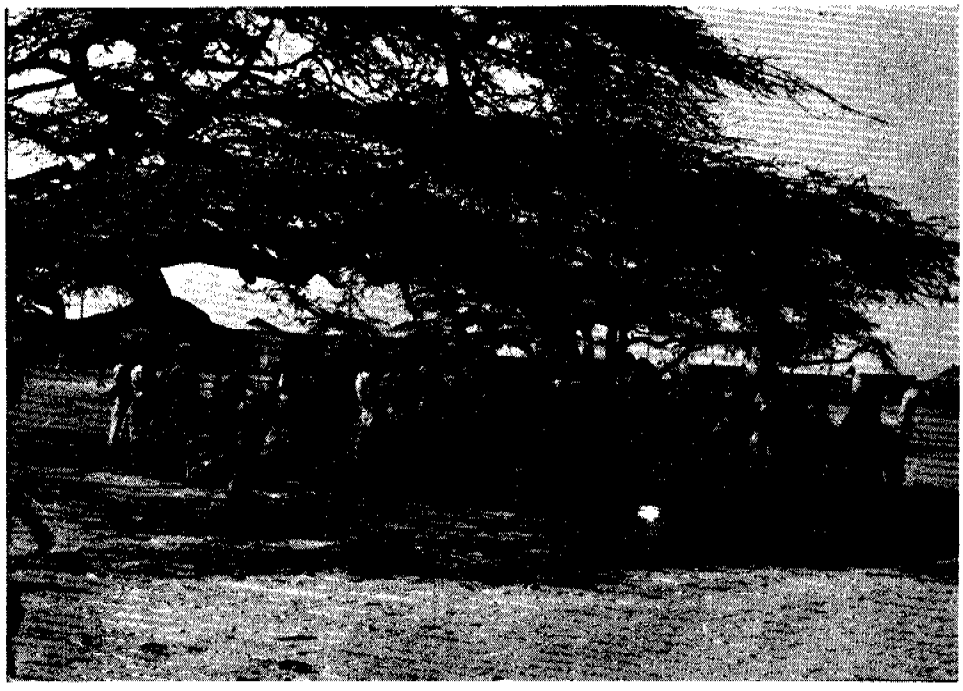

PICTURE 3. The shade of a tree helping to keep water from an improved source clean and cool under a scortching sun.

utilization of the improved water sources at these three sites is partly a reflection of these factors. However, the fact that a large proportion of the household even in these sites continue to use more distant, unimproved sources does indicate the existence of other factors influencing choice and utilization of sources. Some of these factors will be discussed later.

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TABLE 12. Water Sources Used by Study Site and Season

Study Site	Percentage of Household Using Various Sources													
	Dry Season Sources							Wet Season Sources						
	Borehole	Spring	River	Pond	Well	Lake	Irrigation Canal	Borehole	Spring	River	Pond	Well	Lake	Irrigation Canal	Rain Water
Ali	42.28	22.76	26.02	8.13	-	-	0.81	37.90	7.26	20.97	12.90	-	-	6.45	14.52
Chancho	54.55	7.44	38.02	-	-	-	-	35.22	6.29	21.70	-	-	-	-	36.79
Daleti	34.70	0.91	24.66	38.81	0.91	-	-	10.05	-	9.52	34.92	1.59	-	-	43.92
Lante	47.76	-	35.07	-	7.46	8.96	0.75	52.00	-	32.00	-	4.00	7.20	-	3.20
Mermersa	82.39	-	17.61	-	-	-	-	11.76	-	84.97	-	-	-	-	3.27
Muda	40.64	1.60	34.22	-	-	22.46	-	4.13	-	-	82.64	-	9.09	-	4.13
Djido Combel	36.59	-	33.8	20.21	0.70	0.35	8.36	14.02	-	5.14	70.09	-	-	-	10.75
Melka Jilo	8.99	40.74	19.05	31.22	-	-	-	1.63	5.69	21.95	59.35	-	-	-	11.38
Total	42.46	8.32	29.26	13.78	0.91	3.58	1.69	21.83	2.64	23.52	29.67	0.59	1.47	0.59	19.71

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Although the distance of sources has been given as one of the factors influencing choice of sources, it was found that the time required to transport water from the improved sources to the homes of the majority of the respondents was no greater than that required for other, unimproved sources. As can be seen from Table 13 below, the mean time required to transport water from the improved sources is one of the smallest. Moreover, for over 75% of those using the improved sources, collecting and transporting water from these sources takes less than an hour. Ponds and lakes are apparently as near for the majority of the respondents (for 80.23% and 78.43% of the respondents respectively), but the fact remains that significant proportions of these same households use such more distant sources as rivers, lakes and irrigation canals.

TABLE 13. Time Required to Collect Water from Various Sources

Water Sources	Percentage of Household Requiring					Mean time (in minutes) required to collect water
	Less than 30 minutes	Less than 60 minutes	Less than 90 minutes	Less than 120minutes	Over 2 hrs	
Borehole	55.63	75.44	81.14	87.96	12.04	52.10
Spring	25.00	34.56	36.76	43.38	56.62	128.38
River	30.04	47.38	57.26	64.92	35.08	95.67
Pond	62.76	80.23	90.57	90.80	9.20	44.84
Lake	19.61	78.43	90.20	98.04	1.96	50.49
Irrigation Canal	25.40	34.92	39.68	47.62	52.68	119.44
Rain Water	100	100	100	100	-	5

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This does not mean, however, that distance has no role in the choice of sources. Granted that there are a number of other factors such as income, level of education, and perceptions of water quality and quantity that are related to choice of sources. It has been suggested that upto a certain distance, these other factors play equally important, if not more important, roles in the choice of sources. Beyond that distance, however, the time and energy required to collect and transport water assume greater significance. In this study, however, no such pattern could be established as we will see later.

2.2 Quantities of Water Drawn

On the average, households draw between 43 and 47 liters of water per day in the dry and wet seasons respectively. On the basis of this and, taking the combined average size of households, the average daily per capita consumption of water comes to between 9 and 10 liters. (See Table 14 below for details). Both the household and well-site observations yielded essentially the same information. The observed households on the average draw about 60 liters of water per day, and their average per capita consumption comes to slightly over 13 liters per day. However, these observed households cannot be taken as representative as, to begin with, they were willing participants and, hence, very much conscious of their water use behaviour and, secondly, at least in two of the sites (Chancho and Melka Jilo), a number of local drink sellers were included (for want of more oridinary consumers

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of water) and both the amount of water drawn and per capita consumption were thereby inflated.

The well-site observations, on the other hand, revealed much lower amounts of water (30 liters) per household per day. Here again, there is an under-estimation as these observations could not include water drawn from sources other than the improved one. The observations indicated that some 30 liters (or 60-70%) of the water consumed by the observed households come from the improved sources. Although this shows a high and, therefore, encouraging rate of improved source utilization, the finding cannot be generalized to the population of the communities studied.

TABLE 14. Mean Amount of Water Collected and Average Per Capita Consumption by Site and Season (in Liters)

Site	Mean Amount of Water Drawn in			Average Per Capita Consumption in		
	Dry Season	Wet Season	Total	Dry Season	Wet Season	Total
Ali	43.89	38.49	41.19	9.18	8.05	8.71
Chancho	37.50	28.00	32.75	8.47	6.32	7.39
Daleti	57.53	68.91	63.22	9.83	11.78	10.81
Lante	29.92	35.77	32.85	6.09	7.29	6.69
Mermersa	47.42	46.44	46.93	10.05	9.84	9.94
Muda	42.13	44.17	43.15	8.76	9.18	8.97
Djido Combel	41.35	50.19	45.77	7.70	9.35	8.82
Melka Jilo	43.78	67.89	55.83	9.50	14.73	12.11
Total	42.94	46.97	44.99	44.99	9.53	9.75

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Seasonal and site variations in the amount of water drawn do exist. These range between slightly less than 33 liters per day (Lante and Chancho) and over 55 liters per day (Melka Jilo and Daleti). Similarly, the average daily per capita consumption ranges between a little less than 7 and over 12 liters for the same 4 sites. This is again interesting because the sites with the lowest daily collection and consumption of water are those that are more nucleated and, since their improved sources are more conveniently located, one would have logically expected to see comparatively higher amounts of water collection and consumption at these sites.

Earlier studies (White, et.al.1972, WHO 1979/1980) have shown that daily per capita consumption of water in developing countries in general and in their rural areas in particular falls far below the minimum required for consumption, hygiene and for some amenities. Although the minimum required is a function of a number of climatic, topographic and economic factors, the communities covered by this study have much lower per capita consumption (7 to 12 liters) than the minimum of 20 liters identified by White for his East African communities. Our finding in this regard is very much similar to that found by Seblewongel Yeshewaloul (UNICEF, 1982) in Shoa Administrative Region.

According to White, et.al.(1972), larger quantities of water are collected within the critical distance of 1 mile and once that limit is passed, the amount of water drawn tends to decrease. Our finding does neither confirm nor refute this to any conclusive degree. Attempts

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to relate the time required, i.e., as a measure of distance, to collect water and the mean amount of water collected were made but no such pattern of collection as described by White could be established. Our data from the interviews gives a comparatively lower amount of water collection by those having to travel less than 10 minutes (hence suggesting proximity of the sources used). Then amount of water collected increases only to fall of and rise again as the time required increases. This is perhaps to be explained by the respondents' and enumerators' errors in estimating the amount of water collected. Because of their inability to make accurate estimates in liters, respondents were asked for the containers they use and the sizes of these were estimated by the enumerators. Similar problems of estimation were also encountered in relation to the time taken to collect water. In the absence of more accurate measurements, these alternatives were sought.

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TABLE 15. Time Required to Collect Water by Mean Amount Collected

Time Required in Minutes	Mean Amount of Water Collected in Liters
Less than 10	37.25
20	48.23
30	45.61
40	39.24
50	45.00
60	56.09
70	39.52
80	53.67
90	46.67
120	55.80
Over 120	52.41

Although the representativeness of the households that were observed may be questioned, they showed a more consistent pattern in which both the frequencies of collection and amount drawn tended to increase with the proximity of sources. This is particularly true of frequencies of collection. As distance increases, frequencies tend to decrease while quantities of water drawn per day appear to remain rather stable. The limitation to the generalizability of these observations has already been pointed out earlier. In this finding regarding distance and quantity, the fact that they were being observed by an outsider appears to have affected their choice of water sources and, therefore, the distance travelled to collect water. More often than not they used the improved sources.

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2.3 Ways and Means of Collecting Water

The collection of water is predominantly a task left for women and female children. In rural Ethiopia, it is a common practice that the ardous task of gathering fire wood is also assigned to women and small children. These tasks are considered ardous not only by the relative scarcity of both water and wood but also by the climate and terrain of most parts of the country. No doubt, the difficult nature of the task coupled with both the physical weakness of the persons responsible for collecting water and the size of containers used are bound to affect both the frequency and amount of water collected. Though a number of other factors are involved, that modes of collection influence frequency and amount of collection has been ascertained by White et.al.(1972), in the East African study mentioned earlier.

In this study, it was found that the large majority of the households (84.67%) draw water at least once per day. Over half (56.92%) collect at least twice in a day. However, it must be noted that seasonal variations exist. In the dry seasons, 79.26% and 53.56% collect at least once and twice per day respectively. Apparently because of the comparative proximity of wet season sources and probably because water use habits change along with changes in the weather (more frequent washing and cleaning in the rainy and muddy seasons), some 90.29% and 60.43% of the households draw water at least once or twice per day respectively in the rainy months. This is perhaps another indication of the relationship between distance and frequency

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of water collection since we have seen earlier that respondents tend to use more and closer sources like ponds, rain water, and rivers in the rainy seasons.

This relationship between frequency of collection and distance is again brought out by the variations among the study sites since frequencies of collection are significantly higher in the more nucleated communities having closely located improved sources. Thus, Melka Jilo and Mermersa which are two of the more scattered settlements have much lower frequencies of water collection. In the wet season, however, these frequencies even for these sites dramatically increase.

Interestingly enough, there are seasonal variations in the members of households collecting water. While more household heads (34.26%) collect in the dry season, this decreases to a mere 23.62% in the wet season. Since the task is more ardous in the dry season, it is perhaps understandable that household heads (usually men) should share it with their spouses and children. On the average, however, it is still the women (43.95%) that are responsible for water collection as compared to the 28.92% of household heads followed by small children (27.13%).

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TABLE 16. Persons and Frequencies of Collecting Water by Site

Site	Percentage of Households in which Water Collection is done by			Percentage of Households in which Daily Collection of Water is done					
	Household Head	Spouse	Children and Others	At Least Once			At Least Twice		
				Dry	Wet	Total	Dry	Wet	Total
Ali	20.73	47.56	31.71	100	93.90	96.95	87.80	76.83	82.32
Chancho	43.62	22.45	33.93	89.85	92.31	91.07	72.08	54.36	63.27
Daleti	14.88	23.81	61.31	95.24	83.33	89.29	88.10	36.90	62.50
Lante	17.95	49.36	32.69	100	100	100	73.97	63.86	68.59
Mermersa	39.79	41.65	18.56	51.44	78.51	64.95	12.76	30.58	21.65
Muda	13.37	54.10	20.36	96.27	98.44	97.23	69.57	75.78	72.32
Djido Combel	20.10	61.06	18.84	96.65	98.41	97.49	56.46	81.48	68.34
Melka Jilo	39.55	45.45	15.00	26.27	99.02	60	16.95	98.04	54.55
Total	28.92	43.95	27.13	79.26	90.29	84.67	53.56	60.43	56.92

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Most of the time (68.98% of the time), water is carried or - in a few instances - pushed and rolled in a container by people. In the remaining 33.02% of the time donkeys are used to carry water. The more nucleated the community and, hence, the proximity of at least the improved source, the more water tends to be transported by people. In the more scattered communities like Melka Jilo and Mermersa, donkeys are more frequently used.

Similarly, the types of water carrying vessels vary apparently on the basis of their suitability for the particular mode of transport employed. Thus, "ensiras", gourds, pails and some times tin cans are often carried by people. Barrels which are too big to carry or load on donkeys are often rolled on the ground to the home. Containers such as jerrycans, plastic bags, tyre tubes and debbe cans are often loaded and transported on donkeys. "Ensiras" are exclusively carried by women and female children. The mode of transport (carrying or the use of pack animals), the type of containers used and distance are all related. For instance, barrels are exclusively used by those near the source and, often, in more nucleated communities. (See pictures 4 and 5).

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PICTURE 4. Queues of men, women, "ensiras" and jerrycans at an improved source.

PICTURE 5. Barrels have joined the queue.

TABLE 17. Containers, Tasks for which They are Used, Mean Prices and Methods of Transportation

Type of Container	Modes of Transport (%)		Mean Prices of Containers in Birr*	Role of Utilization (in %) for		
	By People	By Animals		Collecting	Traporting	Storing
Ensira	99.80	0.20	2.56	52.94	59.12	82.29
Jerrycan	1.27	98.73	15.00	13.93	16.03	0.80
Gourd	100	-	2.50	0.36	-	-
Plastic Bag	-	100	8.50	1.44	1.86	0.11
Barrel	92.31	7.69	20.00	2.40	2.56	9.37
Total	68.98	31.02				

*One Ethiopian Birr is approximately US$0.48.

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In addition to distance and the mode of transport employed, it appears that certain other characteristics of the containers such as size and capacity to keep water cool influence the specific task for which they may be used in the process of collecting, transporting and storing water. For all three tasks, "ensiras" are used the greatest number of times (52.94%, 59.12%, and 82.29% of the time for collecting, transporting, and storing respectively). Jerrycans and an assortment of other containers such as tin cans, skin bags, plastic or tyre tubes, and pails, are mainly used for collecting and transporting.

Partly due to traditional practice, but also because of their suitability and intrinsic qualities of keeping water relatively cooler, "ensiras" are extensively used in all of the sites for all the three tasks mentioned above (see picture 6). This is particularly true for storing water for which these clay pots are used for over 80% of the time. Moreover, with the exception of smaller cans and gourds, "ensiras" have the lowest mean prices and are comparatively more readily available in the local markets.

While "ensiras" have these advantages, they are nevertheless not quite suitable for carrying other than on the back. But this is said to affect, sometimes very seriously, the physical posture and, particularly, the hip and pelvic bones of the women who carry them every day and from early childhood. "Ensiras" are also less durable compared to those containers made of metal or plastic and in the long run households may end up paying more for these vessels. However, poor subsistence farmers are more concerned in and capable of affording the

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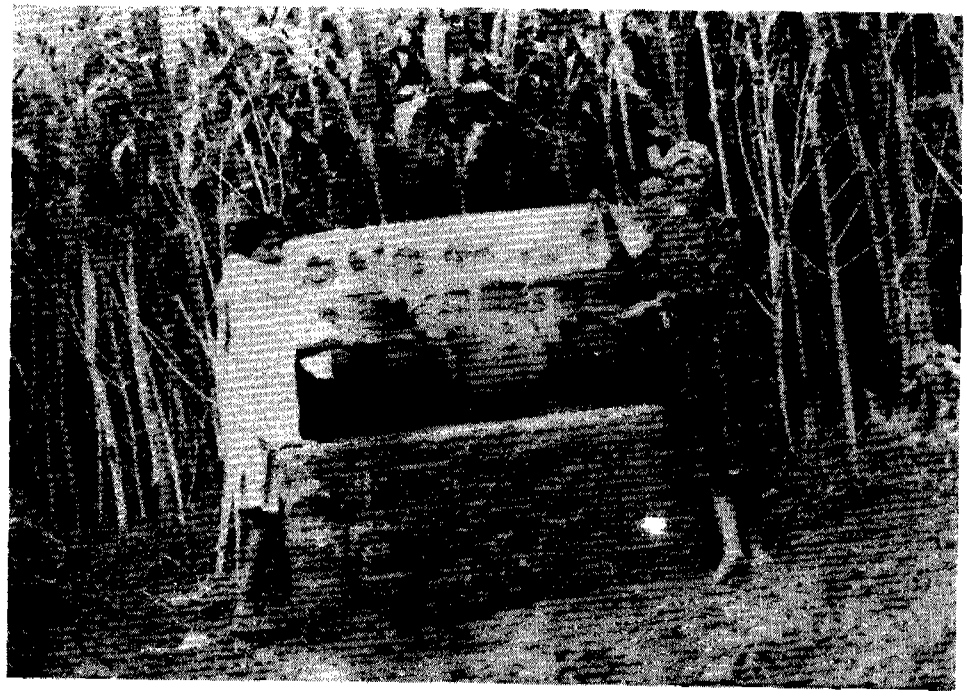

PICTURE 6. Collecting water in "ensiras" at an improved source.

cheaper vessels that meet their immediate needs. The need for a more appropriate and convenient vessel is, therefore, quite apparent. An attempt to provide such a vessel and an alternative mode of transport needs to take a variety of factors into consideration. Not only should these alternative methods be perceived culturally acceptable, but they must also be within the economic means of the users in order to be adopted.

3. The Cost and Various Uses of Domestic Water

The cost of obtaining domestic water is a function of a number of inter-related factors such as the actual cost of water per liter, the size, price and durability of containers used in obtaining and storing water, the time and energy expended in obtaining it, the income foregone (i.e., the opportunity cost incurred in obtaining water instead of doing something else that may perhaps be more productive and income generating), and the effect of the water drawn on health and, thereby, productivity (see White, et.al. 1972).

An examination of the inter-relationship of these factors has not been attempted in this study not only because such an attempt required a much more accurate measurement of variables such as energy and health costs which, by the way, require a more inter-desciplinary approach, but also because the objective in this regard was the assessment of the situation in relation to tarrif structure and collection with the view of making suggestions to EWWCA on improved practices of water point management. Needless to point out, an understanding of the

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relationship among these factors as well as their impact on water use behaviour is bound to assist EWWCA in making policy decisions regarding water supply in general and water point management in particular. Such an investigation of these factors will perhaps have to wait for a second phase of this study or may be picked by another independent study to be conducted by an interdesciplinary team.

Earlier in this report, it has been pointed out that the use of domestic water falls into three broad categories; namely, consumption, hygiene, and amenities. Within each of these broad categories, water is used for a variety of domestic activities. These activities may be carried out either in the home or at the water point itself.

The use of water for these activities, i.e., the activities themselves, how and where these are performed, the quantity of water used for each activity, etc., are also related to a complex set of cultural, social and economic factors. To the extent that our data permits, some of these factors will be examined.

3.1 The Price of Water

In the communities studied domestic water is obtained either from the improved sources or from unimproved ones. In only three of the communities (Ali, Mermersa and Djido Combel), water is sometimes bought from vendors. Water obtained from unimproved sources is obviously free though this was not the case before the agrarian reform when land-lords used to charge fees for water drawn from their private ponds or irrigation canals. In Ali, a resettlement

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community, water even from the improved source is obtained free. In all the rest water from the improved sources is bought apparently for a variety of prices per 20 liters.

The mean price of 20 liters of water at the improved source, for all seven sites (since it is free in Ali) is 3 cents, while the same amount of water costs 5 cents if bought from vendors.

What is perhaps interesting is the apparent lack of any consistent tariff structure. The price of 20 liters of water varies among and even within the sites (see Table 18 below). The official EWWCA rate is fixed at 2½ cents per 20 liters for rural communities and there appears to be no legitimate explaination (except perhaps in Chancho, Daleti and Lante where both the management and maintenance of the improved source is done by other than EWWCA), for these price variations. While interviews with the operators and fee collectors revealed the absence of any such variations, those with peasant women association leaders confirmed these price discrepancies (obtained in the individual household interviews). A partial explanation for the variations within the sites could be the fact that the bill collectors charge individual customers above the official price (often double) if they feel that the containers used are larger than 20 liters. Since this estimation of the size of containers is done with no accurate measurement, there appears to be a considerable amount of arbitrariness in the practice. This was repeatedly seen during the well-site observation at some of the sites. We will come back to this possible problem of management later in this report.

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TABLE 18. Mean Prices of Water Per 20 Liters at Improved Source by Site

Site	Mean Price Per 20 liters in Cents	Price Range in Cents
Ali	Free	Free
Chancho	2	1 - 4
Daleti	3	2½ - 5
Lante	11	10 - 15
Mermersa	7	5 - 15
Muda	2½	Fixed (2½)
Djido Combel	5	1 - 15
Melka Jilo	2½	Fixed (2½)
Total	3	1 - 15

Using the mean price and amount of water drawn per household per day as the basis of our calculations, the average household annual, cash expenditure (to say nothing of the social and energy expenditure mentioned earlier) on water comes to around 18 to 20 Birr. This is about 4 - 5% of the mean annual income of households. But if the objective is to provide rural water supply schemes aimed at raising the per capita daily consumption to the suggested minimum of 20 liters per day at the current, actual tariff structure, the cash cost to the average family will come to 72 to 80 Birr per year or 15-20% of the present mean income of households.

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From the point of view of the majority of these poor, subsistence farmers (whose stated annual incomes range between less than 100 to over a few 1000 Birr), the price of improved water can be quite beyond their ability to pay on a consistent and regular basis throughout the year. It may, therefore, be understandable that the cost of obtaining water from the improved sources should be one of the factors influencing domestic water use (i.e., sources and quantities used for various domestic activities).

On the other hand, EWWCA reports that the monies collected from water sale in most of these rural communities (especially from the scattered ones) fall far too short of the management (workers' wages, fuel, etc.) and maintenance expenses. On the average, between 8 and 10 cubic meters of water are sold per day in these sites, but this is the case only during the dry seasons. Assuming that there are on the average some 8 to 9 such dry months per year, some 19,000 to 27,000 cubic meters of water may besold per year. At the official rate of 1.25 Birr per cubic meter, this comes to an annual revenue of 2400 to 3375 Birr.

The total operation of the water points requires, in terms of manpower, an operator who runs the generators in the case of diesel operated ones, a revenue collector or clerk, and a guard. Usually, however, the same person may function as operator and revenue collector at the same time. In those cases where there are the three workers, the operator and revenue collecter are usually paid about 70 Birr

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each per month while the guard is paid around 50 Birr per month. In such sites the annual expenditure on wages alone comes to about 2280 Birr which is just about the annual revenue obtained from water sale. This means that the maintenance and fuel costs (estimated by EWWCA at 4,000 to 5000 Birr per year per improved water point)has to be borne by EWWCA or, in the case of Daleti, Lante and Chancho, by the Peasants' and Urban Dwellers' Associations respectively.

It is, therefore, clear that the revenue collected at these sites cannot cover even the day to day running costs (i.e., only wages and fuel) let alone the maintenance costs which usually have a very high percentage (sometimes upto 95%) of foreign exchange components for lubricants, vehicles, spare parts, etc. This is said to be particularly the case in the more scattered communities where apparently distance plays an important role in the utilization of the improved sources. People do not seem to use the improved sources in the rainy months in these scattered communities as alternative and more accessible sources - though unimproved - become available for use. Consequently, revenues are much lower in these sites as compared to the more nucleated ones. In this regard EWWCA's experience shows that the revenues obtained in the more nucleated communities often "cover the operation costs and some maintenance" (EWRA, 1982).

Consideration of these and other costs of domestic water supply does raise a number of ethical and political issues and problems. A genuine concern for the welfare and well-being of the people views the provision of such basic service as improved water supply a basic

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human right. In Ethiopia this concern does exist, but the realization of the objective dictated by that concern is severly limited by the scarcity of resources. EWWCA's proposed 10 year plan - though requiring a great deal of resources - is an indication of the more pragmatic view that, under the circumstances, goodwill alone cannot be expected to perform miracles. Since the above, brief discussions on the costs of providing improved water supply appear to suggest that the more nucleated the community, the more economically viable such water supply schemes would be, with the resources available to it EWWCA is justified in its emphasis of schemes for such nucleated communities. Once this decision is made, however, there is often the danger of looking for more justifications (such as the health and other social benefits accruing from improved water and sanitation schemes in crowded communities) to dwell for too long on the rather passive provision of such schemes exclusively to such nucleated communities. What will be needed is a more creative and dynamic linkage of the effort to provide improved rural water supply to other efforts for rural development of which the villagization programme (i.e., creating nucleated communities) embraked upon by the government is, in this regard, an important component.

3.2 The Various Uses of Domestic Water

The water drawn from the different sources identified earlier in this report is used for a variety of domestic activities such as drinking, cooking, washing clothes and cleaning household utencils, bathing, and making local drinks. In addition, animals and plants are watered from these sources.

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The outcomes of these activities appears to be related to the choice and use of sources. For instance, from among the sources used the improved ones are used by the largest proportion of households (33.24%) for all activities. However, these improved sources appear to be more important for activities like making local drinks, drinking, cooking, bathing, and washing clothes and household utencils (see Table 19 below). For watering plants and animals, rivers and ponds assume greater importance respectively.

A look over Table 19 shows that households seem to prefer certain sources for specific activities. For instance, from among those households using the improved sources, the largest proportion (22.43%) use the water from these sources for cooking, followed by those using it for drinking (21.65%), washing clothes and utencils (16.68%), for making local drinks (15.27%), etc. Similarly, users of the different unimproved sources appear to prefer the water they obtain from these sources for specific activities. Thus, pond users seem to prefer its water more for cooking, river users for washing clothes, rain water users for washing, spring users for cooking, lake users for washing and bathing, canal users for drinking, and well users for washing and bathing. Similarly, a look across the Table shows that for each activity, some rather than other sources appear to be preferred. Thus, for making local drinks (43%), for drinking water (37.85%), for cooking (37.56%), for bathing (32.51%) and for washing (28.66%), the water from boreholes used. For watering plants and animals, rivers (69.57% and 42.3% respectively) are used.

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TABLE 19. Source - and Activity - Specific Percentage Distribution of Households

Water Using Activity	Percentage of Households Using								Total
	Borehole	Pond	River	Rain Water	Spring	Lake	Irrigation Canal	Well	
Making Local Drinks	43[a].00 15.27[b]	20.90 10.24	20.54 10.10	5.26 7.59	4.83 9.86	3.62 14.74	1.00 10.53	0.85 14.63	100 11.80
Drinking	37.85 21.65	24.44 19.30	18.92 14.99	8.82 20.51	5.91 19.42	2.25 14.74	1.25 23.31	0.44 12.20	100 19.02
Cooking	37.56 22.43	25.01 20.62	18.50 15.31	8.66 21.03	6.55 22.46	2.15 14.74	1.01 18.05	0.55 15.85	100 19.86
Bathing	32.51 17.84	23.77 18.84	23.36 17.76	9.61 21.44	5.89 18.55	2.76 17.34	1.10 18.05	1.01 26.83	99.99 18.25
Wasing Cloth Utencil's	28.66 16.68	23.50 18.88	25.98 20.94	11.49 27.18	5.64 18.84	2.65 17.63	1.08 18.80	1.00 28.05	100 19.34
Watering Plants	21.74 0.13	-	69.57 0.56	-	4.35 0.14	4.35 0.29	-	-	100.01 0.19
Watering Animals	17.30 6.01	27.03 12.96	42.30 20.34	1.60 2.26	5.38 10.72	5.16 20.52	1.09 11.28	0.15 2.44	100.01 11.54
Total	33.24 100.01	24.08 100.01	24.00 100	8.18 100.01	5.79 99.99	2.90 100	1.12 100.02	0.69 100	100 100

Note: With 14 degrees of freedom; N = 841
Chi-Square Statistic = 490. 21; C_c = 0.2 (significant at the 0.001 level).

[a]Across - Activity - Specific Use of Sources (in percent of total households).

[b]Down - Source - Specific use for various activities (in percent of total households).

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Though this is the general pattern, there are also seasonal variations in regard to the utilization of these various sources and the activities for which their water is used. It has already been pointed out in an earlier section of this report that the proportion of households using the improved sources decreases during the rainy seasons (from 42.46% in the dry season to only 21.83% in the wet season). On the other hand, the proportion of households using such unimproved sources as ponds and rain water rises in the wet seasons. The availability of these wet season sources does affect the general relationship that exists between sources and activities mentioned above. This is particularly true in the case of those households, which collect and use rain water which is unavailable in the dry season.

In all study sites, respondents said that they use the water points (both improved and unimproved) for some of these activities. Often washing clothes and water containers, bathing and watering animals are carried out at the sources. Since the improved sources do not have provisions (except cattle trough at Mermersa, Muda and Djido Combel) for these activities, households tend to use the unimproved sources particularly for washing clothes and, sometimes, for bathing (see picture 7). In the five sites where there is no cattle trough, respondents either use their water containers to water their animals with or travel sometimes long distances in search of more convenient sources for watering their stock.

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PICTURE 7. This picture depicts one of the traditional water sources used for washing cloth and bathing. At times people may take the opportunity to entertain themselves, as in this case they are listening to a traditional "kraar" music being played by an individual.

At the unimproved sources, usually rivers and ponds, people use natural flat stones on which they wash clothes and, at times, for sitting on to bath. Obviously, the lack of even a minimum amount of privacy at these traditional sources must inhibit regular bathing. Perhaps more important is the health risk run by these users of these unimproved and often highly polluted sources.

At the 5 sites where improved well-site observations were made, a total of 589 persons (both men and women) were seen on different occasions engaged in one or another of the activities mentioned. Washing clothes or water containers, partial bathing (i.e., hands, feet, face, hair, etc.), full bathing, watering animals and even drinking were observed. With the exception of those water points where there are cattle troughs, people had to improvise different ways and means of carrying out these tasks. For instance, on a couple of occasions (in Melka Jilo) some three men used the generator room and its backyard for bathing. They either took pails of water with them or water was brought to them by friends and one another. On a number of accasions, both men and women (about 155 persons on 4 different occasions and at 3 sites) washed their hands, feet, hair, etc., by prostrating directly under the open tap. This often resulted in muddying the area around the taps. On other occasions, the same partial bathing was seen when a number of friends helped pour water for one another within the fence of the water taps at Muda.

Washing clothes was seen at 4 of the 5 observed sites and except on one occasion, this was done inside the compound of the stand pipe.

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Quite often water containers are washed - even though none thoroughly - and water appears to be constantly spilled around the taps. The overall effect of these activities has resulted in creating muddy and dangerously slippery ground right under the taps. The inavailability of appropriate provisions at the improved water points does perhaps lead not only to their under-utilization but possibly also to the inhibition of users to engage particularly in personal hygiene practices. Although the distance of these sources from the homes of users may affect the place where these activities are carried out, we would expect such provisions for washing clothes, bathing, watering animals, etc., at the improved sources to save a considerable amount of time and energy for users. This is so because, at the moment a lot of time and energy appears to be expended - to say nothing of the inconvenience of using traditional sources - on going to or collecting and carrying water from various sources for these domestic activities. Moreover, such improved and appropriate provisions may enhance the utilization of the improved sources for the other domestic activities.

4. Some Factors Influencing Domestic Water Use

So far we have briefly touched upon some of the factors that appear to be related to domestic water use in the rural communities covered by this study. In this section we shall try to examine the nature and strength of the relationships between some of the socio-economic and demographic characteristics of the households and the sources and amount of water used.

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It has been pointed out earlier in this report that both the sources used and amount of water drawn are related to a complex set of socio-economic, cultural and even to topographic and climatic factors. Studies like this one cannot be exhaustive. Indeed, both the data generated and the competence and skill of the research team has put a limit to the extent and level of statistical analysis undertaken. Consequently, the attempt has been to identify - as much as this was possible - those variables that seemed to be significantly related to domestic water use in these rural communities. In so doing, it is hoped that EWWCA will be enabled to take these factors into consideration in its efforts to design rural water supply schemes that are utilizable to the maximum extent possible. Undoubtedly, such efforts to maximize utilization of schemes will require a more accurate understanding of the ways in which these and other unidentified variables determine the choice and utilization of water sources. But this will require a different research design as well as a higher level of analysis.

Within these limitations, it has been possible to identify household size, occupation, income, levels of education of both household head and spouse, time required to collect water, respondents' perceptions of water quantity and quality and the relationship of perceived quantity and quality of water to health and disease as some of the factors associated with water use behaviour (see Table 20 below). These will be discussed below.

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TABLE 20. Chi - Square Statistic for Domestic Water Use by Households in Rural Communities

Variables[a]	Chi - Square			
	Statistic	df	p[c]	C_c[b]
Occupation X Income	139.60	18	0.001	0.35
Education X Income	123.12	20	0.001	0.36
Income X Source	51.91	20	0.001	0.19
Income X Amount	106.71	20	0.001	0.34
Education (H. Head) X Source	34.89	10	0.001	0.15
Education (Spouse) X Source	16.81	10	0.10	0.12
Education (H. Head) X Amount	91.59	28	0.001	0.31
Education (Spouse) X Amount	43.60	28	0.05	0.25
Time Required X Source	131.56	18	0.001	0.26
Time Required X Amount	91.53	14	0.001	0.32
Price of Water X Amount	58.34	16	0.001	0.31
Household Size X Amount	10.06	14	0.20	0.11
Perception of Relationship of Illness to Water X Source	31.72	10	0.001	0.13
Illness X Amount	114.73	18	0.001	0.35

a = Variables compared interms of relationship. The (X) mark stands for the phrase "the relationship between."

b = Contingency coefficient.

c = Level of significance.

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4.1 Occupation, Education, Income and Water

The large majority of the households (76.36%) are engaged in farming and raising cattle. The rest are small, retail merchants (11.16%), craftsmen (2.35%) or are engaged in other occupations (10.13%) such as clerical, local drink selling, and bartending. We have pointed out earlier that there appeared to be a relationship between income and these various occupations with the highest mean, annual incomes (602 Birr) being earned by those households engaged in cattle raising. This is followed by those engaged in occupations other than agriculture, trade and crafts, etc. Those who gave farming as their sole occupation - though they often keep a couple of heads of cattle - have the fourth highest (409.40 Birr) mean annual income.

Similarly, income and levels of education of the heads of households are positively related. The annual mean income of the illiterate household heads is about 400 Birr, and as we move to those with literacy, primary and above primary education, the annual mean incomes also rise to 471.71 Birr, 594.44 Birr, and 838.46 Birr respectively. Apparently, income and education are also related to place residence and, hence, to occupation as over half of those with above primary education are found in the relatively more nucleated community of Chancho where the large majority (95.95%) are engaged in occupations other than agriculture.

These occupational, income and educational characteristics of households are apparently related to water use behaviour. Since

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these characteristics are inter-related, we shall here briefly examine the relationship between income, education and water use. The effect of occupation on water use will be inferred from this.

Possible relationships between income and water use (particularly with the choice of water sources) is examined in order to see whether or not the use of improved water points is related to the comparative ability of people to pay user fees that are often charged at these points.

From Table 20, it can be observed that at 20 degrees of freedom (with N = 841), the relationship between income and sources and amount of water used is significant at the 0.001 level. Though significant, the relationship (particularly that between income and source used) is not very strong. Consequently, higher incomes do not apparently lead to the use of the improved sources. On the average, households with higher incomes seem in fact to prefer rain water, ponds and springs to the improved sources. In the case of quantity of water used, however, the relation of this variable to income is apparently stronger and we find a relationship in which, in general, higher incomes are related to higher quantities of water consumption per day.

The relationship between education and sources and quantities of water is statistically significant (see Table 20). However, the level of education attained by spouses as compared to heads of households is, interestingly, not so significant and is in fact weaker. Since almost all spouses are women who are often engaged in water-bound activities,

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one would expect to find more significant and stronger relationship between such characteristics of the spouses and water use. Needless to say, the rather insignificant proportion of spouses with educational levels above mere literacy (only 3.36% of all spouses) must partly explain this discrepancy. In respect to quantity of water consumed, there appears to be a more consistent rise in the mean amount of water consumed as the level of education of the household heads rises. This does not seem to be the case with rises in the level of education of spouses, although, on the average, the quantity of water drawn by households with higher levels of spouses' education tends to show an increase.

4.2 Time Required to Draw Water

The relationship between the time required to collect water and the choice of sources as well as quantity of water drawn has been raised and discussed earlier. With 18 and 14 degrees of freedom (see Table 20)respectively, time is significantly associated with sources used and amount of water drawn by households.

The time required to collect water (both as a measure of the distance travelled and the actual time and energy expended) is apparently more strongly related to both source and amount of water used. For the majority of households (66.6%) sources other than the improved ones appear to require lesser time than the improved sources. From among these sources rain water is of course more quickly obtainable followed by water from ponds and lakes. On the other hand, the

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direction of the relationship between the time required to collect water and the amount actually collected could not be determined.

4.3 Price of Water

Although the price of water per 20 liters appear to be strongly related to quantities of water drawn per day (see Table 20), this price does not apparently affect daily withdrawal since water is obtained free from a variety of sources. A more controlled situation in which households are made to collect water only from the improved sources could not be created. Nor was it possible to record the amount and frequency of water collection by households from the improved sources. Had these been practicable perhaps the possible effect of the tariff structures prevailing at the different sites on water consumption and choice of sources would have been better assessed. Observations and group interviews have, however, clearly indicated that the price of water is considered to be one of the important factors leading households to use the free, unimproved sources.

4.4 Household Size

Studies in East African (White, et.al., 1972) communities had shown that both housing density and household population were significantly related to per capital water use. Per capita consumption was found to decrease with greater density of housing and with households having larger number of children. Our data could not either corroborate or disprove this finding. The relationship between household size and amount of water drawn was perhaps the least significant (see Table 20 above).

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4.5 Illness and Water Use

A strong relationship was found between households' perceptions of water quality and quantity and sources used (see Table 20). In respect to quantitative adequacy, perceived taste, colour, and temperature, 83.56% of the households rated the improved sources either good or very good. Compared to other, unimproved sources, a smaller percentage of the households (26.72%) felt they got sick from the water obtained from these improved sources. However, the complaints identified as being related to the use of water (for instance, coughing, headache, wounds, problems of the ear, nose, throat, etc.) may not necessarily be associated with water use behaviour. While some (28.55%) of those that complained of such symptoms as diarrhea, vomiting, intestinal problems, mottled teeth, etc., associated these to the improved sources, the remaining 71.45% identified other unimproved water sources as responsible.

Respondents in three sites (Djido Combel, Mermersa and Muda) complained of mottling of children's teeth as a result of the high flouride content of the water they get from the improved sources. Though the level of the flouride content could not be known, the existence of this problem in the area around these sites could easily be noticed by a mere look at the front teeth of many of the children in these sites.

Respondents also gave explanations for their perceptions regarding the unhealthy nature of the unimproved sources. The use of these sources quite carelessly by both humans and animals was said to be an

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important cause by 27.24% of the households, followed by those who felt a lot of dirt was carried into them by rain (21.21%), living organisms such as leeches and a variety of insects, feces, etc., were washed or dumped into them (20.72%).

These perceptions of the relationship between illness and water quality do not, however, appear to result in changed water use behaviour. In other words, in order for such perception to be decisive in the choice of sources and in the use of water in general, other factors (such as distance, time and energy required, income, education, etc.) will have to contribute towards the making of the decisions. The importance of noting the complex inter-relationship that does exist among these and other unidentified variables cannot, therefore, be over-emphasized.

4.6 Other Cultural Factors

Other factors that could not be measured even to the extent that some of those discussed above were, do exist. Some of these have to do with the belief, attitudinal and other cultural systems and practices of people. The collection, transportation and performance of water-related activities are almost exclusively the domain of women among most of the nationality groups found in Ethiopia. This division of labour among family members is more strictly adhered to in some cultural groups than in others. Sometimes this cultural requirement is felt so strongly that it is unthinkable for a man to engage in domestic water

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collection. One can of course imagine the difficult situation in which unattached men may find themselves in under such circumstances.

Among the Afar*, for instance, women appeared to be responsible not only for the collection of domestic water but virtually everything else except hunting, herding cattle, camels, and warfare. Discussions with community leaders (men) showed that this rather strict cultural requirement was sometimes waived under special circumstances. If the distance to water sources is big (as is the case in the dry season) or if the women are unable to carry out their duty of collecting water, then society is apparently willing to suspend its prohibitions and the men are permitted to give their women helping hands.

The use of the improved source at Aware Melka is also influenced by the style of life as well as by certain beliefs that these Afars have. As nomads, they are highly mobile and they settle around the improved water point only for a few months in a year. For most of the year, the improved source is not used. What is perhaps interesting was the fact that even during those few months that the band comes and settles around the water point, the improved source is often used for watering animals and domestic activities rather than for direct human consumption. This was later on explained to the research team by the

*An Afar community (Aware Melka) was one of the initial sites selected for this study but was later abandoned for reasons mentioned in the introduction of this report. These comments on the afar are based on preliminary discussions held with community leaders.

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community leaders. They apparently feel that water drawn from so deep in the ground cannot be clean and pure for human consumption since, they believe, dead people who are burried deep down in the ground do some - how "swim" and "bath" in it. Although there was no known graveyard nearby, this did not seem to matter and, according to their view, any such under-ground water anywhere is, for that matter, contaminated and polluted by contact with bodies of long dead people.

5. Health, Sanitation and Domestic Water

In the previous section of this report, we have briefly touched upon the possible relationship between health and the perceived quality and quantity of water used. In this section, we shall try to describe some of the health and sanitation conditions and practices pertaining the communities studied. This will be done in relation to the water use behaviour of people at these sites.

5.1 The Minimum for Survival

In their book on Domestic Water Use in East Africa, White and his associates (1972) point out that at the lowest level, the need and use of domestic water is essentially aimed at meeting the minimum required for survival. But what is that minimum and how is "survival" to be defined?

The definitions of these concepts vary from people to people and from one geographic condition to another. In one community, the minimum required may be defined as consisting of that amount needed for direct

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human ccnsumption in the form of food or drinks; in another it may include an extra amount for personal hygiene and sanitation; and still in a third community, the minimum required may include a comparatively lavish amount for lawn and garden use. These are indeed wide variations - variations that are explained not just by the simple taste of people but by the availability and accessibility of water as well as by a complex set of socio-economic and cultural factors and differences.

It is also important to note that healthful living does require an amount beyond the bare minimum for direct human consumption with food or as drink. The inavailability of water hinders to also meet the minimum requirements for hygiene and saniation which inevitably lead to ill-health, and survival under such conditions often becomes meaningless.

5.2 Water-related Diseases

As pointed out above, our attempt has not been aimed at the more technical task of identifying the varieties of water - related diseases that may possibly exist in the communities. Such an attempt was beyond the scope of the study (as well as the competence of the researchers) and the task could perhaps be taken up in a follow - up study to be conducted by a more inter-disciplinary team.

However, there ia a need here to note a few points on the relationship between domestic water and health by way of providing some basis for an understanding of the possible implications of the discrepancies between perceptions of people and their water use, hygiene and sanitation practices that have been found in this study.

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A number of writers (Bardely, 1971; Bugaisa, 1971; White, et.al., 1972; Saunders & Warford, 1976; WHO, 1979; and Sibiya, 1980, etc.) have shown the complex relationship between health and water. At least four major categories of water-related diseases have been identified by, among others, both G.F. White and his associates (1972), and J.B. Sibiya, (1980).

These are:

> "(1) water-borne infections, e.g., typhoid, cholera, dysentry (bacillary and amoebic), gastro-entrities, other diarrheal diseases, and infections hepatitis; (2) water-washed infections, e.g., skin infections such as scabies, yaws, and leprosy and eye infections such as trachoma and conjunctivities; (3) water-based infections, e.g., schistosomiasis and guinea worm; and (4) water-related infections (some vector-borne diseases are caused by vectors that breed in water), e.g., onchocerciasis, malaria, filariasis, yellow fever, and human trypanosomiasis."

While the use of contaminated and polluted water may lead to the contraction of any or a combination of these water-related diseases, the quantity of water used may also lead to various health problems. Inadequate quantity may result, in the extreme, in "disease by precipitation of urinary constituents" (Sibiya, 1981), and in rendering proper hygienic and sanitary practices impractical and impossible.

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* J.B. Sibiya, "Sanitation and Disease Transmission" in Sanitation in Developing Countries, IDRC Workshop Proceedings, 1981, pp. 68-70. See also G.F. White, et.al, 1972, pp. 161-177.

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These brief facts about the relationship between the use of water and health point at the socio-economic implications of improved water supply and better hygienic and sanitary practices. Both individual households and society as a whole appear to benefit from such improved supplies and practices. Not only individual suffering caused by otherwise controllable water-related diseases could be considerably decreased, but also individual households as well as society may benefit from increased economic productivity resulting from decreased morbidity.

5.3 Perceptions and Practices

The relationship between quality of water and health is apparently more easily recognized by the respondents. As pointed out earlier, they were able to give slovenly use of sources by both humans and stock; washing cloth at points from where domestic water is drawn; the presence of worms, insects, feces and other contaminating dirt; factory waste; and even the chemical contents of water as factors that adversely affect the quality of the water they use and, hence, their health (see Table 21 below).

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TABLE 21. Distribution of Households by Reasons for Perceived Unhealthyness of Water from Various Sources

Reasons for unhealthyness of water	Water Sources							Total
	Borehole	Spring	Pond	Lake	Rain Water	River	Irrigation Canal	
Worms, insects feces and other dirt are found in it	-	10 (3.89)*	88 (34.24)	8 (0.78)	2 (0.78)	126 (49.03)	23 (8.95)	257 100 (39.97)**
Careless Use by both human's and cattle	-	2 (1.2)	64 (38.32)	-	-	100 (59.88)	1 (0.6)	167 (100) (25.97)
Use of Point for Washing cloth	-	1 (13.13)				31 (96.88)		32 100 (5.29)
Factory Waste is dumped into it	-			4 (11.76)		30 (88.24)		34 100 (5.29)
Water is too salty and causes mottling of teeth	89 (58.17)	-	-	4 (2.61)	-	60 (39.22)	-	153 (100) (23.79)
Total	89	13	152	16	2	347	24	643 (100)

*Percentages in parenthesis (of total in that category)

**Percentages of total respondents.

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On the other hand, the relationship between health and quantity of water used is often not as readily recognized. Beyond acknowledging the drastic effects on health of dire shortages of water under exceptional circumstances, even those respondents who seemed to see a connection between health and water quantity were unable to as clearly articulate the possible relationship between these two variables. It appears, therefore, that as much as the availability of water affects people's use of it for various purposes, so are their attitudes, and cultural practices related to the actual uses to which they put water.

Unfortunately, perceptions alone do not apparently lead to correct behaviour and we find the large majority of our respondents continuing to use sources that they otherwise consider polluted and, therefore, dangerous to their health. Some of the other factors associated with water use behaviour have already been identified and discussed earlier and there will be no need to repeat them here. Nevertheless, it is important to note here that the respondents themselves identified some of these factors as leading to their continued use of sources they consider to be rather unhealthy.

Since the large majority of respondents rated the improved sources as relatively better and healthier, they were asked to explain the discrepancy between their evaluation of the improved sources and their continued use of the unimproved ones. The distance (24.83%) and the time and energy expended on queuing at the improved sources (12.9%) and management (8.6%), maintenance problems (18.28%) and inability to pay water fees (10.07%) were some of the important explanations given (see Table 22 for further details).

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TABLE 22. Percentage Distribution of Households by Reasons for Continued Use of Unimproved Instead of Improved Sources

Reasons	Percentage of Households
Only for washing, bathing and watering animals	12.41
Too much queuing at improved source	12.9
Improved source is inadequate and unhealthy	9.68
Improved source is too far	24.83
Not used to taste of water from improved source	1.86
Whenever the improved source is out of order	18.28
Operator of improved source is often not on time	8.6
Inability to pay for water from improved source	10.07
Closure of improved source in wet season	0.78
Lack of provisions for cattle, washing cloth and problems of operation	0.59

The question now arises as to whether or not respondents make any other attempts - given their continued use of water from sources perceived as unhealthy - to improve upon the quality of such water before use. It was found that the large majority (68.5%) do not all make any such attempts. The rest try to use such water

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purification techniques as boiling (6.09%) filtering with cloth (23.84%) and with grass and other similar methods (1.57%).

The use of these water purification methods by households also appears to be positively related to a number of socio-economic and cultural factors such as education. As shown in Table 23 below, the level of education attained by both heads of households and their spouses is significantly related to the use of these methods of water purification. It appears that while the probability of using any or a combination of these techniques increases with rises in levels of education, the proportions of those using boiling (as opposed to those using the more traditional and less effective techniques of filtering with cloth and grass) increases with increasing levels in education.

TABLE 23. Distribution of Household Heads and their Spouses by Levels of Education and Water Purification Method Used

Water Purification Method Used	Levels of Education				Total
	Illiterate	Read & Write	Primary	Above Primary	
Boiling	33 (2.16)*	35 (2.29)	19 (1.24)	6 (0.39)	93 (6.09)
Filtering with cloth	246 (16.11)	73 (4.78)	35 (2.29)	10 (0.65)	364 (23.84)
Filtering with Grass & other	20 (1.31)	1 (0.07)	-	3 (0.2)	24 (1.57)
None used	854 (55.93)	148 (9.69)	34 (2.23)	10 (0.65)	1046 (68.5)
Total	1153 (75.51)	257 (16.83)	88 (5.76)	29 (1.9)	1527** (100)

Notes:

With 6 degrees of freedom
Chi-Square Statistic + 133.46 C_C + 0.28
(significant at the 0.001 level)

* Percentage in parenthesis.

** Multiple responses.

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Similar relationships were also found between types of toilet facilities used and levels of income and education. Greater proportions of households with higher annual incomes appear to use pit latrines that may be either shared or privately owned. Similarly, the higher the educational level attained by household heads and spouses, the more likely are such households to use such toilet facilities as opposed to the open field or woods. The fact remains, however, that the large majority of the respondents (72.76%) use only the open field and woods.

Our visits and observations at many of the sites showed personal hygiene and sanitary practices that appeared to us as greatly wanting and potentially dangerous to health in these communities. People used the open field or fallows and at times even the edges and banks of streams and rivers for toilet. Apparently streams and rivers are preferred perhaps because of the relative privacy afforded by the small gorges. Watering animals, washing clothes and bathing were also carried out at some of these traditional sources with an apparent lack of concern for people who may be using these for their domestic water needs. The community leaders seem to think that these are often the workings of nonresidents (i.e., passers by) of the communities. It is argued that since they themselves use these water sources, residents would be more concerned. This may very well be the case in which case the communities themselves will probably have to devise methods of caring for and protecting the sources they use. So far, no such method has been developed by any of the communities.

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At the improved water points and in the homes of those observed households, people were seen engaging in water-related activities that may not be considered conspicuously unhygienic or unsanitary. The main constraints seem to lie around the inavailability of appropriate facilities for such activities as washing clothes and bathing. This is true in the homes as well as at the improved water points. Often people used small plastic plates or bowls, metal plates and even dried animal skins on which to wash clothes. And this is done squatting or bending down on the ground as people do not seem to have as yet found less strainful methods.

In a few instances, however, people were observed using unwashed utencils and containers for drinking, cooking, transferring water from one container to another and for collecting water from sources. On a couple of occasions, people (women) were seen going to the toilet and coming back, to directly go to their domestic activities of cooking, making local drinks and cleaning the house. On numerous occasions, coffee drinking sessions were observed in many of these homes. Culturally, coffee drinking is a highly socializing activity particularly for the women. Women in the immediate neighbourhood are invited and they are served a number of small cups of coffee each. Initially, the cups are washed reasonably thoroughly, but once coffee has been served in them they are simply rinsed, often with a little drop of coffee, and used again possibly by another person.

Similarly, on some occasions unwashed pails, gourds, cans and ensiras were seen being used for collecting and transferring water to

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other containers. Pails and ensiras that had been lying open in the queue were picked and used to collect water; gourds and cans that were similarly lying around in the house were simply picked and dipped into water containers to draw water for use.

These people are often aware of the possible implications of these practices to health. But whether because that awareness is neither clear nor sufficiently internalized, or still, because these practiceshave, over the years, become part of tradition, the practices continue. Here again, the futility of trying to find a single causative factor is demonstrated.

6. Construction, Management and Maintenance of Water Points

The effectivenss of rural water supply schemes may be measured from number of perspectives. They may be seen from the point of the politician whose primary concern is the provision of such services to a constituency (specially in countries where the politician's career may very much depend on the votes of the citizens); or they may be looked at from the engineer's point who may be much more concerned in the more technical aspects of the schemes (see Saunders and Warford, 1976). No doubt both of these considerations, particularly the latter, are important. These implicit or explicit considerations do affect the strategies employed in the implementation of schemes.

Studies in other parts of the developing world have whown that strategies that have failed to take community participation into

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serious consideration have, more often than not, resulted at least in the under-utilization, as well as in a host of management and maintenance problems of the water supply schemes. We believe that the extent to which the people (for whom these provisions are made) utilize and benefit from the schemes should be accorded equal, if not greater, consideration. This is much more so in developing countries like Ethiopia where limited resources coupled with the overwhelming prevalence of poverty, ignorance and diseases demand the utilization of strategies aimed at the attainment by the people of the maximum possible benefits from services and programmes such as improved rural water supply.

It is argued that in order to attain these objectives, the active participation of the communities through the whole process of planning, construction, and the day-to-day operation of the schemes is considered essential. This strategy is expected to generate not only the feeling of involvement and, hence, a sense of ownership of the schemes, but also the confidence and selfreliance needed for further endeavours in community development.

We also believe that the creation of the various mass organizations of peasants, urban dwellers, women and youth has provided the conducive situation for such and continuous community participation in development efforts. Already these various organizations are fruitfully engaged in numerous activities such as literacy, educational and training, health and sanitation programmes, etc. In short, the structure has been laid

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and what remains for agencies like EWWCA is to create the appropriate linkage and coordination with both these mass organizations and the various agencies involved in similar development efforts.

It is true that in view of the considerable amount of apathy and suspicion as well as poverty that prevail in rural communities, even this task of creating effective linkages for popular participation will no doubt require a great deal of effort and perseverance on the part of EWWCA. This section of our report is, therefore, aimed at providing the Authority with some feed-back on the respondents' attitudes and perceptions regarding community involvement in the provision, operation and maintenance of the improved water supply schemes in their respective communities. At the same time, the important management and maintenance problems identified will be summarized and presented.

6.1 Community Participation and Construction of Water Points

All 8 communities reported having a number of village organizations all of which are engaged in a variety of self-help and developmental activities. These are peasants', women's and youth associations created after the February Revolution, school administration communities, and the more traditional, mutual aid societies such as edir, ekub, and debbo (see Table 24 for community - specific details).

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Table 24. Village Organizations Found in Site

Site	Type of Village Organizations Found in Communities							
	Peasants	Womens	Youth	School Adminis-tration	Urban Dwellers	Edir	Ekub	Debbo Jighe
Ali	X	X		X				
Chanco		X	X	X	X	X	X	
Lante	X	X		X				
Mermersa	X	X		X		X		X
Muda	X	X	X			X		X
Daleti	X	X		X		X		
Djido Combel	X	X		X		X	X	
Melka Jilo	X	X		X		X	X	X

Since the traditional, self-help associations usually have the limited objective of providing services to their needy members, and since they often tend to be rather exclusive in their memberships, they are not active participants in community - wide, development efforts. However, since some of these, particularly edirs and ekubs, do sometimes generate funds and other resources, they may be potential sources for the funding of smaller development schemes.

The greatest potential for different levels of community participation now and in the future lies in the peasants', women's, youth, and school

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administration associations and committees. Already these village organizations have undertaken and, in most cases, completed quite a variety of development projects. Among these are to be found roads, schools, housing, dispensary, cooperative shops, meeting halls, etc. (see Table 25 below).

TABLE 25. Construction Activities Undertaken by Site

Construction Activities Undertaken	Study Sites							
	Ali	Chancho	Daleti	Lante	Mermersa	Muda	Djido Combel	Melka Jilo
School		X	X	X	X	X		
Road		X				X		
Dispensary	X							
Housing	X		X					
Cooperative Shop	X		X	X	X	X	X	
Hall	X		X	X				
Mills	X		X					
Library	X							
Offices	X							
Day-care Centre	X							
Afforestation		X				X		
Irrigation Teraces	X	X						X
School Toilet								X

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From conversations with community leaders, it was learned that in 5 of the 8 communities the improved water points were constructed (often by the former EWRA and in the case of Chancho, Lante and Djido Combel by a water drilling company and the former Ministry of Community and Social Affairs; by the former EWRA and the Chinese; and by EWRA and the Japanese respectively) upon the request and some participation of the communities. In the remaining 3 sites, i.e., Lante, Djido Combel, and Melka Jilo, no such requests, consultations or participations took place. We are not certain, however, how far this absence or presence of community participation in these communities has resulted in differences in the utilization, care and protection of the improved water points by these same communities.

Judging from the types and variety of communal activities undertaken, the experience and potential for further, similar endeavours does seem to exist. And although the fact that most of the water points were constructed upon the communities' request it appears that their participation was often sought once the initiative was taken by the communities themselves. Moreover, this initial attempt on the part of the former EWRA to solicit and secure the communities' participation often focused solely on the construction aspect of the schemes. In other words, it appears that even those communities which claimed to have been consulted before the construction of the water points stated, upon further discussions, that these consultations revolved around the ways and means in which they would be able and willing to contribute towards the construction of these points.

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In one instance, Melka Jilo, people were apparently consulted on the possible location of the borehole before it was actually constructed. In all the other instances, these consultations do not seem to have occurred either in the planning or the management phases of the schemes. Thus, more often than not, the practice has been for engineers and technicians to go into the identified communities, make the necessary technical studies, and with some contributions (material, financial, and/or labour) from the communities, carry out the construction work on the basis of plans developed and finalized in offices far away from the communities themselves. Once these constructions have been completed no serious attempt was apparently made to enable these communities create the mechanisms and capabilities to ensure the effective operation and maintenance of these water points.

Since the reorganization of the former Ethiopian Water Resources Authority and the establishment and further reorganization of the National Water Resources Commission (NWRC), it appears that the situation in this respect as well as in the day-to-day operation and maintenance of water points has greatly improved. Part of the explanation for this lies in this restructuring of the national agency responsible for the development of the country's water resources. The main aspect of this reorganization that probably gave rise to improvements in the strategies employed is the intensive decentralization of the Ethiopian Water Works Authority, one of the four main agencies under the NWRC, into eight regional offices. This has apparently resulted in closer and more frequent contacts and interactions with the communities

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being served either by providing them with new water sources or by ensuring more effective operation and maintenance services. Undoubtedly, a great deal more remains to be attained in this regard by way of raising the capabilities of both the central and these regional offices to enable them carry out their respective responsibilities and duties. In light of what is envisioned for the next ten years and considering the numerous and complex problems of management and maintenance of already existing water supply schemes, the building up of that capability in terms of manpower, finance, equipment, etc., becomes decisive.

The task of building this capability is part and parcel of the nation's expressed intention to gradually create self-reliance and sufficiency. The need for realizing this objective is perhaps not felt as intensely as in agencies like the EWWCA where the variety and complexity of technologies (almost exclusively gotten from external sources and often in the form of donations) used are constant sources of equally complex problems for those crew engaged in the construction, operation and maintenance of these equipment. In this regard, it was rather disappointing to see that a significant component of the aids obtained from various donor agencies and governments consist of sophisticated and complex equipment whose day-to-day operation and particularly maintenance is far beyond the manpower (i.e., skill) and material (spare parts) capacity of the agency's field staff. With the exception of an on going and, by the way, commendable effort (financed by IDRC) that is being made to develop simpler and more appropriate pumps, this research team was unable to find any similar attempt to

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deal with this critical problem of creating appropriate technologies. A conscious effort needs to be made by EWWCA to explore and tap the possibilities that do exist in this regard.

6.2 The Management and Maintenance of Water Points

The day-to-day operation and maintenance of the improved water points is perhaps the most complex and difficult aspect in this process of planning, construction and management of water supply schemes in general and rural water supply in particular. This is because the task is fraught with numerous problems arising from, among others, lack of adequate and appropriate preparation and logistic support; problems associated with the selection, training and supervision of water point workers; and the apparent lack or inadequacy of efforts to secure and sustain the active involvement of the communities particularly in this difficult phase of operation and maintenance. These are ongoing tasks and as such require a more vigilant and relatively more regular follow-up.

The well-site personnel responsible for the day-to-day operation and, in very few instances, for minor repairs like changing water faucets, cleaning oil filters, etc., may consist of an operator whose main responsibility is to operate the generator; a revenue collector or clerk; and guard. In many sites only one of these may be available to carry out these separate responsibilities, in others there may be an operator and either of the other two. Among the study sites, Ali has none of these personnel since the borehole is fitted with a hand pump and water is gotten free; Chancho has an operator and some four part-time revenue

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collectors manning the different stand posts; Muda has an operator and a guard; Mermersa has all three; and the remaining four sites have only one operator each.

The number of personnel at each site is determined on the basis of the size of regular users. The heavier the work load of a given site, the more likely for more than one worker to be assigned. Similarly, the payment to these workers is also determined by the responsibility each carries. Thus the operator and the revenue collector are often paid 70 Birr each per month and the guard is paid 50 Birr per month. In those instances where the operator also functions as revenue collector, he is paid 95 Birr.

These well-site workers at these sites were selected by the communities themselves in consultation with EWWCA. Often these consultations revolved around the criteria to be used in the selection process. Some of these criteria were that the person to be selected must be able to read and write so that he can record what is required by the job; that he should be a responsible and honest person; and that he should be deemed by the community to have the proper attitude towards the people he is expected to serve. These criteria were used to varying degrees in the selection of the three types of workers and there appears to have been much greater adherence to them in the selection of the operator and the revenue collector.

The selected workers were given some orientation and training. This was particularly the case with the operators who were often given more prolonged training (usually a couple of weeks) on how

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to operate the generators and pumps; on checking the oil level and changing it when necessary; on the normal time of pump operation; on how and when to clean oil filters, etc.. None of these workers were apparently given any training on even rudimentary maintenance since it is believed that such work "involves a lot of things like spare parts and other equipment which are not found in the different localities"(EWRA, 1978). Moreover, until very recently when the re-organization of EWWCA and the opening of the regional offices was undertaken, no effort seems to have been made by way of creating the possibility for carrying out at least a minimum amount of maintenance work within the localities themselves.

In addition to this general procedure used in the selection and training of the well-site personnel, in principle these workers are said to be regularly supervised at least once a month. This supervision is usually done by the revenue collectors from the regional offices. It is these regional officers who are also responsible for providing the sites with fuel while collecting the sales made upto the time of their visits.

That the situation in general is not as smooth and perfectly functioning as it sounds is clear not only from our own observations but also from the responses of both individual households and the community leaders.

Our well-site observations were informative in this regard. They revealed that many of these improved water points are faced with quite a number of, and at times very serious, problems of water source

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management and maintenance. Perhaps the most serious had to do with the frequent breakage and malfunctioning of pumps and generators. Equally frequent instances of fuel shortage were also encountered in all sites but Daleti which has an electric operated generator. What made these incidents serious was not that they occurred at all but the rather long time - extending from just a few days in the case of fuel shortage to over four months in the case of breakages at some of the sites - required to obtain the necessary assistance from the regional or central offices of the EWWCA. On the part of EWWCA itself these are explained by shortages of all kinds: finance, spare parts, vehicles, enough trained manpower, etc.

Secondly, in many of these sites there appeared to be a lack of any consistently observed time for the operation of the water points. Consequently, in many of these sites, operators seemed to decide the time for opening and closing the points. As a result no pattern could be established by our observations that would be applicable to all sites that were observed. Broadly speaking, however, we could note that while in some sites (Mermersa, Muda and Melka Jilo) there were more regular operating hours that on the average lasted between 5 to 7 hours a day, in the remaining sites such regularity was lacking and often the working hours ranged, on the average, between 1 hour (Chancho) and 2 hours (Daleti).

In a total of 44 well-site observations about 3500 water-collecting individuals, some 350 different animals which had been brought for either watering or for transporting water were observed

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at the five water points of which Melka Jilo, Mermersa and Muda were the most crowded by both humans and animals. These were the sites where the absence of queue organizers was sometimes felt as now and then some queue jumpers tended to create skirmishes. The sometimes uncontrollable situations at Mermersa and Melka Jilo also resulted in rendering the area around the taps and, in the case of Mermersa, Muda and Djido Combel, around the cattle troughs quite muddy and slippery. Under these circumstances, the well-site workers often became overwhelmed and quite irritable although they were all rated as being quite friendly and polite by the observers.

Finally, in connection with the supervision of these workers by staff from the regional offices, we were able to note that these are not carried out on a regular basis as testified by the frequent shortages of fuel which, as pointed out earlier, are brought to the water points by the revenue collectors from the regional offices. The uncollected revenues often left in the hands of the well-site personnel for months at a time are also indications of the irregularity of these otherwise scheduled supervisions.

Our observations regarding some of the management and maintenance problems were confirmed by our interveiws. Respondents mentioned a variety of such problems and these are summarized in Table 26 below.

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TABLE 26. Distribution of Households by Management Problems of Water Points at Each Site

Problems	Number of Households Per Study Site								Total
	Ali	Chancho	Daleti	Lante	Mermersa	Muda	Djido Combel	Melka Jilo	
Hand Pump Difficult to Operate	13 (1.75)*	-	-	-	-	-	-	-	13 (1.75)
Too Much Queuing	51 (6.87)	-	1 (0.13)	14 (1.89)	129 (17.39)	33 (4.45)	72 (9.7)	3 (0.4)	303 (40.84)
Expensive Tariff	-	8 (1.08)	-	-	-	13 (1.75)	4 (0.54)	-	25 (3.37)
Impolite/unfair Operator	-	8 (1.08)	-	-	-	-	1 (0.13)	-	9 (1.21)
Irregular Working hours	-	41 (5.53)	5 (0.67)	4 (0.54)	34 (4.58)	11 (1.48)	24 (3.23)	5 (0.67)	124 (16.71)
Frequent Breakage Delayed Repair	-	11 (1.48)	3 (0.4)	17 (2.29)	7 (0.94)	58 (7.82)	8 (1.08)	12 (1.62)	116 (15.63)
Fuel Shortage/ Delayed Supply	-	6 (0.81)	-	4 (0.54)	9 (1.21)	-	8 (1.08)	12 (1.62)	39 (5.26)
Inadequate Facilities	-	-	-	-	1 (0.13)	-	3 (0.4)	-	4 (0.54)
Unhealthy Water	-	-	-	-	-	-	40 (5.39)	-	40 (5.39)
Distance/Inadequate Water	4 (0.54)	1 (0.13)	-	3 (0.40)	11 (1.48)	40 (5.39)	9 (1.21)	1 (0.13)	69 (9.3)
Total	68 (9.16)	75 (10.11)	9 (1.21)	42 (5.66)	191 (25.74)	155 (20.89)	169 (22.78)	33 (4.45)	742** (100)

*Percentages in parenthesis (of total respondents).

** Multiple responses.

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The problem of queuing comes back as the single most important management problem. This is considered a problem in most of the sites. In Chancho, Daleti and Melka Jilo, the irregular working hours and breakdowns of pumps are considered more important management problems. For the sites as a whole these three, i.e., queuing, irregular working hours, and stoppages due to breakdowns of pumps and fuel shortage, are the most important ones. Respondents made a number of suggestions in order to deal with these management and maintenance problems. The more important ones were the following: construction of additional new sources or improvement of traditional ones such as ponds and springs (57.74%); providing and sustaining prompt repair and fuel supply services (15.34%), instituting and supervising more regular and longer working hours (16.82%); engaging more workers and especially operators (7.4%); and lower water tariff (2.29%).

It was also felt by the majority of these respondents (55.63%) that EWWCA was the best suited agency that could more effectively carry out these and the day-to-day operation of the water points. The EWWCA is thought to have the manpower and capacity to handle these problems (see Table 25 below for details). The fact that about a quarter of the respondents felt that their mass organizations (peasants and urban dwellers' associations) could handle these and the day-to-day operation of the water points may be taken as an encouraging indicator of the will to assume at least some of the responsibilities in the operation of the improved water points.

TABLE 27. Distribution of Households by Agency Considered Better Suited to Run Water Points with Reasons

Reasons	Name of Agency to be Responsible					Total
	EWWCA	Peasants Associations	Municipality Local Admin.	EWWCA + Peasants Association	Dont't Know	
Got the Manpower, Know how and Experience	344 (23.77)*	77 (5.32)	2 (0.14)	-	-	423 (29.23)
Can Better Supervise and Solve Problems	386 (26.68)	104 (7.19)	13 (0.90)	-	-	503 (34.76)
Can be Reached more Easily	1 (0.07	90 (6.22)	5 (0.35)	-	-	96 (6.63)
Already Responsible for it and doing ok.	-	27 (1.87)	-	-	-	27 (1.87)
Lower Water Tariff Possible	-	28 (1.94)	-	-	-	28 (1.94)
Encourage Self-reliance	-	20 (1.38)	-	-	-	20 (1.38)
Peasants Association not ready	74 (5.11)		-	-	-	74 (5.11)
Fosters Cooperation	-	-	-	2 (0.14)	-	2 (0.14)
Don't Know	-	-	-	-	274 (18.94)	274 (18.94)
Total	805 (55.63)	346 (23.91)	20 (1.38)	2 (0.14)	274 (18.94)	1447** (100)

* Percentages in parenthesis (of total respondents).

** Multiple responses.

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III. Summary and Recommendations

1. Summary

Extending over a period of some 14 months, 8 rural communities in the Administrative Regions of Shoa, Gamo Gofa and Bale were studied with the specific objective of gathering information on their domestic water use behaviour; on factors influencing such behaviour; and on identifying the communities' perceptions, needs and preferences in relation to water supply for domestic use. The findings of the study were expected to aid the National Water Works Commission (and particularly the Ethiopian Water Works Construction Authotiry in its endeavour to provide safe and adequate water for domestic use by the country's population in general and the under-served rural population in particular.

These 8 rural communities were selected from 3 of the 4 climatic and topographic zones found in the country. These communities are Ali, Chancho, Daleti, Lante, Mermersa, Muda, Djido Combel, and Melka Jilo. While the first 3 communities are found in the highland - settled and more temperate zone; the second 3 communities are found in the lowland settled; and the last 2 are found in the low, pastoral and semi-arid zone.

The population living in these communities are essentially engaged in subsistence agriculture, i.e., farming and cattle rasing. As subsistence producers in a poor and backward country, these people are faced with quite numerous and complex socio-economic problems that are

manifested in low incomes, very high rates of illiteracy and traditional, and often harmful, cultural beliefs and practices.

On the average, some 17% of the total number of over 5000 households (i.e., 841 households) were interviewed. Using a separate questionnaire, community leaders (i.e., the elected officers of peasants' and women's associations) were also interviewed. Moreover, household and well-site observations during both the rainy and dry seasons were conducted at 5 of the 8 study sites.

All of these rural communities have been provided with at least one improved water supply scheme. But, in addition to these improved ones, these communities were found to use other, unimproved water sources such as rivers, ponds, springs, lakes, irrigation canals and rain.

The choice of sources as well as the quantities and frequencies of water collection were found to vary both within and among the communities studied. These variations are apparently explained by quite a number of interrelated climatic and a complex set of socio-economic and cultural factors. Among these seasonal changes; the occupation, levels of income and education of households; the time required to collect and transport water to the home; the price of water per liter; and the perceptions of the households about the quality and quantity of water were all found to be significantly related to sources used, frequencies of collection and the amount of water collected. Though unable to say how significantly, the

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size and price of water containers used, the persons collecting water, and the modes of transport employed (i.e., by people or animals) also appeared to be related to both the frequency and quantity of water collection. Similarly, the attitudes and cultural beliefs and practices of the households also seem to influence both the choice of sources and at least the amount of water drawn and used for various domestic activities.

The direction of the relationship between the sources used and the various factors identified above could not be exactly determined. Nevertheless, the distance of these sources as measured by the perceived time required to collect water appeared to be the more important factor as shown by the fact that the utilization of these improved sources is enhanced in the more nucleated communities that have more conveniently located near improved water supply systems. Nevertheless, the fact that even in these communities, a large number of households continue to use more distant, unimproved sources suggests the existence of other factors influencing the choice of sources.

Similarly, frequencies of collection were found to be strongly and positively related to the time required to collect water. Thus, the shorter the time required - thereby suggesting proximity of sources used - the more frequent the collection of water per day. However, greater frequencies of collection do not apparently lead to higher amounts of water collection per day.

The quantity of water collected, on the other hand, appeared to be more definitely and positively related to such factors as

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income and levels of education. Thus, higher incomes and levels of education seem to lead to greater quantities of water collected per day.

Although there were site and seasonal variations, on the average, households were found to draw a little over 40 liters of water per day. On the basis of the overall household size of about 5 persons, the per capita consumption for these communities comes to an average of about 10 liters per day. This was found to be much lower than the 20 liters suggested for similar East African communities studied by Gilbert F. White and his associates (1972). Moreover, this water is used not only for direct human consumption in the form of food or drink, but also for a variety of domestic activities such as bathing, washing clothes and household utencils, and at times even for watering animals and plants. The performance of these activities was also found to be related to the sources used with the improved ones being used for making local drinks, drinking, cooking, bathing and washing, while the unimproved ones tend to be used more for watering plants and animals.

The performance of these various domestic activities may take place either at the sources or in the home. The nature of the activity, the distance of the source and the availability of facilities may, among others, influence where these activities are carried out. Thus, cloth washing and watering animals are more water-source activities while drinking, cooking and making local drinks are obviously household ones. With the exception of cattle troughs at three of the improved water points, and some natural facilities for washing clothes at unimproved

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sources, the lack of appropriate provisions particularly for bathing, washing clothes and watering animals was felt to be a major constraint.

The collection of domestic water is mainly a task for women and children with household heads (in most of the cases men) participating more in the dry seasons when water tends to be relatively more scarce and sources become more distant. Domestic water is often carried by people usually in ensiras (clay pots). At times and when longer distances are involved, water in such containers as jerrycans, plastic bags, skin bags, etc., may be transported on donkeys. The containers used, their properties, modes of transport, the distance of sources, and the activities for which these containers are used all seem to be interrelated. Consequently, bigger and heavier containers such as barrels are used by households near the sources; ensiras appear to be used and considered to be better suited for collecting, transporting and storing water and particularly for the latter; while ensiras are carried exclusively by women, barrles are rolled and pushed by men, and jerrycans and bags are loaded on donkeys; at the same time ensiras are considered to have the property of keeping water cooler and therefore good for storing it, jerrycans and cans are considered good mainly for collecting and transporting water, etc.

Discrepancies between people's perceptions about quantity and quality of water and the relationship of these to health and disease and their own actual behaviour were found. The respondents' own explanations for these discrepancies confirmed the fact that perception alone does not determine the choice of sources as well as the use of

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water and that a host of interrelated factors must be taken into consideration for a more complete understanding of people's water use behaviour. In this regard it was found, for instance, that such factors as levels of education and income were positively related to the use of more sanitary toilet facilities (pit latrines as opposed to the open field) and to the use of water purification methods such as boiling.

The communities covered by the study were found to have a number of village organizations such as peasants', urban dwellers', women's and youth associations, school administration committees and more traditional mutual aid societies such as edir, ekub and debbo or jighe. Through these, all of these communities have been able to successfully engage in a variety of development activities. However, so far no serious attempt appears to have been made by EWWCA to exploit this potential organizations in a more systematic and continuous manner in order to ensure the communities' active participation in the process of the planning, construction, management and maintenance of the improved water points.

While the construction of improved water points is faced with the serious problems of developing and utilizing technologies that are within the capacities of these communities and even those of EWWCA's regional offices to effectively operate and maintain, the management and maintenance of these sources are also faced by these and such other problems as the shortage of adequately trained manpower, inadequate logistic support to field staff, irregular water point

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working hours, equally irregular water prices and inadequate training, supervision and guidance of water point workers, etc.

2. Recommendations

The findings of our survey on rural water use lead to conclusions that are not really new particularly to agencies like the EWWCA which has amassed, over the years, a considerable amount of practical experiences and insight. It will nevertheless be necessary on our part to identify some of the important implications of these findings and, on the basis of these, attempt to make some recommendations for possible implementation.

2.1 The Need for an Integrated Approach

We have seen that the choice and use of water sources, and the amount of water collected and used for various domestic activities including personal hygiene and sanitation are all influenced by a number of complex socio-economic factors. This fact suggests that the mere provision of improved water supply schemes does not automatically lead to its maximum utilization. Nor do such provisions on their own result in improvements in the style and standard of living of the population for whom these provisions are made.

It is therefore extremely important for the EWWCA to create the necessary linkages with both the communities to be served and the various government ministries and agencies that are directly and actively involved in rural development programmes in order to develop

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and implement more integrated rural development projects such as health, nutrition, personal hygiene and sanitation, education and training, communication and better methods of agricultural production and, of course, improved domestic water supply schemes, etc. In the absence of such an integrated approach, the possible impact of improved water supply schemes will continue to be swallowed up, so to speak, by the enormous problems of mass poverty, ignorance, diseases and unscientific beliefs and practices.

The specific ways in which these coordinations for integrated rural development are to be actualized could be worked out by the ministries and agencies concerned and it will perhaps suffice to note here the importance of establishing these linkages not only at the level of the head offices but also, and probably more so, at the lower levels where the actual work is always done.

This integrated approach is also expected to eliminate unnecessary duplications as well as the numerous and often confusing demands for participation that are made on the rural communities.

2.2 The Need for Community Participation

Securing and sustaining the active participation of the communities in the long process of identifying their own needs, setting their own priorities and planning and implementing services and programmes is an extremely important strategy that is bound to eventually pay off not only in the utilization of these services and programmes but also in creating the confidence needed for further undertakings.

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Consequently, EWWCA in cooperation with other development agencies should encourage such community participation.

The planning, construction, day-to-day operation and maintenance of rural water supply schemes will undoubtedly benefit from such community participation in more than one ways. The utilization, care and protection of these schemes as well as the costs of construction, operation and maintenance of the schemes will be at least partly shared by the communities being served. In view of the huge investments required to meet the national targets set for the next decade, this community contribution cannot be lightly taken.

2.3 The Need for Appropriate Technologies

The use of technologies that are both complex and expensive appear to be beyond the capability and resources of the rural communities as well as of EWWCA itself. The continued use of such technologies may be justified in more densely and nucleated communities as these appear to be more effective and efficient in serving the rather huge number of users. In the more scattered and sparsely populated ones simpler and less expensive ones such as hand pumps appear to be more appropriate.

Moreover, the possibilities that seem to exist in the area of developing locally made equipment such as what had recently come to be known as the "Jensen Pumps" should be further and more rigorously explored.

Similar attempts need to be made in relation to developing containers used for water, particularly for transporting and storing

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water. In this regard, while the need is for containers that are durable, more convenient to carry and inexpensive, these containers will have to possess the characteristics for which the traditional ensiras are preferred.

2.4 The Need for Improvements in the Management and Maintenance of Sources

In view of our earlier suggestion for community involvement, there appears to be an urgent need to seek the assistance of the peasants, women's and urban dwellers associations in these communities with the view of creating small committees of members that will assume at least part of the responsibility for the day-to-day operation and maintenance of the improved sources. These committees could serve as the nucleus around which in time stronger water committees that will eventually take over the full responsibility of these tasks could be organized.

These committees could also be used to mobilize resources and community members to undertake the improvement and protection of both the improved and, particularly, of the unimproved ones. This is particularly important in view of the fact that a considerable number of people still use and will continue to use unimproved sources for sometime to come. Moreover, the provision of improved schemes to the country's rural population will be a long term objective. Hence, the need to embark upon the improvement and protection of some of these unimproved sources so as to make them a little safer.

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There is also a need for improvement in at least the training and supervision of water point workers. It is felt that while their training could and should include at least some aspects of maintenance work, the irregular supervision of these workers has also resulted in equally irregular working hours which appear to have adversely affected the use of the improved water points. This has also resulted in arbitrary prices of water per liter at many of the sites. In order for operators and revenue collectors to adhere to the officially set prices, such regular supervisions and controls will be necessary. We believe that part of the problem arises from the requirement placed on these well-site workers by EWWCA to account for all the water collected on the basis of water readings while they themselves have no way of determining the amount consumed since there is no device for accurately measuring the size of the containers used by customers. It may therefore be becessary to either provide these workers with more accurate methods of estimating the size of containers (say by providing them with 20 liter containers) or be a little more flexible in the demands for accuracy made on them.

Lastly, but not least, the inadequacy or virtual absence of facilities for carrying out water-related activities such as washing, bathing and watering animals is a major constraint at many of the sources. There is, therefore, a need for such provisions not only for the purposes of providing these facilities but also for the purposes of enhancing the use of the improved sources themselves.

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5. The Need for Follow-up Studies

This study has been limited both by its design and by the composition and equally limited experience of the research team. While its initial design excluded the possibility of including control groups, the composition of the team gave rise to its inability to more thoroughly investigate factors related to the quantity and quality of water and their actual relationship to health and disease.

The inclusion of control groups, i.e., communities without improved water points; and communities selected on the basis of more definite social, economic and cultural characteristics, etc., could perhaps have assisted in the establishment of the relative strengths of factors that influence domestic water use. Some of the questions that have not been answered to any conclusive extent in this regard have to do with the following.

1. In what specific ways and to what extent exactly do the identified socio-economic and cultural factors influence the use of domestic water?
2. What other possible factors could be related to water use behaviour? For instance, now and to what extent are climatic and topographic characteristic of communities related to work and energy expenditure and the use of water for various domestic activities?
3. Could such socio-cultural factors as religion and traditional beliefs lead to differences in water use behaviour and, if so, how and to what extent?

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The fact that the research team did not include health and sanitation experts led to serious deficiencies in the assessment of the actual relationship between the quantities and qualities of the water used in these communities and health status of the populations using these various sources of water. There is, therefore, a need to try to answer at least the following questions which are related to health and water use.

1. Under the climatic and socio-economic conditions prevailing in these communities, can a minimum level of water for daily per capita consumption for various purposes be established? How does actual consumption in these communities relate to that minimum? What are the implications of this to health?
2. On the basis of water tests and morbidity studies, could the actual relationship between the quality of water used for various domestic activities and the health status of the populations of these rural communities be more accurately determined? What are the differential impacts of more integrated approaches (e.g., improved water supply, health and other services), on the health of these people?

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Bibliography

1. Beyene, A., and Tesfa, W. Report on Water Needs Areas in Shewa Region, EWRA, Addis Ababa, 1976.

2. Bradely, D.J. "Infective Disease and Domestic Water Supplies" in Proceedings of the Conference on Rural Water Supply in East Africa, University of Dar-es-Salam, 1971

3. Bugaisa, S.L. "Significance of Flourine in Tanzanian Drinking Water" in Proceedings of the Conference on Rural Water Supply in East Africa, University of Dar-es-Salam, 1971.

4. Carr, M. Appropriate Technology for African Women, ECA, Addis Ababa, 1978.

5. Central Statistical Office. Ethiopian Statistical Abstract, CSO, Addis Ababa, 1978.

6. Ethiopian Water Resources Authority. Report by the Government of Ethiopia: Community Water Supply and Sanitation Rapid Assessment of Current and Projected Sector Development, EWRA, Addis Ababa, 1978.

7. Ethiopian Water Resources Authority. Preliminary Proposals for a 10-year Plan for Rural Water Supply 1973-1982, EWRA, Addis Ababa, 1980.

8. Feechem, R., Burns, et.al. Water Health and Development: An Interdesciplinary Evaluation. Tri-Med Books Ltd., London, 1978.

9. Gamachu, D. Aspects of Climate and Water Budget in Ethiopia, Addis Ababa University Press, Addis Ababa, 1977.

10. Kebede, H. Improving Village Water Supplies in Ethiopia: A Case Study of Socio-economic Implications, ECA, Addis Ababa, 1978.

11. Saunders, R.J. and Warford, J.J. Village Water Supply: Economics and Policy in the Developing World, The John Hopkins University Press, Baltimore and London, 1976.

12. Sibiya, J.B. "Sanitation and Disease Transmission" in Sanitation in Developing Countries, IDRC, Ottowa, Canada, 1980.

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13. The National Literacy Campaign Coordinating Committee, Every Ethiopian Will be Literate and Will Remain Literate, Addis Ababa, 1981.

14. UN. Habitat: United Nations Conference on Human Settlements, New York, 1976.

15. UN. Report of the United Nations Water Conference. Mar del Plata, New York, 1977.

16. White, A.U. Study Guide for Community Participation in National Activities for the International Drinking Water Supply and Sanitation Decade, WHO, Geneva, 1980.

17. White G.F., Bradley, D.J., and White, A.U. Drawers of Water: Domestic Water Use in East Africa, University of Chicago Press, Chicago and London, 1972.

18. White G.F. Domestic Water Supply in the Third World, Pergamon Press Ltd., London, 1978.

19. WHO-UNICEF, Alma - Ata: Primary Health Care: Report of the International Conference on Primary Health Care, Alma - Ata, USSR, 1978.

20. WHO. Workshop on the Role of Human/Water Contact in Schistosomiasis Transmission, St. Lucia, 1979.

21. WHO. International Drinking Water and Sanitation Decade: Briefing Document. WHO, Geneva, 1980.

22. Yeshewaloul, S. Multi-sectoral Baseline Study on Water Health Sanitation and Education, UNICEF, Addis Ababa, 1982.