RiPPLE

Equitable water service for multiple uses

A case from Southern Nations Nationalities and Peoples Region (SNNPR), Ethiopia

Habtamu Abebe, Mitiku Bedru, Ashibre Ashine, Gosaye Hilemariam, Bekele Haile, Desta Demtse and Marieke Adank

May 2010

Working Paper 17

Research-inspired Policy and Practice Learning in Ethiopia and the Nile region

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August 2010

Research-inspired Policy and Practice Learning in Ethiopia and the Nile region (RiPPLE) is a 5-year Research Programme Consortium funded by UKaid from the Department for International Development aiming to advance evidence-based learning on water supply and sanitation (WSS). The RiPPLE Consortium is led by the Overseas Development Institute (ODI), working with the College of Development Studies at Addis Ababa University; the Ethiopian Catholic Church Social and Development Coordination Office of Harar (ECC-SDCOH), International Water & Sanitation Centre (IRC) and WaterAid-Ethiopia.

RiPPLE Working Papers contain research questions, methods, analysis and discussion of research results (from case studies or desk research). They are intended to stimulate debate on policy implications of research findings as well as feed into Long-term Action Research.

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Acknowledgements

The Equity research team would like to express its gratitude to the RiPPLE programme for the initiation of this research. We would like to give special thanks to Marieke Adank for her inspiring work with the team in producing this manuscript. Further, we would to like to express our gratitude to Ato Zemede Abebe, the growth team leader, for his regular follow-up and provision of timely technical support via Marieke.

Our thanks also go to Ato Desta Demtse, the RiPPLE office Hawassa coordinator, for arranging and providing all the necessary logistics. We would also like to thank the guards in the RiPPLE office, Awassa and the work of our drivers, Ato Hailu, Yared and Ato Desaleghn, who drove us around the rural areas with no complaints.

Our gratitude is also extended to Ato Tsegaw, Mirab Abaya, RiPPLE office coordinator, Ato Dawit, WFEDO head, Ato Tariku of WWRDO and the staff, as well as Ato Argaw, the WARDO deputy head, for their supply of relevant secondary data and for their assistance during our travels to the areas covered in this study.

We are grateful to the *kebele* managers for their unreserved efforts in coordinating the communities we visited, as well as for their dedicated cooperation during our research.

Lastly, the research team would like to thank the water supply and irrigation committees, and the farmers we contacted in the three *kebeles* for sharing their valuable time with us.

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List of Acronyms and Abbreviations

ARDO	Agriculture and Rural Development Office
BH	Bore hole
BoARD	Bureau of Agriculture and Rural Development
BoFED	Bureau of Finance and Economic Development
BoWRD	Bureau of Water Resource Development
CSA	Central Statistical Authority
E.C.	Ethiopian Calendar
EU	European Union
FAO	Food and Agriculture Organisation
FEDO	Woreda Finance and Economic Development Office
FN	Functional
GPS	Gravity Piped System
HDWs	Hand-dug Wells
Lpcd	litre (of water) per capita and day
M&E	Monitoring and Evaluation
MAW-WRDO	Mirab Abaya Woreda Water Resource Development Office
MoARD	Ministry of Agriculture and Rural Development
MoWRD	Ministry of Water Resource Development
MSWs	Machine Shallow Wells
NF	Non Functional
NGOs	Non Governmental Organisations
PS	Protected Spring
SNNPR	Southern Nations, Nationalities and Peoples Region

TEVT	Technical and Vocational Education and Training College
UAP	Universal Access Program
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Science and Culture Organisation
WARDO	Woreda Agriculture and Rural Development Office
WEO	Woreda Education Office
WASH	Water Sanitation and Hygiene
WASHCO	Water Sanitation and Hygiene Committee
WATSAN	Water supply and sanitation
WHO	Woreda Health Office
WSG	Woreda Support Group
WVE	World Vision Ethiopia
WWRDO	Woreda Water Resource Development Office
ZWRDO	Zonal Water Resource Development office

List of Ethiopian Terms

Dega	Highland (2,300-3,000 meters, annual rainfall ranges from 1,200 to 2,200-mm)
Kolla	Lowland (below 1,500 meters, annual rainfall ranges from 200-800 mm)
Teff	A fine grain which is a staple of the Ethiopian diet
Woha Agar	Disinfectant/ Sodium hypochlorite used to treat drinking water
Woyna dega	Mid highland (1,500 to 2,300 meters, annual rainfall ranges from 800-1,200-mm)

Executive Summary

People use water for a wide range of activities essential to their livelihoods. These can include both domestic as well as productive uses. The multiple uses of water can deliver multiple benefits and can contribute to economic growth. However, whether or not these benefits are distributed in an equitable way within the benefiting communities is less clear.

Equity is a multi-faceted issue that is, in the abstract, rather vague, often undefined and usually ambiguous. For this action research study, the following equity issues were considered important in relation to equitable growth:

- Equitable spatial distribution of water services;
- Equitable access to water services;
- Equitable water use;
- Equitable benefits from water use;
- Equitable decision making.

There are two types of equity fault lines: the geographical (spatial) fault line, based on people's locations, and the social fault line, based on how different groups within communities are defined. The degree of equity in decision making can have impact of the degree of spatial (equitable allocation of services) and social equity (equitable access to services).

During a Learning and Practice Alliance (LPA) workshop held in Hawassa in December 2008, LPA members identified the lack of up-to-date information systems as one of the main challenges for spatial equity of water services provision. Therefore the objectives of this study were (i) to improve insight in spatial equity at *woreda* level through the development of an information base on water resources, infrastructure and water demand for multiple uses; and (ii) to develop better understanding of the barriers to equitable access to water services, equitable water use and equitable decision-making at community level.

Of the two *woredas* in the Southern Nations, Nationalities and Peoples Region (SNNPR) where RiPPLE is working, Mirab Abaya was chosen because of greater diversity of agro-ecological zones and livelihood groups. Two communities - Omolante in the lowlands and Woye Barena in the highlands - were selected for in-depth analysis of factors contributing to social (in)equity around access to and use of water services and decision-making.

Based on the information and data needs assessment, an inventory of available data and information was made. A RIDA (Resources, Infrastructure, Demand and Access) framework was used to collect and analyse data and information at *woreda* level. An inventory of water resources and water infrastructure was undertaken at *woreda* level. Information on water resources and infrastructure was collected though review of available documents, interviews and mapping in the field. The collected data were linked to a Geographic Information System (GIS) in order to visualise the spatial distribution of water resources and water services.

In the case study areas different livelihood and wealth groups were identified through a livelihood group and wealth ranking exercise. Furthermore, a community mapping exercise was carried out in order to gain better understanding of water resources in the community and the main areas of water

use. Barriers to access to water services and water use were assessed through Focus Group Discussions (FGD) and household questionnaires.

Budget allocation and water scheme construction at *woreda* level

The majority of water infrastructure is implemented though donor and NGO projects. Financial support obtained from donors and earmarked to the water sector is directly allocated by the BoWRD to the *woredas*, based on a pre-set priority criteria. The task of the BoWRD is to carry out monitoring and supervision of the implementation projects.

The SNNPR BoWRD identifies poor information access and weak information dissemination as one of the major challenges in an effort to provide equitable and sustainable service. To improve the situation, the bureau is promoting the generation and dissemination of data and information in collaboration with relevant institutions. However, despite the policy commitment, no comprehensive water resource database has been developed at either national or regional levels.

At the moment, there is no standard system to gather and monitor data and information on available water resources, water infrastructure, a demand for water services and current access to these services in Mirab Abaya *woreda*. The absence of an information centre at *woreda* level as well as poor coordination and communication between and within the sector offices has made the Woreda Agriculture and Rural Development Office (WARDO) weak in the area of information accessibility and database management systems.

Available water resources and infrastructure

So far, no comprehensive study on the water resources potential has been conducted in Mirab Abaya *woreda*, thus the study tried to estimate available water resources. Based on area coverage and average rainfall in the *kolla*, *woyna dega* and *dega* agro-ecological zones, it is estimated that Mirab Abaya *woreda* receives an estimated amount of about 0.503 km^3 of rainfall per year. Availability of groundwater is difficult to estimate, but there are no indications that either quantity or quality of groundwater is a problem. Only limited data and information on surface water resources are available. The *woreda* contains nine rivers: seven permanent and two intermittent. According to the WWRDO and WARDO, the rivers provide a good source of irrigation for agriculture in the lowland areas of Mirab Abaya *woreda*.

Mapping of available domestic water schemes in 2007 by RiPPLE showed that there were 70 water supply schemes. Mapping of infrastructure for this study showed 79 schemes in early 2009. Of the 70 systems identified in 2007, 30 (43%) have been found non-functioning. In 2009, 29 systems (37%) were found to be non-functional and 10 schemes (12%) were abandoned.

In Mirab Abaya *woreda* there are eight modern and four traditional irrigation systems. Of the eight modern systems, three are surface irrigation systems with diversion structures and canals, while the remaining five are drip irrigation systems. In areas where there are inadequate water structures and a shortage of water, the community has constructed water harvesting structures such as household ponds or hand-dug shallow wells.

Water requirements

Total human water demand, based on 20 lpcd, is estimated at 458,967 m^3/year for 2010. Annual water demand for crops has been estimated at around 0.138 km^3, and annual livestock water demand is estimated to be about 375,226 m^3. On an annual basis, there does not seem to be a lack of water resources in the *woreda* to satisfy the demand for different uses. However, there is a lack of functioning infrastructure to convert the water resources into water services, to make reliable quantities of water of good quality can be made available.

Spatial distribution of water schemes

The degree of equitable water services does not depend on the equal spatial distribution of water infrastructure over an area, but rather on the degree to which people's demands for water services for multiple uses, in terms of water quantity, quality, reliability and accessibility are met. The distribution of water supply schemes in Mirab Abaya *woreda* shows that the majority of the schemes (82%) are located in the *kolla,* and only 9% each are found in the *dega* and *woyna dega* zone. Comparing the population of an area with the population that the functional water infrastructure in that area can potentially cover, it shows that in the *dega* agro-ecological belt, only 25% of the population has access to improved water sources and in the *kolla*, access to improved systems stands at 52%.

Water access at community level

In both case study *kebeles* the key barrier to water access is the lack of functioning water infrastructure. Regardless of wealth, all households within the community experience this barrier in an 'equitable' way, regardless of 'what they have' or 'who they are'. Sustainability of water infrastructure is a major issue in both cases. In case of scheme breakdown or limited water availability, wealthier households in the lowland area of Omolante are able to access alternative water sources in neighbouring *kebeles*. In the highland case (Woye Barena), no such differences have been observed between wealthier and poorer households.

In principle, there is equal distribution of communal irrigation water between *kebeles* and within a community. The distribution of irrigation water does not take into account the irrigable land size, crop type and distance from the source. In practice, the water arbiter often allocates unfavourable times to the poor and favourable times for himself, his relatives and the influential and richer people in the community. Irrigation water can thus be considered to be distributed inequally, giving priority to certain people, based on their identity and their relationships to influential people. Wealthier households are also able to benefit more from irrigation water, as they tend to have bigger and more fertile plots and they irrigate cash crops rather than food crops.

In both the highland as well as the lowland case, it was especially the wealthier households benefiting from self-made (self-supply) hand-dug wells for irrigation of crops and trees. Better-off households were found to benefit the most from irrigation, because of their livelihood assets (cash crops such as apple and banana, bigger land size and more fertile land).

Regarding equity in decision-making, both cases showed the limited influence of women and daily labourers in decision-making around water services, including WASHCO elections, the election of water arbiters, and the setting of tariffs. According to previous RiPPLE studies, culture contributes to the low participation and involvement of women in water-related decision-making. It further showed that when women were involved in key management positions, both the service delivery and financial management of the schemes were improved. Exclusion of women from water- related decision-making may thus have contributed to the poor water service delivery in the case study areas.

Conclusions

Up-to-date data and information would help monitoring progress towards achievements of goals as set in the Universal Access Plan, and to guide decision-making around allocation of water services. In order for information and data to be useful for the planning of spatially equitable water services, there is a need for up-to-date information on available water resources, population patterns, water demand for multiple uses, current status of infrastructure (functionality, capacity and actual discharge), and access for people to this infrastructure (distance, waiting time, and reliability).

In Mirab Abaya *woreda*, there is spatial inequity in the distribution of water services between the agro-ecological zones and between the different *kebeles*. The highest concentration of water systems is found in the *kolla* area. Despite, this is also the area where the highest number of unserved people can be found.

Non-functionality of water infrastructure is a big issue in Mirab Abaya *woreda*. Projects tend to focus on the construction of new infrastructure, rather than maintaining and rehabilitating existing infrastructure. The continuous investment in new systems to replace non-functional existing systems may prevent the provision of service to unserved areas, thereby increasing spatial inequity.

Regarding social equity in access to and use of water for domestic use, it was found that different groups of people (defined by wealth and livelihoods) face similar barriers. However, the better-off households were able to use financial resources to access alternative water sources, where these were available. This has helped them to save more time and use the extra time for other productive purposes and to access larger quantity and better quality water. It should be noted, however, that this has also contributed to a (temporary) income generation opportunity for some, such as those engaged in providing water transporting services.

In principle, there is equal distribution of irrigation water within a community and between communities. However, in reality, the water arbiter, who is responsible for allocating irrigation times, often allocates unfavourable times to the poor and favourable times to himself, his relatives and influential and wealthier people in the community. This contributes to the social inequity of the use of irrigation water.

There is also social inequity in decision-making processes around water services, as women and daily labourers are generally excluded from the process. This has most likely contributed to poor sustainability of water infrastructure and poor service delivery.

Recommendations

There is an urgent need for policy-makers and implementers to use reliable and consistent information and data to identify gaps prior to decision-making and planning provision of water service. For this to happen it is important to establish a database on the available water resources, infrastructure, and demand to water service. It is also important to undertake monitoring activities in order to have up-to-date information and data regarding service coverage, as well as schemes requiring maintenance, repair and rehabilitation.

There is a need for appropriate budget allocation for maintenance and rehabilitation and replacement of broken down systems. The most important thing to improve water supply should be to reduce the non-functionality rate of water schemes by building the capacity of the WWRDO.

The *woreda*, in its *kolla* part, has considerable potential for irrigation. However, only a fraction of irrigable land is currently developed. It is important to develop existing local systems in order to use the available water resource more efficiently in a way to reach distant users and satisfy water requirements for crops. In addition, surface water should be supplement with ground water options to overcome the deficit in the dry season.

To overcome social inequity in irrigation services, by-laws should be established and enforced.

There is a need to address social inequity in decision-making, by devising ways to include women and the landless in the decision making processes. This could also contribute to increase the sustainability of water systems.

To improve access to water services, household level options, implemented through self-supply, especially in places where the hydrology permits and where people are sparsely settled, like in the highland area in Mirab Abaya, should be considered.

1 Introduction

People use water for a wide range of activities essential to their livelihoods. These can include both domestic as well as productive uses. The multiple uses of water can deliver multiple benefits. As well documented and confirmed by findings from case studies done under RiPPLE[1] (Adank et al., 2008; Hagos et al., 2008), multiple uses of water can contribute to economic growth. However, whether or not these benefits are distributed in an equitable way within the benefitting communities is less clear.

This report presents the results of a study on equitable water services for multiple uses executed under RiPPLE. This chapter gives an introduction on equity as a concept. It also presents the objectives of the study, the outline of this report and the methodology used in this study.

1.1 Equity: Conceptual and theoretical framework

Equity is a multi-faceted issue that is, in the abstract, rather vague (IRC, 2005). It is often undefined and usually ambiguous (Wegerich, 2007). Here an attempt will be made to explain this concept.

It should be noted that equity is not the same as equality. Equality is an objective or quantitative term, referring to equal shares of the whole related to 'a directly measurable parameter'. Equity is a subjective or qualitative term, contextualised within existing social values (Sivramkrishna and Jyotishi, 2006). It is related to the perception of fairness and the idea that all members in society should have equal rights (Taylor, 2008). What is acceptable to one community might not be acceptable to another or even to the same community over a period of time with changes in its social and economic structure. Referring to equitable distribution of (irrigation) water, Murray-Rust et al. (2000) define equity as 'distribution of a whole into parts that is acceptable to all members of a community'.

For this action research study, the following equity issues were considered important in relation to equitable growth:

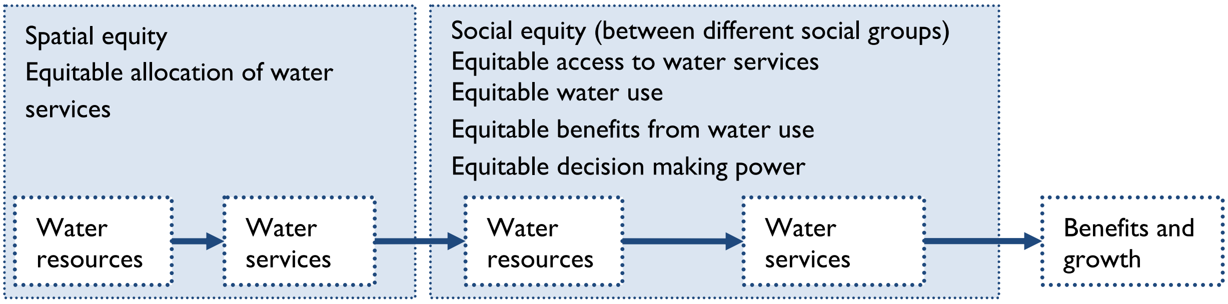
- Equitable spatial distribution of water services;
- Equitable access to water services;
- Equitable water use;
- Equitable benefits from water use;
- Equitable decision making.

Taylor (2008) identified two types of equity fault lines: the geographical fault line, based on people's locations, and the social fault line, based on how different groups within communities are defined cutting across geographical boundaries. The degree of equity related to the first fault line is referred

1 Research-inspired Policy and Practice Learning in Ethiopia and the Nile region (RiPPLE) is a 5-year Research Programme Consortium funded by the UK's Department for International Development (DFID), aiming to advance evidence-based learning on water supply and sanitation (WSS). The RiPPLE Consortium is led by the Overseas Development Institute (ODI), in partnership with College of Development Studies at Addis Ababa University; the Ethiopian Catholic Church Social and Development Coordination Office of Harar (ECC-SDCOH); International Water & Sanitation Centre (IRC) and WaterAid-Ethiopia.

to as spatial equity, while the degree of equity related to latter is referred to as social equity. Equitable spatial distribution of water services is mostly related to spatial equity, while equitable access, water use and decision making are more related to social equity. This is illustrated in figure 1.1.

Figure 1.1: Different forms of equity in water services



The degree of equity in decision making can have impact of the degree of spatial (equitable allocation of services) and social equity (equitable access to services).

1.1.1 Spatial equity

Spatial equity can be considered at different levels: between urban and rural areas, between different regions, districts and *kebeles*, and between different agro-ecological zones. Whether or not there will be equitable distribution of water services depends on a large number of factors that determine the degree of spatial equity. These include natural and physical factors, like topography and the availability of water resources in different spatial locations. Furthermore, it will depend on decisions related to resource allocation, like human, logistical and financial resources, which are in turn influenced by availability of these resources, but also factors like political will and knowledge and information on available water resources, infrastructure and current and future water demand.

1.1.2 Social equity

Social inequity, which might result in inequitable decision making, inequitable access to the water services, inequitable use of available water and inequitable benefits from the use of water, can be regarded from different perspectives. Economic theories focus primarily on *resource-based* paradigms of advantage and disadvantage, generally taking the individual, or the individual household, as their unit of analysis (Kabeer, 2004). Within the paradigm, the ‘winners’ and ‘losers’ are differentiated based on what they have.

Box 1.1: Livelihood assets

Livelihood assets serve as the basis for people’s livelihoods. There are five types of asset that together enable people to pursue sustainable livelihoods:

- Human: knowledge, skills, ability to labour and good health
- Social: social networks and relationships of trust and reciprocity
- Natural: the natural resources available
- Physical: basic infrastructure and producer goods available
- Financial: the financial resources people have available

Social theories on the other hand have focused more on *identity-based* forms of advantages and disadvantage, which reflects the cultural devaluation of groups and categories of people in a society by virtue of *who they are*, or rather, who they are perceived to be. The identity in question may relate to a distinct and bounded *group* of people who are defined by their distinct cultural practices and shared way of life. Caste, ethnicity and religion are examples of such group identities. Alternatively, it may relate to an unbounded *category* of people who are defined by a single shared characteristic (e.g. gender, disability or HIV-positive status). Members of such categories may have very little in common, aside from the discrimination they face (Kabeer, 2004).

The two paradigms thus focus on quite distinct understandings of advantages and disadvantages: one relating to resources or, more broadly, livelihood assets ('what they have') (see Box 1.1) and the other to identity-based characteristics ('who they are'). It is possible to be poor without facing cultural devaluation ('the deserving poor') just as it is possible to be discriminated against without being poor (for example women can face gender-based discrimination without necessarily being poor). It should be noted that the spatial dimension is not entirely separate from resource and identity dimensions, since it is usually culturally devalued and economically impoverished groups that inhabit physically deprived locations (Kabeer, 2004).

1.2 Objectives of the study

This study intends to contribute to the central problem of how to stimulate and facilitate equitable water services for multiple uses.

A Learning and Practice Alliance (LPA)[2] workshop was held in Hawassa in December 2008 on issues around equitable water services. During the workshop, the LPA members identified the lack of up-to-date information systems as one of the main challenges for spatial equity of water services provision. Therefore the first objective of this study was:

- To improve insight in spatial equity at *woreda* level and improve equitable distribution of water services, through the development of an information-base at *woreda* level, on water resources, infrastructure and water demand for multiple uses.

In addition, there was a need for developing better understanding of social equity. Therefore the second objective of this study was:

- To develop better understanding of the barriers to equitable access to water services, equitable water use and equitable decision-making at community level.

1.3 Methodology, tools and sampling

Following the LPA workshop in December 2008, an Equity research team consisting of key LPA members was established in January 2009. Individuals from the Bureau of Water Resources Development (BoWRD), Bureau of Agricultural and Rural Development (BoARD), Bureau of Finance and Economic Development (BoFED), and the Technical and Vocational Education and Training College (TEVT) at regional level and the Woreda Water Resources Development Office (WWRDO), Woreda Agriculture and Rural Development Office (WARDO), Woreda Finance and

2 Learning and Practice Alliance platforms bring together stakeholders to share, discuss and learn.

Economic Development Office (WFEDO) and the RiPPLE facilitator at *woreda* level were involved in the research activity. The research period was from 16 January to 6 May 2009. The actual field activity took about four weeks, during which the team was divided into two groups.

In the Southern Nations, Nationalities and Peoples Region (SNNPR), RiPPLE is mainly working in two *woredas*: Mirab Abaya and Alaba *woredas*. Because of the greater diversity of agro-ecological zones and livelihood groups, the members of the SNNPR LPA agreed to start off this study in the Mirab Abaya *woreda*.

In order to explore spatial equity, an analysis was done on decision making in the allocation of water services. Also an assessment was carried out to consider the information needed for improved and more spatial equitable planning of water services. This was done through the review of policy documents and key informant interviews with implementers and government staff from regional, zonal and *woreda* levels.

Based on the information and data needs assessment, an inventory of available data and information was made. A RIDA (Resources, Infrastructure, Demand and Access) framework was used to collect and analyse data and information at *woreda* level. An inventory of water resources and water infrastructure was undertaken at *woreda* level in Mirab Abaya. Information on water resources and infrastructure was collected though review of available documents, interviews and mapping in the field. The collected data were linked to a Geographic Information System (GIS) in order to visualise the spatial distribution of water resources and water services.

Two communities were selected for more in-depth analysis of the factors contributing to social (in)equity around access to and use to of water services and the decision-making processes related to them. The site selection was conducted with the active participation of the Mirab Abaya Woreda LPA members on 16 January 2009. The major site selection criteria included: agro-ecological difference and the presence of different livelihood groups; presence of water supply and irrigation systems; presence of water committee and multiple use water services (either from a developed or undeveloped sources). Based on this, two communities were selected for the case study: Omolante in the lowland area and Woye Barena in the highland area.

In the two case study areas different livelihood and wealth groups were identified through a livelihood group and wealth ranking exercise. Furthermore, a community mapping exercise was carried out in order to gain a better understanding of the water resources in the community and the main areas of water use. Barriers to access water services and water use were assessed through Focus Group Discussions (FGD) and household questionnaires. The participants in focus groups were selected based on the livelihood group ranking and wealth ranking groups in the three case study areas. Furthermore, FGDs were conducted in each community based on wealth ranking and with a group of men and a group of women. The household sampling for the admission of the household questionnaire was done for a total of 18 households per community. The households were selected through a process of targeted sampling, based on the livelihood grouping and wealth ranking[3]. Furthermore, key informant interviews were administered at community and *kebele* level to

3 In Omolante labour selling is the second major livelihood activity next to farming. However, the number of daily labourers in the *kebeles* is very small compared the farming community. Accordingly six daily labourers and 12 farmers (four from each wealth group) were incorporated in the study. In the other two case study areas where there is one major livelihood group (farming), and the 18 questionnaires were distributed equally among the three wealth groups with each represented by six individuals.

gain insight in the institutional arrangements at community level, regarding water use, and how these have changed over time. As far as possible, documents at community level and at implementation level were reviewed, while observations and measurements, where necessary, were made and global positioning system (GPS) references were taken.

On 27 March 2009, the preliminary findings of the study were presented to the *woreda* LPA for verification and endorsement. After incorporation of comments and suggestions from the *woreda* LPA members, preliminary results from the study were presented at the regional level LPA, on 13th May 2009. This report was produced after further analysis of the results and after incorporating the comments from the regional LPA.

1.4 Outline of the report

After the introduction into the study - the underlying concepts and methodology in this chapter - Chapter 2 describes the process of allocation of water services, and the challenges to spatial equity at *woreda* level and above. Chapter 3 gives an analysis of the degree of spatial equity of water services for multiple uses at *woreda* level, focussing on one specific *woreda*: Mirab Abaya. Chapter 4 focuses on social equity by analysing the barriers to access to water services, water use and decision making at community level. Here, two case studies are presented from communities in different agro-ecological zones in Mirab Abaya *woreda*. Finally, conclusions and recommendations are presented in Chapter 5.

2 Allocation of water services and the need for reliable information

This chapter deals with decision-making around allocation of water services, which will be of influence on the degree of spatial equity of water services. First an overview is given of the budget allocation process, considering block grants and sector earmarked grants. Furthermore, the decision-making process of where to focus safety-net activities and NGO activities will be described. This is followed by a section on information and data needed to inform these decisions.

Box 2.1: Roles and responsibilities in the water sector

The main government actors in the water sector are the Regional Bureau of Water Resources Development (BoWRD), Zonal Water Resources Development Office and the Woreda Water Resources Development office (WWRDO). The roles and responsibilities of BoWRD include studying, designing and constructing water supply and irrigation facilities. Furthermore, it is responsible for managing and maintaining the quality of projects. The Zonal Water Resource office is responsible for the provision of technical support during project implementation and regulation of water supply and irrigation services activities in their jurisdiction. The role of the Zonal office in scheme construction is insignificant; however, it is involved in the monitoring and supervision of water projects. This arrangement is workable mainly when the budget comes from a government source. The WWRDO is responsible for planning, implementing and evaluating water supply activities in the *woreda* (BoWR, 2006; MAW-WRDO, 2007).

There is a lack of clarity on roles and responsibilities, between the WWRDO and Woreda Agriculture and Rural Development Office (WARDO), regarding the irrigation sector. In theory the WARDO is given the responsibility in the agronomic part while the WWRDO is given the responsibility in the structural part. However, in the Mirab Abaya *woreda* WARDO has been carrying out the monitoring and supervision of construction of small-scale irrigation systems.

2.1 Water service allocation

In terms of the allocation of the necessary budget to support water services, the regional Bureau of Finance and Economic Development (BoFED) allocates the block grant to the respective zones and special *woredas*. The Zonal Office of Finance and Economic Development (ZoFED) then allocates the block grant to the *woredas* and town administrations under its jurisdiction. After receiving its share, the *woreda* makes decisions on how to distribute the budget among the sector offices, on the basis of pre-set priority criteria.

At *woreda* level, the distribution of the lump sum budget is carried out by the Woreda Cabinet, which was, during the time of the research, composed of sector offices, except the WWRDO. Hence, WWRDO did not have a say in the distribution of the budget. According to the Mirab Abaya WWRDO, this has adversely affected the office, as no budget for scheme construction, maintenance and expansion has been allocated since its establishment. Because of this, no scheme was constructed by the office using direct government funds.

Under the Safety Net programme, a special budget is allocated to *woredas* and *kebeles* where there is a food security problem. The lump sum budget is allocated to the Woreda Council from the Regional Food Security and Disaster Prevention and Preparedness office. The *woreda* sector offices will be asked to submit their proposals showing vital priority intervention areas to assist the food insecure community. Depending on the magnitude and depth of the problem, the intervention area is identified by the *woreda* council. The area of intervention could thereby focus on water, irrigation structure, schools, health, road developments, depending on the area given priority within the budget limit (BoWRD, 2007).

The majority of water infrastructure is implemented though donor and NGO projects. Financial support obtained from donors and earmarked to the water sector is directly allocated by the BoWRD to the *woredas,* based on a pre-set priority criteria. The task of the BoWRD is to carry out monitoring and supervision of the implementation projects.

Any NGO that wants to start up a project or programme may enter into agreement either at *woreda*, zonal or regional level. The level at which the NGO enters into an agreement mainly depends on the amount of budget allocated and the trans-boundary nature of the project or programme. NGOs with a project budget up to 2,000,000 ETB (about 180,000 US$[4]) and working in one *woreda* will sign an agreement at *woreda* level. For projects up to 2,000,000 ETB and covering more than one *woreda* the project agreement will be signed at zonal level. NGOs having a project budget above 2,000,000 ETB and up to 5,000,000 ETB (about 450,000 US$) and working in one zone will also sign the project agreement at zonal level. For projects with a budget exceeding 5,000,000 ETB and/or working in more than one zone, the project agreement will be signed at regional level (BoFED, 2005). The government is supposed to provide relevant information to help NGOs determine the development gap.

NGOs often decide for themselves where to work and how much budget to put up for a project or programme, although it is the responsibility of the regional government to determine the allocation of resources from all sources in the region, based on the level of socioeconomic development in different parts of the region. Most of the time, NGOs only come to the bureau for agreement after they have identified the area of intervention and project location themselves, either after independently conducting a survey or based on prior information they have gathered from government offices. The NGOs then carry out a feasibility study in the area and select *kebeles* of intervention. NGOs can expand their project and programme into other *kebeles* and *woredas* after they start implementation.

An example of an NGO that has been working in Mirab Abaya for more than 20 years is World Vision Ethiopia (WVE). Every five years, WVE designs its programme document in coordination with the sector offices and bureaus. To design the document, the WVE field staff visit the community and identify and prioritise the vital intervention areas. Communities play an important role in the prioritisation process. If the community prefers water supply or irrigation structures over other facilities, the organisation conducts a feasibility study on the identified area of intervention. The feasibility study for water supply systems is conducted by the ZWRDO, while the feasibility study for irrigation systems is conducted by the BoWRD. Based on the feasibility study, site selection, project design, technology and service level will be determined by the respective organisations that conducted the study. The site and technology selection is mainly done based on the hydrogeology of the study area. The WWRDO and WARDO are involved in the monitoring and supervision of the project activities.

4 1 Ethiopian Birr = 0.09 US$ (Source: Oanda, February 2009).

2.2 Information needs and availability

In an effort towards the efficient, equitable and optimum utilisation of the available water resources of the country, the Ministry of Water Resource Development (MoWRD), in its policy and subsequent water sector strategy, underlined the importance of developing a coherent, efficient and streamlined process of information management (MoWRD, 2001; MoWRD, 1999). Moreover, the water sector strategy highlights the need for preliminary development of databases on all aspects of water resources, such as surface water, groundwater, hydrology, meteorology, wells, bore holes, springs, and water works. Furthermore, it encourages the development of databases to facilitate entry, storage, retrieval, review, analysis and dissemination of collected water data. The strategy points out the importance of reviewing and assessing available water resources data and information at all levels (down to the lowest administrative structure), and identifying water resource information gaps (MoWRD, 2001).

The water strategy also advocates the importance of developing and strengthening information management capacities in the irrigation sector. It involves improving the adequacy, reliability and accessibility of existing databases at the national and regional levels (especially with regard to data on potential irrigable land, water resources availability, water use patterns, crop water requirements, farming systems, and irrigation efficiency) to carry out water management analysis and to determine the potential to increase agricultural production (ibid).

The SNNPR BoWRD identifies poor information access and weak information dissemination as one of the major challenges in an effort to provide equitable and sustainable service. To improve the situation, the bureau has been promoting the significance of systematically generating and disseminating data and information in collaboration with relevant institutions (BoWRD, 2007). However, despite the policy commitment, so far no comprehensive water resource database has been developed at either national or regional levels.

The policy seems to focus on national and regional level initiatives, rather than *woreda* level initiatives. The RiPPLE sustainability case study (Deneke and Abebe, 2008) identified weak information management and poor documentation systems at the *woreda* sector offices as one of the factors preventing the WWRDO from developing plans for rehabilitation, expansion and new scheme development activities in the *woreda*.

2.2.1 Demand for information management at woreda level

As shown in Box 2.2, all *woreda* level institutions in Mirab Abaya underline the importance of reliable, accurate and consistent data and information for the decision-making and resource distribution process, in an effort to achieve equitable water service allocation. To easily utilise and manage the data and information, the offices demand a simple and straightforward working database system (e.g. consisting of Microsoft Excel and Word files), which can be managed and utilised by all personnel in the sector offices.

Box 2.2: The importance of *woreda* level information and data

The head of the Mirab Abaya WWRDO said that the presence of quality data and information will help the office to plan and allocate its resource appropriately and make accurate decisions. Furthermore, he mentioned that it is important to provide the information and data to the relevant stakeholders such as WFED, ZWRDO and the BoWRD, to help them allocate the available resources based on the objective reality of the office. He said, *'In a globalised world reliable data and information are significantly important for proper planning, accurate decision making, problem identification and efficient utilisation of resources. Ultimately, it is these data and information which are converted into money. Therefore, it is important for every sector office to rely, use and provide reliable and consistent data and information to ensure equitable resource allocation.'*

The Mirab Abaya WARDO representative was also of the opinion that the presence of relevant data and information is a prerequisite to any sound decision-making and for fair allocation of irrigation infrastructures.

The head of the Mirab Abaya WFEDO mentioned that their office had been authorised to be the information centre at the *woreda* level and is responsible for organising all the basic data, updating the data collected, and subsequently making the official data available directly to the beneficiary and other stakeholders. Therefore, it would be appropriate if it could host the database. If the office had a comprehensive database on the sector, conflict among service providers and planners would be avoided, according to the office budget and information head. He also mentioned that the WVE (WATSAN) and World Bank (WASH) programme had difficulty in trying to construct schemes independently in the same *kebele* (Kola Barena) because of a lack of reliable information. He added that this had led to conflicts and was a duplication of scarce resources and efforts, rather than having complimentary effect.

Depending on the mission of the organisations, there are slight differences in the type and nature of the data and information need. However, most of the institutions have a common interest in and demand for similar information and data on the available water resources, infrastructure, demand and access.

Consolidated and consistent information and data demanded in the water supply sector include:

- The number and types of water infrastructures including where the systems are located in the *kebele*, installing organisations, date of construction;
- Discharge of the schemes;
- The status of the schemes (functional, non–functional, need repair, maintenance, rehabilitation, abandoned, complete and incomplete scheme);
- Number of beneficiaries of each scheme;
- Water demand of communities;
- Drinking water supply coverage;
- *Kebeles* with water shortage.

Concerning irrigation, the following information was identified by the stakeholders as being essential for decision making and planning:

- Water resource potential;
- The status and location of previously constructed structures, installing organisation, year of construction and type of structure;

- Discharge of the systems;
- The number of beneficiary at each system;
- The amount of land irrigated;
- Potentially irrigable area.

2.2.2 Current reality: Data and information collection and storage processes and systems

At the moment, there is no standard system to gather and monitor data and information on available water resources, water infrastructure, the demand for water services and current access to these services in Mirab Abaya *woreda*. Because of this, various organisations use different approaches to collect primary and secondary data. Because of a lack of budget to gather primary data and information, most institutions rely on estimates and data from secondary sources to inform planning and decision-making. With the exception of World Vision Ethiopia (WVE), which stores data and information (both in hard as well as soft copy format), none of the *woreda* level sector offices have a computerised information and data system.

According to WVE, the lack of a central database and reliable data and information at the *woreda* level has led to additional costs for the NGO and a duplication of efforts. According to the WARDO representative in Mirab Abaya, the government offices face a lack of resources (budget) and the necessary logistics for data collection in order to develop and maintain a collection of data and information and making it available and accessible.

2.3 Conclusion

In theory, equitable distribution of water services should be guided by the Regional Bureau and Woreda level Office for Water Resources Development, based on up-to-date information and data. In practice, however, water infrastructure is mostly implemented under donor and NGO projects, as capital investment by the Government of Ethiopia into the water sector is very small. The regions are supposed to play a role in deciding how to allocate funds to different *woredas*, based on available data and information. There is wide agreement that access to consistent and reliable data and information is a must for equitable allocation of resources and water services. However, with the absence of a central information system at *woreda* level, NGOs generally collect and assess their own data and information on which they base decisions that ultimately have an influence on the spatial distribution of water infrastructure. The lack of a centrally located, consistent and up-to-date information and database at *woreda* level presents a challenge for planning and implementation of water infrastructure in a spatially equitable way.

3 Water resources and water services in Mirab Abaya *woreda*

In order to get a better insight into the degree of spatial equity related to water services in Mirab Abaya *woreda*, a so-called RIDA analysis was done as part of this study on water resources and infrastructure availability and the demand for and access to water services in the *woreda*. The RIDA analysis was also intended as a start-up exercise for the development of a comprehensive information system at *woreda* level, which could support the equitable allocation of water services in the future. This section will present the results of the RIDA analysis.

3.1 Introduction to Mirab Abaya *woreda*

Mirab Abaya *woreda* is located in the Gamo Gofa zone of the Southern Nations, Nationalities and Peoples Region (SNNPR), It is divided into 24 *kebeles*: one urban and 23 rural. The *woreda* is bordered in the north by Wolayita zone (Humbo *woreda* and Boreda *woreda*) and in the south by Arba Minch Zuria *woreda* and Lake Abaya. In the east, it is bordered by Lake Abaya and in the west by Chencha *woreda*. It has three major agro-ecological zones; *kolla* (lowland), *woyna dega* (medium elevation) and *dega* (highland). Table 3.1 below shows the land proportion of each zone, population proportion and population density in each agro-ecological zone.

Table 3.1: Proportion of land area, population and population density in the three agro-ecologies

	Kolla	Woyna dega	Dega
% land area	62%	11%	27%
% population	67%	2%	31%
Population density (Persons / km^2)	124	25	129

Birbir is the political centre of the *woreda* and is located about 230 km away from the regional capital, Hawassa. According to the 2007 population census, the total population of the *woreda* is estimated to be 74,901 with 69,070 and 5,831 of the population living in rural and urban settings, respectively (BoFED, 2007). Religion-wise, 52 percent of residents are Protestant, 41 percent Christian Orthodox, five percent Muslim and one percent Catholic. About one percent of residents follow traditional religions (MAW-WRDO, 2007).

Malaria is the most prevalent and fatal disease in the *woreda*. The second and third most prevalent diseases are intestinal parasites (13.7 percent) and diarrhoeal diseases (6.6 percent), both of which result from contaminated water, or from poor sanitation and hygienic practices (MAW-WRDO, 2005).

3.2 Water resources

So far, no comprehensive study on the water resources potential has been conducted in Mirab Abaya *woreda*. Information on water resources in the *woreda* given in this paragraph is therefore mostly based on assessments made from field visits, observations and discussions held with *woreda* officials and community members.

3.2.1 Rainfall

In Mirab Abaya, the land area of the agro-ecological zones *kolla*, *dega* and *woyna dega* comprises of 407 km^2, 177 km^2 and 72 km^2 respectively. The average rainfall in the lowland (*kolla*) is 580 mm, and 1,000 to 1,100 mm in the highlands (*dega* and *woyna dega*). It can thus be estimated that the *kolla* area receives a total annual rainfall of about 0.236 km^3, and the *dega* and *woyna dega* areas receive an annual rainfall of 0.195 km^3 and 0.072 km^3 respectively. Considering the three agro-ecological zones, Mirab Abaya *woreda* receives an estimated amount of rainfall of about 0.503 km^3 per year.

The lowland is known for its high rainfall variability. Furthermore, there is high evapo-transpiration in the area. A study by Murthy (2004) has shown that the drought situation in the *kolla* has been mounting significantly year after year and the frequency of drought occurrence has been escalating. During the period 1972 to 1983, there were eight moderate and one severe drought, while during the period 1984 to1995 the area faced five moderate, one severe and three extreme droughts (Murthy, 2004).

3.2.2 Groundwater

According to WVE (WAA-WVE, 2002), the *woreda* is gifted with enough groundwater for human consumption and irrigation development. However, no information on the actual extent of these groundwater resources is available. If we take a conservative estimate of 5% of ground water recharge by rainwater, the estimated amount of ground water recharge would be 0.025 km^3 per year.

According to the Mirab Abaya WWRDO head, the *woreda* has a landscape with all the three agro-ecologies (*kolla, dega* and *woyna dega*), which results in the availability of springs, surface and groundwater resources. The WWRDO head has so far not encountered challenges in establishing drinking water facilities. From his practical experience, bore holes in the *woreda* can yield water at a depth range between 50 to 107 metres and medium shallow wells (MSWs) and hand-dug wells (HDWs) yield water at a depth range of 12 to 45 metres. The mapping exercise conducted under this study revealed that household hand-dug wells yield water in the *dega* at a depth range between three to 10 metres while in *woyna dega* it yields at a range between two to seven metres.

The quality of the groundwater is in general perceived to be good. The WWRDO head confirmed that no groundwater source was abandoned due to quality problems. However, people around Abaya Lake complained of salinity problems when digging a hand-dug well at a depth between 12 and 15 metres.

3.2.3 Surface water

Only limited data and information on surface water resources are available in the *woreda*. The research team gathered as much detailed information as possible from field observations and through interviewing the WWRDO head and expert team about the rivers and lakes in the region. The map below (Figure 3.1) shows the rivers and lakes available in the *woreda*.

The *woreda* contains nine rivers; seven permanent and two intermittent. All the rivers have their sources in the highland areas of the *woreda* and adjacent *woredas* and all discharge into Lake Abaya in the lowland area. According to the WWRDO and WARDO, the rivers provide a good source of irrigation for agriculture in the lowland areas of Mirab Abaya *woreda.*

No water quality assessment has been done on the rivers. Communities generally utilise the rivers for irrigation, bathing, livestock watering and drinking water when there is a water scheme breakdown and when the distance from improved sources is too big. During the rainy season rivers carry heavy loads of sediments and water cannot be used for drinking. The Hamesa River is situated between Gamo Gofa (Korga) and Wolayta zones (Humbo) and it is used by both bordering communities for irrigation and other purposes. The community residing on the other side has been using the river effectively by employing a modern diversion structure while on the side of Mirab Abaya a traditional system has been used.

Figure 3.1: Surface water resources in Mirab Abaya *woreda*

Based on data from SNNPR BoFED GIS department and field data.

The *woreda* has two lakes: part of Lake Abaya and a small crater lake in the highland area, known as Done Ela. Lake Abaya is located at the eastern side of the *woreda* at 1,285 metres above sea level with a total area of 1,070 km^2; the part of lake in the *woreda* covers 38 percent (402 km^2). It has a maximum depth of 13 metres with an average of 7.1 metres (WAA-WVE, 2002; RPDB, 2007). Accordingly, the total volume of water found is about 2,854 km^3 in the area covered by the *woreda*. Lake Abaya has a salinity problem, as studied by Arba Minch University and witnessed by the local communities. According to the WWRDO head, the water from the lake has never been reported to create any serious health problems. Both Done Ela and Lake Abaya are accessible throughout the year.

Springs can be found in Faragosa, Doshe and Yeyke *kebele,* in the Kolla and Dega Shengole, Dega Barena, Woye Barena and Dega Done *kebele* in the *dega*, and Menene *kebele* in the *woyna dega*, as shown in Figure 3.1.

There is little coordination and communication between the two *woreda* sector offices, the Water Resources Development Office (WWRDO) and the Agriculture and Rural Development Office (WARDO), nor is there an effort to conserve water resources in the *woreda*. The WWRDO irrigation expert indicated that conservation of water resources on the basis of integrated watershed management has not yet been exercised, except for the protection of water points. Soil and water conservation are considered to be the task of the WARDO. The WARDO representative, however, reported that different soil and water conservation efforts, including development of bench terraces, check dams, and forestation and planting of fodder grass, had been implemented. He added that watershed management was being practiced in almost all of the *kebeles* in the *woreda*, especially in the *dega* part.

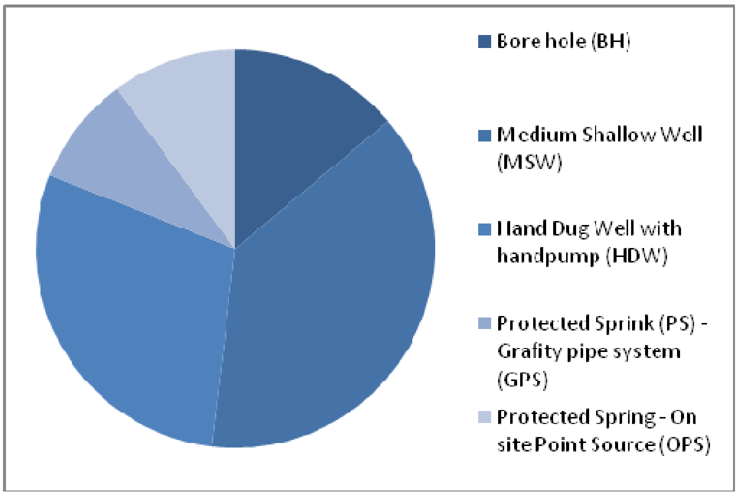
3.3 Infrastructure

3.3.1 Water supply infrastructure

Under the RiPPLE sustainability case study, all water supply schemes in Mirab Abaya *woreda* were mapped in the period of November-December 2007. At that time, a total of 70 water supply schemes were identified. These included 11 bore holes (BH), 20 hand-dug wells (HDW) fitted with hand pumps, 26 medium shallow wells (MSW) fitted with hand pumps and 13 protected springs (PS) with network or on-spot distribution points (Deneke and Abebe, 2008). Through the mapping exercise under the equity study in the beginning of 2009, the sustainability inventory was updated with nine newly constructed schemes and ten schemes under construction. The total number of completed schemes was thus found to be 79. The systems include 11 bore holes, 23 hand-dug wells fitted with hand pumps, 30 medium shallow wells fitted with hand pumps and 15 protected springs with network (seven) or on-spot distribution points (eight). All the schemes under construction were bore holes.

Of the total of 70 systems identified under the sustainability case study in 2008 (Deneke and Abebe, 2008), 30 or 43 percent of the systems had been found non-functioning. Various technical problems, water quality problems, water table draw down and unavailability/lack of spare parts and maintenance equipment were identified as major reasons for the high level of non-functionality in the *woreda* (Deneke and Abebe, 2008).

Figure 3.2: Water supply infrastructure in Mirab Abaya



The mapping exercise done under this study at the beginning of 2009 illustrated that 40 systems (51 percent) were functioning, while 39 systems were non-functioning (49 percent). Of the 39 non-functioning systems, 10 systems had been completely abandoned. Not taking into account the abandoned systems, the end result shows a non-functionality rate of 41 percent. Table 3.2 below gives an overview of the functioning, non-functioning and abandoned systems in the *woreda.*

Table 3.2: Proportion of schemes by types of technology

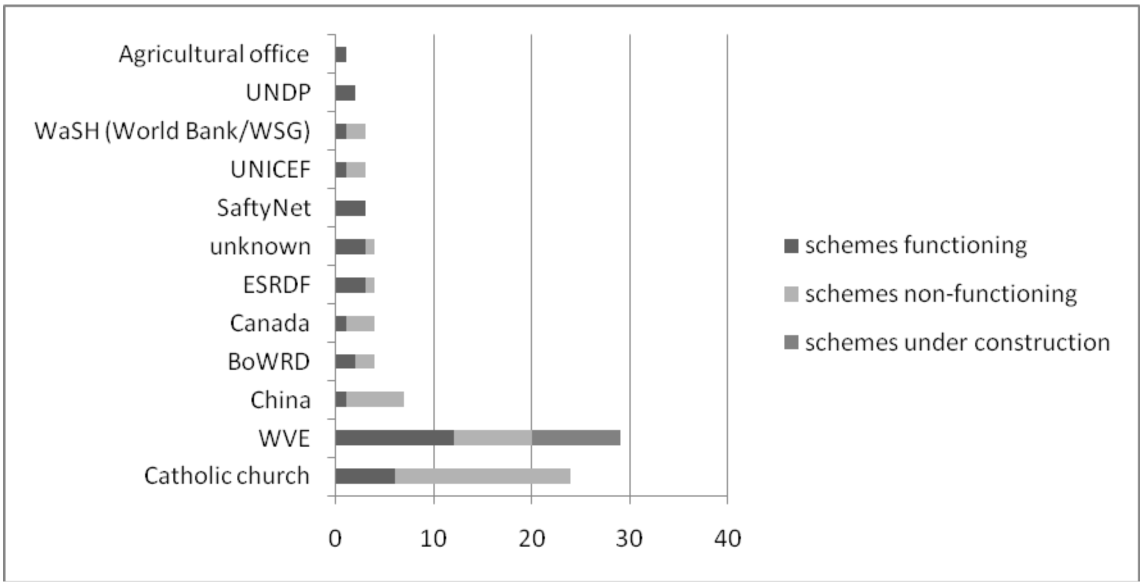
Scheme type	Functional	Non-Functional	Abandoned
Bore holes	3	6	2
Hand-dug wells	10	6	7
Medium shallow wells	17	12	1
Protected springs	10	5	-
TOTAL	40	29	10

In the period between the sustainability case study (end of 2007) and this study (beginning of 2009), the number of water supply systems has increased by 22 percent , but the percentage of non-functional schemes increased from 43 percent by the end of 2007 (Deneke and Abebe, 2008) to 49% in 2009.

According to the BoWRD report, the non-functionality rate in the region has been lowered from 24 percent in 2005 to 14 percent in 2008 (BoFED, 2008). This is much more optimistic than the 43 percent and 49 percent non-functionality rate as found by the sustainability case of 2007 (Deneke and Abebe, 2008), and this study, based on field data from early 2009, respectively.

Different organisations have been involved in the development of these water schemes. The figure below shows that most water supply schemes in the *woreda*, some 39 percent, have been financed by World Vision Ethiopia (WVE).

Figure 3.3: The main service providers and number of schemes constructed.



Non-functional cattle troughs were observed in the *woreda*. Some of these cattle troughs were linked to a few non-functional gravity piped spring systems and bore holes.

Figure 3.4: An abandoned cattle trough at Doshe *kebele*

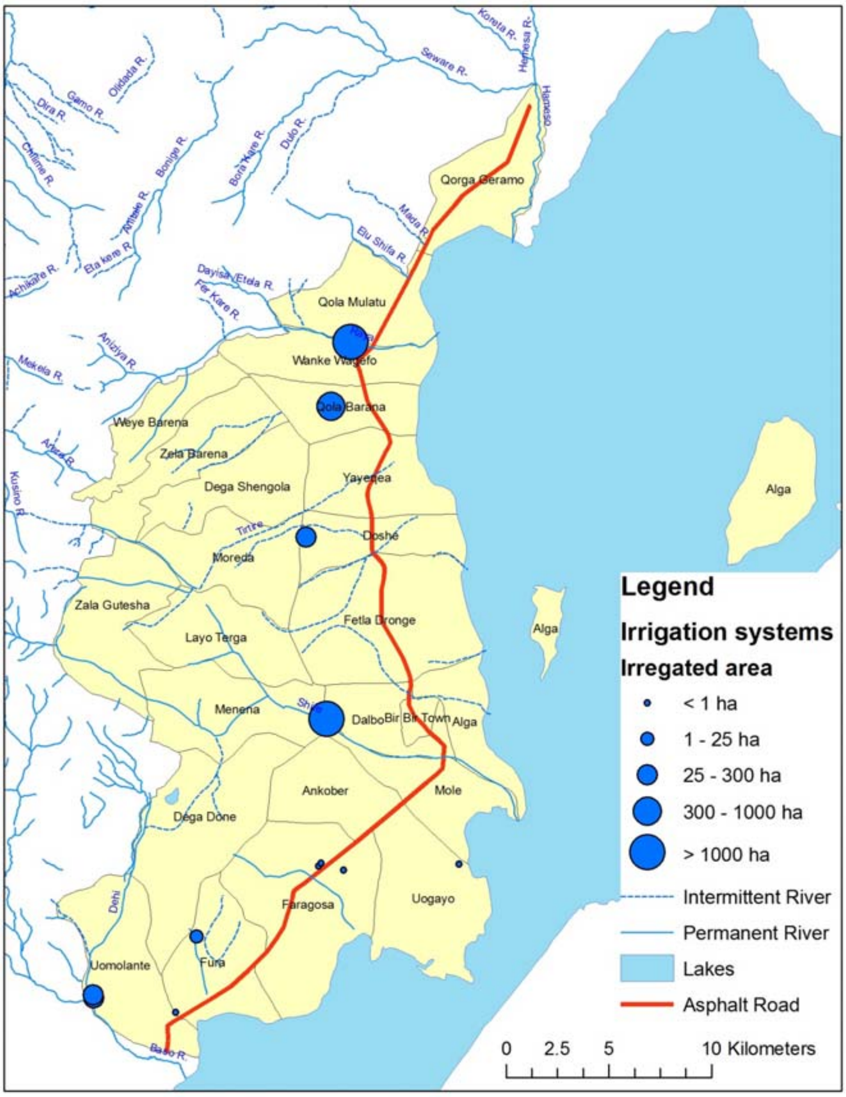
3.3.2 Irrigation infrastructure

In Mirab Abaya *woreda* there are eight modern and four traditional irrigation systems (Figure 3.5). Of the eight modern systems, three are surface irrigation systems with diversion structures and canals, while the remaining five are drip irrigation systems. Rivers and springs are major sources of water for the systems, except for the drips systems in Omolante, which use hand-dug wells fitted with hand pumps.

All the small scale modern drip irrigation systems in the *woreda* were developed by WVE. Through the Safety Net programme the community developed traditional irrigation schemes in food insecure *kebeles*.

Of the five drip irrigation systems, four are located in Faragosa *kebele* and one in Omolante *kebele*. The sources of water for the drip irrigation are a spring in Faragosa and hand pump in Omolante. At the time of the study, this system was still under construction. Additionally, two drip systems in Faragosa were not providing services due to water shortages. Also noted during the survey, the diversion head works in all the remaining structures were seen to be filling up with silt and boulders, thus resulting in the decrease of water flow through the off-taking canal. Moreover, damage to the gates and the intake parts was observed, particularly in the case of Raya diversion head works in Wanke Wagifo *kebele*.

Figure 3.5: Irrigation systems in Mirab Abaya *woreda*



3.3.3 Household level ponds and shallow wells

There is an effort to cope with water stress during the dry season in the *woreda*. In areas where there are inadequate water structures and a shortage of water, the community has been constructing water-harvesting structures. In each *kebele*, depending on the situation, either household ponds or hand-dug shallow wells have been built.

In areas where the water table is shallow, especially in the *dega* and *woyna dega*, hand-dug wells have been developed by individual households. In the *kolla* part where the water table is especially deep, household ponds have been built. As a result, in the *woreda* almost all the household ponds are concentrated in the *kolla* areas while the hand-dug shallow wells are concentrated in the highland areas, with Omolante the exception to the rule. The water table in Omolante is very shallow because of its proximity to Lake Abaya.

3.4 Water demand

3.4.1 Demand for domestic water services

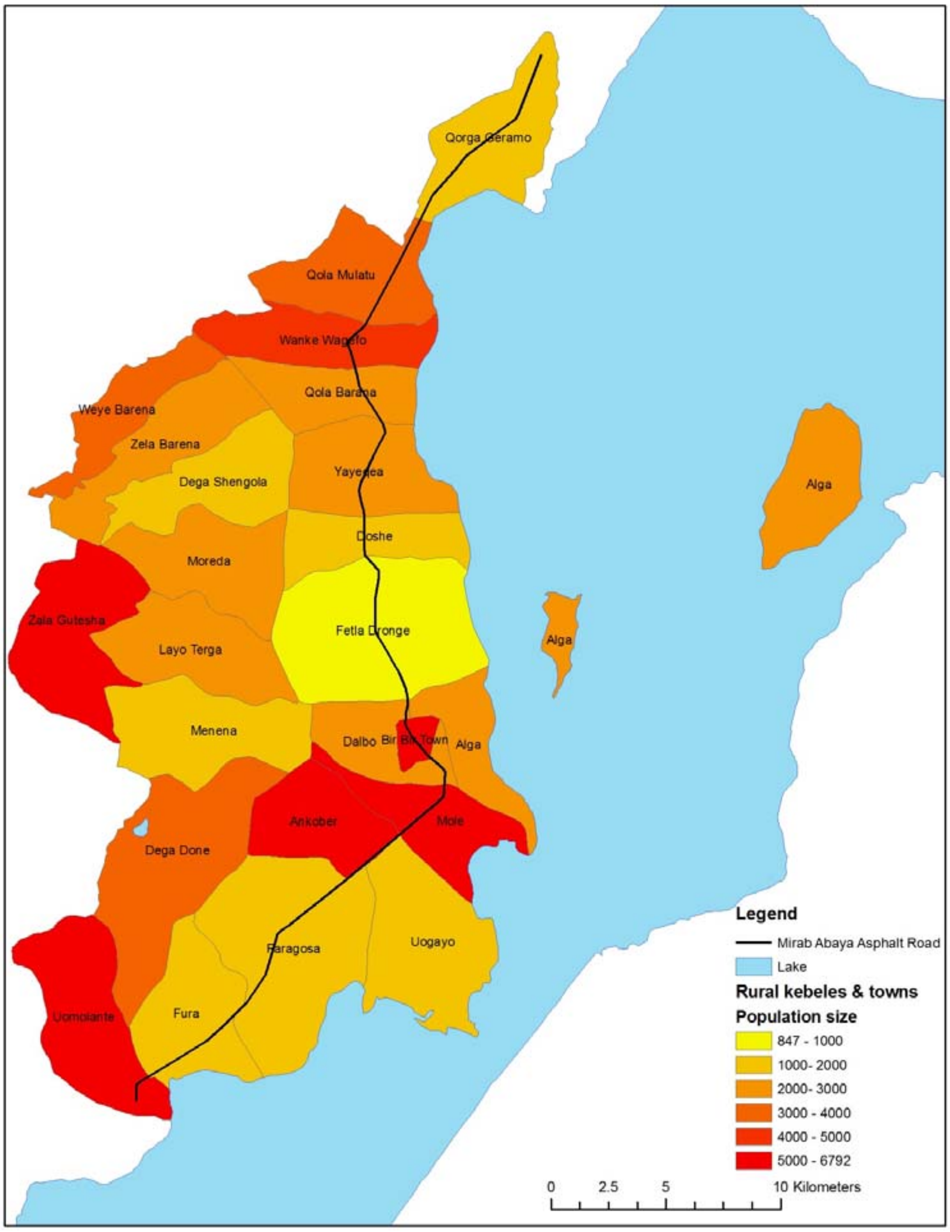
In 2007, the population of the *woreda* was estimated to be 74,901 with the regional average growth rate of 2.9 (UNFPE, 2007). The population of the *kolla*, *dega* and *woyna dega* agro-ecologies is 50,316 (including the 5,831 persons living in the town of Birbir), 22,788, and 1,797, respectively (BoFED, 2007). Figure 3.6 illustrates the population sizes of the *kebeles* in Mirab Abaya *woreda*.

The government of Ethiopia intends to provide its people with 15 litres of water per capita per day (lpcd) within 1.5 km radius in rural and 20 lpcd within 0.5 km radius in urban settings by the year 2012, as stated in its Universal Access Plan (UAP) (MoWRD, 2006). Based on the standard set in the UAP the total domestic water requirement of the *woreda* has been calculated taking population growth for the next four decades into consideration (See Table 3.3 below).

Table 3.3: Projected domestic water demand in the *woreda* for the next four decades

Year	Projected population size	Domestic water demand (m^3/year)
2007	74,901	420,725
2010	81,709	458,967
2020	109,198	613,376
2030	145,936	819,733

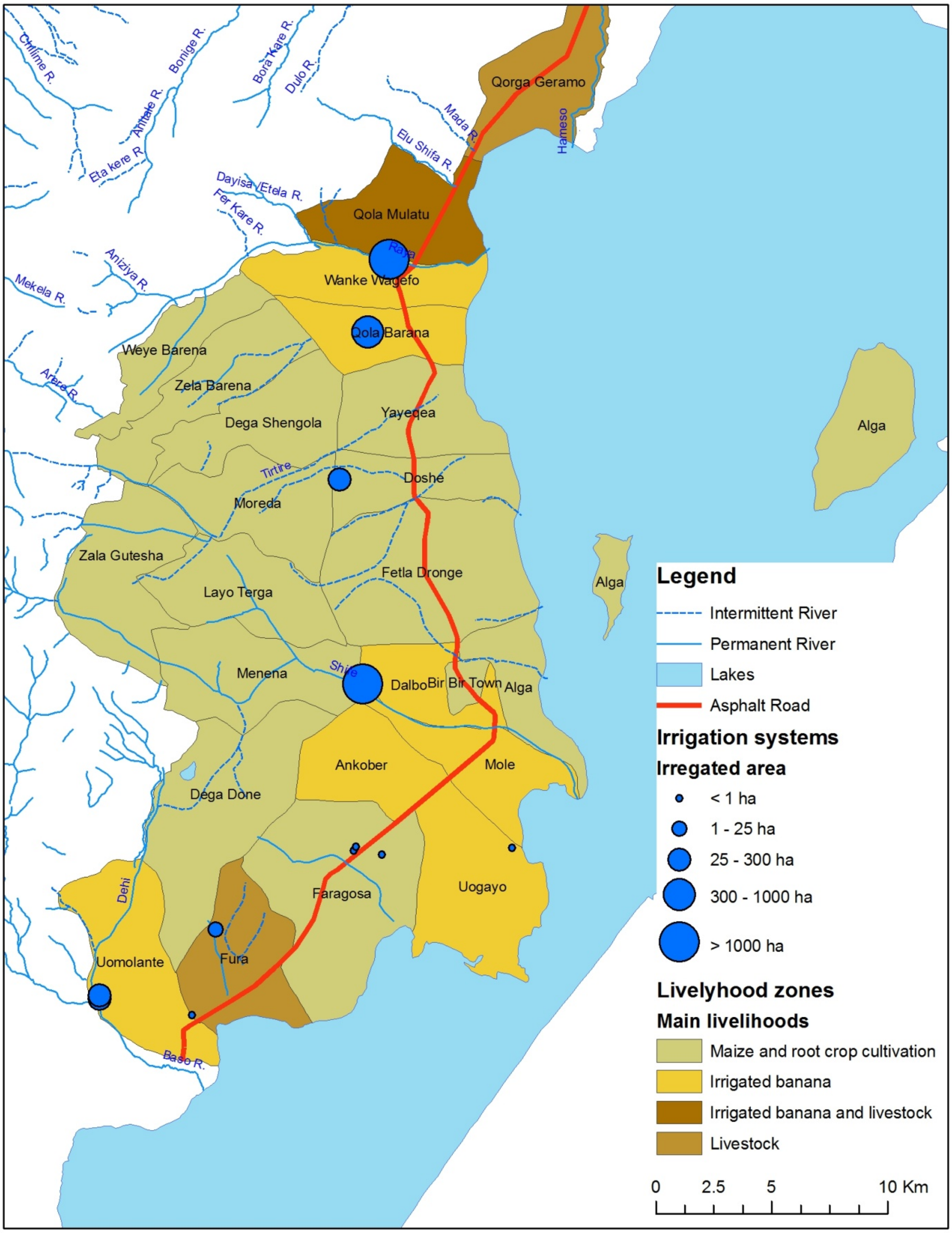
Figure 3.6: *Kebele* population size



3.4.2 Water requirement for livelihood activities

Besides water for domestic uses, as presented above, people use water for a variety of livelihood activities. Figure 3.7 below shows an overview of the main livelihood zones in Mirab Abaya *woreda*. The SNNPR livelihood profile only indicates two main livelihood zones (LZ) in the *woreda*: Gamo Gofa maize and root crop LZ and Chamo-Abaya irrigated banana LZ. However, during the field work of this study, livestock keeping was also identified as an important livelihood activity, and is therefore also included in the figures below.

Figure 3.7: Main livelihood zones in Mirab Abaya *woreda*



Irrigated cash crop cultivation, like banana and mango in the *woreda* are mainly concentrated in the *kolla* areas including: Omolante, Ankober, Wanke Wajefo, Kolla Mulatto, Kolla Barena, Ogayo, Molle and Delbo[5]. Furra, Korga and Kolla Mulatto are predominantly known for their animal products. Food crops are concentrated and mainly grown in all the other *kebeles* and to some extent in the *kebeles* that are growing cash crops.

It is difficult to give an accurate estimate of the crop water requirement in Mirab Abaya *woreda* due to the difficulty of getting monthly average evapo-transpiration data and information on cultivated area by different crop types in the *woreda*. Therefore, for this study an estimate of optimal crop water requirements is made based on data obtained from national studies on major crops of Ethiopia. For example, the water requirement for banana, a common cash crop in the *kolla*, varies between 1,200 mm per year in the humid tropics to 2,200mm per year in the dry tropics (MoA, 1990). In general, total water requirements of citrus vary between 900 and 1,200 mm per year. The optimal crop water requirement for potato is 500 to 700 mm, depending on climate; whereas that of sweet potato is between 400 and 675 mm. Maize is an efficient user of water with regard to the production of dry matter. For maximum production a medium maturing variety grown for grain requires between 500 to 800 mm of water depending on the local climate (MoA, 1990).

Table 3.4: Water requirement of major crops in Ethiopia

Type of crops	Sensitivity to salinity	Optimal water requirement (mm)
Banana	Sensitive	1200-2200
Potato	Moderate	500-700
Sweet potato	*	400-675
Citrus	Sensitive	900-1200
Maize	Moderate	500-800
Cabbage	Moderate	380-500

Source: Ministry of Agriculture, 1990.

After taking a rough estimation of the cultivated area of perennial and annual crops, the total optimal annual water demand of crops in the *woreda* can be estimated to be around 0.138 km^3.

Animals get some of their water needs from foraging, but livestock also need drinking water. If an animal is thirsty, it will eat less, lose weight and provide less power, meat or milk. The amount of water an animal needs is dependent on its size, the season, the type of food it eats, how it is kept and whether or not it is milking. During the dry season, animals tend to drink 20 to 25 percent more water than in the rainy season (MoARD, 2005). Animals that graze outside or are engaged in work require more water than animals kept under cover. A milking cow needs about five to seven litres of water for every litre of milk it produces. Generally, dairy cattle should always have water available to drink. If not possible, farmers are advised to make sure their cattle drink as much as they can at least twice a day (MoARD, 2005).

The total livestock population in Mirab Abaya *woreda* and its daily water demand is shown in the table below. The total annual livestock water demand is estimated to be about 375,226 m^3.

5 According to the SNNPR Livelihood Profile (2005), the following kebeles fall under the Chamo-Abaya irrigated banana livelihood zone: Ankober, Dalbo, Kola Museto, Mole, Ogayo, Wanke Wajefo.

Table 3.5: Daily livestock water demand in Mirab Ababya

Type of animal	Daily water demand of livestock in Ethiopia (litres per head per day)*	Number of heads**	Daily water demand in the *woreda* (litres per day)
Cattle	25	33,270	831,750
Goat	10	14,436	144,360
Sheep	10	2,892	28,920
Pack animal	20	990	19,800
Chicken	15 (100 birds)	21,243	3187
			1,028,017

Source: * Managing Land, MoARD,2005; ** EDCS,2007.

3.4.3 Environmental water demand

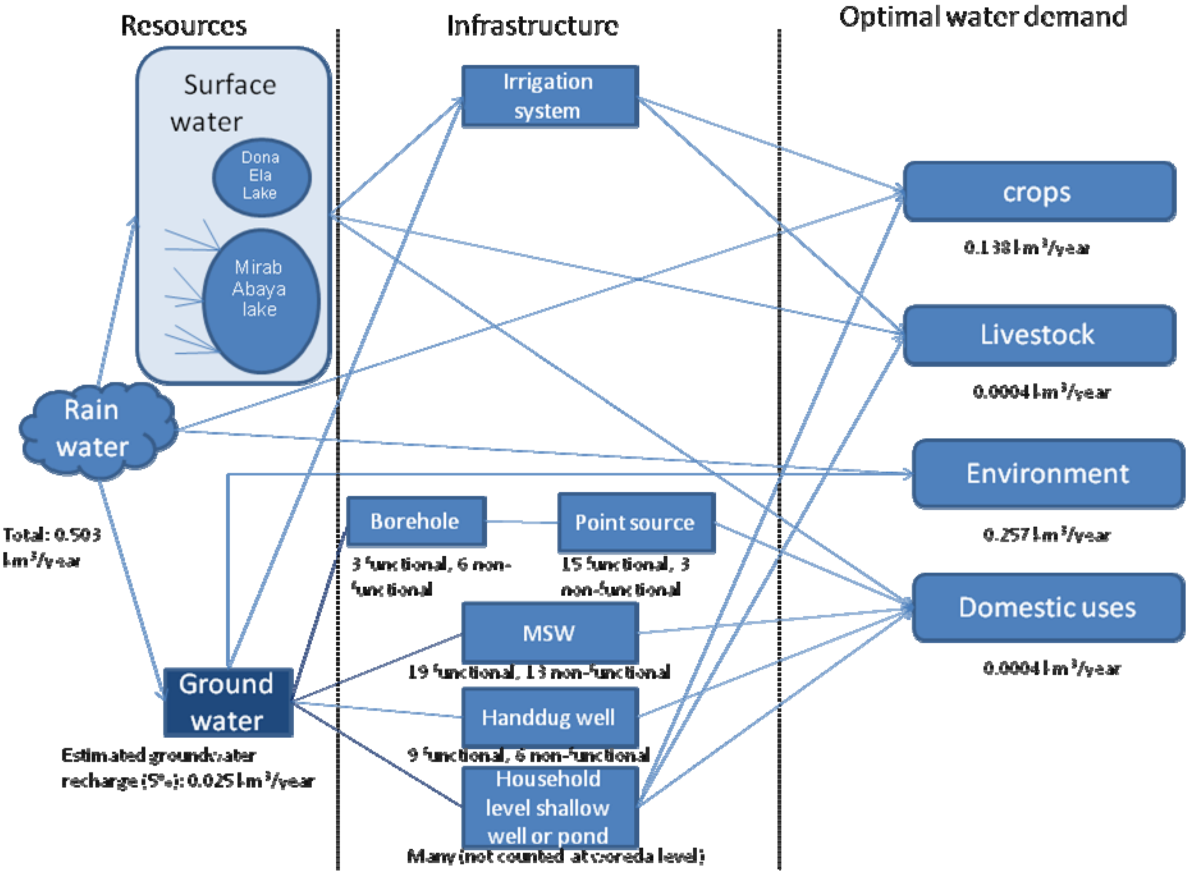
As mentioned above, the total land area of the *woreda* is 1,058 km^2. Out of this, 43 percent is covered by forest (20 percent), bush (8 percent), fallow (5 percent) and fallow and grazing (10 percent) (WAA-WVE, 2002). Owing to the unavailability of data for the average rain fall and evapo-transpiration, or national/regional standard water demand for fallow land, grazing land and land covered by forest and bush, it was difficult to determine the demand for water in the region. However, the water demand was estimated by relating the demand of the above plants with the same water requirement of plants in similar agro-ecology areas. The annual environmental water demand of the *woreda* was estimated to be 0.257 km^3.

3.5 Overview of water resources, infrastructure, demand and use

Figure 3.8 below gives an overview of the water resources, infrastructure and demand for water in Mirab Abaya *woreda*. The arrows indicate which source of water is used for what purpose. Surface water resources are used for livestock watering, domestic uses and non-consumptive uses like fishing and transportation. According to the WWRDO, communities had used Abaya Lake for drinking water, but this is no longer practiced because of the introduction of quality water supplies. Done Ela Lake, which has no salinity problem, is used for domestic use including drinking water. The household level shallow wells and ponds are often used for both domestic purposes (except drinking), and for irrigating homestead vegetables and garden crops, as well as cattle watering.

The above information shows that on an annual basis, there does not seem to be a lack of water resources in the *woreda* to satisfy the demand for different uses. The annual total water demand of the *woreda* is estimated to be about 0.395 km^3, which is less than the amount of annual rainfall the *woreda* receives. However, there is a lack of a functioning infrastructure to convert the water resources into water services, so that accessible and reliable quantities of water of a certain quality can be put to use by people. Moreover, seasonal water shortages also occur.

Figure 3.8: Overview of water resources, infrastructure and water demand in Mirab Abaya *woreda*

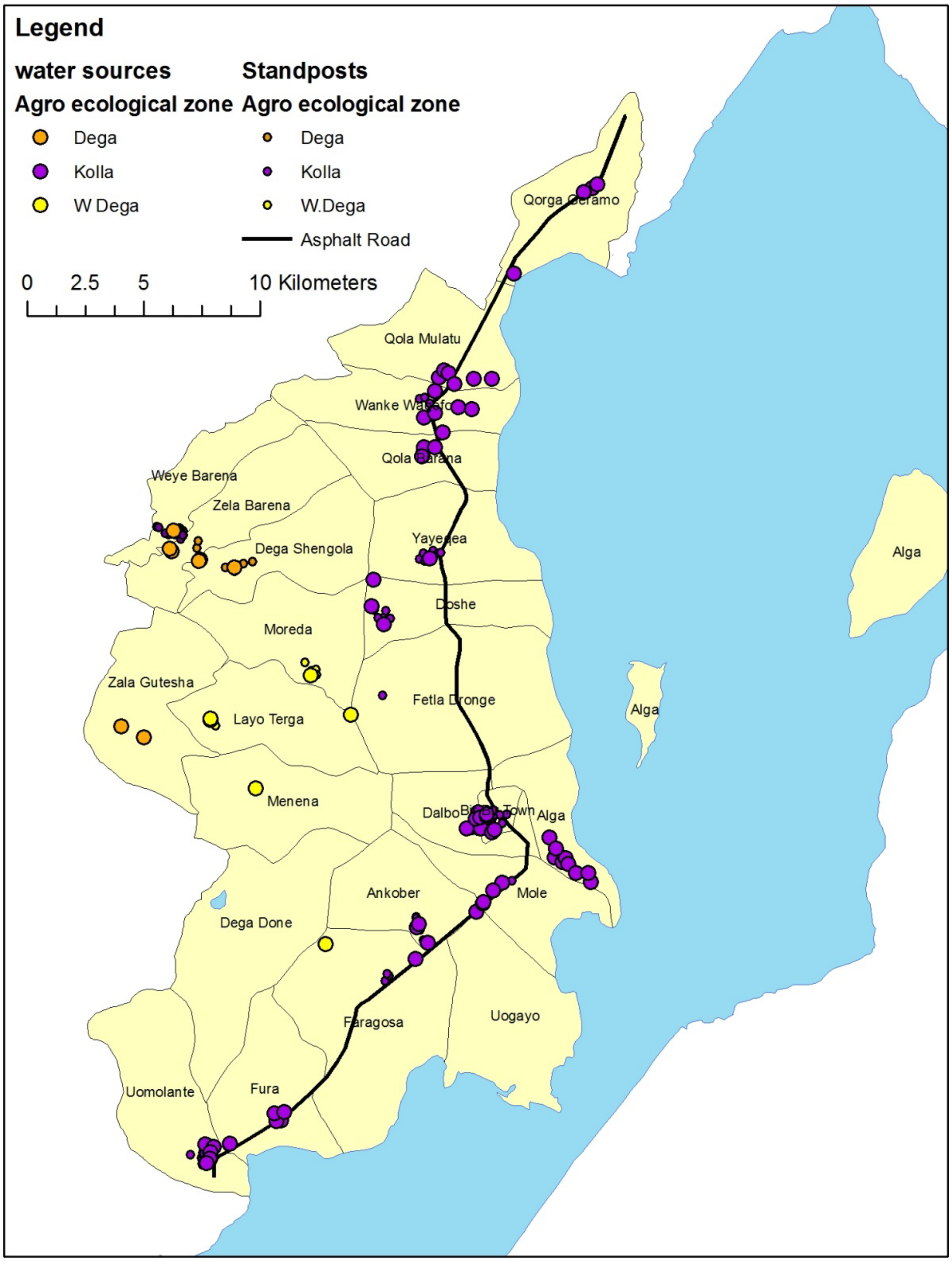


3.6 Spatial equity: the distribution of water services in the *woreda*

The degree of equitable water services does not depend on the equal spatial distribution of water infrastructure over an area, but rather on the degree to which people's demands for water services for multiple uses, in terms of water quantity, quality, reliability and accessibility are met, regardless of their location. Here, we will first look at the spatial distribution of infrastructure between the different agro-ecological zones and the different *kebeles* in the *woreda*, after which we will look at the degree to which demand for water services are met in different locations within the *woreda*.

The figure below illustrates the distribution of water supply schemes over the different *kebeles* of Mirab Abaya *woreda*, and the different agro-ecological zones as shown in figure 3.3. The majority of the schemes (82 percent) are located in the *kolla* (11 BH, 29 MSW, 23 HDW, and two PS) followed by *dega* (nine percent) (one MSW, six PS) and *woyna dega* (nine percent) (seven PS). Furthermore, all the current schemes under construction were found in the *kolla* area of the *woreda*.

Figure 3.9: The distribution of schemes over the three agro-ecological zones

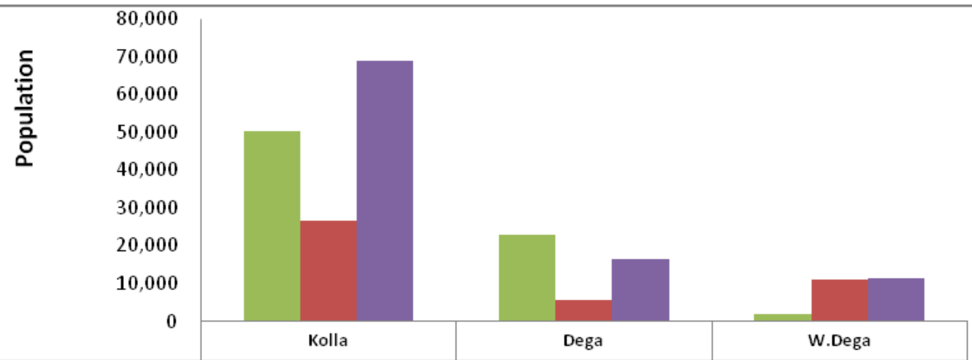


Based on data collected by the Equity research team, beginning 2009.

However, as mentioned above, in order to be able to address the issue of spatial equity, the availability of water infrastructure will have to be compared with the demand for water services. Firstly, we will compare the number of people in each agro-ecological zone and each *kebele* with the potential number of people served by the water supply schemes in those areas. This is one way of estimating the coverage of water supply, which is also commonly used by the BoWRD.

The figure 3.10 below gives an overview of the population of each of the three agro-ecological zones, the total number of people that could be served by the functioning infrastructure as per the UAP standard and the maximal potential population that could be served if water supply infrastructure in the area was fully functional. Based on this, water supply coverage of the functional water supply infrastructure is estimated to be 53 percent, 25 percent and 623 percent in the *kolla, dega* and *woyna dega* agro-ecologies respectively, giving a total coverage of 58 percent at *woreda* level. If all schemes were functional, including the currently non-functional schemes, the water supply coverage in the *kolla, dega* and *woyna dega* would amount to 137 percent, 72 percent and 640 percent, respectively, giving a *woreda* level coverage of 129 percent.

Figure 3.10: Total population, people served by functional water supply infrastructure, and maximal potential number of people served per agro-ecological zone in Mirab Abaya *woreda*

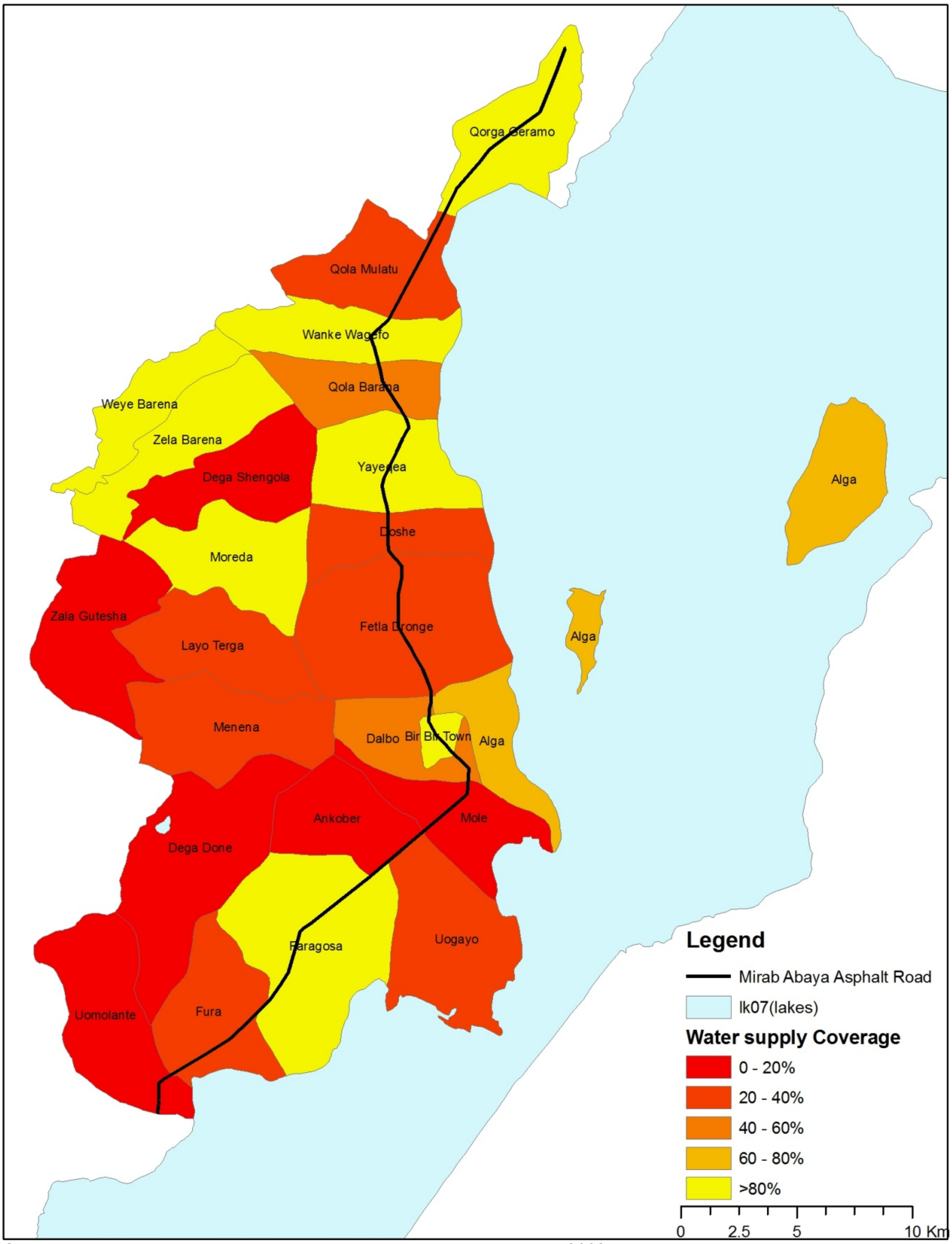


	Kolla	Dega	W.Dega
Polulation (2007)	50,316	22,788	1,797
Potentially served population by functional water supply infrastructure (2009)	26,500	5,600	11,200
Max potentially served population (if 100% of the infrastructure would be functional)	68,750	16,400	11,500

In the same way, coverage can be estimated per *kebele*, as shown in Figure 3.11. For more detailed information, please see the table in Annex 2, which demonstrates the remarkably high water coverage of *kebeles* with small populations (Korga, Faragosa, Wajefo) and poor coverage of *kebeles* (Ankober, Omolante, Mole) with a population size of two to three times higher than the majority of the *kebeles*.

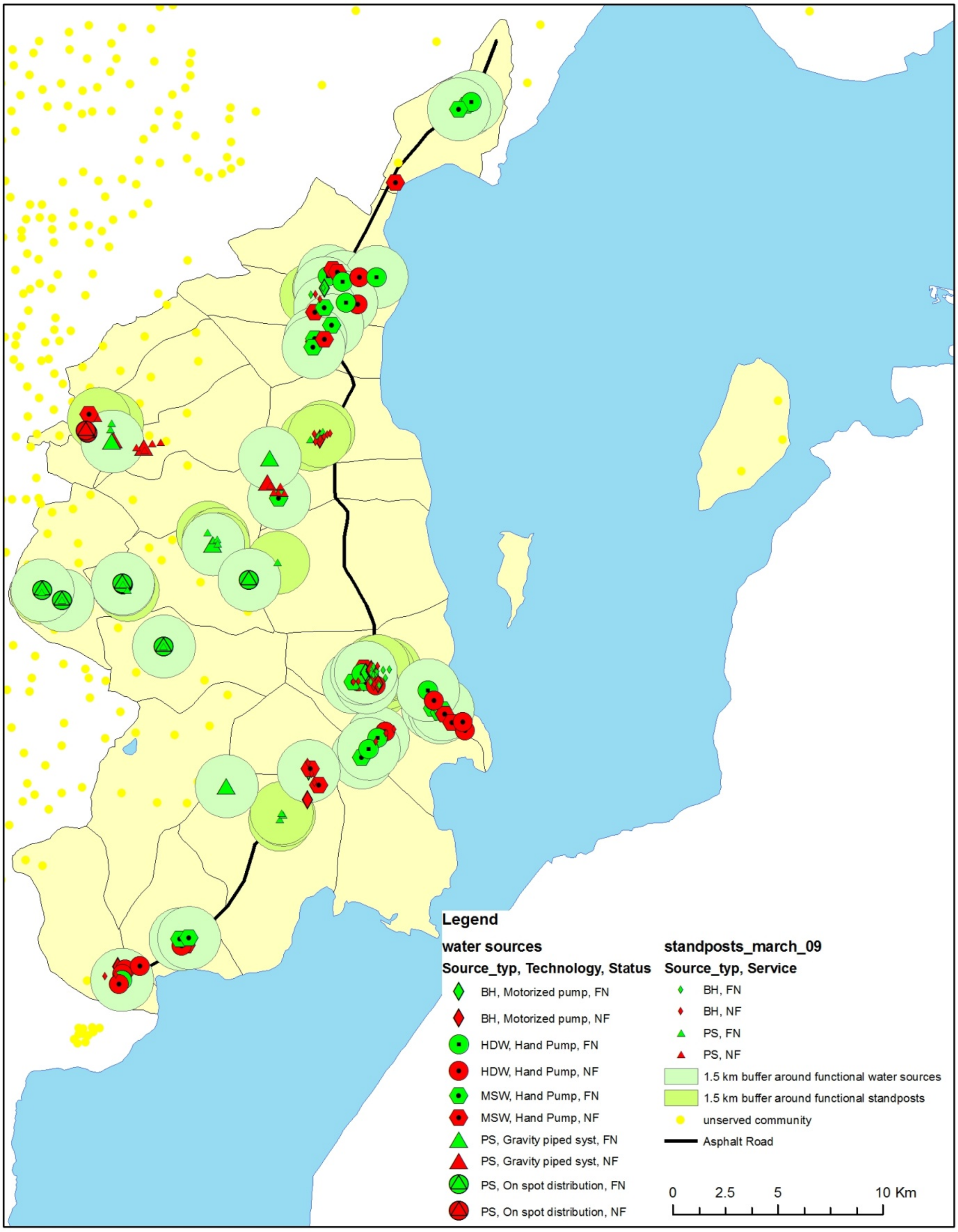
By comparing the population of an area with the population that the functional water infrastructure in that area can potentially cover, we do not take into account the actual discharge of the infrastructure and its accessibility. As discharge has not been measured consistently in this study, we will instead limit ourselves to examining the distance of water infrastructure in relation to the communities it serves. Particularly in the highland areas, many settlements are without access to water within the 1.5 km service radius as per the UAP, as illustrated in Figure 3.12. In the lowland, most of the settlement areas seem to be within the reach of functional water supply infrastructure. This is probably due in part to the fact that the settlement pattern is more concentrated in the lowland areas, while settlements are much more scattered in the highland areas. In the lowland areas, the distance to water infrastructure does not seem to be the limiting factor for people to have access to water services. Rather, access is limited by the fact that the population is far greater than the number of people that can be served by the functional infrastructure, leading to long queues and waiting times.

Figure 3.11: Coverage of functioning systems per *kebele* in Mirab Abaya *woreda*.



Source: Based on data collected by the Equity research team beginning 2009.

Figure 3.12: The distribution of water service within 1.5 km radius



Source: Based on data collected by the Equity research team beginning 2009.

3.7 Discussion

As shown above, care should be taken in calculating water supply coverage. Based on the population that could be served by all water systems in the *woreda*, the total water supply coverage in the *woreda* was estimated to be 58 percent. This is about seven percent lower than the regional coverage reported by the regional Bureau of Water Resource (BoFED, 2008) of 63.4 percent. However, coverage could be much lower than the estimated 58 percent, if accessibility to systems and actual yield of systems are taken into account.

The mapping results have revealed inequitable distribution of water infrastructures/services among the three agro-ecological zones, between *kebeles* and within *kebeles* in the *woreda.* The highest concentration of systems is located in the *kolla* area. However, this is also the area with the largest absolute number of unserved people, i.e. comparing the total population with the population that can potentially be served by functioning water infrastructure. The *dega* area has relatively the lowest coverage (25 percent).

When considering a service radius of 1.5 km as per the UAP norm, the majority of the population in the *kolla* has access to water supply infrastructure, while many settlements in the highland remain uncovered. The nature of the population distribution might influence this. In the *kolla*, the population tends to be concentrated, while in the *dega* and *wonya dega* the population tends to be more scattered, making it more difficult to provide infrastructure within 1.5 km of every household. Even within a 1.5 km service radius, the rugged landscape in the highland area may result in difficulty of accessing the systems.

In the lowland area, the distance to water infrastructure does not seem to be the limiting factor for people to have access to water services. Rather, access is limited by the fact that the population is far greater than the number of people that can be served by functioning infrastructure, leading to long queues and waiting times.

The high rate of non-functionality of water infrastructure is as much a problem in the *woreda*, if not more, than the limited number of systems that have been implemented. Importantly, if the infrastructure that has been implemented over time was functional, the majority of the *woreda*, except for part of the *dega* areas, would be fully covered. However, rather than maintaining and rehabilitating broken schemes which are abundantly available in the *kolla*, the focus is primarily on the construction of new schemes. It could be argued that this may actually hamper efforts to provide service to the unreached parts of the community, leading to greater spatial inequity between the highland and lowland areas.

4 Case studies: access to water services and to water use at community level

This chapter discusses the barriers to access to water services, water use and to decision-making processes around water services in the community, and the degree to which these barriers contribute to social inequity in access to and use of water services for multiple uses. To identify the various constraints to access to water services, two case study *kebeles* in Mirab Abaya *woreda* were selected. The site selection was conducted with the active participation of the Mirab Abaya *woreda* LPA members on 16 January 2009. The site selection criteria included: agro-ecological difference and the presence of different livelihood groups; presence of water supply and irrigation systems; presence of water committee and multiple use water services (either from developed or undeveloped sources). The two communities selected for the case study were Omolante and Woye Barena, located in the *kolla* and *dega* areas.

4.1 Omolante

Omolante is about 30 km away from the *woreda* capital Birbir, on the way to Arba Minch. The *kebele* comprises two villages: Ketena One, situated in the *kolla* agro-ecological zone and the Ketena Two in the *dega* agro-ecological zone. The total population in the *kebele* is estimated to be 6,776. Wolayta and Gamo, the major ethnic groups found in the *kebele*, coexist alongside a few Amhara.

There are two rivers in the *kebele*: Dehi and Baso, both used for irrigation purposes with Dehi River being the most important. In addition to irrigation, the rivers are used for bathing, washing cloths, and drinking water.

4.1.1 Livelihoods and wealth groups in the community

In Omolante *kebele*, farming is the most important livelihood activity. The *kebele* is known for its banana and mango production, which is the main source of income. Water from the rivers and from the nearby Abaya Lake is used to support the production of banana and mango throughout the year. In addition to banana and mango, *teff*, maize, sweet potato, *cassava* and other vegetables are cultivated.

Another livelihood group, uniquely consisting of men, are the daily labourers. There are also a few people whose livelihoods depend on petty trade and some others who are engaged in making money by transporting water from the neighbouring *kebele* (Ochololante) to Ketena One and Two using donkey cart and bicycle. Those involved in transporting water use the shortcomings in the provision of water services as an opportunity for income generation.

Table 4.1 below shows the three major wealth groups found in the *kebele* with their distinct characteristics as defined and stratified by the local community.

Table 4.1: The different wealth groups and their characteristics

Category and characteristics		
Poor	Medium	Best off
Livelihood assets: • No cattle • No land or unable to cultivate it, or unproductive/infertile land • Unable to send children to school • Lives in a grass thatched hut/unable to change the hut, does not have own house and lives in a rented house	Livelihood assets: • At least an ox, a milk providing cow, a goat or a sheep • At least one hectare of land • Can dress children and can send some of the children to school/college	Livelihood assets: • At least four oxen, four cows, four sheep, four goats • At least one hectare of fertile land • Can hire land from other people • A car • A mill house • Can send children to college • Built or bought a house in town • Lives in a house with a corrugated iron roof and with a cemented floor • Savings in the bank, can provide loans
Main livelihood activity: Begging, selling fire wood and grass	Main livelihood activity: • Land cultivation • Does not rent his land for contract	Main livelihood activity: Able to produce a surplus harvest and bring the surplus to the market

4.1.2 Equity of water supply service

Description of water supply service

During the community mapping exercise, five hand pumps and a bore hole with two distribution water points were identified in the community. In addition, one bore hole was found to be under construction. Of the hand pumps, only one was functioning and providing water. According to the community, the mechanised bore hole began to fail frequently and they began to use the hand pump for drinking water two years ago. Until nine months ago, the bore hole still regularly provided service. At the moment of the field research, the non-functionality rate of schemes in Omolante (excluding those abandoned and those under construction) was around 80 percent, which is far beyond the non-functionality rate for the *woreda*, which was found to be 49 percent.

According to the UAP standard, a hand pump and a bore hole are expected to serve 250 people and 3,500 people respectively (MoWRD, 2006). Therefore, if all the schemes (excluding the abandoned and under construction) were functioning, they could serve about 4,500 people, which is about 66 percent of the estimated population in this *kebele* of 6,776 persons. With the complete breakdown of the mechanised bore hole, the population is now reliant on a single hand pump, which can serve only 250 people as per the UAP standard. This gives a rate of the population served by functional water infrastructure of four percent.

Box 4.1: Perception on levels of water services

One participant during a focus group discussion mentioned: *'Before the construction of a hand pump in 1978 E.C., the community had been using water from swampy areas, rivers and Abaya Lake for drinking. When we drank the water, we were suffering from diseases, including swelling of the stomach. As a result, we lost many of our colleagues and children. However, after we began to use the hand pump, the health situation of the community significantly improved. Furthermore, recognising the increasing number of people in the area, owing to resettlement, the government constructed a bore hole with two distribution water points. This had further improved the health and increased the confidence of the community. Because of very good quality of the water from the bore hole, we had been using the water from the hand pump only for bathing, cloth washing and washing utensils. When the bore hole was constructed, we thought we got relief from water related problems. However, now it seems we are getting back to 1970s, where we had been suffering from water born diseases as the number of functional schemes decreased to one'.*

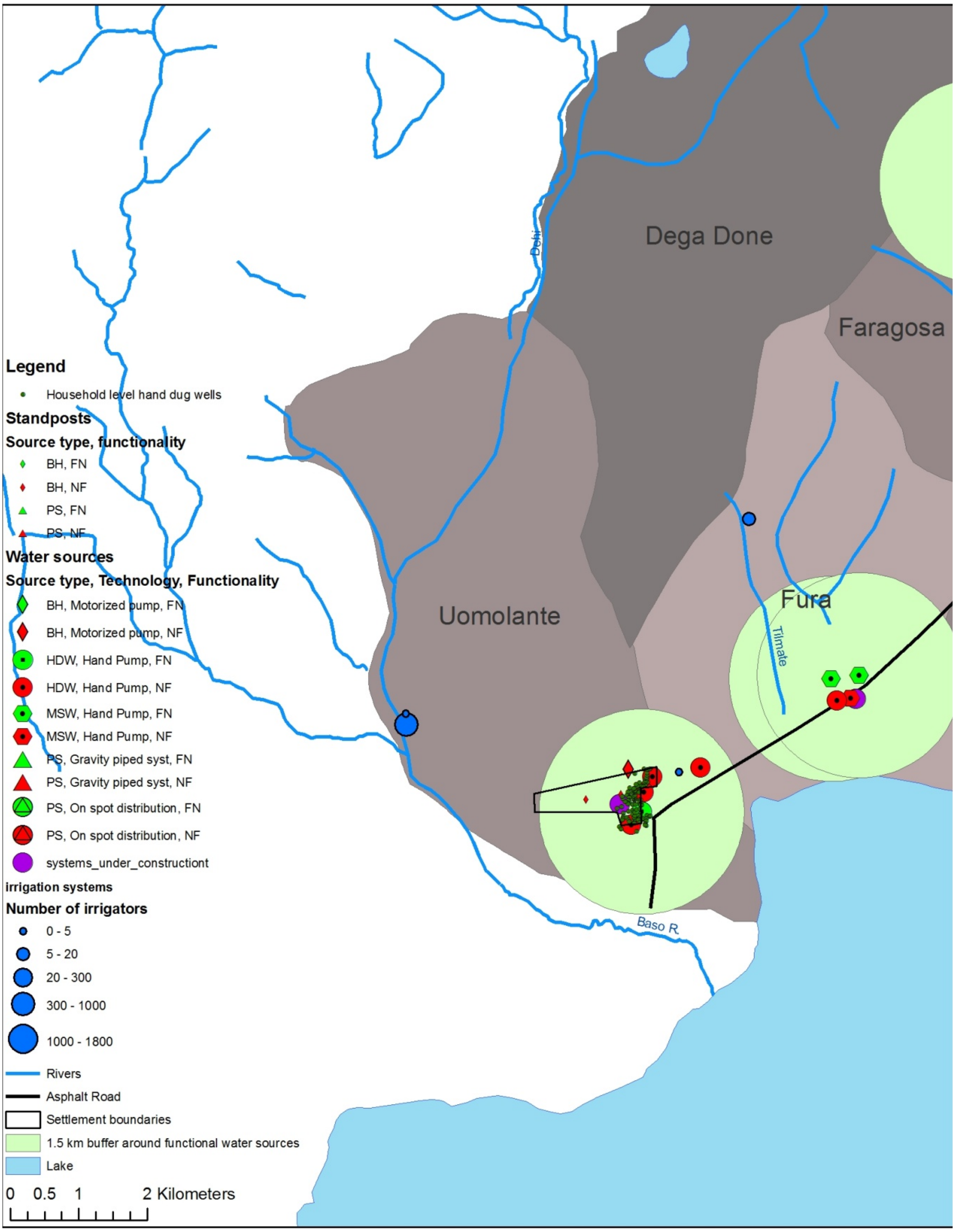
Box 4.2: Another bore hole, or not?

Another individual mentioned *'When the community had seen WVE beginning to dig a new bore hole, their hope of getting clean water was restored again. However, not soon after that the community was disappointed by the disappearance of the organisation after drilling the bore hole, leaving the structure unfinished and unusable'.*

Most of the respondents believed the water from the hand pump to be of poor quality. They did not perceive the water from the hand pump to be ground water, but rather surface water from the nearby lake. For this reason, the hand pump was not used for drinking water. Now that the bore hole is no longer functioning, people depend on the hand pump. They use 'Woha Agar' (chlorine) to treat the water to make it safe for drinking, or, boil the water when they cannot afford to buy chlorine.

In addition to the hand pumps and mechanised bore hole, 106 household level hand-dug wells were identified during the community mapping exercise, with depths ranging from 4 to 14 meters.

Figure 4.1: Omolante



Based on data collected by the research team, beginning of 2009.

Barriers to access to water services for domestic purpose

The distance to the water points connected to the bore hole was considered to be fair by the users, while the distance to the hand pump was considered too far by most respondents. Respondents reported a round trip to fetch water from the hand pump during the dry season to take about 31 minutes on average, with a minimum of 10 minutes and maximum of two hours. During the wet season a round trip takes 40 minutes on average. The average waiting time during the dry season is about four hours, while the average waiting time during the wet season is two hours and 15 minutes. This suggests that distance is a barrier to access to water services from the functioning hand pump, but an even bigger barrier is the long waiting time, which is caused by the high volume of people relying of the hand pump for their water supply.

People can only get water from the hand pump if they pay five cent for 20 litres of water and if they keep their place in the queue. In all the discussions the participants reported that no one would be allowed to fetch water without paying. When asked whether there were any people exempted of payment, the hand pump caretaker responded that she did not think that there was an individual in her community who could not afford to pay five cent for 20 litres of water and she believed that there was no opportunity for anyone to get water for free. The caretaker could at most let the user take water on loan with the condition that payment would be made the following day. Financial barriers to using the hand pump thus seem to be limited. When it was still fully operational, water from the bore hole could be fetched for the price of ten cent for 20 litres.

Figure 4.2: Girls carrying water back home and waiting their turn at the hand pump in Omolante

Equity of water use

All wealth groups of the community use water from the hand pump for drinking and cooking purposes. For bathing, cloth washing and washing utensils, during both the dry and the wet season, most people use the Dehi and Baso rivers. Most of the poor and daily labourers indicated that community members whose residences are far from the hand pump were also using the Dehi and Baso rivers for drinking water, particularly during the dry season. One participant indicated that people fetched water early in the morning expecting that no one would defecate near the rivers or contaminate the sources. However, during the wet season, and owing to turbidity problems, the river water was said not to be used for drinking. To fetch water from Dehi and Baso rivers women and girls travel for more than two hours.

The mapping results showed that 89 percent (94) of the households with hand-dug wells used the water for washing clothes, bathing, washing utensils, and cooking, and 11 percent (12) of the households used water for livestock watering and irrigating vegetables. Some community members reported that they do not use the water for irrigation because of salinity problems, while others reported that they had made an attempt to grow vegetables but the water burnt and destroyed their crops. The wealthy participants at Ketena One said they were using water from hand-dug wells for all domestic purposes except drinking. They mentioned that those who had no access to a hand-dug well could fetch water from a neighbour's hand-dug well. About half of the poor farmers and some medium-wealthy people reportedly used hand-dug well water taken from a neighbour's well.

During the wet season, roof top rain water harvesting is also used as a supplementary source of water for domestic use. Furthermore, the community uses water from the irrigation canal for washing clothes and for bathing, as seen in Figure 4.4.

Community members from better-off wealth groups fetch and/or buy drinking water from the neighbouring *kebele* (Ochololante) approximately five kilometres away, with the help of donkey carts. A round trip to Ochololante takes more than two hours, but the average waiting time is only about ten minutes. The number of people fetching water from the neighbouring *kebele* increases during the dry season as there is high pressure on the hand pump. The cost of the water from Ochololante is 10 cent per 20 litre jerry can (which is similar to the cost of water from the mechanised bore hole, when it is functioning). However, the cost of transportation by donkey cart is one ETB per 20 litre jerry can and two ETB for water transported by bicycle. A donkey cart can carry about 20 jerry cans per trip, while a bicycle can only carry one at a time (See Figure 4.3 below). A donkey cart can thus make about 20 ETB in a single trip, while the bicycle can make two ETB per trip. Most of the cart riders are teenagers whose earnings supplement their family's income.

Figure 4.3: Teenagers transporting jerry cans of water from Ochololante by donkey carts and bicycle

In the dry season the amount of water collected for drinking and cooking purposes ranges from 20 to 60 litres per household per day with an average of 29 litres. Per capita water use for drinking and cooking in the dry season ranges between 2.5 and 7.1 litres with an average of five litres per person per day. In the dry season the per capita water use among the poor, medium-wealthy and wealthy is, on average, four, five and six litres, respectively. The water used for drinking and cooking in the wet season ranges from 10 to 50 litres with an average of 24 litres per household per day. Per capita water use in the wet season is on average three, 3.5 and four litres, for the poor, medium and wealthy, respectively. The per capita clean water use in Omolante of around five litres is thus far lower than the UAP standard of 15 lpcd.

The above shows that, although all people in the community, regardless of the wealth status, face the same barriers to access water supply services (distance and long waiting times), wealthier households of Omolante manage to acquire and use slightly more drinking and cooking water than poorer households, mainly because they have the necessary financial resources to buy water or pay for transport of water from neighbouring communities.

Figure 4.4: Multipurpose water use from unprotected sources, women and children washing cloth and bathing, respectively

Equity in decision making

Almost all male respondents reported their participation in the Water Sanitation and Hygiene Committee (WASHCO) election. According to them, the election was democratic. However, almost none of the daily labourers participated in the WASHCO election. The daily labourers indicated that they do not participate in *kebele* meetings where water issues are discussed as they feel excluded and insufficient attention given by the *kebele* administration to their needs. In addition, they mention that their income is hand-to-mouth and that they need to give priority to earning their daily income, rather than participating in community meetings. Most women reported that they are also not invited by the *kebele* administration to discuss water-related issues. Widows are an exception to this rule as they are considered the head of the household. Other women mentioned that they are represented by their husbands in the WASHCO election process.

According to the UAP, the WASHCO, under close supervision of the *kebele* and *woreda* administrations, and with support from the *woreda* support groups, should prepare and adopt tariffs that take into consideration the capacity of the beneficiary (MoWRD, 2006). In Omolante the tariff was decided exclusively in consultation with household heads. The majority of the daily labourers indicated that they did not have any role in setting the water tariff. For the bore hole, separate tariffs were set for those having farm land and those who did not. No additional consideration was made to financially weak and marginalised people.

4.1.3 Irrigation Services

Description of irrigation services

Baso and Dehi rivers are used to irrigate areas in the southern part of Omolante *kebele*. Two canals from Dehi River, one crossing the village at the centre and the other passing on the northern part of the village, are used to irrigate the command area on the southern part of the village. The Baso River had been primarily serving the neighbouring *kebele* (Ochololante), while the Dehi is uniquely used at Omolante.

In the *kebele* there is an effort by WVE to modernise the traditional irrigation system. The construction of a diversion weir has been under way since 1999 E.C. However, owing to a budget cut from the donor, construction work has halted. As a result, a system which was planned to irrigate 300 ha of land is currently out of use. About 500 households are forced to rely on the traditional system, while the majority of the respondents reported water scarcity during the dry season and flooding of farmland during the rainy season.

There are no plans to revise the management of the irrigation system with the construction of a modern irrigation system. The WVE representative indicated that the organisation will hand over the irrigation system to WARDO after completion. Regarding the system management, no new guidelines or by-laws will be implemented by the organisation.

WVE have introduced drip irrigation systems on a small scale. During the scheme mapping activity, the construction of two drip irrigation systems fitted with a hand pump was under way. The project hopes to irrigate 0.4 ha of land and expected to serve four households after completion.

Barriers to access to irrigation water services

Anyone who has irrigable land within reach of irrigation water is allowed access to this water according to a schedule set by the irrigation arbiter. The arbiters do not have explicitly written legal by-laws, but are governed by unwritten community agreed by-laws for irrigation water use. In this case, a person is given six hours to irrigate his/her land. Depending on the amount of water from the source, the water from the main canal can be diverted into two or four canals. During the survey there were only two operational canals, each supplying one user group. Only one farmer per user group is allowed to irrigate his land at a time. Therefore, in each 24 hour period only four farmers can irrigate their land. The irrigation time does not take into consideration the type of crops grown and the amount of land, growth period of the crop and the distance from the source.

The distribution of water is in principle conducted according to the rules and regulation of irrigation water use. Accordingly, the arbiter gives priority to perennial crops, while people growing vegetables (tomato, pepper, and cabbage) are served last, if there is enough irrigation water. Although sweet potato is a staple food in the *kolla*, growing it is very difficult because of the unavailability of water. The arbiters do not keep records of the water distribution, which is conducted through oral communication. Most of the rich and medium wealthy farmers were of the opinion that the water arbiter provides water in an equitable way. However, the majority of the poor farmers mentioned that the water arbiter usually favoured the rich and their relatives when distributing water. The water arbiters only allow the poor to access water at night. One poor farmer mentioned: 'The rich people pay some young people who will attack the poor man by waiting along the way to this farm land. When they threaten and let the poor go home the rich use the water to irrigate his land.'

According to some farmers there are some less-experienced farmers who only want to grow fast growing vegetables in an effort to get rich quickly. When the arbiter refuses to give water for these crops, they steal water at night to irrigate their crops. According to the *kebele* manager, if an individual is found to be illegally diverting the water from another individual and uses it to irrigate his land, he is arrested for 24 hours and will receive an additional 100 ETB fine.

Figure 4.5: A farmer irrigating his banana farm by diverting water

Equity of irrigation water use and benefits

Banana, maize, *teff,* sweet potato, *cassava*, and tomato are the crops being irrigated in order of importance, as indicated by respondents. The Ministry of Agriculture (1990) advises farmers to irrigate banana, sweet potato and tomato for an interval of seven to 15 days, and an interval of 14 to 21 days for maize. In practice the irrigation interval in Omolante is generally at least one month, which is considerably longer than the advised interval.

Almost all households including poor, medium-wealthy and wealthy, have irrigated land. The size of the irrigated land holding of a household ranges from 0.25 to one ha with an average of 0.75 ha. The average irrigated land holdings of poor, medium and wealthy households are 0.4 ha, 0.9 ha and 0.9 ha, respectively. During the wealth ranking activity the participants categorised the wealthy as those having fertile land. They added that it was not the land size that mattered most, but rather it was the skills and means of the farmer and the fertility of the land that made the difference. The majority of rich farmers rent land from the poor farmers in Omolante. As a result, the majority of the daily labourers do not have any land. Only a few daily labourers have a small parcel of land that was inherited from their parents.

Besides differences in land quantity and quality, there are differences in the crops cultivated between the poor and the rich within the community. Most of the poor grow maize, which is a food crop cultivated in rainy season, followed by *teff*. About half of the poor farmers also grow banana throughout the year. In addition, some grow sweet potato during the dry season.

Figure 4.6: Daily labourers weighing and loading banana bunches on a car

In addition to the direct benefits of irrigated agriculture, a large part of the population depends indirectly on irrigated agriculture for their livelihood. The livelihood of many daily labourers is primarily dependent on the irrigated banana crop. Daily labourers said their main work consisted of loading and unloading bananas and other materials, and that they work on farm land owned by others. The daily labourers mentioned that if the banana was adversely affected or if there was a reduction in agricultural production because of flooding due to overflow of water or through severe drought, then they would lose their daily income. Daily labourers earn between five and 15 ETB per day. Moreover, there are also some other community groups (primarily women and girls) who are engaged in selling fruit (banana, mango, lemon) to passengers travelling to and from Arba Minch and to other places along the main road.

From the above observations, it seems that, although people from all wealth classes and livelihood groups manage to benefit from irrigated agriculture, it is the wealthier farmers that manage to benefit the most, as they have slightly better access to irrigation water (because of their social status and their relationship with the water arbiter), as well as access to more and better land; they also have the opportunity to irrigate cash crops.

Box 4.3: Equitability of the division of irrigation water between communities

Some communities rely on indigenous knowledge to divide irrigation water among neighbouring communities. In this case they use the principle of equality rather than equity to divide the water for use. The division between the communities sharing the irrigation water is carried out without considering factors such as the land holding size and crop types grown. During the field visit, the research team witnessed the neighbouring communities of Kola Barena and Wanke Wajifo divide the water from Qeume River into two equal parts, as seen in Figure 4.7 below. To make sure that the water has been divided equally, the communities put a piece of tree branch in the canal some distance away from the point of division. The communities believe that the water is fairly distributed when the branch arrives at the junction point. The distributors make a number of trials, by adjusting the two paths, until the branch arrives at the junction point. Experienced individuals, in the presence of representatives from both communities carry out the distribution. The water distributors during a field visit reported that the allocation strategy was something they inherited from their fathers and grandfathers and they had the responsibility to use the resource accordingly and to pass to the next generation. The same method was observed at Omolante, where water users within the same community divide water among different irrigation groups. In all cases the distribution is carried out by elected water distributors.

Figure 4.7: Traditional sharing of irrigation water in Wajifo, by dividing the stream into 2 equal parts

Equity in decision-making

The formation and the organisational set-up of an irrigation water committee are different than those of the WATSAN committee. The members of the irrigation committee are not elected all at once but instead join the committee at different times, with each member responsible for a part of the system. In Omolante, the beneficiaries are divided into six groups, wherein each group elects an individual who serves as a water distributor or water arbiter. His duties include monitoring whether the water use is done according to the time set per individual for irrigation (six hours per day per individual) as well as making arrangements for water use in order of priority and checking whether the water users are not competing for water.

All six water arbiters in Omolante are men and there is no specific selection criteria. The *kebele* manager reported that a water arbiter is sometimes replaced after community complaints. During the field work period of this research, the team witnessed the replacement of an arbiter. The replacement was made by the community in a meeting organised by the *kebele* administration during which most of the participants accused the arbiter of abusing his position by giving his relatives and friends favourable access to water.

4.1.4 Access to and use of water for livestock

Depending on the location of both their residence and grazing areas from the water sources, the community uses either Lake Abaya or the rivers to water their livestock. During the survey no cattle trough or other livestock water supply infrastructure was observed in the *kebele*. However, water from ditches and irrigation canals is also used for livestock watering, as shown in Figure 4.8. On average livestock travel 45 minutes for a round trip to drink water. Livestock watering takes place once a day during the wet season and twice a day during the dry season. Some people at Ketena One use water from the hand-dug well for livestock watering.

Figure 4.8: Livestock drinking water from ditches and canals

During the survey it was difficult to get information on the daily water intake of animals. Nevertheless, from their practical experience, most of the respondents made an attempt to identify the water intake of their cattle. The average water intake of the different domestic animals per head per day during dry and the wet seasons has been outlined in Table 4.2 below.

Table 4.2: Estimated livestock water use (in litres per head per day)

	Cow	Ox	Heifer	Sheep	Goat
Dry season	25	24	9	1	1
Wet season	13	15	6	0.5	0.5

4.1.5 Social equity at community level in Omolante

Going back to the analytical framework as presented in part 1 we will give an overview here of the main barriers to water services and use, and how these influence the degree of equity of benefits from water services.

The first barrier to access to water services and use of water is the fact that few water resources have been converted into water services by putting in place water infrastructure and institutional arrangements: there are few functional water systems in the community for water supply, crop irrigation and watering livestock. Although several water systems have been implemented over time, only one hand pump is currently operational. Besides the lack of systems, the sustainability of available systems is a major problem as indicated by the sustainability case study (Deneke and Abebe, 2008).

In terms of access to water services for domestic use, different people within the community, regardless of 'what they have' and 'who they are,' face similar barriers: long distances and long queues. However, differences in financial assets between rich and poorer households have led to differences in access to and use of water from alternative sources. Wealthier households can buy water from an improved source further away, while poor households have to rely on unimproved sources, such as rivers. Because of 'what they have,' in terms of financial resources, the rich households are able to collect and use more water for domestic use and also spend less time on collecting it, compared to poor households.

Access to irrigation water is in principle equal for all those with irrigated land. However, in reality, personal relationships and status tend to influence the allocation of irrigation turns in favour of the better-off households of the community. This inequity is based on 'who they are' rather than on 'what they have'. Better-off households are also able to profit more from irrigation, as they tend to have more and better land and cultivate irrigated cash crops.

Regarding barriers to decision making, landless and women are to a large extent excluded from decision making processes around water management in the community (including tariff setting), in spite of the fact that it is mostly the women who are involved in collecting water for domestic use.

4.2 Woye Barena

Woye Barena *kebele* is located at 14.5 km from the *woreda* centre, Birbir. The *kebele* has a total population of 3,800 people. The *kebele* comprises three main villages: Murgeta, Zala and Gamo. The *kebele* has two agro-climatic zones, *dega* and *woyna dega*. The landscape of the *kebele* is rugged and characterised by its mountainous and hilly terrain. The majority of the population are farmers, and the land holding ranges from 0.10 to 2.0 ha per household. To supplement their income, some farmers are also engaged in the weaving of 'shema' cloth.

4.2.1 Livelihood and wealth groups in the community

The community is stratified into three major wealth groups (Table 4.3).

Table 4.3: The different wealth groups and the corresponding features, Gamo community

Category and characteristics		
Poor	Medium	Best off
Livelihood assets: • No cattle • Maximum of a quarter hectare farm land • Does not have good clothes (does not dress well)	Livelihood assets: • A quarter of hectare farm land • A good house with all the necessary equipments	Livelihood assets: • At least a cow, an ox, a goat, a sheep, a donkey and a mule • At least half a hectare of land and; • A house with at least 40 corrugated iron sheets
Livelihood activity: • Sells labour and struggles to feed his family • Sells grass to support his family	Livelihood activity: • Brings water from different sources and grows vegetables • Can buy heifer and bulls for fattening and selling • Is involved in poultry (sell eggs)	Livelihood activity: • Grows grass as a supplement to crops and increase his income • Brings water from different sources and grow apple and eucalyptus as cash crops
Other characteristics: Has difficulty to send his children into school	Other characteristics: • Feeds his family without difficulty. Does not have to beg for food • Can educate his children at the nearby schools	Other characteristics: • Can cultivate and feed his family throughout the year • Educate his children up to grade 10

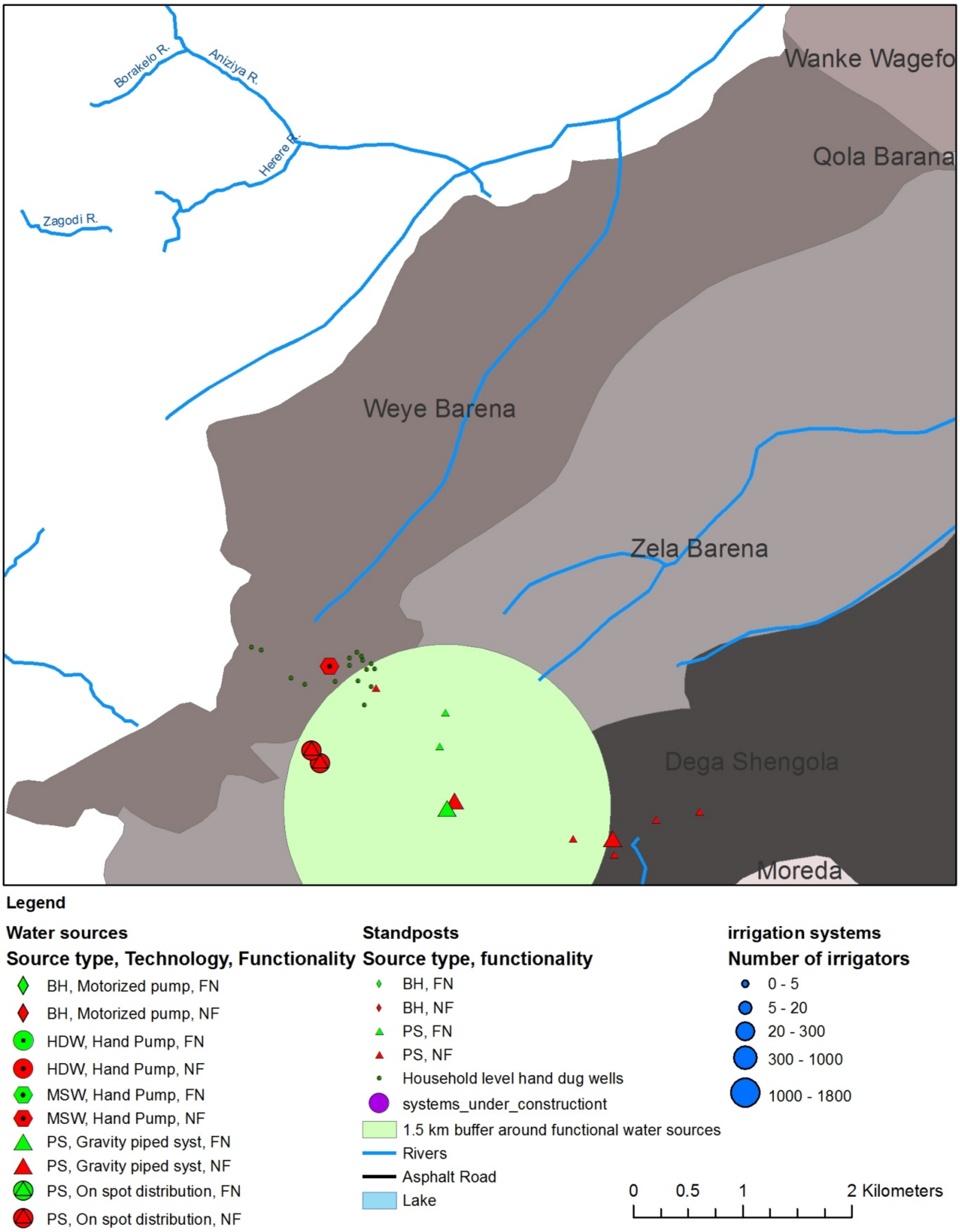
4.2.2 Description of water services

In Gamo village there is one machine shallow well (MSW) which was constructed by WVE in 1995 E.C. According to community members, it once provided very good quality water. However, three years ago it stopped working because of water table draw down (Deneke and Abebe, 2008). Furthermore, in 2001 E.C. there was a stand post extended from a developed spring from the neighbouring *kebele*, Zela Barena. At the time of the study, this water point was not providing services, as the pipeline taking water to the village was broken at the border between the Weye Barena and Zela Barena *kebeles.*

Figure 4.9: The non-functional MSW fitted with a hand pump

During the mapping exercise, 16 functional hand-dug wells were identified. According to the WARDO representative, these facilities are intended to aid people to irrigate crops during water stress periods, which should help them to become food self-sufficient. However, many hand-dug wells were either damaged or abandoned. The community reported that they were promised cement covers by the government after completing the hand-dug wells. However, the covers never materialised. According to the community, the open wells were a danger to children and livestock, and in order to protect children and animals, many hand-dug wells were refilled. However, according to the WARDO representative, those who understand the benefits continued to use the hand-dug wells and developed their own protection mechanisms.

Figure 4.10: Weye Barena *kebele*



Based on data collected by the research team, beginning of 2009.

4.2.3 Barriers to access to water services

The main barrier to access water services is the lack of functional water systems in the community. The WASHCO indicated that they did not have the necessary technical knowledge and capacity to repair the scheme and water points. They could only report breakdowns to WWRDO. Because of the lack of immediate response from the WWRDO, once the infrastructure is broken down, the community was forced to use unsafe water.

When still operational, people could fetch water from the MSW and stand post without paying a fee. There were no tap attendants and the water points were open 24 hours. Women participated in the fencing and cleaning of the sources.

Since the hand-dug wells are private property, whether or not other people have access to these sources of water depends on the owners.

4.2.4 Equity of water use

Because of the non-functionality of the improved water supply systems in the community, people are forced to use water from four undeveloped springs, the Kello River, as well as hand-dug wells, for domestic use, livestock watering and growing fruits (apple) and vegetables. The undeveloped spring provides enough for drinking purposes both during the dry and the wet seasons, though the water quality is poor. Moreover, the location of the spring and the river is up to four kilometres away from the homes of most community members.

On average, people in Gamo village used only 3.5 litres of water per capita per day in the dry season and 2.1 litres in the wet season for drinking. No clear differences in amounts of drinking water used between poor and rich households have been observed.

The Kello River is a prominent source of water for livestock. According to community members, the discharge of the Kello River decreases in the dry season. In that case, leeches, locally known as *alkit,* that attack the throats and lungs of livestock, are said to infest the water. In order to protect livestock, water is filtered. In the rainy season the worms are dispersed and washed away. Table 4.4 below gives an indication of the water use per livestock head, as indicated by the respondents.

Table 4.4: Estimated livestock water use (in litres per head)

	Cow	Ox	Heifer	Sheep/Goat	Horse / Donkey
Dry season	13	14	7	1	20
Wet season	6	7	4	0.5	10

People from all wealth groups grow vegetables using hand-dug wells. Some of the better-off and medium groups use hand-dug wells and undeveloped spring water sources for watering vegetables and apple seedlings (Figure 4.11). Vegetables are primarily used for household consumption, while an apple seedling is sold for 40 ETB. Because of the long maturing period of apple (four to seven years), farmers prefer to sell seedlings to other farmers, mainly from the Amhara region. However, the WARDO representative warns of the saturation of the apple seedling market and advises farmers to begin producing apple, for which there is a growing demand. Some farmers managed to buy additional cattle and improve their livelihoods with the revenues from selling apple seedlings or apples. The poorest farmers are not engaged in planting apple as it does not satisfy their immediate income needs.

4.2.5 Decision making

A WASHCO was established in the *kebele* to manage the water supply infrastructures, but was inactive as a result of the non-functionality of the infrastructure. Almost all the users, especially women, said that they did not participate in infrastructure planning, construction and maintenance. Women mentioned that it was not them but their husbands, considered heads of the households that participated in *kebele* meetings where water issues are discussed. Widows and unmarried women are the only women that can participate in these meeting.

Figure 4.11: Hand-dug well used to irrigate apple seedling

4.2.6 Spatial and social equity at community level in Woye Barena

The main access barrier to water services and use of water is lack of water infrastructure in and near the villages. Unlike in the case of Omolante, there are no improved alternative options near Woye Barena. All people, regardless of economic or livelihood status, depend on the same unimproved water sources. Consumption levels of drinking water are more or less the same across the different wealth groups within the community.

Although people can construct hand-dug wells themselves, regardless of their wealth status, it is mostly the better-off households in the community who benefit from using water from these wells for irrigating cash crops.

4.3 Discussion

In both of the above presented cases, the main barrier to water access is the lack of functioning water infrastructure. Different people within the community experience this barrier in an 'equitable' way, regardless of 'what they have' or 'who they are'. In the densely populated *kolla* area in Omolante, several water systems had been implemented over time, but only one hand pump was functioning at the time the research took place. In Woye Barena, fewer systems had been implemented, which were not functional either. Sustainability of water infrastructure is thus a major issue in both cases. Root causes for the lack of sustainability have been explored by the sustainability case study (Abebe and Deneke, 2008) carried out by RiPPLE in 2007.

In case of scheme breakdown or limited water service, medium and rich households in the lowland area (Omolante) are able to get water from neighbouring *kebeles*. The poor, on the other hand, who do not have the financial resources to buy or pay for transport of water from alternative improved sources, have to rely on unimproved sources of water. In the highland case (Woye Barena), no such differences have been observed between poor and rich households because of lack of alternative water sources.

In principle, there is equal distribution of communal irrigation water between *kebeles* (e.g. Kola Barana and Wanke Wajifo) and within a community (e.g. six hour rotation in Omolante). The distribution of irrigation water does not take into account the irrigable land size, crop type and distance from the source. In practice, the water arbiter often allocates unfavourable times to poor and favourable times to himself, his relatives and the influential and richer people in the community. Irrigation water can thus be considered to be distributed in an inequitable way, giving priority to specific people, based on their identity and their personal relationships.

Rich people are able to benefit more from irrigation water, as they tend to have bigger and more fertile plots and irrigate cash crops, rather than food crops.

In both the highland as well as the lowland case, it was especially richer households profiting from self made (self supply) hand-dug wells for irrigation of crops and trees. Better off households were found to benefit the most from irrigation, because of their livelihood assets (cash crops (apple, banana), land size, fertility of the land).

Regarding equity in decision making, both cases showed the limited influence of women and daily labourers in decision making around water services, including WASHCO elections, the election of water arbiters, and the setting of tariffs. According to the sustainability case study (Deneke and Abebe, 2008), culture contributes to the low participation and involvement of women in water related decision making. The sustainability case study showed that when women were involved in key management positions it resulted in improved service delivery and good financial management of the schemes (Abebe and Deneke, 2008). The exclusion of women from the water-related decision-making may thus have contributed to the poor water service delivery in the case study areas.

5 Conclusion and recommendation

5.1 Conclusions

To guide decision-making around allocation of water services, but also monitoring progress towards goals like the ones set in the Universal Access Plan and the Millennium Development Goals, there is a widely recognised need for information systems with up-to-date data and information. In order for information and data to be useful for the planning of spatially equitable water services, there is a need for up-to-date information on available water resources, settlement patterns and population dynamics, water demand for different uses (including water for agriculture and livestock), current status of infrastructure (functionality, capacity and actual discharge), and access for people to this infrastructure (distance, waiting time, and reliability). Maps, like the ones presented in this document, can play an important role in analysing and visualising information, thereby facilitating decision-making around the equitable distribution of water services. However, as shown by the large discrepancy between the mapping results of the field work done at the end of 2007 in the sustainability case study and the beginning of 2009 (this study), there is an urgent need for a system that allows for regular updating of data and information.

In Mirab Abaya *woreda*, there is spatial inequity in the distribution of water services between agro-ecological zones and between *kebeles*. The highest concentration of water systems is found in the *kolla* area. This is also the area where the highest number of unserved people can be found according to the potential number of people served by functional infrastructure. However, the percentage of people unserved is bigger in the *dega* than in the *kolla*. Because of the scattered nature of the population in the *dega*, the distance to water services for many people is more than the 1.5 km prescribed by the UAP. There is also spatial inequity in the distribution of irrigation schemes which are only found in the *kolla* area. The main reason for this is the availability of suitable irrigable land in this area.

Non-functionality of water infrastructure is a big issue in Mirab Abaya *woreda*. Projects tend to focus on the construction of new infrastructure, rather than on maintaining and rehabilitating existing infrastructure. The continuous investment in new systems to replace non-functional existing systems may prevent the provision of service to currently unserved areas, thereby increasing spatial inequity.

Regarding social equity in access to and use of water for domestic use, it was found that different groups of people (different wealth and livelihood groups) face similar barriers. However, better-off households were able to use financial resources to access alternative water sources, where these were available. This has helped them to save more time and use the extra time for other productive purposes; and to have access to larger quantity and better quality water. It should be noted, however, that this has also contributed to a (temporary) income generation opportunity for some, such as those engaged in providing water transportation services.

In principle, there is equal distribution of irrigation water within a community and between communities, based on a given irrigation time per user, regardless of the crops and amount of land irrigated. However, in reality, the water arbiter, who is responsible for allocating irrigation times to users, often allocates unfavourable times to the poor and favourable times to himself, his relatives and the influential and wealthier people in the community. This contributes to social inequity of the use of irrigation water.

There is also social inequity in decision-making processes around water services, as women and daily labourers are generally not participating in the process. This has most likely contributed to poor sustainability of water infrastructure and poor service delivery.

Water systems in Mirab Abaya were found to be designed and used for specific uses, either domestic use, or irrigation. Exceptions to this rule are the household level hand-dug wells implemented through self supply. Most of these structures are used for multiple purposes, including domestic use, watering livestock and crop irrigation.

5.2 Recommendation

There is an urgent need for policy makers and implementers to use reliable and consistent information and data to identify gaps prior to decision making and planning for the provision of water services. For this to happen it is important to establish a database on the available water resources, infrastructure, and demand for water. It is also important to undertake monitoring activities in order to have up-to-date information and data regarding service coverage, as well as schemes requiring maintenance, repair and rehabilitation.

Service providers and planners should not merely focus on the expected number of people served per system as it may lead to faulty generalisation of water supply coverage. Therefore, service delivery should also include accessibility of the system to the user, the actual yield of the source, number of water points around the system in the case of bore hole and gravity piped systems.

There is a need for appropriate budget allocation for maintenance and rehabilitation and replacement of broken down systems. The most important thing to improve water supply should be addressing the high rate of non-functional schemes by establishing a ‘maintenance culture’ and building the capacity of the WWRDO.

Particularly the *kolla* area of the *woreda* has fertile and flat land that could be irrigated. However, only a fraction of this land has so far been developed, using both traditional and modern irrigation systems. In future, a larger portion of this land should be irrigated using the various water sources. First, it is important to develop the traditional systems in order to use locally available water resource more efficiently. In addition, surface water sources should be supplemented with ground water options to overcome the deficit during the dry season.

To overcome social inequity in irrigation services, by-laws could be established and enforced.

There is a need to address social inequity in decision-making, by devising ways to include marginalised groups such as women and daily labourers. This could also contribute to increase the sustainability of water systems.

Furthermore, to improve access to water services, it is important to consider household level options implemented through self-supply, especially in places where the hydrology permits and where people are sparsely settled, like in the highland area in Mirab Abaya. This should be incorporated into the information/monitoring system. How to achieve this could be the subject of follow-up research.

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Annex 1: Comparison of *woreda* water services against UAP standard.

Scheme type		Agro-ecology									
		Kolla (number of schemes)		Dega (number of schemes)		Woyna dega (number of schemes)		No. of people served	Total number of people served		
	Total	FN	NF	FN	NF	FN	NF	As UAP standard	Kolla	Dega	W.Dega
Bore hole (BH)	11	3	8	0	0	0	0	3500	10,500	0	0
Medium Shallow Well (MSW)	30	17	12	0	1	0	0	500	8,500	0	0
Hand-dug Well with hand pump (HDW)	23	10	13	0	0	0	0	250	2,500	0	0
Protected Spring (PS) - Gravity pipe system (GPS)	7	1	1	1	2	2	0	5000	5,000	5,000	10,000
Protected Spring - On site Point Source (OPS)	8	0	0	2	1	4	1	300	0	600	1,200
Total	79	31	34	3	4	6	1		26,500	5,600	11,200

Annex 2: The water supply coverage in each *kebele* in the *woreda* as per the UAP standard.

No	Kebele	Population Size	Schemes										Population served as UAP	Water supply Coverage (%)
			BH		HDW		MSW		OPS		GPS			
			F N	N F	F N	N F	F N	N F	F N	N F	F N	N F		
1	Alge	2,864			1	3	3	2					2000	70
2	Ankober	6,067	1					2					0	0
3	Birbir*	5,831	1	3		1							7000	120
4	Delbo	2,949		1	1	1	2						1250	42
5	Doshe	1,130					1					1	300	27
6	Faragosa	1,371		1							1		5000	365
7	Fetelle	847							1				300	35
8	Fura	1,698				1	2	1					500	29
9	Kolla Barena	2,173					2	2					1000	46
10	Kolla Mulato	3,172			3	1		2					750	24
11	Korega Geramo	1185			1		4	1					2000	169
12	Mole	5,401	1		2	1							500	9
13	Omolante	6,737		1	1	4							250	4
14	Ugayehu	1,720					1	1					500	29
15	Wanke Wajefo	4,546	1		1	1	2	1					4750	105
16	Yayike	2,625		1							1		5000	191
17	Zela barena	2,735								1	1		10000	366
18	Weye Barena	3,238						1		1			5000	154
19	Dega shengole	1,772										2	0	0
20	Moreda	2,159									1		5000	232
21	Zela gutisha	6,733							2				600	9
22	Layo tirga	2,619							2				600	23
23	Menena	1,797							1				600	33
24	Dega done	3,532							2				600	17

*urban area

Research-inspired Policy and Practice Learning in Ethiopia and the Nile Region

RiPPLE

Research-inspired Policy and Practice Learning in Ethiopia and the Nile Region (RiPPLE) is a Research Programme Consortium funded by UKaid from the Department for International Development and led by the Overseas Development Institute (ODI) in partnership with IRC, Addis Ababa University, WaterAid Ethiopia and Hareghe Catholic Secretariat

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