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DETERMINANTS AND IMPACTS OF COLLECTIVE WATER MANAGEMENT IN KENYA'S LOWER NYANDO BASIN

By

Mamta Vardhan

A THESIS

Submitted to
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ABSTRACT

DETERMINANTS AND IMPACTS OF COLLECTIVE WATER MANAGEMENT IN KENYA'S LOWER NYANDO BASIN

By

Mamta Vardhan

Water management is a priority concern for communities in Nyando basin. Kenya's new water act calls for community based water management. Despite the significance of water for communities, and the policy focus on community involvement, community organization for water management is not forthcoming. The study used a mixed methods approach to understand factors that facilitate or constrain community based water management and the impacts of improved water availability on household water uses. Findings reveal that while assistance from an external agency facilitates community involvement, at the same time constraints such as poverty, gender and property rights need to be addressed in order to encourage community involvement in water management. Improved water management has the potential to bring about livelihood and wellbeing benefits for the community. This knowledge will help policy makers and water sector agencies to create the right institutional environment to allow for community based water management.

For Chandrakala & Harsh, my muse

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1.1 Introduction

Rural communities around the global south face critical challenges regarding availability of adequate water of acceptable quality (WHO/UNICEF, 2000a). The situation in rural Kenya exhibits a similar trend, with only 31% of the rural population having access to improved water supplies as compared to 87% coverage in urban areas (WHO/UNICEF, 2000b). In research conducted in western Kenya, communities indicate water management as their primary concern (Shepherd et.al, 2000 cited in Swallow 2002). The negative impacts of low water availability in the region are typically borne disproportionately by the women as they are the drawers of water in the family. An improvement in water availability has the potential to lead people out of poverty by enabling them to undertake new livelihood strategies (Swallow et.al, 2005). Despite the significance of water in their life, communities in western Kenya are not motivated to invest in water management (Swallow, 2002). It is worthwhile to understand the factors that determine community organization around water management, and in what ways does improved water management influences use and availability of water. This is important as Kenya's new Water Act of 2002, provides a greater role for communities in water management. In rural areas where private water service providers are likely to be few, the role of community self-help groups in the provision of water services is likely to remain significant (Mumma, 2005). In the current context of the decentralization of water sector there is growing consensus about community based approaches to water management. In spite of the growing acceptance of this approach, community organization around water management remains low.

1.2 The Study

In the context of environmental degradation and ongoing initiatives to promote decentralized community based approaches, it is important to understand the reasons for the inability of local communities to organize collectively to initiate water management, and the potential role of improved water availability in enabling people to undertake productive activities that reduce their vulnerability. The current research was launched to address the following objectives:

1. Water governance- To understand community organization around water management, so as to identify factors that facilitate or constrain community management of water resources.
2. Water availability and household use of water- To explore the benefits of improved water management on people's use of water for various activities at the household level.

Specifically, the research attempts to address the following key questions:–

1. What are the factors that facilitate or constrain community action around water management in the lower Nyando basin?
2. What is the impact of improved water management on allocations of water across various activities in the house?

1.2.1 Study approach

A combination of qualitative and quantitative data collection techniques were chosen to conduct the present study. This approach is called multiple methods research (Chung, 2000; Reinharz, 1992). The current research is an exploratory study to understand the constraints to collective action for water management, and the impact of improved water

availability on household allocations of water in the lower Nyando basin. Thus, the first research question necessitated the use of ethnographic methods such as interviewing and focus groups to understand various situations under which water is managed by local communities. The second research question concerning the impacts of improved water availability required that the amount of water that households collect and use be quantified and thus entailed use of a household survey.

Semi-structured, topical interviews were conducted with key informants in various agencies in water management in the study area. A total of eighteen interviews were conducted including informants from government, non-government agencies, village representatives and members of water users association.

Fourteen focus group sessions with individuals from a well-defined target population across three administrative divisions in Nyando district on topics relating to water were conducted. A research protocol explicitly aimed at capturing the heterogeneity that existed in the study area (in terms of contrasting views concerning water uses and users as per socio-economic groups, gender, physical characteristics of water resources and differences in institutional arrangements) was developed, by classifying research communities as per break and control characteristics. Break variables define how study villages are differentiated from each other. Characteristics that are shared by all members of each group are referred to as control characteristics. (Knodel, 1990).

Participatory rural appraisal (PRA) sessions involving wealth ranking and mapping to understand the distribution of and access to water resources were conducted in two villages, to triangulate findings emerging from the focus groups.

A household survey aimed at capturing the impact of improved water availability on use of water for various activities was conducted with 45 respondents, selected from across focus groups. The survey respondents were selected based on a stratified purposeful approach (Patton, 2001), by choosing respondents from within the sampled pool of focus group participants.

1.3 Problem Context

The present study is an attempt to understand the factors that determine community management of water and the impact of improved water availability on water allocations across household activities in lower Nyando basin in western Kenya. The research problem is particularly relevant in the twin context of decentralization of water management in Kenya, and the great proportion of rural population without access to safe water supplies.

Kenya suffers from a problem of low water availability in terms of the uneven coverage of population to improved[1] water supply systems. The percentage of the Kenyan population with access to an improved water supply is the lowest among the countries in East Africa. The data for the levels of water supply services in urban and rural areas reveals that while 58% and 36% of the urban population is served by a house tap and public water point respectively, the corresponding figure in rural areas is much

[1] The definition of coverage used in the WHO/UNICEF (2000) assessment is based on the technology type. The assessment assumes that certain types of technology are safer or more adequate than others. Thus, the population with "improved" water supply is considered to be covered. The coverage figures produced by these technology indicators do not provide information about the quality of water provided or its use. The technologies considered "improved" for water supply are- Household connection, Public standpipe, Borehole, protected dug well, protected spring, rainwater collection. The technologies considered "not improved" are Unprotected well, Unprotected spring, Vendor-provided water, Bottled water (not considered improved because of limitations concerning potential quantity of supplied water, not the quality) and Tanker truck provision of water.

lower at 12% and 28%. Although more than 80% of the total population in Kenya lives in rural areas, only about 34% of the total average annual water sector investments are made in the rural areas (WHO/UNICEF, 2000b).

The National Water Master Plan in Kenya aimed to ensure the availability of potable water to all households by the year 2000. As such the role of the Government was to provide water to consumers, in addition to making policy and regulations regarding water use. Despite the ambitious plan, water supplies by 2000 did not extend to even half of the rural and urban areas. In 1980s, the state experienced budgetary constraints and therefore decided to hand over government water supply systems to the communities (Mumma A, 2005). Further, the impetus to hand over water management responsibility to communities was influenced by the understanding that good governance of water resources is crucial to provide water across sections of population (Kisima, 2005).

Kenya passed a Water Act in 2002 aimed at restructuring and decentralizing water sector management. These reforms revolve around decentralization of functions to lower level state organizations; and the involvement of non-government entities in the management of water and provision of water services. The act has redefined the role of government from a focus on direct service provision to a focus on carrying out regulatory and enabling functions to support private sector participation and community based provision. Most significantly, the act provides a role for community groups, organized as water resource users associations, in the management of water resources (Mumma, 2005). Thus, participation of local community groups will be critical to ensure the success of decentralization efforts and the sustainability of water supply systems.

1.4 Organization of thesis

The thesis is arranged in five chapters. The first chapter gives an introduction to the problem, study area, study approach and the relevance of the problem in Kenyan context.

Chapter two presents a review of literature. The chapter locates the problem of water availability, access and management in a global context, and traces the evolution of major approaches to management of water, and the implications of these for provision of water to rural poor.

Chapter three gives details about the study area, the lower Nyando basin and links the problem in this location to broader challenges surrounding water management in the catchment of Lake Victoria. The chapter also discusses the methods used for data collection, research protocol, data analysis and issues of validity and generalizability.

Chapter four presents findings from the qualitative and quantitative data. The findings are organized around four broad conceptual areas that were identified as part of the analysis of qualitative data.

Chapter five presents conclusion from the research findings and also indicates areas requiring future research.

Chapter 2

Literature Review

Chapter Two is organized in eight sections. The first and second section discusses the status of world water resources, drivers of water crisis and the implications of water scarcity in developing countries. Section three reviews certain characteristics of water as a resource, which hold implications for its management. The fourth section traces the emergence of water management paradigms to address the water crisis. This section is divided into three sub-sections. Each sub-section details the experience, outcomes and limitations of the implementation of major approaches to water management in the context of developing countries. The fifth section examines the water policy stance on household water use and its relation to water policy development. The final section links the literature to the research problem

2.1 Global water resources

Water is a precious resource for all living beings on earth. Fresh water is essential for the survival of human beings and the sustenance of ecosystems. With two thirds of earth's surface consisting of water, water appears to be an abundant resource. However, this abundance is an illusion. Most water on earth (97.5%) is saline, present in oceans or locked as permanent ice in glaciers (1.85%) and therefore, unavailable for human use. Even a large proportion of groundwater is difficult to access as it lies deep down in the earth's crust (Cech, 2002; Postel, 1992). Only about 0.01% of the total water available on earth (in lakes, rivers, soil moisture, and in atmosphere) (Cech, 2002) or about 40,000 cubic kilometers per year, is readily available as fresh water for human withdrawals

(Cosgrove & Rijsberman, 2000). Moreover, this water is not distributed evenly across time and space, and its availability depends on the variations in the natural hydrological cycle. An average of 7,400 cubic meters per person of water is renewed by the natural water cycle each year- much above what is required to lead a moderate standard of living. However a large part of this global renewable fresh water supply is available in areas where human demands are small, such as in Alaska and Canada (Postel, 1992; Cosgrove & Rijsberman, 2000). Although annual water withdrawals for human consumption represent a small proportion (9% in 2000) of available freshwater resources, the fraction is higher in arid and semi-arid regions where water is scarce and populations are high (DFID, 2001; Postel, 1992). For instance, in Asia, water availability per person at 4,000 cubic meters is only half the global average (DFID, 2001).

2.2 Water crisis

While the global fresh water resources are finite and fixed, the same cannot be said about their demand. Rising human population in developing countries, agricultural development and industrial growth are creating an increased demand for fresh water. Whereas, in the developed economies, the increase in water demand caused by economic growth can be offset by efficiency in water use in industry and households, in developing countries rise in standards of living across a growing population and economic growth is expected to result in large increases in water withdrawals in agriculture and the industrial and domestic sectors (Cosgrove & Rijsberman, 2000). Apart from the pressures of increasing demand, fresh water resources in these regions also face a threat in terms of declining quality and availability.

The global per capita fresh water consumption has increased six-times, between 1900 and 2000 – more than twice the rate of population growth (DFID, 2001). Population growth estimates project that of the total growth in world population by 2025, around 84% would occur in the less developed regions of the world (UN, 2003). This high population growth along with uneven distribution of water resources, especially in developing countries implies that by 2025 about 3 billion people will live in water stressed or water scarce[2] countries, with less than 1700 cubic meters of water per person per year (Cosgrove & Rijsberman, 2000). Africa, with the highest decadal population growth of 27.5% in the world (WHO/UNICEF, 2000a), by 2000, will also have the largest number of water scarce countries, with almost one-third of Africans living in water scarce conditions (Postel, 1992). In developing countries, providing adequate supplies of water for the growing human population would be a significant challenge. This limitation is relevant in the context of the vast number of people who remain to be provided with water supplies to meet the Millennium Development Goals of halving the number of people without access to water and sanitation by 2015. As per the estimates of global water supply and sanitation assessment, 1.1 billion people around the world lack access to improved drinking water supplies. More than 80% of this "unserved" population lives in rural areas (WHO/UNICEF, 2000a). In 2000, Africa accounted for 28% of the world's population without access to improved water supply. The situation in rural Africa is worse, with only 47% coverage as compared to 85% in urban areas (WHO/UNICEF, 2000a). Further, house water connections in Africa serve about 51% of urban population as compared to less than 3% in rural areas.

[2] A region is said to be water stressed if the per capita availability of water is less than 2,000 cubic meters per year, and when this drops to below 1,000 cubic meters per person per year, the region is considered water scarce (Postel, 1992).

A change in the demographic distribution of the population in developing countries is expected to place higher demands on the already stretched water supply and sanitation infrastructure of the cities as well as increased vulnerability of poor urban dwellers (UN, 2003; WHO/UNICEF, 2000b). Africa experiences the highest growth rate for urban population (4.02%) and also has the highest proportion of urban population (31%) not served by any water supply service (WHO/UNICEF, 2000b).

Growing population results in an increase in demand for domestic water as well as water for food production through irrigated agriculture. The area under irrigated land doubled during the twentieth century (UN, 2003). Such increases particularly in South Asia have been through exploitation of ground water resources and bringing dry lands under irrigation. However, the situation in many areas is alarming; with groundwater levels falling, threatening not only food security but also access to water supply (Postel, 1992). Thus, water management to meet competing uses remains a challenge in developing countries.

Water quality in developing countries is also an important concern along with water availability. With weak institutional and structural arrangements for regulation and abatement of water pollution in many of these countries, ground and surface water resources are becoming polluted through human, industrial and agricultural waste. Asian rivers have three times as many bacteria from human waste as compared to the global average (UN, 2003).

Along with water scarcity and declining water quality, global climate change is emerging as a new challenge to water management, with potential implications for water availability especially for the developing countries. Lower and erratic precipitation

patterns as a result of global climate change are likely to worsen the water availability in countries such as India, northern China, middle-east and Sub-Saharan Africa (UN, 2003).

Two things emerge from this discussion. First, the growing population, urbanization and economic activity are increasing the demand on world's fresh water resources, creating a situation of water crisis. Second, the water crisis is particularly worse in developing countries, particularly in Africa and parts of Asia. The impacts of poor water supply in terms of health, economic and social development are disproportionately borne by these poor people. The crisis implies that the health of poor people is affected by inadequate access to clean water and sanitation. Each year approximately, 2.2 million deaths occur, mostly of children under five years of age from diarrhea in developing countries (WHO/UNICEF, 2000a). Further, the poor depend for their livelihoods on ecosystems. Contamination of rivers, coastal areas and overexploitation of ground water implies low incomes, poor agricultural productivity and declining food security for the poor. The negative effects of poor water availability are borne mostly by women and children as they walk several kilometers each day to collect water, often foregoing engagement in productive activities and opportunities for education.

2.3 Water as a social and economic good

The Dublin principles articulated at the International Conference on Water and Environment in 1992 recognize: "Water has an economic value in all its competing uses and should be recognized as an economic good" (Cosgrove & Rijsberman, 2000). At the same time, the NGO statement at the Second World Water Forum held at the Hague,

maintains, "Access to basic water and sanitation are universal rights, and cannot therefore be negotiated as commodities" (Gleick, 2003).

These proposals for water management have created a controversy about management of water as a social good versus its management as an economic good. Characteristics of water as a resource have relevance for how it should be managed. A social good is one which has significant "spillover" benefits and costs (Gleick, 2003). Availability of safe and affordable water to fulfill basic human needs is important for individual and social wellbeing. This characteristic of water makes it a social good. However, water also has characteristics of a private good in the sense that its use is consumptive and subtractive. Use of water by one individual means less is available for other individuals. Given the social good characteristic of water, free markets cannot be solely responsible for its provision and supply. Left to the markets, social goods are under-produced or not supplied to all sections of the community (Perman, 2003). Therefore, some level of government action is deemed necessary in water supply and provision, in so far as the basic needs of all sections of community can be addressed. Thus, water has traditionally been provided at subsidized prices. However, this introduces distortions and inefficiencies in its use, as water users including large institutions and agriculture operations indulge into wasteful use (Postel, 1992) , with the result that less water is available to be supplied to other sections of the population.

At the same time, concerns over inefficient water use alongside its subsidized provision have resulted in a call for increasing efficiency in water supply and use, through adoption of economic principles of pricing and private sector participation in water provision. However because water is essential for humans and ecosystems,

managing it as an economic good could jeopardize the ability of poor and other marginal groups to access it.

In view of the special features of water as resource and its significance for basic human needs, water management requires that the public and private benefits of water be balanced, through adoption of approaches that promote efficiency in use and social equity in its distribution. The United Nations Earth Summit in 1992 recognized that water should be managed both as a social and economic good, through adoption of integrated water resource management (IWRM) approach (UN, 2003). This broader approach to water management calls for maximizing social benefits of water for human needs and ecosystems, while at the same time introducing stakeholder participation processes.

2.4 Water management paradigms

Consultations among a number of international institutions have contributed to shaping the guidelines for water management to address the problem of water scarcity and poor management, particularly in the developing countries. A major thrust of these processes has been to move away from the welfare notions of the state as the provider of water services to neo-liberal approaches, with an emphasis on withdrawal of governments, focus on cost-recovery, private sector participation in water management and decentralized management at community level (Kleemier, 2000; Schouten & Moriarty, 2003).

2.4.1 Role of the State

Water policy in the past was focused on supplying more and more water to meet the growth in population and the economy. This approach resulted in investments in

construction of centralized water storage and supply infrastructure to cities and agricultural fields (Kleemeier, 2000). Under this approach, the provision of water supply was the responsibility of the state and public sector agencies. Accordingly, these agencies were given this responsibility in countries around the world. Private sector involvement was not considered appropriate given the public good and basic need characteristics of the water supply sector. The provision of better water supply and sewerage systems under this approach to water management led to large scale benefits in sanitation especially in industrialized countries (Gleick, 2003). However, the progress of water and sanitation service provision remained uneven, with countries in Asia, Africa and Latin America lagging behind (Budds & McGranahan, 2003). In order to provide a momentum to water supply and sanitation efforts in these regions, the 1980s were declared as the International Drinking Water Supply and Sanitation Decade (IDWSSD). This declaration brought water and sanitation to the fore-front of the agenda of governments and donor organizations, and adopted "Water and Sanitation for All" as the slogan for the decade (UN, 2003). A major thrust of this period was to persuade governments and donors to invest in water supply sector so as to achieve the goal of universal provision of safe water supply (Schouten & Moriarty, 2003). In Africa, this approach meant that water and sanitation development was the responsibility of the central or provisional government, and the nature and extent of projects were dependent on the resource availability and planning decisions of the project implementing organizations (WHO/UNICEF, 2000b). Thus, the decade saw massive investments by donors and governments in centralized water supply and sanitation.

Despite the investments in extending water and sanitation services and construction of new infrastructure to increase the availability of water, the IDWSSD goal for universal coverage of water and sanitation was not realized. One of the reasons for this was the focus of these services on urban areas, leaving behind a majority of poor users in peri-urban and rural areas (Budds & McGranahan, 2003). A problem associated with subsidized water systems is that they do not reach everyone, and the people who benefit from these are the ones who can afford to pay, and use greater quantities of subsidized water (Gleick, 2003). Another reason for the limited performance of centralized water supply systems was the lack of adequate investment in maintenance and management which resulted into break-down of many of these systems after their construction (Schouten & Moriarty, 2003).

The problems associated with management of centralized water supply systems and the under-achievement of targets set under IDWSSD called for a review of the top-down supply oriented water management paradigm. The international donor community argued that sustainable water supply cannot be achieved unless local communities were involved in planning of water projects and the choice of technology (Schouten & Moriarty, 2003). Moreover, the governments in developing countries, confronted with rising costs of development, operation and maintenance of water infrastructure started acknowledging the need for involvement of the private sector (Thompson, 2001; Budds & McGranahan, 2003) in the management of these systems. For instance, the World Bank estimated that countries needed to invest $600 billion in water infrastructure during the 1990s alone (Thompson, 2001; Postel, 1992). At the same time increasing concern with growing water scarcity led to the view that water is a scarce economic good and should not be

provided as a free public good. This view called for efficiency in use through adoption of pricing policies (Baden, 1993).

2.4.2 Private sector participation

The need for private sector participation in water supply, while also involving local communities in planning and cost-sharing arrangements, emerged as a key lesson from the review of IDWSSD. These concerns were incorporated into the contemporary water management paradigm and were articulated in the Dublin principles in 1992. The Dublin principles recognize that water should be recognized as an economic good and also maintain that water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels (Cosgrove & Rijsberman, 2000).

The international development organizations and financial institutions realigned their position and started promoting approaches for water management consistent with the Dublin principles, in particular the treatment of water as an economic good. Privatization of water systems also received a thrust from the World Water Forum held at the Hague in 2000, where the need to mobilize greater financial resources to solve water problems was underscored (Gleick, 2003). Accordingly, private sector investment and institutional reforms were incorporated into the water policy of many developing countries. Private sector participation in the provision of water supply and sanitation in the developing countries increased between 1990 and 1997, with cumulative private sector capital investments in these projects growing from $297 million in the period 1984-90 to $25 billion in 1997 (Thompson, 2001). Increasingly, many developing countries unable to find capital to expand and maintain current water supply systems have turned to private

sector participation. By 2000, around 93 countries had partially privatized water services (Gleick, 2003)

The rationale behind promotion of market approaches to water supply emerges from the belief that private sector providers may be more efficient than public sector agencies, supply water at lower costs, improve coverage to previously under-served communities and ensure service quality (Thompson, 2001; Budds & McGranahan, 2003, Gleick, 2003). While the case for private sector participation in water supply is strong on grounds of improving economic efficiency, cost recovery and better services, there are concerns about the ability of these approaches to necessarily keep the interests of the poor in mind. Due to the monopolistic nature of the private water supply systems, a common outcome of privatization is an increase in water prices. As the companies negotiate prices with government regulators, the preferences of all sections of the consumers are not addressed in pricing decisions. In Cochabamba, Bolivia, after grant of water contract to a private operator, Aguas del Tunari, water rates increased immediately – by 100 to 200 percent. Instead of improving service delivery and coverage, the private water contract resulted in people spending a substantial proportion of their monthly wages to pay water bills. Public protests unfolded, and after considerable resistance, the government canceled the contract. Similarly, in Buenos Aires, Argentina the water contract awarded to Aguas Argentinas promised a reduction in water rates by 27%, but in reality water rates rose more than 20% (Public Citizen, 2003). The impact of these initiatives was disproportionately borne by the poor and women, who adjusted their budgets to reduce expenditure on food and other necessities to pay for water.

Despite its claim to efficiency, privatization of water has been unable to achieve the purported objectives of scale and improved coverage. A major drawback of private sector involvement in the context of developing countries is that private operators are reluctant to make investments in the water sector in poor regions of a country. Thus, private investments in water and sanitation services have so far have been targeted in urban areas of Latin America and Asia (Thompson, 2001). Sub-Saharan Africa accounts for less than 1% of the total private sector investment in water supply and sanitation, and multinational companies often state that investments in Africa are unattractive as most consumers cannot afford tariffs that are high enough to generate returns on investment (Budds & McGranahan, 2003).

2.4.3 Community based approaches

In the context of the characteristics of water as a resource and the social, economic and capacity challenges that beset the water resource management sector in developing countries, both the state-led centralized water management as well as the market-based private provision approaches have had limited success. The results of research on limited performance of state managed resource systems emphasize the need to review the technical planning approach and incorporate community organizations into design and management of water supply systems (Ostrom, 1992). IWRM has emerged in response to the failure of centralized and sectoral approaches to water resource management. It is a cross-sectoral policy approach based on the understanding that water resources are an integral component of the ecosystem, a natural resource, and a social and economic good (UNDP, 2004). IWRM requires that water resources be managed at the lowest appropriate level- from households to community and to higher levels, through the

involvement of women, men and all sections of the community in water resources management (WSSCC, 2000; Cosgrove & Rijsberman, 2000). Decentralization and demand responsive water supply are essential features of IWRM, which acknowledges that sustainable water management at the community level can be achieved if people are provided with the level of service they want and are able to pay for it (Perez de Mendiguren, 2003).

A number of countries around the globe have recognized the potential of community based management of water resources, and accordingly have initiated the processes of decentralization in the water sector. Demand-responsive approaches to water management promoted as part of IWRM is a new strategy to achieve sustainable water systems at the community level. In Cote d'Ivoire, a new policy has been established calling for community participation in management and operation of water supply and sanitation systems. Similarly, in Malawi, the government has introduced Community Based Management and Village Operation and Maintenance systems in the communities under which the local communities organize themselves into Village health and water communities (WHO/UNICEF, 2000b). Apart from enacting policies, many countries in the global South are already implementing community based water resources management projects. About one quarter of African countries reported that all rural systems are managed by their communities. For instance, in Burkina Faso, Central African Republic and Mali 100% of all rural water supply and sanitation systems are being managed by communities (WHO/UNICEF, 2000b).

The promotion of community based decentralized water management under IWRM can be viewed as part of a wider policy trend, prevalent across natural resources sectors

such as forestry, irrigation, fisheries and wildlife. A large body of research has presented evidence that government systems for managing resources in a centralized manner are inefficient in maintaining the resource. For instance, Baland & Platteau (1996) attribute the failure of forest management regimes in India and Nepal to centralized and top-down management systems, which excluded local users and undermined traditional authority. The strong focus of planners on design of physical infrastructure while ignoring social and institutional infrastructure has been cited as a reason for the failure of large scale water supply systems (Ostrom, 1992). These scholars have also documented several successful examples of management of fisheries, forests and irrigation systems by communities at the local level without any regulation imposed from the outside (Wade, 1987; Ostrom, 1992).

Community based management entails increasing the participation of resource users in decisions concerning management and distribution of benefits from the resource. Community management in water projects goes beyond the traditional definition of community participation. Rather than limiting community participation to the provision of labor and materials, community management of water resources is based on the concept of ownership, control and responsibility of the development process (WHO/UNICEF, 2000b). Community based management of natural resources is based on the premise that natural resources can be best managed by village communities, who possess important time- and place- specific knowledge about resources and institutional arrangements that can be forged to achieve successful, local level resource management (Ostrom, 1992; Baland & Platteau,1996, Brosius et.al, 1997). Another important factor justifying the move towards community based management of resources is the constraint

faced by governments in terms of limited resources to manage natural resources on its own (Baland & Platteau, 1996). Strategies promoting community based resource management are also justified on the grounds that they not only improve the status of natural resources, but also enhance efficiency, equity and democracy (Bergh, 2004). Considerable evidence from community based rural water supply projects points to the efficacy of dialogue between water agencies and local communities on water management issues increases the efficiency and effectiveness and sustainability of water projects (Katz & Sara,1997). Ostrom (1992) also recognizes that incorporating needs and expectations of local water users into design and management of water systems can contribute to sustainability.

Analysis of the conditions under which collective management of resources by local communities emerges and is sustained is important to develop effective programs for community participation. The scholarship on communal management of natural resources has enlisted a set of conditions under which local institutions are able to successfully manage commons. These conditions can be broadly classified into four categories- characteristics of the resource, characteristics of the group, institutional arrangements and external environment (Gibson, 2005). According to Wade (1987), the likelihood of collective action depends upon small size of the resource and user group, clearly demarcated resource boundaries, the vitality of the resource for users, ease of detection of rule-breaking free-riders. Ostrom (1992) has added presence of nested enterprises as necessary condition for local resource management institutions, especially in cases where the resource systems are parts of larger systems. Baland & Platteau (1996) contribute several additional factors such as need for external inputs to communities in form of

incentives or subsidies to initiate management of their resources. Success in past attempts at collective action and presence of traditional leadership structures also contributes to cooperative arrangements at the community level. However, these scholars do not enumerate much on under what conditions are we likely to find groups that apply these principles (Meinzen-Dick, Raju & Gulati, 2002).

The widespread policy thrust on community based water management apparently leads to the belief that community based approaches are easy to implement. The broad implicit assumptions of these approaches are that the communities are close-knit, homogeneous entities, willing to invest in resource conservation and possess the relevant capacities to undertake management of local resources. These images of communities are attractive especially as they contest the dominant narratives that favor privatization or state control of resources (Agrawal & Gibson, 1999). Going by these views, it appears that decentralized community based resource management would always lead to successful outcomes. However, these notions about community and community based resource management processes exhibit a misplaced optimism, not relevant in contexts of limited experience of various community based resource management projects. Research on water systems in Malawi produced evidence that projects calling for greater devolution to communities without adequate institutional backing fail to take off (Kleemier, 2000). Campbell et. al.(2001) identify a number of factors that challenge community based management of social forests in Zimbabwe, and include the absence of adequate state support to enable the functioning of decentralized policies, as one of the reasons. Other scholars point out that inadequacy to account for multiple interests, actors within the community and the internal and external institutions that affect resource

management decisions at the local level have implications for the sustenance of collective arrangements at the community level (Agrawal, 2001). Social differences within a community also affect the outcomes of community based processes, in terms of the profile of participants and the distribution of benefits. Differently positioned actors within a community on account of their social identity command different entitlements to local resources and can affect the continuity of effective resource management (Leach, Mearns & Scoones, 1999). Gender is a significant source of heterogeneity at the community level, and has frequently been left out from debates on community participation in collective resource management (Agarwal, 2001). The use of water and responsibilities related to its management are often gender-specific: men use water for irrigated agriculture and livestock, while women use it for household uses and for generating incomes from domestic vegetable gardens. This differentiation in needs, responsibilities and roles requires that the interests of women and men should be accounted for differently in water management and formal rules and informal modes of membership should not exclude women (Zwarteween and Meinzen-Dick, 2001). In several community based water management projects, cost recovery was low, because affordability studies were based on men's incomes and did not include the possibility that women have differential access to intra-household cash resources, and are often unable to pay for water services (Green & Baden, 1994).

2.5 Approaches to household water

Domestic water provision is being recognized as a priority in national water policies of countries such as South Africa, India, Mozambique and Bangladesh (Soussan, 2003).

In the context of demand responsive approaches to water management being promoted to supply water for domestic purposes, the question that arises is, how well is this demand understood? (Perez de Mendiguren, 2003). The current understanding of water demand is biased towards formal sector uses of water, viz. irrigation and forestry. The contributions to rural livelihoods from these formal sector uses of water are widely acknowledged. It does not consider the central role that household water plays in the livelihoods of poor rural households. However, recent research (Hope, Dixon & von Maltitz, 2003, Perez de Mendiguren, 2003, Mokgope, and Butterworth, 2001) points that in rural areas, water is used for a combination of basic human consumption (drinking, cooking, bathing, personal hygiene and household cleaning) and productive purposes (vegetable gardens, cattle farming, traditional beer making, brick making). Women are involved in productive activities that take place inside the domain of the household (for example vegetable garden, beer brewing) and use these incomes on children's educational expenses (Mokogpe & Butterworth, 2001).

The average amount of water consumed for basic needs is close to the minimum basic needs requirement of 25 liters per capita per day. An additional 40 liters per capita per day of water are required to support a wide range of productive activities. Income from productive water use represents 17% of the average household income in worst case villages and 31% in best case villages (Perez de Mendiguren, 2003). The availability of reliable water supply has the potential to lessen the burden of poverty experienced by marginalized groups and improve their food security and associated health benefits (Hope, Dixon & von Maltitiz, 2003). However, people's ability to participate in these activities is related to access to water supplies and the reliability of these supplies. Water

consumption for all productive activities is much higher in villages with better water systems, and these systems contribute significantly to rural livelihoods (Mokogpe & Butterworth, 2001). The evidence from these studies points that household water is used for productive purposes and securing access to such water has significant benefits for the poor.

Given the narrow understanding of household water, the issue of allocation of water for productive uses has largely remained invisible in water policy design. For instance, the 1998 National Water Act in South Africa recognizes provision of water for basic human needs, established at 25 liters per person per day. This low target reflects the focus of the policy on providing water for basic consumption needs only, and does not recognize the potential of domestic water in catering to household livelihoods (Mokogpe & Butterworth, 2001). The priority given to provision of water for basic needs in water policies of developing countries is worthwhile; however there is a concern that this minimum allocation may become the norm in deciding about levels of service delivery to poor (Moriarty,). Given the importance of productive uses of water for livelihoods of rural poor, the water policies need to take a more holistic view of water, and incorporate these uses into system design and supply. This calls for a need to articulate a wider perspective on household water use and to develop an understanding about water allocation across various activities in the household, who participates in these activities and in what ways does productive water use impact livelihoods.

2.6 Linking literature to the research problem

Water sector reforms in many countries in the global south call for greater involvement of local communities to undertake management of water resources. However, simply because the state has created spaces for community participation in water management does not mean that communities would be interested in shouldering these responsibilities. Non-involvement of communities in water supply management and inappropriate institutional structures has been identified as one of the constraints to development of water sector in Africa (WHO/UNICEFF, 2000b).

In the Nyando basin, in western Kenya, basin level research is ongoing to understand the factors that may prevent poor communities to invest in resource conservation and water management undertakings. Most communities indicate water management as their primary concern (Shepherd et.al, 2000 cited in Swallow 2002). The negative impacts of low water availability in the region are typically borne disproportionately by the poor and marginal members of community. A study by Water Aid in Tanzania, documented the impact of borehole development, water distribution and community management in terms of improvement in health of women, children, improved agriculture output, reduced expenditure on water and savings in women and children's water collection time, enabling them to spend more time in family activities and attending schools (Swallow, 2002). Improved water management is important for people's livelihood's and increases the availability of water for irrigating tree nurseries and tea gardens (Swallow et al., 2003).

Despite the significance of water in the daily life of people, very few communities have been able to organize themselves to improve their water supplies. As per a

discussion on community poverty traps by Swallow (2002), there are certain conditions that trap a community in low levels of action around investment in water management. Some of these conditions for western Kenya are dependent on factors such as – high fixed cost associated with water management vis-à-vis poverty level in the community, non-availability of credit to finance community investments, social capital present in the community to undertake collective water management, issues of property and tenure security, interference of neighboring communities.

Gender differences in water collection roles at the community level came up as a reason for men's low interest in initiating water management projects in upper Nyando basin. (Roy et. al, 2005). Knox, Meinzen-Dick and Hazell indicate watershed/catchment management as a resource investment that requires both secure property rights and strong collective action (Swallow et al. 2002).

Provisions of Kenya's new Water Act of 2002 also limit community initiative to manage water in several ways. The reforms of the Water Act of 2002 introduced in Kenya have created space for the participation of rural communities in water management. The act calls for appointment of catchment area committees, including representatives of farmers, non-government organizations and other stakeholders review water management at catchment level. At the same time, the act vests ownership of all water resources in the country in the State. Accordingly, community based water providers need to acquire licenses to continue providing water to their members. Acquisition of permit runs with land ownership and the current administrative systems to acquire permits are constraining. In this way, the provisions of the act effectively disenfranchise poor rural communities from acquiring water permits as they do not own

land (Mumma, 2005). Given the limited reach of state run water provision system in rural areas, the communities in these areas already undertake water management on their own accord. However, these provisions of the act diminish the incentives for communities to undertake collective water management.

In preliminary research in Nyando, it has emerged that property rights to land and the process of land adjudication in riparian zones not only distorts incentives to manage water resources located on private lands but also impairs the ability of marginal members of the community to access water (Onyango et.al, 2005).

Given the significance of community based approaches to water management it is important to understand the factors that facilitate or constrain community based water management in the lower Nyando basin. The current research explores answers to the following research questions,

1. What are the factors that facilitate or constrain community action around water management in the lower Nyando basin?
2. What is the impact of improved water management on allocations of water across various activities in the house?

Chapter 3

Methods and Analysis

3.1 The study area

The study was carried out in the lower Nyando basin, in western Kenya. Geographically, the lower Nyando basin is a part of the much larger Nyando basin which forms a major river basin of Lake Victoria in western Kenya. Lake Victoria is the second largest lake in the world and the lake basin spreads across five countries in east Africa[3], and supports 28 million people, a majority of them being poor (ICRAF, 2003). But the lake faces a crisis today- in terms of high population pressures, pollution from industries and urban sewage and soil erosion from farmlands.

Nyando basin covers an area of 3500 square kilometers, with a population of 750,000 people. The catchment is surrounded by Tinderet hills to the east, Nandi escarpment to the north and Mau escarpment to the south. (Karoki, 2000). River Nyando passes through Nandi hills where high rainfall is received, drains into Lake Victoria, through the lower Nyando basin and is the major cause of flooding in these plains, as well as a major contributor of sedimentation to Lake Victoria (RoK.,2002).

Nyando basin is very heterogeneous in terms of soils, climatic conditions and land use. Based on the altitude gradient, the watershed can be divided into five different land-use zones. Small scale subsistence maize and sorghum farming characterize the lower part of the watershed between 1100-1300mm. Large scale sugar plantations and smaller sugar schemes are located between 1300 m and 1700 m. Coffee plantations range in the

[3] The lake basin covers an area of 184, 200 square kilometers of Kenya, Uganda, Tanzania, Rwanda and Burundi. The lake basin is among the most densely populated and poor regions of the world, with population densities of up to 1200 persons per square kilometer and poverty levels of 50% or more. (Swallow, Okono, Ong, Place,).

zone between 1600m-2000m. Small scale tea farmers and large scale tea estates are located at 1900m-2100m. Large scale maize and potato farming characterize areas above 2100 meters (Onyango.et.al, 2005)

3.1.1 Lower Nyando basin

i. Administrative units

The Nyando basin is composed of several administrative districts, namely, Kericho, Nyando and Nandi. Nyando district covers an area of 1,168.4 square kilometers, and is divided into five administrative divisions namely, Upper Nyakach, Lower Nyakach, Muhoroni, Miwani and Nyando divisions (RoK, 2002). The 1999 census indicates the district has a population of 299,930 with a population density of 270 persons per square kilometer (RoK, 2001). The population of Nyando district constitutes 35% of the population of the Nyando basin (ICRAF, 2002,).

ii. Physiography

The district can be divided into three topographical zones, namely: Nandi hills, the Nyando plateau and Kano plains. The altitude in the district varies from 1,800 meters above sea level (masl) in the Nyabondo plateau to 1,100 masl in the Kano plains. The district receives bimodal rainfall with the long rains received between March and May and short rain between September to November. The mean average rainfall in the district ranges between 600mm to 1,630mm (RoK., 2002). Administratively, the divisions of Miwani, Lower Nyakach and Nyando of Nyando district form a part of the Kano plain areas. While parts of Sigowet and Soin divisions of Kericho district also fall in the lower Nyando basin the present study focuses on the three divisions of Nyando district which constitute the Kano plains.

The Kano plains consist of black cotton clay soils with poor drainage. The region is characterized by heavy seasonal flooding. The flood prone lakeshore area is mostly used for subsistence production of maize, beans and sorghum production, combined with commercial production of sugarcane and irrigated rice.

Most of the land in the lower part of the basin is held as adjudicated land, with titles in the name of the people who cultivate these lands. Land adjudication was carried out on ethnic lines and thus sections of adjudicated land are homogenous in terms of ethnicity. Women do not have titles over adjudicated land (Onyango et. al.,2005).

iii. Social features

The Luo inhabit the lower Nyando basin. The Luo society is organized by lineages which are formed by descents from a common ancestor. Among Luo, clans and sub-clans are an important source of authority. The marriage system is exogamous and virilocal, with married women moving to stay with their husband's lineage. Originally the Luos were nomads, but now are predominantly peasant farmers and fishermen. Cattle assume an important place within the farming system and culture, and are used for ploughing, and as a payment for bride-wealth. The customary practice in land inheritance is patrilineal. Men have access to land by belonging to a lineage while women hold usufruct rights by means of their marriage. The Luo have strong customary authority and prohibition on individual land use (Hulseboch & van Koppen, 1993). Polygamy is common among the Luo. There is a complex system of duties and obligations among these polygamous households. Women have little customary access to land as per the Luo custom, with the exception of a small home garden (Orundu) that even junior wives are entitled to (ICRAF, 2002).

iv. Institutions in water sector

Several agencies are involved in the rural water supply sector in the study area. The Department of Water is responsible for management and development of water resources. In addition, the government departments of Health and Agriculture and parastatal organizations (such as Kenya Water Pipeline corporation, Lake Basin Development Authority), also develop water sources in the study area. Institutions such as self help groups, women's groups, church organizations, non-government organizations, external support agencies, schools, hospitals and private individuals also contribute to water resource development in the study area (IRC, 1997; ICRAF, 2002).

3.2 Multiple methods: what and why?

Multiple methods were chosen to conduct the present study. Multiple methods entail combining qualitative and quantitative data collection techniques in a single study (Reinharz,1992; Chung, 2000).

Use of multiple methods was guided by the research objectives. The research is an exploratory attempt to understand the constraints to collective action for water management; and the impact of improved water availability on household use of water. The first part of the research topic necessitated the use of qualitative methods such as interviewing and focus groups to understand various situations under which water is managed by local communities. Rubin & Rubin (2005) justify the use of qualitative interviewing methods in research topics that require capturing the details and nuances of the social phenomenon under study. Morgan (1988) suggests that focus groups be used in situations where the researcher is new to the area and the research topic requires an

exploration of topics. However, the second part of the research objective concerning the impacts of improved water availability required that the amount of water that households collect and use be quantified, using a standard format across informants. Therefore, to elicit responses to this research question quantification techniques were used.

There are many advantages to using multiple methods. Chung (2000) emphasizes that combining qualitative and quantitative methods improves the quality of research and policy recommendations emerging from the research. This is because multiple methods allow the researcher to exploit multiple perspectives. Multiple methods increase the likelihood of obtaining scientific credibility and research utility, by adding layers of information and by using one type of data to refine other (Reinharz, 1992).

3.3 Phases of Research

The study was carried out in three phases (table 1). The objective of the first phase was to gain an understanding of the water scenario in the lower Nyando basin, including the major agencies and problems pertaining to water management in the region. During this phase of the research, reconnaissance of several villages in the Nyando basin was undertaken and qualitative interviews with government agencies and village representatives were conducted extensively. A key output of this phase was a broad understanding of the water sector in the Nyando basin, and a list of villages where a range of water resources are being managed under various types of institutional arrangements. Based on information from first phase, the second phase of the study was designed to gain a comprehensive understanding of the dynamics of community level management of water in villages selected across the lower Nyando basin. Focus groups

were used during this phase of the study. Information to assess the impact of improved water availability was also gathered in the second phase of the research. This was done through use of semi-structured surveys, with selected respondents in each focus group. During the third and final phase of the research, participatory rural appraisal (PRA) sessions were conducted to ascertain and triangulate information as regards various water sources in a village and their use across various socio-economic classes in a village.

Table 1. Phases of data collection

Data collection phase	Method of data collection	Objective of data collection	Number of data points
I	Field visits to several villages, key informant interviews	Explore the types of water facility and understand community management	18 key informant interviews with NGO and government agency staff
II	Focus group discussions	Information on factors facilitating community action	14 Group discussions
	Semi-structured individual questionnaires	Impact of improved water management in terms of use of water for various activities	45 questionnaires
III	PRAs	Triangulation of information from focus groups and assess use of water by socio-economic classes in a village	2 PRAs

3.4 Methods of data collection

The study combined use of qualitative and quantitative methods. However, the present study is predominantly a qualitative work, supplemented by quantitative methods to a limited extent.

3.4.1. Qualitative methods

Qualitative data are non-numeric, textual and visual data derived from interviews, observations, documents or records, gathered from a small number of informants (Chung, 2000). The study mainly utilized qualitative techniques of enquiry, which included focus group discussions, semi-structured interviews with key informants and PRA exercises.

i. Semi-Structured interviews

Qualitative interviews are conversations in which the researcher guides the informants to elicit details and depth about the research topic (Rubin & Rubin, 2005). Interviews yield direct quotations from people about their experiences, opinions and knowledge (Patton, 2001). A semi-structured or general interview guide approach involves outlining a set of issues to be explored with the informant before the start of the interview. These interviews use an interview guide with open-ended questions to ensure that all relevant topics are covered (Patton, 2001). Topical interviews are used to study research problems that are highly visible at the beginning of the study, and the researcher interviews several informants to gather facts about events and piece together a coherent explanation. Accordingly informants with a variety of perspectives are chosen who have experience and knowledge about the problem (Rubin & Rubin, 2005).

Semi-structured, topical interviews were conducted with key informants in various government agencies, non-government organizations, village representatives and members of water user groups in the study area at various phases of the research. In all, eight interviews were conducted with staff of government and non-government agencies, six interviews with assistant chiefs in various villages and four interviews with office-bearers from different water user groups. An interview guide was prepared to guide

interviews with each of these various categories of informants. Interview participants were chosen because of the knowledge they hold about the area and on account of their experience of dealing with water issues in the study area. Most interviews were conducted in English and were audio-recorded.

ii. Focus group discussions

A focus group consists of a small group of individuals from a well-defined target population in order to generate discussion focused on preselected topics of interest to the researcher (Knodel, et. al., 1990). The main feature of the focus groups is the explicit use of the group interaction to produce data and insights that would be less accessible without the interaction found in the group (Morgan, 1988). Focus groups are appropriate tools to generate explanations and theories (Morgan, 1988).

The villages in the study area were similar in socio-economic attributes; they differed in terms of water availability and the type of institution involved in water provision. Thus, there were villages with shallow wells or boreholes or water pans initiated by an external agency (donor/ NGO) and those where these were established by community members themselves. A study design was developed to classify study villages as per break and control variables (Knodel, 1990), so as to compare and capture this heterogeneity that existed among villages. This design was used to determine the number and composition of focus groups to be organized.

Break variables define how study villages are differentiated from each other. In the present study three set of break variables were identified. These are: (i) the type of water resource (shallow well/ borehole/ water pan), (ii) type of water agency intervention (external agency initiated/ self-initiated community group/no intervention) and (iii) type

of water users (men/ women). Together these three break variables define different subsets for which separate focus group sessions were held: donor initiated borehole men, donor initiated borehole women, donor initiated shallow well men, donor initiated shallow well women, community initiated shallow well men, community initiated shallow well women, no intervention men, no intervention women, donor initiated water pan men, donor initiated water pan women, community initiated water pan men, community initiated water pan women and so on. Twelve groups emerged from the combination of break variables. Since all combinations of break variables were not found in the study area, a few of these were eliminated. For instance, during fieldwork it was found that community initiated boreholes do not exist so this category was eliminated. Thus, focus groups were purposively selected to ensure a match between break characteristics and actual situations on the ground. While the groups were differentiated along various break variables, it was also ensured that they share some common characteristics. Such characteristics that are shared by all members of each group are referred to as uniform control characteristics (Knodel, 1990). Ethnicity, residence and geographical region were the three uniform control characteristics chosen to design focus groups. Thus, all focus groups were organized with Luo individuals who were rural residents, from the lower Nyando basin. Age of participants was a characteristic explicitly taken into consideration when forming groups, ensuring that adult participants were recruited for each one. Such characteristics that are taken into account in order to impose a common group composition can be referred to as composition control characteristics (Knodel, 1990). The study design based on the combination of break and control characteristic is illustrated in table 1.

Table 2. Use of break & control characteristics in selecting focus groups

Group	Uniform Characteristics				Break Characteristics							
	Control			Composition	Type of Agency involvement			Type of Resource			Type of Users	
	Ethnicity	Region	Residence	Age	Community	Donor	None	Bore-hole	Shallow well	Water pan	Men	Women
1	√	√	√	√		√		√			√	
2	√	√	√	√		√		√				√
3	√	√	√	√		√				√	√	
4	√	√	√	√		√				√		√
5	√	√	√	√		√			√		√	
6	√	√	√	√		√			√			√
7	√	√	√	√	√					√	√	
8	√	√	√	√	√					√		√
9	√	√	√	√	√				√		√	
10	√	√	√	√	√				√			√
11	√	√	√	√			√				√	
12	√	√	√	√			√					√

As the focus groups progressed, the findings from initial groups led to a modification in the study design to include an additional group of donor initiated shallow wells as these faced particular problems, regarding land ownership. In addition, during the selection of villages to match groups it was ensured that water facilities that are functional and non-functional are represented. Intra-group homogeneity in order to facilitate discussion was ensured by holding separate sessions with members and non-members of the group. Finally, fourteen focus groups spread over eleven villages were selected that represented the contrast in break variables as well as the field conditions. These are presented in table 3.

Table 3. Focus group sessions

1. Donor supported, borehole, men (functional)
2. Donor supported, borehole, women (functional)
3. Donor supported, water pan, men (non-functional)
4. Donor supported, water pan, women (functional)
5. Donor supported, shallow well, men (non-functional)
6. Donor supported, shallow well, women (functional)
7. Community initiated, water pan, men (functional)
8. Community initiated, water pan, women (non-functional)
9. Community initiated, shallow well, men(functional)
10. Community initiated, shallow well, women (functional)
11. Village with no intervention, men (river)
12. Village with no intervention, women (river)
13. Community managed piped water kiosk, women (functional)
14. Donor supported, shallow well women (non-functional)

Each focus group discussion followed a similar question guide. The discussion guide consisted of a number of open-ended questions arranged under specific topics. The topics of discussion in each group included various factors that influence community action around water, viz.-characteristics of resource, role of external agency, institutional issues, collective action, responsibility of water collection and maintenance, impact of improved water management (refer to Appendix 2 for focus group discussion guides). The focus

group guide was translated into Luo and field tested in three dummy sessions before it was finalized.

The participants of the focus group were purposively recruited after conducting key informant interviews with village chiefs and members of water management committees across selected villages. An attempt was made to restrict group size to a maximum of ten participants. However, on more than one occasions the number of group participants was more than ten. All group discussions were conducted in Luo, the language spoken by the participants.

A moderator and a note-taker were provided hands-on training through three trial focus group sessions. The moderator had long standing experience of interacting with rural communities on water management issues. All focus group sessions were audio-taped and transcribed verbatim by the note-taker who was also present during the time when the group was organized.

iii. Participatory Rural Appraisal

Participatory research is a method of social investigation of problems, involving participation of ordinary people in problem posing and solving. The main aim of participatory research is not merely to describe social reality but to change it (Maguire, 1987). PRA techniques are used to gain information from rural people in an open-ended manner. PRA consists of a group of tools that are flexible in nature and help generates discussion among rural communities about their notions of reality (Chambers, 1997).

PRA techniques were conducted in two villages after completion of focus group discussions, to triangulate findings emerging from them. The PRA sessions involved wealth ranking and drawing up of social and resource maps to understand the spatial

distribution of water resources in a village vis-à-vis habitation and to understand patterns of access to these resources by various socio-economic groups in the village. These PRA sessions were conducted by the researcher, with help from a translator.

3.4.2 Quantitative methods

Quantitative data are invariably numerical, collected by means of structured standardized surveys from a large group of individuals, and analyzed using statistical techniques (Chung, 2000).

A survey was designed to analyze the impact of improved water availability on use of water for various activities in a household. The survey questions focused on recording the total amount of water collected for various activities in the house before and after the initiation of the water project.

The survey population consisted of all participants of the 14 focus groups as per the study design. Since the participants to focus groups were purposively selected, rendering the survey sample purposive by default. The sampling of survey respondents can thus be said to correspond to a stratified purposeful approach, by sampling within sample. A stratified purposeful sampling involves creating strata among population of interest, and further categorizing among these strata (Patton, 2001). In the present study, the two strata were- the type of focus group (as per table 1); and the distance between the homestead of focus group participants and the water point. After the end of each focus group session (first stratum of sampling) participants who stay nearest and farthest (second stratum of sampling) from the water source were identified. One participant who stayed nearest to the water source and the other staying farthest from the water point were selected. Two participants were selected from each group and interviewed as regards their use of water

for various activities, in the period before and after the initiation of the water project. However, in a few groups, more than two respondents were also interviewed. Thus, all survey respondents were purposively selected from within the sample of focus group participants.

A total of 45 respondents were surveyed, of which 22 were women. Ten female headed households were also interviewed. The distribution of survey respondents as per villages is given below (refer to table 4).

Table 4. Distribution of survey respondents across study villages

S. No.	Village	Sub-location	Location	Division	Water project	Male	Female
1	Kasaye	Kasaye	Rangul	Lower Nyakach	Shallow well		4
2	Kogada lower	Moro	Paponditi	Lower Nyakach	Water pan	3	
3	Kasaye Cherwa	Jimo-east	East Nyakach	Lower Nyakach	Shallow well	2	1
4	Kowala	Jimo-east	East Nyakach	Lower Nyakach	None	4	4
5	Kowuor	Kasaye	Rangul	Lower Nyakach	Shallow well		3
6.	Kasirindwa	Jimo-middle	Rangul	Lower Nyakach	Water pan		3
7.	Kasirere	Kakmie	Onjiko	Nyando	Shallow well	2	3
8.	Ngere	Nyangoma	Wangaya1	Miwani	Borehole	3	4
9.	Achego	Achego	East Kano	Nyando	Piped water kiosk		3
10.	Kagure	Jimo-east	East Nyakach	Lower Nyakach	Water pan		2
11.	Kamula	Jimo-east	East Nyakach	Lower Nyakach	Water pan	2	
12.	Kagaya	Jimo-east	East Nyakach	Lower Nyakach	Piped water		2

3.5 Data Description

The original data set from focus group discussions consisted of audio-recorded tapes. These were transcribed in Luo, and translated in English to produce the textual data for the purpose of analysis. Textual data for 14 focus groups was thus produced and considered for analysis. Thus, transcripts from focus groups consist of translation of quotes about ideas expressed by the participants.

Most semi-structured interviews were conducted in English, the language common to the researcher and the participants. The interviews were audio recorded and verbatim transcripts were generated. Transcripts from eighteen interviews were included in data analysis. Thus, most data from semi-structured interviews consists of verbatim quotes expressed by participants.

The data from household survey consisted of demographic details about households and numeric information about amount of water collected and used in the household before and after the initiation of the water project. A total of 45 households were surveyed. Of these, data on before and after project scenario was collected for 37 households, while the remaining 8 households did not have a project and so did not report on after project scenario. One of the responses for before and after project situation was dropped because of incomplete recording. Thus, the before and after project analysis of quantitative data included only 36 responses.

A general weakness with the reporting of amount of water used for household activities (such as washing laundry, watering cattle) concerns the inability of the respondents to specify exact amounts of water used in liters, as water is not carried to the homestead for these activities rather the activities are carried out at the water source

(river, water pan). Thus, while some households could accurately report on these uses, others could not. These incidents of non-reporting were not considered in quantitative analysis. Therefore, the sample sizes used for statistical tests to analyze water uses over particular activities include only those households which quantified their use over these activities. Thus, while data on before-and-after project water use was collected for 36 households, since water use for particular activities for some households was missing, the descriptive statistics and statistical are not based on uniform sample size (n is not equal to 36 in all cases).

Data from PRA sessions was in the form of village resource and social maps, a seasonality chart of use of water sources, and a list of vulnerable households in the community based on wealth ranking criteria.

3.6 Data analysis

Data collected from a combination of qualitative and quantitative methods was subjected to different forms of analysis, as appropriate for qualitative and quantitative data.

3.6.1 Analysis of qualitative data

All focus group discussions were audio recorded and transcribed verbatim. Similar verbatim transcripts were prepared for all the key informant interviews. This resulted in a rich set of data which were analyzed manually using Carney's ladder of analytical abstraction (Miles & Huberman, 1997). This ladder follows three levels:-

i. Summarizing and packing the data

The aim of this step is to create a text to work upon. Transcription of recorded data from discussions and reconstruction of written notes was done at this stage, using a word processor. At this stage, the transcripts of the initial data set were read with an eye to look for codes. Codes are tags or labels used for assigning units of meaning to the descriptive information gathered during a research (Miles & Huberman, 1997). A provisional list of codes thus emerged from this early coding. These first rounds of codes were descriptive in nature (Miles & Huberman, 1997) and entailed little interpretation, and related directly to the topics covered in the group discussions. These descriptive codes were later applied to the data to look for relationships among codes and to arrive at a revised and enlarged code list. These second order codes were recorded in a memo.

ii. Repackaging and aggregating the data

The aim of this step along the analytical ladder is to search for relationships in the data and find out the areas of emphases and gaps. At this stage, the transcriptions from all sets of data were searched for relationships and patterns among codes. Definitions and operational rules for application of codes were developed for each of these codes, to help in the process of standardization and cross-comparison of the data (refer to Appendix for a table of themes and definitions). Upon completion of coding a final family of inferential codes emerged, termed as a structure. The final structure thus contained "larger" (more conceptually inclusive) and "smaller" (more differentiated instances) codes (Miles & Huberman, 1994). This final structure thus tied related codes or themes into a pattern or a meta-code. These meta-codes elaborate upon explanations for the

research problem (Miles & Huberman, 1994). In the analysis the pattern of themes and meta-codes generated three broad conceptual areas to answer the first research question. These areas were: constraints to initiate water management, constraints to sustain water management and the process of community based water management. Other key conceptual areas addressed during thematic coding were factors that facilitate community based water management, characteristics of water resources, seasonality, and socio-economic differentiation in their use and the impacts of improved water availability.

After the entire data had been coded, case summaries were prepared for each theme or concept that emerged from the list of codes. These case summaries were then arranged as per research questions, in order to have an overall summary statement for each research question. This step resulted in reduction of the entire transcribed data, into three-four line summaries around major themes and concepts in the data.

iii. Developing and testing hypotheses to construct an exploratory framework

The aim of this level of analysis is to cross-check findings through matrix-analysis of major themes in data and finally integration of data into an exploratory framework. At this stage, the summary statements developed in the previous step are sorted and organized as per each research question or some important concepts that emerge from the data. These summary statements are organized in form of matrices or grids, and can take many forms, depending upon the nature of relationships and patterns among themes. Specifically, conceptually clustered matrices to identify factors that constrain and facilitate community level water management and effects matrices for impact of improved water management were developed to bring themes and concepts that belong together, as per the break characteristics identified in the study design.

3.6.2 Analysis of quantitative data

All raw data from the semi-structured surveys were key-entered into a Microsoft Excel database and later imported into the statistical software SPSS. At the same time each data point was coded and a descriptive label for each variable was given. The database was verified against the raw data to check for inconsistencies. The original data files were stored while a set of work files were created to facilitate analysis. Descriptive statistics and hypothesis testing through statistical tests was done through SPSS.

In the wet season, the respondents reported using an unlimited quantity of water (usually not specified in terms of liters used), due to greater availability through rain water harvesting at household level. These data from the wet season were transformed and recoded and the analysis was deliberately limited to comparing means across activities during the dry season only.

Similarly, for activities such as washing laundry, watering cattle carried out at water points such as rivers and water pans, the respondents did not specify the amount of water used in liters. On account of this non-reporting of water use for specific activities, the analysis of statistical tests uses a number of sample sizes.

i. Descriptive statistics

Descriptive statistics such as means of water used in various domestic and productive activities in dry and wet seasons before and after the project were calculated. Bar-charts were developed to illustrate various sources of water and their use by activities before and after the project.

ii. Testing a-priori hypotheses using statistical tests

Two hypotheses were formulated from among the data that was collected about household water use before and after the water project.

1. The first hypothesis is stated as: the amount of water used in various household activities before the initiation of a water project is different from the amount of water used in household activities after the initiation of the water project. The assumption behind this hypothesis is that when a water project is established in a village, households use greater amounts of water because of proximity of source and certainty in water availability. The null hypothesis is that there is no difference between uses of water for various activities in a household before and after the initiation of a water project.
2. The second hypothesis can be stated as: there is an association between the amount of water use in a household and the distance of that household from the water point. The underlying assumption behind this hypothesis is that when water is available closer to homesteads as a result of a water project, households tend to use more water as compared to cases when water is hauled over from relatively distant sources. The null hypothesis is that there is no association between amount of water use in the household and distance of the household from the water source.

The first hypothesis was tested using a t-test for paired samples. A paired sample t test acknowledges that the sample data are not independent. The analysis of paired data requires that differences in means of n pairs of measurements be computed, so as to

obtain *d* bar and standard deviations. The hypothesis is formulated about μ_1 and μ_2 in terms of the mean of the differences, $\mu_d = \mu_1 - \mu_2$, with $\mu_d \geq D_0$ (where D_0 is a specified value, often zero). The paired sample t test is used when population variation is unknown, and the distribution of differences of means is normally distributed (Ott & Longnecker, 2001).

The first hypothesis was thus tested by comparing means of the amount of water used in the dry season before and after the initiation of the project for both domestic and productive activities. The decision to restrict comparison to dry season data was taken because the use of water in dry season (especially for productive activities) indicates that use of water as a result of project has changed after the project as opposed to wet season when households have access to wide variety of water sources apart from the water project.

The second hypothesis was tested using a Chi square test of association which tests whether perceived association in the sample data is real or a result of random variability. The frequency data are arranged in crosstabs with *r* rows and *c* columns. The possible values of one variable determine the rows of the table and possible values of the other determine the columns. The population proportion in row *i* and column *j* is denoted by π_{ij}, the total row proportion by π_i and total column proportion by π_j. If the row and column proportions are not associated, then $\pi_{ij} = \pi_i \cdot \pi_j$ (Ott & Longnecker, 2001).

The hypothesis was tested by grouping distance to water source in four categories and arranging these categories in rows. Similarly, the total amount of water used in productive activities during dry season was grouped into four categories and arranged in

columns. A 4x4 crosstab was generated and analyzed using SPSS. The grouping criteria for distance to water source and amount of water used are presented in table 5.

Table 5. Grouping variables for Pearson test of association

Distance between homestead and water point	Group	Quantity of water used for productive activities	Group
0.0 km	Homestead	61-200 liters	High use
0.01-0.4 km	Short distance	21- 60 liters	Medium use
0.41-0.75km	Medium distance	10-20 liters	Low use
0.76-2 km	Long distance	0.0 liters	Very low use

3.6.3 Analysis of PRA sessions

PRA sessions were conducted primarily as a means to triangulate data from the focus group and interviews, especially with regards to access of various users in the community to water sources. The data from PRA resource and social maps was tabulated to describe the total households in the village and their classification in socio-economic categories as identified by the village groups. Accordingly, the distribution of poor, female headed and orphan headed households in the two villages was generated. A discussion on the main water sources in the community was facilitated, and main reasons that prevent households from accessing particular water sources were documented.

3.7 Validity and Generalizability

Validity refers to the correctness of a description, conclusion, explanation or interpretation (Maxwell, 1996). A key concept for validity is to rule out ways in which the researcher can be wrong.

The qualitative aspects of the present research may suffer from threats to descriptive validity implying parts of what as observed or recorded can be incomplete (Maxwell, 1996). The threat to descriptive validity or credibility emerges (Patton, 2001) from the fact that the research was conducted in Luo, which is not the language of the researcher. In addition, the collection of quantitative data about the qualities of water used before and after the initiation of a water project was subject to recall. This may pose threats to descriptive validity in terms of inconsistent recording. This threat can be ensured by getting the data right and complete through use of rigorous methods of data collection and integrity of analysis (Patton, 2001).

In the present research, this was attempted through audio-recording of data and its expansion into verbatim transcripts. Thus, all focus group sessions were audio recorded and transcribed in Luo, and later translated into English. In addition, before launching full-scale focus group sessions, three sets of trial groups were conducted in order to test the process and focus group guides, and to train the facilitator and notes-taker. The facilitator and the notes-taker were fluent in Luo. However, it is still possible that richness of data that can be captured in the native language may be missing. In an attempt to further address this issue, a part of the audio-tapes were randomly checked for consistency through employing the technique of back-translation. In addition, all focus group guides were translated in Luo and back-translated in English to ascertain coherence. Threats to descriptive validity were also taken care of by the study design, which involved recording data from at least two groups who share some common break variable. PRA sessions held towards the end of the study helped to triangulate data sources and address the threat to descriptive validity.

Interpretive validity (Maxwell, 1996) refers to interpreting the data correctly, and resisting from imposing the researcher's bias into the data. As discussed earlier, since English is not the native language of the participants, parts of data might have been subject to varying interpretation. However, to address this threat, the researcher cross-compared data across transcripts and key break variables to ensure consistency of meaning and interpretation. The key informant interviews with office-bearers and area chiefs provided a chance to undertake triangulation, through building on questions that were posed to participants in focus group sessions. In addition, two PRA sessions were organized to ascertain the consistency of data, especially as regards use of various water sources across socio-economic classes in a village. Thus, iteration helped to address the threat to interpretative validity.

Threats to theoretical validity occur because of failure to consider discrepant data or failure to account for alternative explanations (Maxwell, 1996). However, this is addressed in the analysis stage by comparison of case summaries across focus groups, study sites and subsequently employing further comparison as per chosen break variables. This repeated comparison allows for identification of discrepant data and understanding of the phenomenon holistically.

In addition, the reactivity caused by the presence of the researcher might also pose a validity threat. However, trying to minimize researcher influence is not a goal for qualitative research (Maxwell, 1996). Therefore, to control for this threat to a certain extent, the study was conducted in natural, non-threatening settings in the language of the participants and with groups that were homogeneous in terms of gender and their status as members/non-members of a water project.

Generalizability consists of two key issues: internal and external generalizability. Internal generalizability refers to the generalizability of a research finding within the group studied; while external generalizability refers to its generalizability beyond the study group (Maxwell, 1996).

Since, both the quantitative and qualitative parts of the present study were designed explicitly as exploratory phases rather than to draw conclusions across sites, external generalizability is not a significant issue for the present research. Further, the study is based on purposively selected samples rather than randomly selected ones, therefore the findings have limited external generalizability.

The congruence in community dynamics and the universality of key issues across sites provide credibility that the findings from both qualitative and quantitative phases of the study do have high internal generalizability. In addition, the qualitative findings also have external generalizability, albeit limited, in terms of the useful lessons that can be drawn about the process of community management of water in rural areas of developing countries.

Although the findings from qualitative methods have some degree of generalizability, the results from household survey cannot be extrapolated to the population at large, because survey sample was not randomly selected. The recall method used to assess water use before the project also limit the external generalizability of the survey results to the population.

3.8 Limitations of the study

1. The data on amount of water used both before and after the project were subject to recall, and thus are subject to incorrect reporting. In addition, it is possible that

people are unable to segregate amounts of water used for each activity and report it accurately, and thus the amounts recorded for each activity may be misrepresented. However, in terms of the time-frame for the present study, methods such as respondent diary etc could not be used.

2. The respondents for the survey were selected as per break characteristics. Thus, at least two respondents from various types of water facilities under different institutional arrangements formed part of the survey cohort. This variation in water facilities and institutions limits the generalizability of findings across any type of water resources or institutional arrangements.
3. The respondents for the survey within each group were identified based on the respondents' self-reporting of the distance between their household and the water point. Since villagers do not usually calculate distances in kilometers, the reported distances are subject to being under or over-reported, thus affecting the sample selection.
4. The data on amount of water used in activities such as washing, bathing, watering cattle in dry and wet seasons were not reported in quantifiable terms by the survey respondents. Thus, all analysis of use of amount of water in household activities uses is restricted to those activities where estimates in liters were provided (drinking, cooking, washing utensils and homestead gardening). In cases where analysis extends to activities where water use was not reported in liters (water for laundry, livestock) in post-project scenario, the results should be interpreted with caution.

5. The research was conducted in Luo, which is not the language of the researcher, and this inhibited a spontaneous exchange between participants of focus groups and the researcher. As such, the researcher inputs in probing and steering the conversations were limited, which could have affected the quality of textual data.

Chapter 4

Findings

This chapter presents the results from interviews, focus group discussions and the survey. The chapter is organized around the conceptual areas that emerged during the analysis of textual data. Specifically, the broad conceptual areas that are presented in the chapter are the overview of water resources in Nyando, impacts of water availability, what works and what doesn't in community based water management and the process of community management. Several themes cut across more than one conceptual area, and therefore the discussion in each of these stages of water management weaves in evidence from the most recurrent themes.

4.1 Overview of water resources in Nyando

A range of surface and ground water resources are used and managed by communities in the study area. A number of government, non-government agencies and community groups are active in water sector in lower Nyando.

4.1.1 Types of water sources and their uses

People in the study area access a variety of water sources. The main sources of water in the study area can be classified as protected and unprotected water sources. Borehole, shallow wells, private piped water supplies and community managed piped water kiosks are considered to be protected[4] water sources. Rain water harvested from roof catchments

[4] The term "protected" refers to the fact that the resource is being managed by a user group and is relatively closed to contamination by human or animal interference, on account of the technology employed (covered shallow wells, tap). Protected however does not convey that the water from the resource is safe for human consumption and use.

is also a protected source of water. Rivers, seasonal streams and water pans are unprotected[5] water sources.

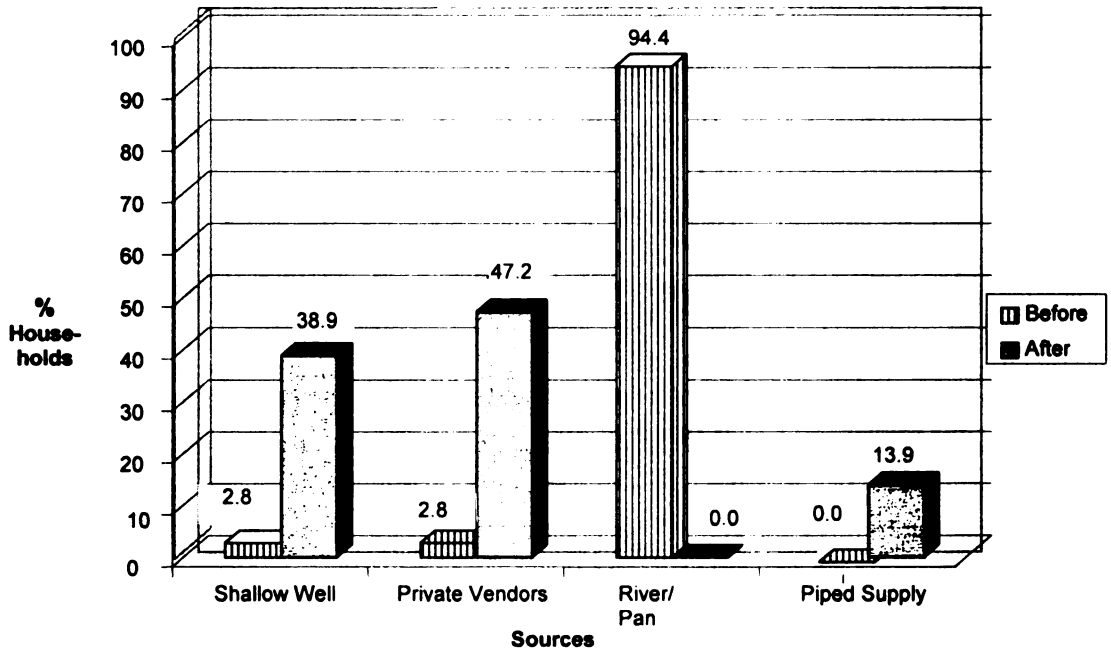
The rivers Awach, Asawo, and Nyando have been the traditional sources of water in the region. Water pans are an indigenous source of water in the region, and are common throughout the Kano plains of Nyando basin. These pans have traditionally been constructed and managed under community initiative that involves digging up land to allow harvest of surface run-off. Boreholes are drilled using machines and often reach a depth of 300 feet. Ground water is pumped from boreholes through electric pumps and is stored in overhead tanks. From these tanks it is supplied to individual households and to communal water kiosks. Shallow wells are a common water source in the lower Nyando basin. These are usually hand-dug and reach up to a depth of 70-100 feet, and are usually installed with hand-pumps to draw water. Piped water schemes in the study area not well developed. Piped water is supplied either under donor initiated borehole project, or by the parastatal agency, the National Water Conservation Pipeline Corporation (NWCPC). Water from piped supplies is supplied to individual consumers as well as community kiosks. Roof rain water harvesting is common in the region, and is mostly done at individual level. Many NGOs provide technical assistance to undertake household level roof water catchment projects. The use of rain water assures clean water to the people at almost no cost.

The research indicates that before the onset of a water project, a majority of respondents(94%, n=36) during the dry season accessed unprotected water sources (rivers/water pans/lakes) for the purpose of fetching water for drinking and cooking, and

[5] Unprotected water sources refer to the fact tat the resource is open to contamination as a result of human and animal interference, which is not controlled by the user group managing the resource. The water from these sources is of questionable quality.

only 5.6% had access to protected water sources. This trend however changes during the pre-project wet season, when around 75 % (n=36) of the households use rain water, a protected water source to fulfill their need for drinking and cooking water (refer to figure1).

Figure 1: Change in Sources of Water (drinking/cooking) during dry season from Before-Project to After-Project



The study indicates that the scenario of water use for drinking and cooking purposes in the dry season changes dramatically after the initiation of a water project. The post-project figures across respondents show that all respondents access protected water sources, with a majority of respondents (86%, n=36) accessing water sources such as shallow wells, boreholes and private water vendors, while the rest having a piped water supply (refer to figure 1).

During the post-project, wet season, the drinking and cooking water needs are fulfilled from a wide range of sources, with rain water from roofs being the main source (44%, n=36), and often supplemented by water from shallow wells, piped supplies. Interestingly, even in the post-project period, during the wet season around 11% of people rely on unprotected water sources such as rivers and water pans (refer to table 6). This however is not an anomaly, and was reported by focus group participants as well. According to women, especially those who are unable to buy water from protected sources, rivers and water pans are used as a source for drinking and cooking water in the wet season because there are no user fees to use them and secondly, and also because they are perceived to be cleaner during the rains than during the dry season.

Table 6. Post-project wet season- Sources of water for drinking and cooking

Water source	**Households using (percentage)**
Shallow well	2.8
Private vendor	5.6
Piped supply	13.9
Rain water	44.4
Rain water & shallow wells	22.2
Roof rain water and river/pond/pan/lake	11.1
Total	100.00

For uses such as bathing, 100 % (n=36) of respondents before the initiation of a water project used unprotected sources such as river and water pans during the dry season. However, the change in the post-project period bath water sources is not as dramatic as observed for drinking water. About one-third of respondents (36%, n=36) access unprotected water sources for getting bath water in the dry season after the establishment of the water project. A similar trend is observed for uses such as washing clothes, wherein all respondents used unprotected sources prior to the establishment of a water

project, and about 33% (n=36) of respondents still access unprotected sources for washing clothes during dry season after the project. During the wet season, 47% (n=36) of people use rain water for washing clothes.

4.1.2 Types of water use

Domestic water in the household can be grouped into three categories: consumption needs (drinking and cooking), hygiene (washing and bathing) and productive needs (livestock and vegetable gardening), IIED (2001). The mean per capita household water use (including consumption, hygiene[6] and productive activities[7]) during the pre-project situation was 20.9 (n=21) liters as compared to 29.44 (n=33) liters/per capita/day during the post project situation. These figures suggest that per capita water use in the post-project scenario is greater than the pre-project one. However, it is important to examine this change in water use as per various activities in a household.

i. Water for consumptive needs

People use water for drinking and cooking in the household. The study found that there is no statistical difference in the per capita total water used for consumption needs (drinking and cooking) before and after the initiation of a water project. The mean per capita water used for drinking and cooking in the dry season before the project was found to be 4.91 liters (n=36), while it was 5.11 (n=36) liters after the project. A study by IIED (2001) also reports a comparable figure for mean per capita water use in East Africa. Thus, while total per capita water use in post-project situation increases as compared to

[6] The use of water for washing clothes is not considered n this calculation, as this activity takes place at the river and water is not collected and carried to the homestead.

[7] The figures for per capita total water use in the household (both before and after project) do not include water for livestock. In the study area, water for livestock is generally not transported to homesteads; rather watering of livestock takes place at the water source.

the pre-project situation, this change does not occur so much over consumption needs. Water use in other household activities must account for this change.

ii. Water for hygiene uses

Hygiene uses include bathing, washing clothes and utensils, flushing toilets and cleaning the house (IIED, 2001). In the present study, hygiene uses include water used for all these activities except washing clothes and flushing toilets. Water for flushing toilets was not a variable of interest because such uses are not prevalent in the study area. The amount of water used for hygiene activities depends on the distance to the water point. In the study area, the mean per capita dry season water use for hygiene (excluding washing clothes) during pre-project situation is 11.8 (n=21) liters per day, while it is 15.7(n=33) liters per capita per day after the onset of a water project. Clearly, even after excluding water for washing clothes from analysis, an increase in water use over hygiene activities is reported. However, upon including washing clothes in hygiene uses of water, the study indicates that the water use for hygiene before project is 9.2 liters per capita while it increases to 22.98 liters per capita after the project (refer to figure 3). This finding is also substantiated by focus group discussions, as men and women members reported using greater amounts of water for bathing and washing clothes. However, the comparison of water use for hygiene purposes before and after the project should be taken with caution, as many respondents washed clothes at the river prior to the project and were unable to report these figures.

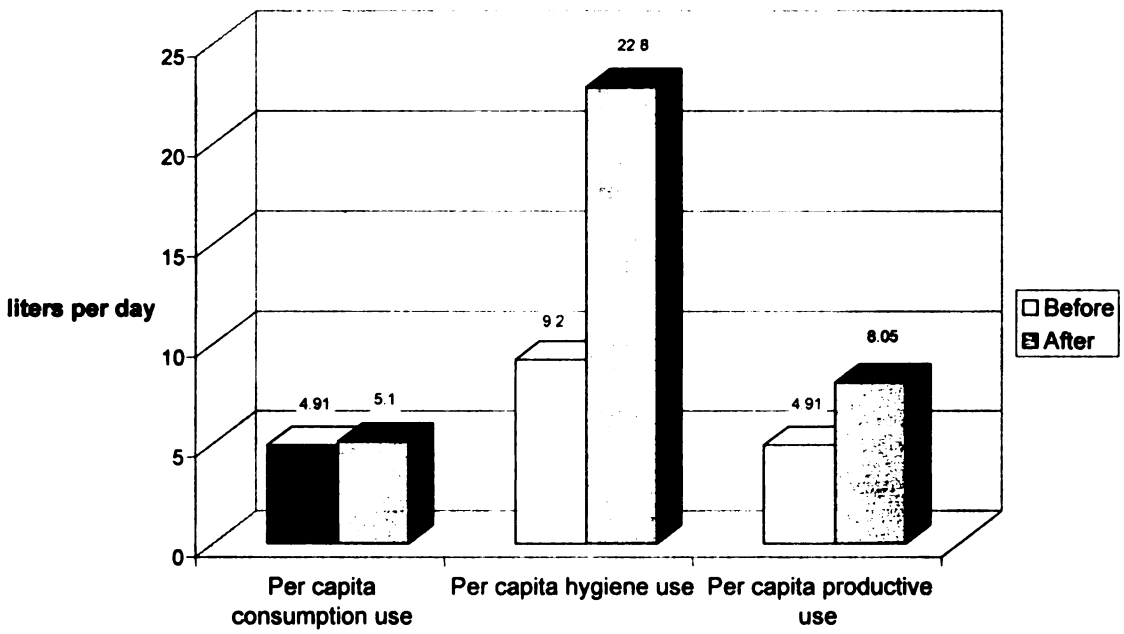
The total water used in consumption and hygiene needs in a household can be termed as water for basic needs (Perez de Mendiguren, 2003). A per capita average of 16.8 liters (n=21) of water is consumed during the dry season for basic needs prior to the project,

while the per capita average water use for basic needs (excluding washing clothes) is 20.87 (n=33) liters during dry season after the initiation of a water project. Thus, as per the data on the amount of water carried and consumed, the per capita water use in study villages is below the minimum "basic needs" figure of 25 liters per capita per day even after the initiation of the project. The main reason behind these low figures is that the households in the sample access water from water points situated at an average distance of about 0.54 km from the homestead. These people without access to homestead taps thus avoid carrying water for purposes such as washing clothes and bathing. Previous research in East Africa has shown that if water must be carried, there is not much difference in the quantity of water brought home from sources between 30 meters and 100 meters from the household (Perez de Mendiguren, 2003 citing White, Bradley, White, 1972). Thus, in the study area although reported per capita water use is below the minimum "basic needs" figure, in reality people do supplement this by washing and bathing at unprotected sources such as river and water pans. Although this supplementary use was widely reported it was not quantified in the present study.

Even if the people in the study area are able to fulfill their minimum per capita daily water requirements for basic needs from other sources, the fact remains that this basic minimum of 25 liters per capita per day is achieved by supplementing water from unprotected sources. Thus, people use water of poor quality for bathing and washing clothes as they are unable to access protected water either because it is far or has to be paid for. The qualitative data points out strongly that in absence of piped water supply in homesteads, people access unprotected water sources such as rivers for laundry and

bathing. The participants of several group discussions have remarked that using these unprotected sources results in skin diseases and dirty laundry.

Figure 2: Before and after project household water use



iii. Productive use of domestic water

Productive use of domestic water includes use of water for livestock, vegetable gardening, beer brewing etc. In the study area, livestock and vegetable gardens were the productive uses of domestic water.

a. *Water for livestock*

The communities in the study area keep cows, sheep and goats. The study found that before the onset of a water project, all respondents (100%, n=36) reported watering their livestock at the rivers and water pans. In the post-project scenario too, around 66% (n=36) of the respondents water livestock at rivers and water pans. Thus, water for livestock is generally sourced outside of the domestic system. This was also established

by a previous study in South Africa (Perez de Mendiguren, 2003).A similar situation was found in the village without a water project, where 100% (n=8) of respondents during the dry season water their livestock at the river.

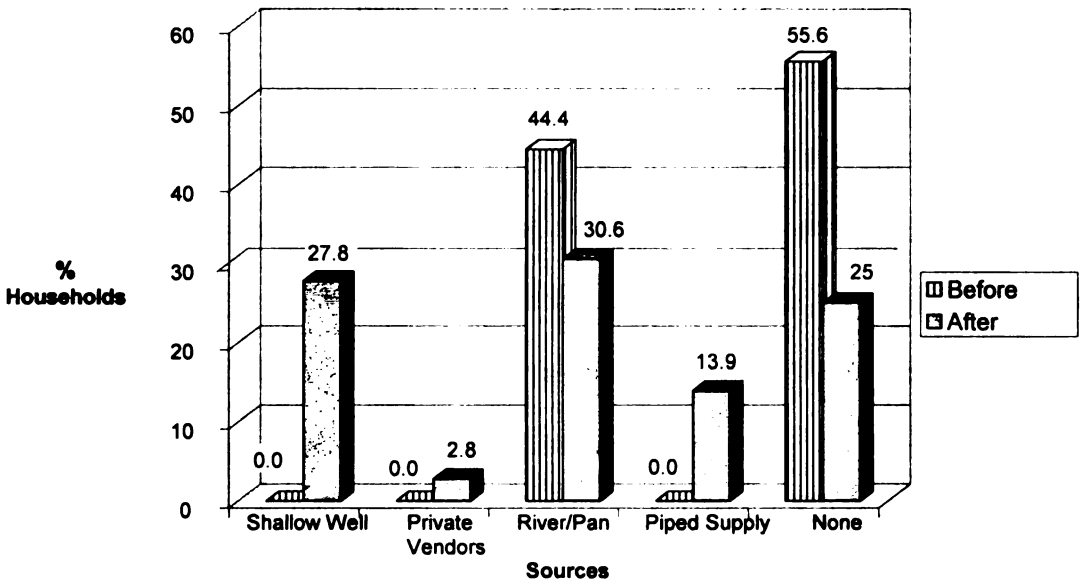
b. Water for homestead vegetable gardens

Vegetable gardening in the homesteads is a common productive use of domestic water. The presence of these gardens in dry season is an indicator of productive uses of water. Vegetables such as onions, tomatoes, kales are grown in these plots. These gardens are usually maintained by the women. Most produce grown is used for household purposes, but occasionally it is also sold. Of the respondents[8] interviewed 79.5% (n=44) grow vegetable gardens.

While during the pre-project situation 44% (n=36) of the households were engaged in homestead gardening, the figure jumps to 75% after the establishment of a water project. All respondents engaged in gardening in pre-project situation reported sourcing water for these gardens from rivers and pans. During the post-project situation, 44.3% respondents reported sourcing water from the water project (either shallow well, community kiosk, piped supply or water pan), indicating that the establishment of a water project is beneficial to rural households from a productive and well-being perspective.

[8] The total number of respondents includes eight households in the village without any intervention around water.

Figure 3: Change in sources of water for homestead gardens) from Before-Project to After-Project



A per capita mean of 4.91 liters (n=36) of water was used to irrigate vegetable gardens before the onset of a water project. After the initiation of water project, the per capita mean water use in homestead gardens was found to be 8.05 liters (n=36). Households carried an average 23 liters (n=36) of water per day during the pre-project period for homestead gardens, which increased to 60 liters (n=36) after the initiation of water project (refer to table 7).

Table 7. Water use in homestead gardens

Water use in homestead gardens	Before Project	After Project
Mean (liters) water use	23	60
Per capita mean	4.91	8.05
No. of households engaged in gardening	16	27

It can be concluded from the data that total water use in a household changes after the establishment of a water project, as compared to pre-project situation. While, the water use does not change over consumption activities (drinking and cooking), the change

usually occurs over hygiene uses. This has significant implications for rural health and sanitation. The data also show that when water is available as a result of a water project more families are able to take up productive activities especially vegetable gardens. This finding illustrates that productive use of domestic water has implications for food-security and nutrition of rural households. In addition, it also means that water projects in rural areas should incorporate this demand for productive water uses into design of water supply system. However, the quantity of vegetables grown and their use whether for subsistence or sale needs to be explored further.

4.1.3 Before-and-after project water use- a priori hypothesis testing

As discussed in previous chapters, as per the first a-priori hypothesis it was expected that the amount of water used in various household activities before the initiation of a water project is different from the amount of water used in household activities after the initiation of the water project. The null hypothesis was that there is no such difference. A paired sample t-test was conducted to test the difference between household water uses across activities before and after the water project. The comparison was made for total water use in the dry season, which included both domestic activities (drinking, cooking, bathing, washing utensils and cleaning the house) and productive activities (watering homestead gardens) before and after the project. The results from the paired t-test supports the notion that the difference between total amount of water used in a household over various activities before and after the initiation of water project is great enough to be statistically significant, $t = -3.647$, $n = 19$, $p < 0.002$ (refer to table 8 and to the t-test output in the Appendix A). Based on the results of the statistical test, the null hypothesis can be rejected.

In addition, per capita dry season water use over domestic activities (drinking, cooking, bathing, washing utensils and cleaning the house) before the project was compared with per capita domestic water use after the project. The difference between the per capita water used across domestic activities before and after the project was found to be statistically significant, $t= 9.433$, $n=20$, two-tail $p<0.000$, indicating that water use of individual members in a household increases significantly in the post-project situation (refer to table 8 and the t-test output in Appendix A).

However, there was no statistical difference between per capita water use for drinking and cooking purposes before and after the project with $t=0.670$, $n=35$, $p<0.507$. This indicates that while the total per capita water use over domestic activities increases, it remains unchanged for basic consumption activities (drinking and cooking). However, as pointed out elsewhere the water for basic consumption activities is sourced from protected sources. It seems plausible that this increase in per capita water consumption in the domestic sphere is translated into greater amounts being used for bathing, washing and cleaning utensils.

Having established that there is a difference between the amount of water used over various household activities before and after the project, it is imperative to know what those activities are where water use increases after the initiation of the water project. Previous work has pointed out that with availability of water in a village, households undertake homestead gardens. The presence of these gardens during the dry season is an indication of productive use of water, as also a pointer to the status of domestic water supply in a village (Perez de Mendiguren, 2005).

Water use during dry season in productive activities (watering homestead gardens) before the initiation of a water project was compared with productive water use after the initiation of the project. The difference in before and after productive water use was found to be statistically significant, $t=3.654, n=35, p<0.001$, confirming that households use greater amounts of water in productive activities after the establishment of water project (refer to the t-test output in the Appendix A). The results from the all statistical test are summarized in table 8.

Table 8. Before & after project water use: results from paired sample t-tests

Water use in liters	N	Mean	Min	Max	Standard deviation	Statistical significance
Before [9]project total household water use in dry season	20	150.00	65.00	450.00	82.11	Yes, p<0.002
After project total household water use in dry season	20	241.00	75.00	790.00	178.63	
Before project per capita total household water use in dry season	21	16.82	6.67	32.50	6.30	Yes, p<0.000
After project per capita total household water use in dry season	21	20.87	10.00	40.00	7.16	
Before project per capita use in drinking & cooking needs in dry season	36	4.91	1.00	15.00	2.95	No, p<0.507
After project per capita use in drinking & cooking needs in dry season	36	5.11	2.50	15.00	2.28	
Before project homestead garden	36	23.89	0.0	0.0	41.28	Yes, p<0.001
After project homestead garden	36	60.00	200.00	400.00	88.89	

[9] The comparison includes total water use in the dry season, in domestic activities (drinking, cooking, bathing, washing utensils and cleaning the house) and productive activities (watering homestead gardens) before and after the project.

These findings have implications for the rural poor, as an increased amount of water has the potential to address food-insecurity and livelihood concerns by providing nutritional options and a chance to earn income from vegetable gardens. This opportunity is significant as the entry barriers to undertake this activity are low (Perez de Mendiguren, 2005). It is the women who generally fetch water to undertake homestead gardening. Thus, improved availability of water has the potential to enhance nutrition availability and economic opportunities to rural families in general and women in particular.

It is clear that not only does the total water use change in the dry season before and after the initiation of a water project, but such changes occur for productive activities. But do these changes in water consumption occur uniformly for all categories of households, or are there certain household categories where this change is greater than others? Answering this requires understanding the factors upon which change in water consumption depends.

According to the second a-priori hypotheses it is expected that there is an association between the amount of water use in a household and the distance of that household from the water point. The Pearson chi-square test of association between productive water use in the dry season after the initiation of a water project and the distance between individual homesteads and water points is found to be statistically significant, $\chi 2 = 16.040$, $df = 9$, $p < 0.066$. This means that distance between homestead and water point and post-project productive use of water in the dry season are associated. Examination of cell values indicates that for 50% households with piped supply within their homesteads water use for productive purposes (vegetable gardens) falls in the category of "high uses"

(between 60-200 liters per day).Productive water use for none of the households staying at distance of 0.76 to 2km falls in the category of high uses. A similar trend is observed for people who live at short and medium distances from the water point, with percentage of water uses in high use category declining from 27% to 11% respectively (refer to Appendix A for results of Pearson test of association). These results point out that availability of water close to the homesteads allows households to use more water for productive activities.

4.1.4 Water rights and access to water

Access to various sources of water is governed by a system of rights that users possess. In the study area, these rights to access and use of resource are defined in six ways: payment in market, ownership of private asset, negotiation, rights to communal resource, rights to open access resource, and rights defined by culture.

i. Market- Rights to access protected water sources secured through a market operate through payment of water tariff to a water user association or to private water vendors. In Nyando, these rights are differentiated among members and non-members of a water users association. The members of water users associations secure these rights by paying a water tariff at a flat rate while non-members[10] pay a volume based tariff. The continued existence of these rights depends on the ability of the holder to make payments for water tariff. Market-based rights work as follows,

> *"No.6: We buy from taps.*
> *No.6: We have some in individuals' homes where we buy a pail at 2/- each; I personally buy water from Josh Agengo's home.*
> *No.1: From the taps after paying for the fee paid per pail you are allowed*
> *No. 5: You are allowed so long as you pay money"*

[10] The criteria of membership and exclusion are discussed later in the chapter.

ii. Ownership of private asset- Water rights can be secured through ownership of a piped water connection, storage facilities for rain water, and private shallow wells. People who are economically well-off thus own individual pipe connections or private wells in their homesteads. Households with tin sheet roofs have the right to rain water falling down the roof. 97% of the households included in the survey owned tin roof houses and thus had secure availability of protected water in the rainy season. Women members without piped water supply discuss how those who own piped water have an assured access to water,

> *"No.5: Some have taps in their homesteads.*
> *No.4: Some have built very big tanks in their compounds hence they always have water"*

iii. Social negotiations- Negotiations with neighbors or family members with piped connections or private wells are a common way to ensure rights to access protected water sources. However, these negotiations are informal ways of securing rights to safe water and can be operationalised only at certain times and not others. In the event of the breakdown of these negotiated rights, the right holders avail water from unprotected sources. The women without piped water supply discuss how they negotiate for water,

> *"No.1: I get water for free, I don't pay anything he is my neighbor and he allowed me to get water for free.*
> *NO.11: If I can add a point, there are some tap owners who don't allow us in their compounds. So those who have agreed and negotiated with us allow us in their homes"*

iv. Communal resource- Rights to common property water resources such as water pans are secured by way of contributing labor towards maintenance of these resources. These rights are household based and theoretically users are obliged to contribute towards upkeep of water resources, by way of participating in scooping the mud to deepen the

pan. In practice, water from these sources is not denied to anyone. There exist opportunities for free-riding by many community members. Since the assignment of these rights is culturally based, their monitoring and enforcement is informal, use of the resource by non-right holders is not sanctioned. The women explain how rights to use water pans are secured,

> *"NO.8: Like the ponds during the dry season, we dig them so when the rain comes we are allowed to collect water, if you don't, you are not allowed*
> *NO.4: After participating in anything that concerns them or working on them you are allowed to these water sources."*

v. Open access resource- Rights to open access resources such as rivers, streams are held by everyone in the community, without corresponding obligations. Thus, all households have rights to access the river, free of cost. Women from a village without a water project explain their use of river,

> *"NO.3:- Asawo river is very near so we go any time we are in need.*
> *NO.1:- The river, we fetch water free of charge, its nobody's water, so we access it any time"*

vi. By Culture- As per Luo custom, everyone in the community is allowed to access water. These culture based rights in fact under gird the operation of other rights related to water. Thus, land owners allow use of rivers or pans located on their private lands to others without any corresponding obligations. However, the possession of culturally sanctioned rights does not automatically translate into rights to all water sources. In the study area, culturally based rights assure everyone access to unprotected and unpaid sources (river, pans, streams) of water but not to protected and paid water sources (piped water, shallow wells). This implies that while anyone can access a river or water pan, they cannot use a group managed piped water supply or shallow well. The following remark explains how rights to water are culturally determined,

"In African society, the water is used as community resource and everybody has a right".

The access to water of different social and economic groups in the community is thus determined by these rights. Economically well off households in the villages in the study area generally are water secure, as they have the water rights based on private ownership and market. Thus, these households use water from protected sources such as private piped connections, shallow well. These households also have the facilities to store rain water and tap water and use it during times when safe water supply from other sources becomes unavailable. However, in a few instances, in villages where piped water or shallow wells are not present, economically well-off households rely on unprotected sources such as pans. The members of focus group discuss the sources of water for the economically well off households,

"MODERATOR: What about the rich, where do they get water?
No.5: Some have taps in their homesteads.
No.4: From kisima (shallow well)
No.8: Some even go up to Ahero using their cars to get water if the tap has broken down.
No.4: Some have built very big tanks in their compounds hence they always have water."

Most poor households in the village do not have piped water supply in their homesteads. They access water to fulfill their drinking water needs from the protected sources such as taps whenever they have the ability to pay for it. They also access water from the unprotected sources such as pans and rivers, on occasions when they cannot pay for water. During rains, the poor rely on rain water but they do not have the ability to store it and use it during drier periods.

"No.4: They get water from the pans.
No.3: From the pans along the roadside.
No.7: From river Nyando.
No.9: Some get from the tap.

No.3: Just from the pans, that collect alongside the road, which are clean, they can filter and drink because they lack money.
No.11: At times when they have money they can collect from the tap and when they don't they collect from the pans.
No.2: They also get from kisima.
No.5: Once in a while if they have money they can buy"

Female headed households in the study area access protected water often by way of negotiations with neighbors and family. In cases of community initiated shallow well projects, there are institutional rules that allow for female headed household and orphan households to get water free of charge. These households reserve the use of water from protected sources for drinking and cooking. However, as these negotiation based rights are not secure, these households also rely on unprotected water sources to fulfill their water needs. The women explain the situation of these households in their village,

"NO.2: From the ponds.
NO.6: From the river.
NO.11: From the ponds(apida)
NO. 6: From the tap they have to pay
NO. 7: Those who go to the river doesn't have to pay. We have the small ponds that are formed along the roadside during rainy seasons. We collect water from them and use them if they are clean because at times you don't have the money to buy tap water".

4.1.5 Gender differentiated water use

There are significant gender differences in the ways in which men and women use water. These differences depend on the gender roles of men and women, and affect the ways in which the task of water management is perceived in the community.

In all study sites, men self-reported their use of water to productive activities such as irrigating the farm and watering livestock and personal needs such as bathing and drinking, as illustrated by the following discussion,

"NO.1: Men use water for planting vegetables, tomatoes, onions in their shamba.
NO. 1: Use water for our livestock.
NO.3: We also use water in our tree nurseries."

Women self-report their use of water for both productive and consumptive purposes (as against reporting by men who generally cited only consumptive water uses by women us in household). The productive uses involve watering vegetable gardens in the homestead. The produce from these gardens is either used in the house or sold. They also bring water for irrigation on their husband's farm. The majority of the water they use is for consumptive purposes in domestic activities- cooking, laundry, bathing children smearing the house. Women explain their use of water,

> *"NO.8: Women are the ones with many duties.*
> *NO.6: Cooking and bathing children.*
> *NO.2: Washing plates and irrigating vegetables garden.*
> *NO.9: washing clothes and bathing.*
> *NO.1: smearing the house".*

4.1.6 Drawers of water

Water collection is the primary responsibility of women in the study area. The children assist them in this task. In the study area, in 58.3% (n=36) cases, water collection is done jointly by woman and children (refer to table 9). The responses from men in one of the group members illustrate this fact,

> *"NO.9: Women of the house [collect water].*
> *NO.10: The woman of the house.*
> *NO. 6: The children also help to collect water"*

Table 9. Water collector in the household

Water collector	Percentage
woman only	11.1
woman and children	58.3
man & woman	16.7
man, woman & children	13.9
Total	100.00

16% (n=36) of the survey responses indicate that men assist women in water collection task, but it is not their primary duty. According to data from focus group

discussions, men assist in fetching water for household uses when it has to be carried over a long distance. The men usually transport this water on a bicycle or wheelbarrow. A woman member from one of the group remarks,

> *"NO.11: My children and I normally share the task. Men also help when it comes to collecting water from far distance where women cannot ride the bicycle."*

In addition, the data from focus groups also reveals that men usually assist in water collection for activities which fall into their domain, as illustrated by the following comment made by a male participant,

> *"NO. 3: When I see my livestock are thirsty I can use the bicycle or wheelbarrow to collect and transport for them water for drinking"*

However, men explicitly acknowledge their role in water collection when they have an opportunity to earn money, as bicycle peddling private vendors. A man from one of the focus groups explains thus,

> *"Truly speaking men collect water, there are women in this village who send bicycle riders (boda boda) to go collect for them water at Onyuongo junction and they just sit back doing nothing because they have money. There are women too, who may be they've braided their hair [women with new braids] and river Asawo is very far so they cannot carry water on their heads so they send men with donkeys or with bicycles to collect for them. Is it not a man doing this?"*

According to some men, they shoulder the responsibility of water collection by contributing money to their wives to pay for the water tariff. A male participant remarks,

> *"NO.7: In my house we share it in this sense, I pay for the water bill and her she gets from the tap to the house".*

The Luo community is polygamous. In a polygamous household, there are no specific arrangements among co-wives to share the task of water collection on a day-to-day basis, as each woman maintains her own residential unit. The task is occasionally shared when

one of the co-wife is sick. The woman discuss water collection in a polygamous household,

> *"NO.1: Once a woman gets into her house, it's her responsibility to get water.*
> *NO. 2: Everybody collects her own water."*

At the community level, water collection tasks are shared among women in during community event such as a funeral or during construction of house. The men explain the water collection arrangements at the community,

> *"NO.3: No, it only comes when one of them is smearing her house then she collects the women to help her. When one is sick, she can also be helped.*
> *NO.9: When there's a funeral, women offer to help.*
> *NO.5: They also help old women."*

The engagement of women and children in water collection implies that they forego opportunities for other tasks. In absence of reliable water supplies, the women bear the burden of water provision, and spend long hours fulfilling this task, often at the neglect of reproductive and productive activities that they perform in the household. An excerpt from a discussion among women is presented below to illustrate that women forego a host of activities as they spend long hours fetching water,

> *"NO.9: It is women because all duties of the house that need clean water look up to her.*
> *NO.7: I cannot wash clothes.*
> *NO.3: I do not go to the shamba [farm] in time.*
> *NO.2: I cannot get clean drinking water.*
> *NO.8: You cannot sweep the house.*
> *NO.9: I cannot remove cows from the shed early.*
> *NO.2: I cannot wake up early and go and work in other people's farms to get money.*
> *NO.7: I do not take breakfast on time."*

Poor water availability affects children as they forego school work and other household tasks that they assist in. Women explain the tasks children are unable to devote time to when they are engaged in water collection,

"No. 4: When a child goes collecting water, may be the teacher gave her/him some homework, so she fails to do her homework and looses a lot, this will definitely interfere with her studies and performance in school.
NO.10: They miss doing the homework.
NO.1: They miss helping in cooking and fetching firewood."

4.1.7 Agencies in community based management of water

Before discussing the rural water supply scenario in Nyando basin, it is imperative to differentiate between a water supply project and water supply services. Under a water supply project approach, water supply infrastructure is provided through discrete, stand-alone projects, without much consideration to past and future needs. Such projects operate at a limited spatial scale, catering to some communities and not to others. This approach is generally implemented by donor agencies, with limited links to government policy development, leading to piecemeal results servicing some areas and leaving others. In contrast to this, a water supply service perspective works in a bigger geographic and temporal scale. It goes beyond looking at individual communities in which the system is being designed, but seeks achieve total coverage. This approach implies building of structures not only for execution of service but also for follow-up support. Under this approach the role of governments remains crucial in establishing enabling policy environment and legislation (Lockwood, 2004). Clarifying this distinction is important to understand the various stages at which water supply systems in lower Nyando exist.

There are several agencies involved in rural water supply and projects in Nyando. These include government departments of water, agriculture, parastatal agencies such as National Water Conservation Pipeline Corporation (NWCPC), NGOs, donor agencies, public institutions such as church, schools and hospitals and village level self-help groups. None of these agencies can be said to have a water supply service focus, rather

they all operate on piecemeal basis serving specific pockets in the region and not aiming to achieve total coverage.

i. Government

The government Departments of Water and Agriculture play a major role in water provision and supply. While, the Department of Water undertakes provision of drinking water supplies, the Department of Agriculture looks after water development for irrigation and in-situ conservation.

The Department of Water implemented rural water supply projects in Nyanza province during 1982-1990, under a parastatal body called the Lake Basin Development Authority (LBDA), with bilateral support from the Dutch government. Under this program, shallow wells with hand pumps were drilled in various parts of the province. The first phase of the program was output driven with no clear cut community selection criteria. Thus, a specific number of water points were allocated to each area, so that some communities were covered and others were left out. The divisional water officer explains the criteria for community selection under the project.

> *"What happened was there were a specific number of water points per location, so depending on how many could be allocated and which place needs it as also depending on the activeness of the group, the points were rationed. That is why you would find some locations without a water point while some having one".*

However, the subsequent phases of this program in 1990-1994 involved interaction with communities through public meetings and elicited participation through cost-sharing and formation of a water user committee at the level of the community. The divisional water officer explains further,

> *"We did a rapid assessment of water points against the population to know which areas are in need of one. We did transect in each sub-location and location to know the number of people against a given water point. There was community mobilization around places which faced a scarcity of water. The people were encouraged to form group and these groups were given a water point"*

In addition to the shallow well projects under LBDA, the Ministry of Water also established and managed gazette rural water supply schemes in Muhoroni, Boya and several other locations. These schemes supply water through a reticulated network[11] from a borehole installed with electric operated submersible water pumps. The management of most of these water supply schemes vested in the government and it collects water charges from users.

With the water sector reforms underway, the government operates under a demand driven approach with a shift in its role from water provider to facilitator. The divisional water officer states-

> *"Now we have a demand driven policy and we assist communities who ask for it. The communities come to us and to other agencies".*

The government Department of Water no longer finances the establishment of water supply projects in rural areas, but restricts itself to provision of technical assistance in the form of developing proposals and cost estimates for water projects in communities who ask for it. In addition, the department is now handing over the responsibility of management of many of these schemes to the community. The water officer for Nyando district explains this new role-

> *"Currently, we do not provide any financial assistance. Technical assistance is provided by the office. We help the community to prepare a budget of the proposed activity, design the ground survey and alignment of reticulation. The staff does monitoring, while the community pays a mason to do the actual construction work. We assist in finding a donor for the community. There are application forms which we give or the community gets them and they fill it. We then attach our technical report to the application which is sent by the community to the donor. The community also writes directly to donors and they are assisted by ministry"*

[11] Reticulated network is a network of water supply lines extending water to various consumers from the water source.

The water office extends support to the communities in managing water supplies through providing assistance in maintenance of the water points established earlier. The water officer clarifies this-

> "But we are also concerned with the sustainability of the water points done earlier and so we help the groups to maintain them. We make follow-up"

However, this assistance in maintenance of water points established previously is not quite effective, and quite a few shallow wells with hand pumps in the study area are defunct for one reason or the other. The divisional agriculture office staff thus explains,

> *"The problem there has been the lack of spare-parts, so you find that most of the boreholes are not functioning now. On the side of boreholes still the issue of spare parts is still affecting their performance"*

The NWCPC is another parastatal agency in the study area responsible for provision of piped water in rural areas. The water is pumped from the Miriu river under the Nyakach water supply scheme, treated and supplied to individual users as well as community managed water kiosks. The water tariffs charged by NWCPC are differential, with individual consumers paying on flat rate while the communal water points paying on a volume basis.

ii. Non government organizations

There are several NGOs in the study area working on rural water and sanitation projects. SANA, KWAHO, and CARE are a few of these agencies active in Nyanza. These NGOs work on externally funded projects, and establish water facilities such as boreholes with piped supplies, shallow wells, roof water harvesting and spring restoration. These agencies work on a demand responsive approach. Their representatives participate in district development council meetings to discuss plans about their work.

These meetings direct them to specific geographic areas, where they participate in the *baraza* (a community meeting organized by the chief and assistant chief) organized by village chiefs. The community members who attend these *baraza* write to these NGOs about their willingness to initiate water projects.

iii. Community groups

Village level community groups also manage water in the study area. Two types of groups are found: firstly, the community groups who have been handed over the responsibility of management of a water project that was initiated by the government or NGO; and secondly, village based groups who have initiated the water project with their own money. These groups manage various kinds of water facilities, such as boreholes with piped networks, shallow wells and water pans.

Community institutions such as churches, schools and hospitals also play an important role in the provision of water in the study area. These groups generally run a piped water supply, with registered water consumers bearing the operation costs associated with water supply.

4.2 Community based water management- what works?

In lower Nyando basin, there are certain characteristics of the community, the resource system and the larger environment that affect community management of water.

The findings from the qualitative data are presented in the following sections as regards reasons that promote community management of water resources in lower Nyando basin. The listing of these conditions does not follow a hierarchy; instead it is based on the proposition that all conditions are important in their own way.

4.2.1 Assistance from external agency

Across study sites, assistance from external agencies, whether donors, government department or NGOs, emerged as a pre-condition for initiation of water management projects. Most technology-intensive water management projects such as shallow wells with hand pumps, boreholes and piped water supplies included in the present study were initiated with support from an external agency (refer to table 10).

Table 10. Water projects and support agencies in study villages

Village	Type of water project	Support Agency
Ngere-Kagoro	Borehole with piped supply	Kenya-Finland
Kowala	No project	None
Kakmie	Shallow wells without hand pump	Community *Harambee* funds, area MP fund
Kasaye Kolo	Shallow well with hand pump	CARE
Kasaye Cherwa	Shallow well with hand pump	Aga Khan
Kasaye	Shallow well with hand pump	Kenya-Netherlands
Achego	Piped water community kiosk	NWCPC/UNICEF
Kogada lower	Water pan	Community initiated
Kasirindwa	Water pan	Community initiated
Kamula	Water pan	Ministry of Agriculture
Kagure	Water pan	Ministry of Agriculture

The assistance from these agencies comes in various forms, ranging from financing entire project costs, to some sort of cost-sharing arrangements with the community. A typology of sharing of project costs between the external agency and community is discernible from the study villages. The pattern depends upon the nature of external agency and type of projects.

In a Kenya-Finland supported borehole and piped water supply project in one of the study villages, there was no community contribution. The men who are members of the borehole project in the village explain how the donor assisted them in initiating the project,

"NO. 5: They brought us a big tank that would be used to supply water in other areas.
NO.6: They dug us a borehole. They connected steel, sealed then put the tank and pipes later.
NO.8: They gave us cement, sand, ballast and the manpower
NO.1: They brought us electricity"

Similarly, in all project initiated water pans included in the study, there was no cost-sharing during the initiation of the project. Many of these pans were done by the Ministry of Agriculture under a bilateral project called Winam Gulf, under which all construction costs were provided by the ministry. The men of village Kagure explain the ways in which the Ministry of Agriculture supported the village's water pan.

"No. 6: The Ministry of Agriculture
No. 9: They bought a tractor that dug it"

The cost-sharing norms in shallow wells projects differed as per the donor agency, with some agencies financing material costs but requesting community share in manual work, while the others expecting an initial cash contribution from the community members. The women from a village with a shallow well with hand pump explain how cost sharing worked in the initiation of the water project in their village,

"NO.11: The project involved cost sharing, so when we started, we were asked to dig a fifteen feet hole and because women could not do it the men helped in digging the hole."

The external agencies do not just assist during the initiation of water project, but in a few cases they support the communities in maintenance of the water facility. In villages with water pans some kind of assistance in form of food-for-work has been provided to

local communities as an incentive to de-silt the water pans. However, this assistance is mostly sporadic and ad-hoc, with only some communities getting it during some point in time. This aid is also not restricted to water pans initiated by particular agencies, rather it depends upon the availability of funds and the ability of the area chiefs to lobby for them. Assistance in the form of food for work program to communities where the ministry had undertaken water pans has facilitated management of these structures, as explained by divisional agriculture officer,

> *"In Kokota dam built in 1989-90 in East Nyakach location and Jimo east sub-location in village Kamula, Kagore, the committee is maintaining these dams with some assistance from food for work"*

Thus, the role of external agencies in ensuring access to protected sources of water is crucial, and without this assistance, most communities find it difficult to initiate water management projects. In the study village with no external intervention of any sort, there were no protected water sources, and the community members fetch water either from the river or protected sources located more than 2 kms way in the neighboring village.

While the role of the external agency is crucial in the initial stages of project cycle to initiate a water project, communities are willing to come together and contribute in kind once their efforts are subsidized by a donor agency. Men in the village without any water facility feel confident of contributing to water management, if they are assured of support from an external agency,

> *"NO.8: As a community, we will provide a land to be used for the project. We will also contribute something small.*
> *NO.3: I mean money which will be in the account for emergency.*
> *NO.6: We will provide free labor"*

4.2.2 Role of local leadership

Another factor for the successful initiation of water management in the community is the presence of key individuals or village leaders within the community. Where these

leaders do not exist the capacity of the community may be severely inhibited (IRC, 1993). These individuals have the ability to network with external agencies and attract suitable water projects. In addition, these leaders are able to mobilize community members to forge cooperative arrangements. The role of village leaders and representatives is especially relevant in the present context of demand responsive approach to water management being followed by most agencies, which entails that communities contact the water agencies.

In interviews with government officials, the presence of a village leader emerged as an important factor promoting community based water management. The divisional agriculture officer emphasizes the ability of these individuals to attract projects and mobilize the community,

> *"Firstly, there are informed members of the community who are able to identify a donor and attract Ministry of Water or others to their village. These villages are organized around the project and thus can cooperate. One, I think it depends on leadership. For any community to initiate an activity there should be somebody who should be mobilizing them"*

An example of how these people are able to attract projects came up during a focus group discussion in one of the study sites, where a key individual from the village utilized his social position to attract the borehole project in his village.

> *"It was initiated by a prominent man of this village, a professor. He toured the village and saw how cholera was killing us, he could see the kind of water we were using from the water pans. This is why he went and requested help from the two governments"*

Apart from liaising with the donor on behalf of the community, these key individuals in certain cases have also contributed initial start-up costs to initiate the project or resurrect a defunct project. The community members in village Kakmie managed to initiate a shallow well as a result of contribution from a village representative.

"NO.7: We called our Member of Parliament (MP) who contributed for us money and also monthly contribution
NO.4: He contributed Kshs.15, 000[12]/ [200 US$]"

Similarly, traditional village elders have played a prominent role in the setting up and subsequent maintenance of water sources such as pans. In all study sites, traditionally water pans were initiated by village elder who donated their land or initiated work on public land. The women from the village with a community initiated pan explain,

"Who made the pan?
Mzee Paulo. Our grandfather, a village elder.
Whose land was it?
No. 3- It was Mzee Paulo's land.
No. 4- He gave it for donation"

The role of these leaders in maintaining a project is also crucial as they facilitated the setting up of norms for maintenance and mobilized communities to contribute to de-silting of water pans. For instance, in village Kasirindwa, the women reveal that there existed specific norms for using the pond and contributing towards its maintenance set by village elders (such as no washing around the pond bank). The village elder would call people to contribute to de-silting and people would assemble. Men would scoop and women would carry the soil. People who did not scoop the mud were not allowed to fetch water from the pan.

The village leaders also contribute to maintenance of water facilities by resolving disputes over use of water resources.

4.2.3 Role of existing community institutions

Community management of water resources requires building on opportunities for collective action and cooperation that exist amongst community members. Across study villages, there exist a range of community groups that manage various types of collective

[12] There are approximately 75 Kenyan shillings to one US dollar.

enterprises such as horticulture, vegetable gardening, basket weaving, orphans group, and HIV/AIDS awareness groups. Many of these groups are already managing water projects that were handed over by the project implementing agency. Thus, in lower Nyando the presence of many village based self-help groups present the possibility to initiate extensive community networks for resource management, if the right incentives are presented.

4.3 Community based water management: what doesn't work?

A number of factors influence the decisions of the community to invest in water management. The following section discusses some prominent reasons in the study area that inhibit the initiation and maintenance of community based water projects.

4.3.1 Poverty as a constraint

Poverty has emerged as a recurring theme in data from focus groups and interviews with implications for water availability in lower Nyando basin. Poverty interfaces with water availability in several ways. Firstly, poverty levels affect the ability of rural households to access protected water sources, as they lack the ability to pay water tariffs. Secondly, poverty constrains rural households from owning a private protected water source, such as a piped connection or a rain water storage system. Thirdly, poverty constrains the ability of the community to contribute to initiation and continued maintenance of water management initiatives.

At the household level poverty emerges as a factor that limits the ability of individuals to access safe water from protected sources to fulfill their basic needs. Community members in several groups expressed their inability to access protected water

sources due to lack of financial ability, and hence they use river water. The women non-members of the piped water system discuss the implications of poverty on their ability to access safe water.

> *"NO. 7: We have some, like the small pans that are formed along the roadside during rainy seasons. We collect water from them and use them if they are clean because at times you don't have the money to buy tap water*
> *NO.2: Water problems is lack of money, you are then faced to use dirty water."*

Across study sites, members of focus groups specifically pointed out that the vulnerable groups in the community such as very poor and female headed households find it difficult to access safe water on a regular basis. The assistant chief explains the situation in his area,

> "Yes some do not buy water from the Ngere-Kagoro project. Because economically people are below poverty and cannot even afford to buy water at the rate of 2 shillings per 20 liters".

In absence of ability to pay for water from protected sources these vulnerable groups often access unprotected water sources, such as rivers and water pans. Women from a borehole project discuss the situation of poor households with respect to water,

> *"No.4: They get water from the pans.*
> *No.3: From the pans along the roadside.*
> *No.7: From river Nyando.*
> *No.9: Some get from the tap"*

Community members in various sites also cited poverty as a reason that prevents them from owning private piped connections, because they cannot afford the initial startup costs associated with application process and procuring water pipes as well as recurring cost of monthly water bills. The women without piped supplies explain their situation,

"MODERATOR: Now, why have you not tried to have taps in your homestead?
NO. 11: Lack of money
NO. 10: Lack of Money
NO.7&8: The pipes are expensive.
NO. 2: it's just money issue.
NO.3: We don't have the financial back up to start a tap connection"

In Nyando, rain water harvesting is a common source of protected and free water during the wet months. Most households harvest roof rain water. However, financial constraints to invest in construction of water storage infrastructure such as cement tanks limits the ability of the community members to extend the use of this cheap water source to dry months. Members from two focus group discus the potential of roof rain water harvesting in relieving water stress,

"NO.1: You will also find that most of us cannot afford to buy water tanks that we can use to collect water during rainy season.
NO.3: For those who have tin roof, they can construct for them the big tanks so that when it rains; they store water that can last even during dry seasons"

Water projects are expensive to initiate. It costs around 4 million Kshs to establish a borehole and a reticulated network, and roughly about 75, 000 Kshs to establish a shallow well with a hand pump. Because of these high investment costs and prevalent poverty levels, communities are unable to initiate water on their own; instead they need assistance from external sources to initiate water projects. The divisional agriculture officer gives reasons for why communities are unable to invest in collective management of water,

"The poverty levels are very high, and when you talk about water systems in the area it is also very expensive. So most of the time, people cannot use their local resources and so they want to have other external sources or systems to assist them"

A private connection requires an upfront payment of 1200 Kshs for application to the water committee, apart from the fixed cost of buying standpipes, taps and monthly water charges of 200-300 Kshs per month. The staff member of the NWCPC explains why individual households are unable to invest in piped water supplies,

"One, there is a lot of poverty in the area and that does not allow people to have connections very easily. Somebody has to take out the money to get connections [to pay the connection fees and install the pipes]. Two, paying 200 Kshs [the monthly water bill] is difficult for them because in rural areas there are no commercial activities that can generate income for people. It depends on how much people earn"

A major element of the community poverty trap is associated with the high fixed costs associated with water investment vis-à-vis the poverty levels in the community (Swallow, 2002). Thus, even if communities are interested in having a water supply project, the high initial costs may prevent them from doing so. In the study area, the density of water supply lines is low, and communities and individual owners face high initial costs to get the distribution line to their homestead or village. The NWCPC staff member explains,

"Secondly, the distance from where the pipeline is passing [is long], so that the people cannot raise that money to get the supply line to their house. For example there is water project called Holongye water project. Because it is almost a ten km long pipeline and they want to erect a water tank and some fittings along the line. It is in Upper Nyakach. It is a local project and the people want to get this, but the cost is very high. So even if people are interested they cannot raise this money".

Water projects in the region have been initiated by donor agencies. However, in many cases the upfront contribution expected from the community by these agencies is too high for them in context of their poverty levels. This constrains the ability of the community to pay, as explained by the district water office staff,

"The Community Development Trust Fund (CDTF) of the government has funds for water and sanitation projects to be disbursed to communities. The communities have to raise 10% of the project cost, so as to avail CDTF funds. But many communities are unable to do so, because these start-up costs are too high for them"

Poverty not only prevents people from initiating new projects, but also hinders the ability of community members to undertake collective management of traditional structures such as water pans. As the study area is prone to frequent flooding, water pans

have to be maintained through de-silting on a periodic basis. This represents a significant investment for local people in face of the poverty levels, and they are unable to contribute to maintenance of water structures on a voluntary basis.

> *"Most of the people here have tried on their own, but it has been insufficient. For instance, using water committees, communities have tried to dig water pans. But after digging those, because of the flat nature of the area a lot of these pans silt immediately. And because they are poor, they would rather go and look for food than to come and keep on de-silting the pan"*

4.3.2 Gender as a constraint

Gender emerged as a critical factor that constrains community level water management across all study sites.

Luo society is patriarchal, with women in a subordinate position relative to men. The gender differences in the household and community responsibilities of men and women in Luo society are pronounced. This differentiation entails that men have greater role in decision making in the public sphere while women do not enjoy that freedom. As far as this gender differentiation in water management goes, it implies that while water collection for household activities is a woman's job, decision making as regards investment in improving water situation is men's prerogative. The comments of an NWCPC staff member illustrate this sharp division in roles,

> *"On the side of water work, the women suffer the most and she is one person who does not have that economic power with her. She is the sufferer but the investor is a man. Now we don't look into the suffering of woman. It is easy to organize the women, but where do they get their strength- that comes from the men, from husband".*

Across study sites, water collection for all household activities is primarily a woman's job. Water collection for domestic needs (drinking, cooking, washing laundry and utensils, bath water for husband and children, cleaning the house) is an example of the reproductive work performed by women. In addition, collection of water for

homestead gardens falls within the domain of productive work performed by Luo women. However, due to gender differentiated roles in water management in a patriarchal setup such as Luo community, the men in general fail to appreciate and account for the unpaid labor women expend in reproductive and productive tasks within the household. Across focus groups, men made casual remarks that as married men they need not be concerned about where does water come to their house. An example of this indifference is presented below,

> *"NO.1: The women once married they have to bring water for use in the house, it's not a man's responsibility. As the saying goes in Luo "once married you already have a tap in the house"*

On account of these gender differences in roles it is expected that men are not motivated to make improvements in the water situation in the village. In several group discussions, men remarked that thinking about water is not their business,

> *"NO.7:- [Men claim that] it is none of my business, so long as the woman has brought him bathing water, I care less."*

4.3.3 Property rights and access issues

Property rights determine access to resources. The results indicate that ambiguity in property rights restricts the access of communities to resources, and dilutes incentives for management. In lower Nyando region, property rights to land along the river are held under a system that prevents other users from accessing the river. The process of land settlement in the region did not account for riparian areas, and declared them as adjudicated land. This implies that riparian zones are in effect private property under statutory law, and anyone whose land does not lie along the river has no rights to access the river (Onynago. et al., 2005). Adjudicated land is also governed under customary

rules. As per customary law, no one should be denied water, and accordingly people are not denied access. However, this access is not secure and is subject to frequent negotiations with land owners along the river.

The government officers maintain that riparian zoning is enforced in the study area, as explained by this comment by staff of the Ministry of Agriculture,

> *"When it comes to rivers we are also protecting river banks. There is a limit which farmers are not allowed to cultivate. It is equivalent to the width of the river on either side, so in that area is we only advocate for planting of trees"*

In reality, the riparian zones are not enforced in the study sites, and insecure access to river water is a factor that prevents community members from cooperating as a group to manage river water. The men in the village without a project explain the problems related to accessing the river,

> *"NO.1: We don't have proper access road to the river, so you will find that some people go through other people's farm hence the owners make a lot of noise.*
> *NO. 8: And in places there is a problem that paths pass through plots and paths for entry are not there. The farms are fenced so people just follow somebody's plot. The person complains that who is that stepping on his field?"*

The insecure access is a source of significant tension in the community. Conflicts around this issue are common as narrated by men members from the village without a project,

> *"Also, those who bring their cows here to get drinking water, you will find that these cows step on other people's farm hence destroying what they have planted because there is no path for them to follow, this create a conflict and the animals are not allowed to be watered at the hole".*

This restriction on river access is especially relevant for villages where a river is the only source of water for the community, and it often has social equity implications. Even in communities where alternatives to the river are present, community members rely heavily on the river water for certain uses and during particular times of the year. In

addition, the river is significant resource for poor and female-headed households, who in absence of ability to pay for water on regular basis resort to using the river because water availability is certain and free. The women explain their reliance on river,

> *"NO.3: Asawo river is very near so we go any time we are in need.*
> *NO.1: The river, we fetch water free of charge, it's nobody's water, so we access it any time."*

Thus, confusion over property rights and duality of institutional norms governing resource use not only curtails access of community members to resources, but also inhibits community initiative to undertake management of such resources.

4.3.4 Scale of resource

Characteristics of the resource such as its size and scale affect the coordination capacity of users to manage it. The large scale and trans-boundary nature of resources such as rivers limits the extent to which they can be effectively managed by small community groups (Knox and Meinzen-Dick, 2001; Ferguson, 2005). In Nyando, water resources exist at various scales, those that can be effectively managed at the community level, such as boreholes and shallow wells, to the ones where joint-action among users from two neighboring communities is required, as in the case of water pans; to large scale resources such as rivers, which require coordination of activities of users across macro-scales.

The rivers in Nyando basin are resources whose users are spread across spatial scales, and there exist significant upstream-downstream linkages in their management. These linkages in river use not only constrain the availability of water for downstream users, but also impact the ability of communities to initiate management. In lower Nyando basin, rivers form a significant part of the water needs of communities for various activities.

However, with no institutional regulations governing their use and management, they are a classic case of an open access resource system. A woman from one of the focus groups highlights the plight of the river in her village,

> *"NO.3:- Asawo is a river, everybody has a right to do anything and nobody will ever question that. For example, you can be fetching and somebody comes from any direction to wash her legs and then she goes, nobody bothers"*

As a result, rivers are used indiscriminately as a waste sink by users all through the basin. Several sugar factories located in the upstream of the River Nyando, dump molasses into it that alters water quality and creates externalities for downstream users. Pollution of the river by upstream users constrains the access of certain sections of the community who rely on river water for household needs (drinking, cooking, and washing). Women who use the river explain,

> *"NO.7: Like at times you find that some people have poured molasses in the river and it becomes very hard to use the water*
> *NO.12: At times somebody has drowned from somewhere, we still fetch because we don't know what's happening to the river"*

Similarly, deforestation in upper catchments causes the sedimentation and drying up of the springs in lower catchments, compromising the availability of water for downstream users. The staff of the Ministry of Agriculture discusses the implications of these upstream-downstream linkages for availability of water in downstream areas,

> *"One, because we are in lower side, there is little protection in terms of water catchments especially where the springs originate. We had two springs down in west Nyakach near Harambee, but they are not functional anymore because of the interference with the upper catchments where deforestation has taken place and there is no in-filtration."*

These cross-scale linkages in the management of upper catchments of river do not provide incentives for users to undertake its management. Group members feel that they

do not have the authority to establish and enforce rules for river management on their own accord. The men from the village without a water project explain their inability to organize management of river,

> *"NO.6: You see this is a public thing that everybody uses so we had never thought about it.*
> *NO.2: Even when we try to manage from down here you will find that it's being polluted at the source.*
> *No7: May I ask you madam; you are referring to this our river water that is flowing down? We have not thought of managing it because people take it as a public thing and anybody can use it the way they want.*
> *No6: It is just somebody else's property that nobody can go and protect it and say that we don't want such a thing here.*
> *No7: If you want to protect it where do you get the authority?"*

4.3.5 Ownership of the water point

Communities find it to difficult to manage a water system when its ownership is disputed. In a water supply system, ownership operates at various levels: Who owns the water system? Is it the water committee or the community? Who owns the source? Is it the land owner on whose land the source is located? (Schouten & Moriarty, 2003). All these questions are relevant to a community's successful management of its water system, and emerged constantly as significant issues with implications for community level water management in lower Nyando basin.

In the study area, ownership of water facilities established by an external agency (whether government department, donors or NGOs) is addressed through a process called a land easement. A land easement is necessary to ensure that the water project would be maintained by the water user group and also to secure access of all users to the water point. Typically, this process involves donation of land by an individual for the construction of a water project. A land easement form is signed to affect the transfer of land to the project. This is done before the initiation of the water project, so as to ensure

public access to the water point. The divisional water officer explains the process of easement for a shallow well project,

> *"In case of land ownership, we always get a land easement process in which the owner has to fill a land easement form saying that he has offered that piece of land. It is signed in presence of village elders and then the land is used for public purposes. We also have copy of it and the committee has a copy"*

Although the government staff maintain that a copy of the easement record is kept with the water users association, in none of the shallow well villages did the group mention having such records. In fact there exists ambiguity to the extent of formalization of the easement process, with some groups maintaining that the process was formalized and others saying that it was informal. The statement by a woman member from a shallow well village in the study area reveals that a formal process of easement took place, but the records were kept in Nairobi,

> *"NO.5: It was that the owner of the land that had agreed to give out his land was to give the land title deed then this number was filled in a form that were taken to office in Nairobi water project"*

According to group members in two other villages, the easement process was informal, with the land owner giving a verbal consent only. According to the group members in a village with shallow well the easement process went as follows,

> *"MODERATOR: Was there any agreement you made with the owner of the land in writing or it was just by word of mouth?*
> *No. 4:- Just by mouth.*
> *No. 8:- She gave it voluntarily.*
> *No. 9:- She accepted as a clan member. Even if she changes her mind now, its her right. She can do so".*

Whether formal or informal, securing easement over land is not easy and can inhibit the initiation of water management systems at the community and household level (Mumma, 2005). The difficulty to convince land owners to allow trenches to be dug on

their farms came up as reason behind the limited network of piped water supply in the area. The staff of NWCPC explains this as a reason why some community groups cannot initiate management of piped supply-

> *"There are problems sometimes that people do not want the pipe to pass through their lands. We ask the person who wants the connection to come up with land easement or you get a letter from the chief that so and so is the rightful owner of the land. This is because that we have had fights when people have refused to let the pipe pass through their lands, and it stops so many people".*

The assistant chief for a village with a piped water supply also states the difficulty in securing easements from landowners to allow supply pipes through their lands as a reason behind the limited reach of the water supply network in the village.

> *"And also the line cannot be extended because people do not allow the pipes to pass through their land, so many houses cannot have [piped water] connection".*

Although land easements have been carried out in a formal way in most externally aided projects, what emerges from conversations with the government staff and experiences in the study sites is that this easement is not binding. In two of the three external-aided shallow well projects included in the study, the major reasons for failure of the management process are related to the land owner staking claim to the well as his personal property. In local parlance this process is termed as "personalization". Personalization occurs when the land owner starts to interfere in the management of the water user association and pockets the funds collected from water users. The assistant chief explains how personalization takes place,

"Kenya-Netherlands in Kasaye Kolo is also not working. In Kasaye Kolo and Kowuor the wells have been personalized. Somebody donated the land, but land transfer did not take place. And the land owner realized that it is a good chance to make money and so refuses to share water from well. And after some time the NGO also goes away, and then there is no one in the village to remind the land owner that you donated the land. In such a case even the community does not chip in money to repair if it breaks down as they feel that it is somebody's private well. They are willing to buy water at a shilling or two but not contribute money to repair. If the person is claiming to be the caretaker of the well, he eats the money and does not maintain the well. And this problem of personalization is very common. People think that this well is somebody's property and if they contribute to maintaining the pump, what is the assurance that the person will not change and ensure access to water."

As evident from the statement above, personalization dilutes incentives for the management of the water facility by the community group by discouraging users to contribute money towards repair and upkeep of the water point. In the event of a breakdown of the water facility, there is neither any money with the landowner to repair nor any initiative among the community members to cooperate and mobilize maintenance costs. Two of the project-initiated shallow wells out of the three wells included in the study are in need of repair, but at the same time there seem no apparent efforts to break the deadlock between the community and land owner. As a result, the community members get water from sources located further off in the neighboring villages.

This dispute around well ownership is not easily resolved at the village level. In the absence of any documents to prove ownership, the members of water users associations find it difficult to contest the claims of the land owner. The assistant chiefs, who can mediate the conflict, too feel that in absence of any documentation of ownership it is difficult to address the problem. One of the assistant chiefs explains his inability to deal with the situation,

"I also find it very difficult to address, as I cannot trace the records of the project. All these records are taken to Kisumu by the agency, and I do not have any ground to hold that person to answer any charges. It weakens the whole system and the water project is useless."

As suggested by a staff member at the ministry of water, there is an alternative to the land easement process. He suggests a process of land separation, through which the title of the land is changed and it is converted from private to public land, and registering the land under a different cadastral number. However, this process is cumbersome and requires more resources, so the communities may find it difficult to undertake it. The staff at the Ministry of Water discusses the pros and cons of the process,

> *"The community has to get it done through Ministry of Land, and the community is to call those people to come and measure that piece of land and give it a different parcel number. We tell the community to undergo this process. And sometimes the community is in a hurry and so they don't do it and the water point is already constructed on that and they continue to use it. But if the problem comes up then they realize. But land separation is not a condition for a project to initiate. But if it is made a condition, it can take a lot of time. If the community is poor and they cannot raise money to pay for the fees of land separation. This makes people feel that it is unnecessary. When somebody consents for land they just assume that this person will not change. But say later that person dies and the heir to that land comes up, than the community may have no choice".*

The assistant chief suggests a solution to avoid the disputes regarding ownership. He suggests that instead of establishing water projects on donated land, the external agency should buy land from individuals and get it registered as trust land. A public trust land is an open access area with everyone enjoying equal access to water sources located on it.

> *"But if land could be purchased for the project the problems associated with personalization could be avoided. The size of land is very small, and in the whole sub-location only about 1 acre land is left for community purposes. And so people cannot donate the land"*

The fact that external agencies do not already choose such trust lands for establishing a project can be explained by the near absence of such land in Nyando, where most public trust land has already been alienated (Onyango et.al, 2005).

An interesting fact about the easement process in lower Nyando is that while land easement is carried out by external agencies for the water projects they support, it is not done in case of community initiated water projects. In the only community initiated shallow well project studied, formal easement was not done and the project did not encounter any disputes regarding ownership. This finding suggests further enquiry into the ownership patterns of community initiated water projects.

Additionally, in all water pans initiated by the community, ownership is not an issue because these are located on trust land, where access is ensured to everyone. However, even in the external agency initiated water pans, formal land easement was not carried out. The men from the village where the Ministry of Agriculture initiated a water pan explain,

> *"No.5: Nothing was signed that they'll be paid, they just volunteered to donate their land*
> *No. 3: They were three people; Ojal Adwaro, Vitalis and Michael.*
> *No5: Not even their sons have brought problems*

A possible reason for absence of easement around these pans can be attributed to the informal cultural norms that guide water management and use in Luo society. Cultural norms of water use are one such informal institution. As per Luo culture, no one is denied water. It is possible that management of water pans is rooted in these cultural norms, and accordingly it is assumed that land owners would not deny access to water pans located on lands that they donated for the establishment of the pan.

4.3.6 Natural causes

In many parts of the basin, geo-physical properties of the resource present a challenge to the management of water points by communities. Frequent flooding causes subsidence of wells, severing of water lines and breaching of water pans. Because of the large

investments that are needed to restore these structures, communities are unable to maintain these resources.

Lower parts of the basin have a flat terrain, and flooding is frequent. The water pans in the region breach or silt easily, and communities find it difficult to maintain these. The women in the village where the water pan is breached discuss the inability of the community to maintain the pan,

> *"NO. 3- We cannot because the river above it flows too fast and breaches it we cannot do on own.*
> *NO. 4- We have not been able to channel the water and so the pond got breached."*

Due to heavy flooding, the region is also prone to gully erosion. These gullies breach the supply pipes carrying water to villages. As a result, water connections to many areas have been severed. A large financial investment is needed in order to restore these broken connections, which the communities find difficult to undertake. The staff of NWCPC explains,

> *"Some are affected by gully crossings and some because of defaulters. The El Nino rains cut gullies and cut-off connections. There are many groups cut off by gullies- Kosa and the other one is because of gullies. It needs big money to reinstate the pipes cut off by gullies".*

Another natural cause for limited investment by community in maintaining existing water points is that the water in many shallow wells is saline. Since this water cannot be used for human consumption, community management of such water points breaks down.

4.3.7 Managing community funds

Transparency in handling of community finances is essential. Misuse of funds inhibits future contributions and often leads to dissolution of existing management system (IRC, 1993).

In the study area, allegations and actual cases of misuse of funds collected by the water user group came as a common reason for the breakdown of water management arrangements in the community. The misappropriation of funds was observed in case of externally initiated water projects such as shallow wells as well community initiated projects. Community members allege that the funds are being pocketed by the office bearers of the water management group, and stop making any further contributions. The men in the village with shallow well accuse the water user committee,

> *"NO.10: The first conflict comes from office bearers that is, chairlady, secretary and treasurer. One of them can use money that has been collected by the committee and refuse to return back."*

In water pans, similar cases of misappropriation of food for work benefits were recounted in the focus groups. The food benefits for de-silting the pan were distributed among a select few in the village. A young man where this happened reveals,

> *"No.4:-When there is food for work at the pond, you see members give very little to share amongst themselves but a lot remains for the officials. Secondly, tools e.g. wheelbarrow and spade do disappear mysteriously from the committee members' houses, so you find that at the time of working the tools are less, we wonder where they go too."*

This leads to mistrust among the water user association and the members stop paying the water dues. Eventually there is no money with the group to maintain the water facility, and the management system breaks down. The Ministry of Water officer explains,

> *"Most differences come because of money. Someone collects the money and he or she eats it. When there is a breakdown, there is no money to take care of the repairs. So that leads to conflicts."*

4.3.8 Cost recovery

Cost recovery in water systems maintained by the community remains an issue. Convincing community members to pay for water is not easy, and even if people have the

ability to pay they avoid paying for water. The issue of non-payment is a source of conflicts among users and weakens the management of the group.

Cost recovery is an issue in shallow wells with hand pumps more than in boreholes. This is probably because in a shallow well with hand pump, the water committee collects to pay for the maintenance of the water point. The users see no point in paying water tariff when nothing is wrong with the water pump (Schouten & Moriarty, 2003) and therefore, the maintenance fund is not built up. The statement by villagers with a shallow well reveals this attitude,

> *"No. 8: I am just adding a little bit, there is what we call ignorance. You can ask somebody for the 10/= monthly payment but he will bring in small issues of the clan; he does not see that the water is of importance to even him as a member. Even if he can afford, he will just ignore because he feels the water is always available and he can use it as he pleases"*

However, in cases of boreholes with electric operated submersible water pumps, the users realize that non-payment of water tariff would result into disconnection of their private piped supplies. In the village with borehole supported piped supplies, the secretary of water user association mentioned that disconnection of users who do not pay is common.

4.3.9 Clan dynamics

In resources such as water pans, conflicts among clans can disrupt the management of water system. The conflicts were pronounced when a water point is located on the boundary of two or more clans, and the communities are unable to coordinate the maintenance of the water facility. The staff of the Ministry of Water explains how clan conflicts discourage community members to cooperate around water,

> *"If one water source is catering for more than one clan, then some politics comes up in the management and so people then do not want to cooperate"*

In the study area, these conflicts were most common in the case of water pans located on clan boundaries. The clan members do not cooperate in maintaining the water pan, and are unable to sanction users who do not contribute to de-silting of pan. Thus, free riding by a few users stops others from cooperating, leading to the breakdown of community maintenance arrangements. The members of a water pan shared by two other clans discuss their experience,

> *"No. 4- People from neighboring sub-locations do not come for scooping the soil. There is no voluntary effort to de-silt. If there is money, people come.*
> *No.5:- The problem that eats our heads is how we can get clean water also disturbs Agoro people and Kalenjins at our borders too."*

Even if the water pan is located within the boundary of one village, in general the problem of free riding is common. In the four water pans included in the study, the community members reported that all users do not contribute towards maintenance of the pan. It is not feasible to monitor the action of users, as also sanction is difficult to enforce on account of prevailing cultural norms.

In one of the villages, there was a conflict between users who contributed to scooping the soil and those users who did not. The ones who contributed said that they use the pan only for consumption, while those who do not contribute to its maintenance use it for productive purposes such as watering livestock and irrigation. This difference in use and contribution to its maintenance creates conflicts, as explained by the following discussion,

"No.5:- Conflicts are there, when working at the pond, there are people with cows, others don't have so those with cows drink them at the pond to the last bit and the other people only use it for domestic activities and yet they really worked. So, this brings a No.3:- Adding to that, conflicts occur because some people use the water in irrigating onions, tomatoes and yet they did not work at all, when people work they go about their own duties.
No.4:- We have conflicts but our forefathers did not. Especially the youth now do not agree on the issue of working at the pond. When people are called to work only 2 or 3 people turn up and so it's very shallow these days because of laziness. Some people argue that those with cows should do it because their cows must drink but to them who don't have it's not a big deal that they must work."

4.3.10 Supply constraints

Problems associated with the supply end of water management leads to dissolution of management of community run water supply kiosks. The piped water supply systems operated by NWCPC are not designed to cater to growth in demand for water as a result of an increase in users. The staff of NWCPC explains,

"The Sondu-Miriu water supply was designed for a particular number of people. The water goes to lower and upper Nyakach divisions. Since the time the system was designed the number of connections has increased and the population has become doubled. This system is fifteen years old. This brings shortage of water. We try to take care of this through water rationing- today we take water in this area, tomorrow somewhere else or two hours today three hours tomorrow, because water cannot be expanded we have to manage supply. Some people have dropped out of the community water supply scheme because there is not enough water supply. We don't have enough water and there are conflicts around it. We do rationing each week, because the design capacity of the project is 6000, but we are delivering only 3000. And we have a big network and we cannot fulfill demand due to one unit pump. That is conflict between water undertaker and the customer"

As a result, the system is unable to cater to the needs of the present users adequately, and water rationing is common. What is unfortunate is that the users are not particularly aware of the rationing schedules or breakdowns. Thus, water supply is erratic in one sub-location where at least twelve community managed water kiosks operate. The women's groups who manage these kiosks find it difficult to raise the requisite amount to pay the monthly water bills. The inability of the group to pay the water bill led to the disconnection of their water supply. Under these circumstances it is a challenge to sustain the motivation of the community to maintain the water point.

4.3.11 Other issues

The spare parts for shallow wells installed under LBDA project are not easily available, and several water pumps across the district are non-functional on account of this. The community groups as a result get dissuaded and ultimately dissolve. The divisional staff of the Ministry of Water explains,

> *"The technology that was used has made some wells non-operational. Even if the community is prepared to repair, but now the spares are not available. So there are such cases."*

On account of the prevailing socio-economic conditions, the resource persons at the community level trained to undertake repairs of water points have either migrated in search of work or succumbed to diseases such as AIDS. Thus, in many communities the skill level to restore management of water systems is low, and this constrains the community level management of the water facility.

The previous failure at the community level to initiate collective action was also cited as a deterrent to formation of new alliances for management of water. These failures relate mostly to the usurping of funds collected for a water project by someone in the community and the failure of external agencies to deliver project outcomes as planned.

4.4 Institutional issues in community based water management

The institutional structures governing the management of water resources in the study area exhibit variation based on the nature of resource being managed and the intervening agency.

4.4.1 Initiation of a water project

Typically water projects in the study area have been established by external agencies, whether government or NGO. The extent of support provided to establish the projects

varies by agencies. In most cases, the agency covers the material costs, and expects the community to contribute the labor component. While some agencies finance the entire cost of a project, others demand relatively higher levels of cost-sharing, as explained by an NGO functionary, with greater inputs being demanded from local communities to initiate projects.

> *"But we mostly take local materials from the community. If the budget of a project is 4.5 million [Ksh], the donor gives 3 million, the rest has to come from the community and also some part from municipal corporation. Normally we expect local materials, up to 25% from the community"*

In cases where communities have come together to initiate a shallow well project, the cost has been borne by members through a *harambee* (a traditional system of community self-help).

4.4.2 Identification of beneficiaries

The beneficiaries to a water project are the users who use that particular water point. The beneficiary selection criteria differ with the type of resource being managed. With a piped water supply, whoever has the ability to pay for connection fees and associated materials (standpipes, supply pipes) becomes the beneficiary, and is added on to the group of registered users of the project.

However, in shallow well projects, the beneficiaries are based on the location of the water project. The external agency chooses a suitable location for the project based on technical criteria such as water availability and willingness of individuals to donate land. The households living near to the project location participate in the construction of the water point through cash or labor contribution, and thus become members. In this way, those staying far from the point become non-members. The responsibility of management of the water project is then handed over to an existing user group among the

members or a new group is formed. At times, there are more than one water project in a village, and thus many user groups. On the basis of these criteria, members and non-members pay differential water tariffs. On the whole, this system of beneficiary selection does not consider the interests of other stakeholders who get excluded.

4.4.3 Institutional rules

The institutional structures governing the management of water resources vary across resources. While there are well defined user groups with formal norms to manage resources such as shallow wells and piped supplies; resources such as water pans are used and managed by a loosely organized group, often in informal ways.

In the study area, the boreholes and shallow wells are resources which are small in size with a well defined boundary on account of the technology used. Thus, the shallow wells have hand pump which can be locked and their use can be monitored easily. There exists the capacity to exclude others from use of the resource: those who pay for water are granted usufruct rights while those who do not are denied use rights. The management committee in case of these resources is formalized and has set norms for water tariff, water distribution schedules, monitoring of users and sanctioning of violators. For instance, in boreholes with piped water supplies, the group collects water tariffs to cover operating costs (electricity bills) and the users are aware that non-payment will lead to disconnection of electricity and water supply lines. In case of shallow wells too, formal rules for management exist, but they are not applied as rigidly as in case of piped supplies.

Although water pans are also small in size with well defined limits, there are factors which defeat their effective management at the community level. Firstly, the location of

water pans is often at the boundary of more than one clan, which makes it difficult to coordinate management and maintenance by a user group from one community. Even if pans are located within one village, the cultural norms do not allow that users who do not contribute to its maintenance be denied water. Second is the issue of monitoring; their use cannot be monitored in the same way as is possible with shallow wells and boreholes, where non-users can be turned away by locking the water pump. Related to this is the issue of sanctions. As pans are managed as traditional sources and located on trust lands, they are effectively open access resources. In cases where community groups attempt to manage them, they cannot deny non-users from taking water because of cultural norms which dictate that no one should be denied water. The informal nature of management makes sanctioning free-riders difficult, thereby weakening the motivation of other members in the community to contribute to its maintenance.

4.4.4 Gender differentiated participation in water management

The participation of men and women varies in water management as per the institutional arrangement governing a particular water resource. In the present study, different participation levels were observed in community initiated water projects as compared to the ones initiated by an external agency.

Although women are confident of their ability to manage water, at the same time they are aware that men might not give them a space to exercise their authority. The women in a village with a water pan thus remark,

> *"NO.6: Women can decide but it can't work.*
> *NO.8: Men have not given us the authority.*
> *NO.2: The men assume that they should always be on the front line".*

This perception of women about the amount of space men would give them in water management roles is not unfounded. A contrast in the participation of men and women in water management in traditional sources compared to projects introduced by external agencies could be discerned from study sites. In all study sites with traditional water sources such as the water pans, women's participation in decision making spheres was found to be absent or at best low. In addition, women had a limited role in the management of community initiated shallow wells. This was not the case in water projects initiated by external agencies such as shallow wells. It can be deduced from these observations that decision making as regards water management has been a men's job, as evident by the strong presence of men in management of traditional structures such as the water pans. Thus, under traditional norms, women enjoy neither authority nor space in formal decision making bodies of these resources. The women from a community initiated water pan group describe this position,

> *"MOD- Were women allowed to make decisions?*
> *NO. 4- Only Mzee Paulo made decisions.[village elder]*
> *NO.8- That old man was wiser than us.*
> *NO. 3- It was not women's job. Men were considered to be more powerful than woman".*

Even in villages where external agencies have initiated a water pan and instituted a water user committee, traditional norms have overpowered these formally constituted groups, and men take precedence in decision making and management. The discussion among men members from an agency initiated water pan village illustrates this observation,

> *"No.1:-I am differing with him, you all know it that women's decisions are never respected, they must first contact the chairman or else the chairman would question why they did it without his authority."*

The participation of women in visible positions of water management is a more recent phenomenon that was introduced by external agencies. Women's participation in various aspects of management is thus pronounced in all the cases where the external agency handed over the responsibility of management specifically to a women's group. All agency initiated shallow well and piped water kiosk projects included in the research were being managed by women groups and had a significant proportion of women represented on the decision making forum(refer to table 11).

Table 11. Women represented in executive body of water management groups

Village	Project initiating agency (external agency or community initiated)	Women in executive committee
Kasyae	External agency shallow well	All women executive body
Kasaye Kolo	External agency shallow well	All women executive body
Kasaye Cherwa	External agency shallow well	All women executive body
Kamula	External agency, water pan	No women in executive body
Kagure	External agency, water pan	Two women in executive body

4.4.5 Equity in access to water

In Lower Nyakach, one of the administrative divisions of Nyando district and also an area covered under the present study, data in three Luo communities shows that there are only 57% of households having any resident adult males; 25% of the households are headed by widows and 6.4% of households are headed by orphaned children (ICRAF, 2001). The data from participatory rural appraisal exercises carried out in two villages in lower Nyando reveal that a considerable proportion of households are headed by poor widows and orphans. In village Kasaye, 38% of the households belong to the very poor and widows while 8.5% are headed by orphans. These households do not have the ability

to pay for water from protected sources on a regular basis, and are forced to collect water from unprotected sources.

The water projects initiated by various agencies have different norms to ensure access to these vulnerable groups. The projects initiated by an external agency, such as piped supplies and shallow wells operate on user-pay and cost-recovery principles and do not have any institutional rules to allow these vulnerable households to access safe water free of cost. The members of the water user committee from borehole explain,

> *"NO.6: There is no arrangement for poor, every consumer does it his own way.*
> *NO.12: We were so busy working together putting up the project that we never thought about the poor and the widows. But the fee charged was quite affordable."*

The situation regarding access of the poor to protected water sources is different for community initiated projects. In the community initiated shallow wells, the water users group allows poor households to fetch water free of cost.

> *"NO.1: Welfare gives them shallow well water free of charge.[Welfare group in Kasirere]*
> *No.4: The only way is just as we had said earlier that the very poor, orphans and poor widows are given water freely by the Welfare".*

4.4.6 Operation and maintenance

The operation and maintenance of water projects also follows the typology of formal arrangements in external agency supported projects to informal arrangements within community initiated projects.

In general the complex water supply projects such as borehole and piped supplies have the most formal and professionally managed system for maintenance and operation. The water user group generally hires a paid caretaker who repairs breakages and collects water tariffs.

In relatively less complex systems such as external agency assisted shallow wells, the systems for repair and maintenance are simple. The water users committee appoints a volunteer caretaker from the community who is responsible for cleaning the water point. The community initiated shallow wells also care for maintenance in the same way. A person from within the group volunteers to collect water dues. However, this system does not operate as effectively as the ones in piped supplies, and often the cost recovery is poor.

A factor that impairs maintenance of shallow wells with hand pumps in the study area is the non-availability of spare parts, so even if the water management committee is functioning, it is unable to restore the hand pump. The staff of Ministry of Agriculture explains,

> *"When they started they formed water management committee of the beneficiaries for each borehole, but the problem there has been the lack of spare parts, so you find that most of the boreholes are not functioning now"*

At the other extreme are the informal arrangements for maintenance that exist for water pans, whether initiated by an external agency or the community. Traditionally, water pans are managed at the village level by village elders. The users are expected to contribute to de-silting of the pan on a voluntary basis. In pans initiated by an external agency, although a formal management body was organized the actual management and maintenance remained loose and informal.

Chapter 5

Conclusion

Communities in rural Kenya experience severe scarcity of drinking water for household needs, and availability of water is one of their top priorities. Kenya has enacted a new water policy. The policy calls for the decentralization of water supply and management to community groups and non-government entities. Community-based management of water has the potential to meet the millennium development goals. Despite the significance of water in daily life of people and thrust to community based approaches, community level investment in water management is not widespread. What are the reasons for this apparent paradox?

As policies to decentralize water management to community groups become operational, it is essential to understand the impacts of these approaches for water availability, and the circumstances under which community investment in water management would come about. The present study attempts to explore the factors that facilitate and constrain community based water management and the impacts of improved water management on water availability and use at household level, in lower Nyando basin of Lake Victoria watershed in Kenya. The focus group discussions, interviews and survey give rich insights into the practice of community based water management in the area.

5.1 Impacts of improved water management

The study findings indicate that as a result of improved water management at the community level, households use greater quantity of water over various household activities. While the use of water for drinking and cooking does not change in the before-

and-after water project situation, the change occurs mostly in productive uses of water. The study documented productive uses of water in the form of dry-season irrigation in homestead vegetable gardens (Perez de Mendiguren, 2003; Mokogpe & Butterworth 2001). The presence of these gardens points to possible implications for community livelihoods and wellbeing. However, it would be worthwhile to understand two related issues in a subsequent research. Firstly, who in the community is able to take up these gardens? What are the characteristics of these households in terms of socio-economic status (poor/female headed), their location in terms of distance from the water source, and whether water use in gardens is sourced from paid or unpaid sources? Secondly, in order to investigate the impact of these productive activities the amount of vegetables grown in these gardens and their use for subsistence or sale should be quantified. These research issues are important to affect change in the purview of current rural water supply policy from a narrow focus on fulfillment of consumption and hygiene needs to a broader focus on productive uses of domestic water (Moriarty & Butterworth, 2003). There is also a need to incorporate productive water uses water needs into the design of rural water supply systems.

5.2 Factors that facilitate community based water management

The present study points out that facilitation by an external agency and leadership are crucial to establishing community based water management projects. The study documents that the presence of an external agency is important at various stages of the process of community based water management. Although the study shows that communities need external assistance in from of subsidies or full investments to initiate a water project, it also indicates a strong need for continued support to community after the

completion and handing over of projects. This finding has significant implications for sustainability of community based projects. The issue of support is especially relevant for lower Nyando within the prevailing context of decentralization of water sector, withdrawal of the governments, extremely high poverty levels and a high incidence of defunct water systems. Community management of water resources cannot be pushed merely on grounds of efficiency, without adequate support at various stages of the project (Schouten & Moriarty, 2003). Based on these findings governments and other agencies need to undertake efforts to invest in water source development, along with institutional and technical measures to support water management at the community level. These findings also call for a need to investigate the functioning of rural water supply projects that have been handed over to the community. What kinds of support do these groups expect and what is the level of support being provided to maintain them? Answering these questions will help understand what inhibits the day-to-day functioning of projects and identify institutional, technical measures that need to be taken to ensure survival of community initiatives in the long run.

5.3 Factors that constrain community based water management

The study presents with several explanations to this: poverty levels, gender relations, property rights, ownership, and upstream-downstream linkages in resource use that call for cross-scale management of water. The management of water resources at the community level is a complex process and all the above factors need to be addressed to have the desired outcome, rather than focus on one or two. The most important factor that hinders community initiative in water management is the prevalent poverty levels in the community. The study area suffers the highest incidence of poverty in the entire Nyando

basin, and around 35% households in the communities studied are female headed. The findings indicate that poverty influences the ability of a community to start water projects and that of households to invest in safe water delivery systems. Poverty compromises the ability of very poor and vulnerable groups in the community to access safe water on a regular basis. Although a few communities have initiated management of water on their own accord, the scale and nature of the resource limits the provision of safe water. For instance, the findings clearly suggest that the kinds of water resources that are required to provide safe water for rural communities are protected sources such as boreholes and shallow wells, rather than community initiated water pans. Both these protected sources require a high initial investment and recurring costs. These costs are prohibitive given the extreme deprivation and vulnerability in the study area. Thus, communities without sufficient external assistance and material impoverishment would continue to remain trapped in low investment levels. These findings suggest a role for external agencies in investing in water management in the study area, through provision of low cost credit, by earmarking development funds which need to be targeted specifically for the purpose of water development, as well as development of low cost measures that ensure water availability to these communities. The presence of community groups around a number of social issues is an indicator of a culture of community organizing, which can be used to invest in resource development can be targeted to priority areas. In addition, rain water harvesting presents an excellent potential to alleviate the water needs of rural poor and is already prevalent in the study area. What is needed is a boost in investments and technical support to enhance storage of rain water at household or community level so that clean water is available during dry season.

Gender differences in roles of men and women regarding water collection and management came up as an important factor that constrains the initiation of community based water management projects. Women in the study area are responsible for collecting water for domestic and productive activities. However, these roles are not acknowledged by men, who are responsible for making investments in water improvement. Although, the representation of women on water resource committees has been facilitated by external agencies, this representation so far as management of traditional resources goes does not translate into getting their voices heard. This informal culture of day-to-day working of committees constrains the participation of women. These differences in perception should be acknowledged during the planning phase of community based water projects, so as to specifically incorporate the issue of real space for women in institutions and concerns of women into system design, ability to pay (Hellum, 2001) . Based on these findings, there is a need to study the extent to which women's productive water use is a source of economic opportunities and its potential influence on their position in the household and community. An exploration into informal norms of water management prevalent at the community level and the day-to-day way of doing business of water users committee is called for to get a dynamic view of participation and representation of women and other marginalized sections in water management.

In the Nyando basin, land and water exist under a variety of property arrangements. While land is held privately, its adjudication has curtailed the access of several sections of the community to water points located on these adjudicated lands. These insecure access arrangements dilute the incentives for community based management. Related to the issue of property rights is also the issue of ownership of

community water projects in the study area. The ownership of externally aided water points is disputed and community projects have been captured by individuals (IRC, 1997). This is a major reason for the dissolution of community management. However, the issues of ownership did not surface in community initiated water projects such as shallow wells. There is thus a need to study the ownership patterns and access norms of community initiated water projects. The dispute around ownership of water projects also points to a role for government in legislative policies that create right incentives for management by addressing this ambiguity in access to resources and ownership of community based projects. The resolution of these issues is critical to provide momentum to community based water management approaches, as envisaged under the new water policy.

In the Nyando basin, a wide range of water resources is used and managed at various levels. In a single village, there are certain resources that are managed in terms of exclusion of non-users and collection of water tariffs, while there are others that are not subject to such norms. This heterogeneity in management processes is related to the type of resource, its location, its relative significance as a source of protected water, and the availability of alternative water sources within the community. While the management of some resources such as boreholes or shallow wells is possible at the level of local community groups, use of resources such as rivers and water pans transcends community boundaries, and thus presents a challenge for effective management by small communities. In particular rivers in Nyando are important source of water, and their indiscriminate use as waste sinks by upstream users creates externalities for downstream communities in the form of polluted water (Ferguson, 2005). Further, the deforestation in

the upper catchments is a cause of constant flooding in the downstream areas. The existence of these upstream-downstream linkages in the use of rivers calls for a catchment or basin level approach to management. Although the Water Act of 2002, calls for the establishment of catchment councils, as of now, in the lower Nyando basin there exist no institutional arrangements that facilitate the interaction of users from across various scales in the watershed. Given that the Nyando basin is the prime contributor of pollutants and sedimentation to Lake Victoria, the findings suggest the need to create platforms of users across scales in the catchment, to address preservation of water quality and management of rivers and streams.

The issue of capacity building of community institutions to manage funds came up as a significant issue that need to be addressed to ensure functional sustainability of community based water management systems. Several community groups in the study area are not functional because of conflicts relating to misuse of funds and the inability of the community to break the impasse thus created. The ability of communities to contribute to operating costs and maintenance of the system also came up as an issue that constrains management at community level (IRC, 1997). In previous studies in Kenya, it has emerged that the government departments do not have the capacity to provide support to communities after the projects are handed over (IRC, 1997). These findings suggest the need for intermediary institutions that can facilitate the election of new water user groups and provide refresher training so as to resurrect dormant institutions.

Related to this is also the issue of technical failure of many externally-aided water projects, due to non-availability of spare parts and limited skill level in the community to address these failures (IRC, 1997). A large number of shallow well projects initiated

under bilateral projects are lying defunct, and there is no monitoring from the implementing agencies to address this issue. With the state withdrawing its support from management and supply and donors working on a one-off, piece meal approach, this issue presents a challenge to community involvement. The study findings indicate for the need for NGOs or state supported agencies to assist communities on a regular basis on such issues (IRC, 1997; Schouten & Moriarty, 2003).

Cost recovery is the operating principle for rural water supply projects in the study area. However, cost-recovery is possible when communities are delivered the level of service that they are willing to pay for. In the water supplies operated by NWCPC, the service is extremely erratic. The community groups find it extremely difficult to raise enough funds to pay monthly water bills and sustain their motivation to manage group based community kiosks. Thus, for cost-recovery approaches to work, state agencies need to improve service delivery and tailor it to cater to increased demands at the community level.

Communities are not homogenous entities. The participation of community members is decided by location of water project. The individuals who are able to contribute cash or manual labor become members and access water at a flat rate. The poor and vulnerable social groups in the community, such as female headed households who are unable to contribute, remain non-members, and a pay for water on a volume basis. The study findings call for a need to study criteria for enlisting members to shallow well projects and understand who participates and who gets excluded, so as to account for greater equity in participation.

Finally, the communities were willing to invest in management of water supply systems if they feel a sense of ownership, have the right capacity and if they perceive benefits from it.

The study findings conclude that community based management of water resources holds the potential to cater to water needs in rural areas of developing countries. However, this approach cannot function in an institutional vacuum. A range of institutional, capacity and technical support structures are required to initiate and sustain community based water management. The ability of water users to coordinate management varies over time and spatial scale. There is a need to acknowledge these factors in the design and development of water management projects and policies, to strengthen management of resources from local to regional scales, and reach out to community groups across the socio-economic spectrum.

Appendices

Appendix A

T-Test- Comparison of before-and-after-project total water use in household during dry season

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PreDryTtlallHHuse	150.0000	20	82.11032	18.36043
	PostDryTtlallHHuse	241.0000	20	178.63960	39.94503

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	PreDryTtlallHHuse & PostDryTtlallHHuse	20	.893	.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	PreDryTtlallHHuse - PostDryTtlallHHuse	-91.00000	111.59843	24.95417	-143.22967	-38.77033	-3.647	19	.002

T-Test- Comparison of before-and-after-project per capita total water use in household during dry season

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PocapitaTtlHHdrylts	16.8286	21	6.30616	1.37612
	PrecapitaTtlHHdrylts	5.1030	21	1.69337	.36952

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	PocapitaTtlHHdrylts & PrecapitaTtlHHdrylts	21	.477	.029

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	PocapitaTtlHHdrylts - PrecapitaTtlHHdrylts	11.72562	5.69621	1.24301	9.13274	14.31851	9.433	20	.000

T-Test- Comparison of before-and-after-project total water use in homestead gardens during dry season

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre-project Household garden water use dryseason	23.8889	36	41.28492	6.88082
	Post-project Household garden water use dryseason	60.0000	36	88.89802	14.81634

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Pre-project Household garden water use dryseason & Post-project Household garden water use dryseason	36	.830	.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pre-project Household garden water use dryseason - Post-project Household garden water use dryseason	-36.11111	59.29480	9.88247	-56.17358	-16.04864	-3.654	35	.001

Crosstabs- Test of Association between distance between homestead and water point and total water use in homestead gardens.

Distance by group * Post garden dry water use Cross tabulation

			Post garden dry water use				Total
			No use	Low use	Medium use	High	
Distance by group	Homestead	Count	0	1	3	4	8
		% within Distance by group	.0%	12.5%	37.5%	50.0%	100.0%
	Short distance	Count	4	0	4	3	11
		% within Distance by group	36.4%	.0%	36.4%	27.3%	100.0%
	Medium distance	Count	1	4	3	1	9
		% within Distance by group	11.1%	44.4%	33.3%	11.1%	100.0%
	Long distance	Count	4	2	2	0	8
		% within Distance by group	50.0%	25.0%	25.0%	.0%	100.0%
Total		Count	9	7	12	8	36
		% within Distance by group	25.0%	19.4%	33.3%	22.2%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	16.040(a)	9	.066
Likelihood Ratio	20.238	9	.016
Linear-by-Linear Association	7.929	1	.005
N of Valid Cases	36		

a 16 cells (100.0%) have expected count less than 5. The minimum expected count is 1.56.

Appendix B

Interview Guides for Village Chiefs, Government officers

Key Informant interview in Village- with Village chief

Resource system

1. What are the main water collection sources? Are these public or private?
2. Which group of people in the village use which source of water?
3. What do people use water for from this source?
4. What measures were taken to ensure access of people to the water source? How was the land on which the water source is situated was allocated to this use? Land easement process.
5. Are there problems related to water in the village? Lack of access, water quality? Describe the problems, both in the present and in the past in case they have changed over time. How did people access water or manage it traditionally?

Role of External agency

6. Is there a water project in the village? If yes, which agency initiated it? In what ways did it assist the village- financially, technically, capacity building for management.

User group characteristics

7. What are the institutions involved in water management in the village? Who are the members? When did it start?
8. What role did men play in the initiation of project/ What role did women play?
9. How do non-members get water? Do they buy it or collect it from a source where water is free? Where do poor people get water?

Institutional issues

10. What are the rules governing the use and management of water/water sources in the village? Who devised these rules? How are these shared with community members? What happens if water users do not follow these rules?

11. Are there conflicts over water use and management in the village? Between members and non-members or over allocation of land for the water source? If yes, give some examples

12. Who is responsible for resolving conflicts around water in the village? Give examples of how some problems have been resolved or attempted to be resolved.

Leadership

13. Are there any other institutions in the village apart from the water group?

14. What is your role in assisting communities to manage water/ start water projects?

Collective action

15.What prevents people to form groups to manage water in the village?(Explain in as much detail as possible, whether they are collective action problems, financial problems, tenure problems, etc.)

Impacts

16. In what ways has improved water management brought a change in people's life? Does water collection take less time? If so, what do they do with the extra time?

Key Informant interview with Government officials

1. What are the main issues as regards water management in the region/division?

2.What is the role of your department in water management in rural areas?

3. What institutions/agencies are responsible for management of domestic and irrigation water in a village?

4. What assistance does your organization provide to manage domestic and irrigation water in a village? Specify, financial, technical or capacity building assistance (for management or maintenance of water projects).

5. Do you assist only those communities that ask for help or others as well? Do you monitor the projects that you initiate in the village?

6. What is the process of initiation of a water project in a community?

7. What determines people's rights to water?

8. Are there problems related to water in any villages? Access? Water quality?

9. What steps have been taken to improve water supply or access to water? What steps have been considered but not taken?

10. What additional investments need to be made to improve water supply/access? If new investments are needed but haven't been made, what are the main obstacles to making the investments? (Explain in as much detail as possible, whether they are collective action problems, financial problems, tenure problems, etc.)

11. Are there conflicts around water use/management in village? If yes, what are the sources of conflict? Do conflicts arise around domestic water use? Irrigation systems? Other water uses? Are their conflicts around land easement for locating a water project?

12. What is your role in conflict resolution around water in a village?

13. What is your understanding of the new water law and what difference it will make?

14. What in their opinion are the reasons that some villages can't get themselves organized to manage water better? What are the solutions to the problem of lack of community organization around water in these villages?

15. Are they familiar with other villages with a better water situation? If so, can they describe those villages and how their conditions might be different from the ones

where water management is a problem?

16. In what ways has improved water management changed people's life? Does water collection take less time? If so, what do they do with the extra time?

III. Participatory Rural Appraisal Exercise with Local water users including women-

1. What is the location and type of water sources in the village? (Resource mapping)
2. What are the various social and economic groups in the village? (Social mapping and Wealth ranking)
3. Who in the village uses which water source? (Resource and Social mapping)
4. What determines this use? Is it location, water rights or payment?
5. Sources of water used by season/ (Seasonality mapping for each source, household)
6. Who owns various water sources? (Resource, Social Mapping, Transect walk)
7. Collection times for water by season?
8. Who collects it?
9. Use of water for various activities- drinking, bathing, washing, irrigation etc- how much used for each activity, daily(Matrix Ranking)
10. What mechanisms do they use to save water, if any?
11. Where do poor/orphans and widows get water from?

Key Informant interview with office bearer of water management group

Role of external agency

1.Was there any external organization involved in the formation of the group? Name this agency? If yes, in what ways did it help? Technical inputs, Financial inputs, Capacity building trainings?

Resource characteristics

2. What type of water source is being managed in the village? Shallow well/borehole/piped community kiosk/water pan

3. What is the water from this source used for? Bathing, washing, livestock, cooking, drinking, gardening

3. How was the land for the water project is located allocated? Is it private land or public land? Land easement process.

User group characteristics

3.When was the Group formed? What triggered the formation of this group?

3. Who in the village initiated the group formation? What was the gender composition of the original group? How many households were originally involved?

4. What did each person who is currently a member have to contribute to join the group, financially or in terms of personal labor? Was there a membership fees? How much? How much money was collected? What was the money used for?

Institutional issues

5. Is there a management committee? How many women are there in the committee? How were the members to the committee elected? How long does a person holds his position? Who in the community votes to elect the committee members? What types of people are usually chosen to be water association committee members? How are decisions/rules conveyed to members?

6. Is there a water fees? What is it? Per month? Per week? Per household or per member?

How was this decided upon? Did the members participate in deciding this fees? How much money is collected in the group as water fees? Who collects this money? What is the money used for? Do all members pay on time? What do you do if they don't pay on time? Have any penalties been imposed?

7. Who keeps the accounts in the group?
8. How much water is allowed to be used per day?
9. Who/How is the water use among members regulated?
10. Has group membership changed over time? If yes, in what ways?
11. How do you maintain the water source? Has the group undertaken any maintenance/repairs in the past?
12. Have you appointed a caretaker? How much do you pay him?
13. Did the management group receive any training for management of funds, management of water?
14. Are non members allowed any use rights to water? If yes, what are they?
15. Can new members be allowed to join the group later? If yes, what requirements should they meet?
16. Where do non-members bring water from?
17. Are their conflicts over water use/management in the water management members? What is the reason?
18. Are their conflicts with non-members over water use? Are their plans to include non-members?
19. How are these conflicts resolved?
20. If there has been investment in protection or piping of water, how were men and women involved?
21. Are there any regularized arrangements between upstream and downstream users / nonusers of the water source?

Leadership

22. Who in the village initiated the idea of the water project?
23. Are their any other institutions in the village apart from the water project?

Collective action Constraints

24. What prevents non members to join groups to manage water? (Explain in as much detail as possible, whether they are collective action problems, financial problems, tenure problems, etc.)

25. What are the outcomes of improved water management in the community? Initiation of similar projects in nearby villages? Other impacts?

Focus Group with members in a village with a water project

1. Role of External agency

1.1 Is there a water project in the village? If yes, which agency initiated it?

1.2 In what ways did the agency help the group to start the project- Probe whether it was financial assistance, Probe whether it was training to manage the project?

1.3Who took the initiative to start the project- was it the village group or the agency?

1.4 Was anyone from the village trained to repair the water point/water extraction technology?

1.5 Apart from the water project did the agency do any other activities in your village. If yes, please list them.

2. Resource characteristics

2.1 List all types of water sources in the area, their location (whether inside village, outside)

2.2 Which water sources are used at what time of the year?

2.3 Which members in the community use which of these sources ? Ask where do the rich get water from? Ask where do the poor get water from? Ask where do orphans and widows get water from?

3. Topic Water point management

3.1 What type of water source is being managed in the village? Shallow well/borehole/piped community kiosk/water pan

3.2 What months in a year is the source being protected used?

3.3 What is the water from this source used for? Bathing, washing, livestock, cooking, drinking, gardening

3.4 What do you feel about the quality of water from this water point?

3.5 How many families access the water source being managed by the group?

3.6 How was the location of the water point decided?

3.7 How was the land where the water project is located alloted? Is it private land or public land? Describe the Land easement process. How did the group deal with the land

owner?

4. User group characteristics

4.1 When was the Group formed? How many households were originally involved?

4.2. What was the gender composition of the original group? What role did men play in the initiation of project/ What role did women play?

4.3 If there was construction activity for the water point, what did men do? What did women do?

4.4 What did each person who is currently a member have to contribute to join the group, financially or in terms of personal labor? Was there a membership fees? How much? What was the money used for?

4.5 Has group membership changed over time? If yes, in what ways? Give examples when new members were added to the group?

4.6 Can new members be allowed to join the group later? If yes, what requirements should they meet?

5. Institutional issues

5.1 How did the group decide to manage water? What triggered the start of the project?

5.2 What problems did the group face initially to start the project/ How did they solve these?

5.3 Is there a management committee? How many women are there in the committee? Do women hold positions of responsibility in the committee (Chairperson, Treasurer, Secretary)? How were the members to the committee elected? How long does a person hold his position? Who in the community votes to elect the committee members? What types of people are usually chosen to be water association committee members?

5.4 How do you judge the performance of the committee members? What happens if they do not perform well? How is a new committee formed?

5.5 When are the meetings of the committee held? Where are they held? Who calls these meetings? How many members are usually present? How are decisions taken? How are decisions/rules conveyed to members?

5.6 Do women participate in decision making? If yes, give some examples.

5.7 Is there a water fees? What is it? Per month? Per week? Per household or per

member? Who decided upon this fees? Did the members participate in deciding this fees? Who collects this money? What is the money used for? Do all members pay on time? What do you do if they don't pay on time? Have any penalties been imposed?

5. 8 Are non-members allowed to use water? Do they pay more for water? How is this decided?

5.9 Are there any specific arrangements for poor people or widows to access water from this water point? If yes, what are these?

5.10 Are their conflicts over water use/management among the members/non-members? What is the reason? Give examples of these.

5.11 Who is responsible for resolving conflicts around water in the village? Give examples of how some problems have been resolved or attempted to be resolved.

6. Operation and Maintenance

6.1 How do you maintain the water source? Is there a person incharge to look after the water point? Is that person paid? What does he do?

6.2 Is water use among members regulated? How much water is allowed to be used per day? Who/How is the water use among members regulated?

6.3 If the water point (say the handpump) breaks down, how do people repair it? Has the group undertaken any maintenance/repairs in the past? If yes, where did the money come from?

6.4 What is the annual maintenance cost?

6.5 What problems does the group face in maintenance of the water point?

ASK QUESTIONS 6.6 and 6.7 ONLY IF THE WATER POINT IS NON-OPERATIONAL

6.6 If the water point is not operational, what is the reason? Since how many months is it non-operational?

6.7 If the water point is non-operational, Did the group try to repair it? What prevents the group to repair it?

7. Use of water by Gender/Class

7.1 Do you think water is as important to men as it is to women?

7.2 Do men and women use water differently?

7.3 What do men use water for?

7.4 What do women use water for?

7.5 Do you think men are interested in water projects in other villages? Why or why not?

7.6 Where do orphans and poor women/widows/non-members in the village get water from? Do they pay for water? If not. How do they access water?

7.7Are their any specific arrangements in the community to help widows and poor to get water from this water point? If yes, what are they?

7.8. Who in the community suffers most in absence of improved access to water? (Is it men or women). In what ways?

8. Responsibility of water collection

8.1 Who is responsible for water collection? (children, women of household, men)

8.2 Do women help one another with water collection? If yes, in what ways?

8.3 Who is responsible for bringing water in household with more than one wife? New wife or the old wife? How is this decided?

8.4 Is the task of water collection shared between men and women? If yes, in what ways? If no, why not?

8.5 Do children generally assist with water collection? If yes, is it girls or boys? What activities do children miss when they collect water?

9. Responsibility of water management

9.1 If there has been investment in protection of water, how were men and women involved? What did the men do? What did the women do?

9.2 Who in the community is responsible for management of sources? Men or women? What do men do/ What do women do?

9.3 Can women decide independently to undertake management of water sources in a village? If no, why not?

10. Collective action

10.1. Apart from the water project, has the group undertaken any other activity? If yes, please describe.

10.2 Apart from the water project, are there any other groups in the village to manage other activities? What are they?

10.3 What prevents non-members to join the water group ? (Explain in as much detail as possible, whether they are collective action problems, financial problems, tenure problems, etc.)

11. Impacts

11.1 In what ways has improved water management brought a change in your life ? (Probe in terms of health impacts, water collection times of women and girl child) Does water collection take less time? If so, what do they do with the extra time?)

11.2 If Non-Operational, What is the impact of the failure of your water point? What can be done to solve the problem?

Focus group Guide for Non-Members of water association

1. Topic Water resources used

1.1 List all types of water sources in the area, their location (whether inside village, outside)

1.2 Which sources are used at what time of the year?

1.3 Which people in the community use which source? Ask where poor bring water from? Ask where rich get water from? Ask where widows and orphans get water from?

1.4 Explain various activities you use water for, Probe where do they bring drinking water, bathing, washing, livestock.

1.5 How often (days in a week) do you bring water from a paid source? What is this water used for? Are there some days in a week when you are unable to access this water? If yes, what prevents you from accessing this water? In such a case, where do you bring water from?

2. Topic Water rights and problems of water

2.1 How do you obtain access to the water sources? What are their rights to each water source? How are these rights allocated? Ask whether they are negotiated by custom or any other ways?

2.2 Do you face any problems as you fetch water - probe is their a problem of access to water , probe is their a problem of water quality.

2.3 If there are problems of water quality, Do you treat thee water before consumption. If not, what prevents you from doing so?

3. Topic Institutional information

3.1 Are there any group/committee in the village to manage water? If yes, what water point are they managing? When was this group formed? Who elected the committee? How many members are there? How many are women?

3.2 Are you members of this water management group. If yes, what did you have to contribute to become member?

3.3 If you are not a member what prevents you from becoming a member?

3.4 Are you as a non-member allowed to take water from this project? If yes, do you have to pay ? How much?

3.5 Can non-members become members of the water user group at any time? If yes, what requirements should they meet?

3.6 Has anybody among you ever wanted to be a member of a water group but was denied membership? If yes, why?

3.7 Have you experienced any conflicts with members of water group in your village? If yes, what were the reasons for these? Give some examples. How were they resolved?

4. Use of water by Gender/Class

4.1 Do you think water is as important to men as it is to women?

4.2 Do men and women use water differently?

4.3 What do men use water for?

4.4 What do women use water for?

4.5 Do you think men are interested in water projects in other villages? Why or why not?

4.6 Where do orphans and poor women/widows/non-members in the village get water from? Do they pay for water? If not. How do they access water?

4.7 Are their any specific arrangements in the community to help widows and poor to get water? If yes, what are they?

4.8. Who in the community suffers most in absence of improved access to water? (Is it men or women). In what ways?

5. Responsibility of water collection

5.1 Who is responsible for water collection? (children, women of household, men)

5.2 Do women help one another with water collection? If yes, in what ways?

5.3 Who is responsible for bringing water in household with more than one wife? New wife or the old wife? How is this decided?

5.4 Is the task of water collection shared between men and women? If yes, in what ways? If no, why not?

5.5 Do children generally assist with water collection? If yes, is it girls or boys? What activities do children miss when they collect water?

6. Responsibility of water management

6.1 If there has been investment in protection of water, how were men and women involved? What did the men do? What did the women do?

6.2 Who in the community is responsible for management of sources? Men or women? What do men do/ What do women do?

6.3 Can women decide independently to undertake management of water sources in a village? If no, why not?

7. Collective action

7.1. Apart from the water project, has the group undertaken any other activity? If yes, please describe.

7.2 Apart from the water project are there any other groups in the village to manage any other activity?

7.3 What prevents non-members to join the water group to manage water? (Explain in as much detail as possible, whether they are collective action problems, financial problems, tenure problems, etc.)

8. Impacts

8.1 What activities are you unable to attend to because you do not have access to improved water? Ask for women. Ask for men. Ask for children

8.2 What activities would you like to undertake if you had secure access to improved water?

8.3 List benefits of improved water supply?

Probe health, time saved for water collection, what do they do with the time saved, any other benefits.

Focus group Guide for village with no intervention or management of water

1. Topic Water resources used

1.1 List all types of water sources in the area, their location (whether inside village, outside)

1. 2 Which sources of water are used at what time of the year?

1.3 Which people in the community use which source? Ask where do the rich get water from? Ask where do the poor get water from? Ask where do orphans and widows get water from?

1.4 Explain various activities you use water for, Probe where do they bring drinking water, bathing, washing, livestock.

1.5 How often (days in a week) do you bring water from a paid source? What is this water used for? Are there some days in a week when you are unable to access this water? If yes, what prevents you from accessing this water? In such a case, where do you bring water from?

2. Topic Water rights and problems of water

2.1 How do you obtain access to the water sources? What are their rights to each water source? How are these rights allocated?

2.2 Do you face any problems as you fetch water -Probe is their a problem of access to water , probe is their a problem of water quality.

2.3 If there are problems of water quality, Do you treat thee water before consumption. If not, what prevents you from doing so?

3. Topic Attempts to manage water

3.1 Was there at any point an intervention by an outside agency to initiate a water project in the village? If yes, please describe what was attempted? And why does it not exist as of now?

3.2 Was there at any point an intervention by the community members to initiate a water project in the village? If yes, please describe what was attempted? And why does it not exist as of now?

4. Topic Institutional information

4.1 Are there any group/committee in the village to manage water? If yes, what water point are they managing? When was this group formed? Who elected the committee? How many members are there? How many are women?

4.2 Are you members of this water management group. If yes, what did you have to contribute to become member?

4.3 If you are not a member what prevents you from becoming a member?

4.4 Are you as a non-member allowed to take water from this project? If yes, do you have to pay ? How much?

4.5 Can non-members become members of the water user group at any time? If yes, what requirements should they meet?

4.6 Has anybody among you ever wanted to be a member of a water group but was denied membership? If yes, why?

4.7 Do you have any conflicts around use of water or access to water in your village? If yes, please describe with examples. How frequent are these conflicts? How are they resolved?

4.8 Have you experienced any conflicts with members of water group in a neighboring village? If yes, what were the reasons for these? Give some examples. How were they resolved?

5. Use of water by Gender/Class

5.1 Do you think water is as important to men as it is to women?

5.2 Do men and women use water differently?

5.3 What do men use water for?

5.4 What do women use water for?

5.5 Do you think men are interested in water projects in other villages? Why or why not?

5.6 Where do orphans and poor women/widows/non-members in the village get water from? Do they pay for water? If not. How do they access water?

5.7 Are their any specific arrangements in the community to help widows and poor to get water? If yes, what are they?

5.8 Who in the community suffers most in absence of improved access to water? (Is it men or women). In what ways?

6. Responsibility of water collection

6.1 Who is responsible for water collection? (children, women of household, men)

6.2 Do women help one another with water collection? If yes, in what ways?

6.3 Who is responsible for bringing water in household with more than one wife? New wife or the old wife? How is this decided?

6.4 Is the task of water collection shared between men and women? If yes, in what ways? If no, why not?

6.5 Do children generally assist with water collection? If yes, is it girls or boys? What activities do children miss when they collect water?

7. Responsibility of water management

7.1 If there has been investment in protection of water, how were men and women involved? What did the men do? What did the women do?

7.2 Who in the community is responsible to take decisions to improve water sources? Men or women? What do men do/ What do women do?

7.3 Can women decide independently to undertake management of water sources in a village? If no, why not?

8. Collective action

8.1. Are their any groups in the village to manage resources or any other activity? If yes, please describe their roles?

8.2 What prevents the village community to initiate a water to join the water group to manage water? (Explain in as much detail as possible, whether they are collective action problems, financial problems, tenure problems, etc.)

8.3 What type of assistance would people require to initiate a water project in the village? (probe external help, help from within community).

8.4 What role can your community play in ensuring that you have improved access to water?

8.5 Do they know of a village with a better water situation. If yes, can they describe how the conditions in that village might be different from this one. (probe for characteristic of water source, role of leadership, role of external agency)

9. Impacts

9.1 What activities are you unable to attend to because you do not have access to improved water? Ask for women. Ask for men. Ask for children

9.2 What activities would you like to undertake if you had secure access to improved water?

9.3 List benefits of improved water supply?

Probe health, time saved for water collection, what do they do with the time saved, any other benefits.

Perceived Impact of Improved Water management in a household

District Division

Location Sub Location Village

Name of interviewer

Date of interview

Ethnicity of household

Name of Respondent_____ Gender of respondent_____

Status in the household- Only wife _____First wife_____ Second wife_____

1. Gender of household head: Man _____ Woman_____

2. Household details

No. of Adults_____

No. of children_____

3. Type of house- Tin roof_____ Thatch roof_____

4 Do you have a roof/rain water catchment?

5. Area of Shamba_____(Acre/Hectare)

6. Type and number of livestock_____

7. Types of income generating activities in the household, Specify _____,

8. Which of these activities require water,

Specify_____

Questions as regards water user association membership

9. Member of Water Association? yes____ no____ If yes, since when?_____

10. If a member, how much do you pay for water fees per month?

11. If a non-member, how much do you pay for water per month_____ or per bucket_____

Questions as regards sources of water and water collection tasks before the project

12.Do you collect water for the household?_____

13. If no, who does?_____

14. If yes, who else does?_____

Questions about water use, collection AFTER the water project?

15. What is the total daily requirement of water in your household for various activities?

How much time do you spend each day to collect water?_____

How far is your house from the water point?_____ km

How do you transport water?_____

Activities	Source of water for activities		Place where activity occurs		Daily requirement (20 lts cans)	
	Dry	Wet	Dry	Wet	Dry	Wet
Drinking						
Bathing						
Washing clothes						
Washing utensils						
Water for livestock						
Water for cleaning/smearing the house						
Water for Toilets/Sanitation						
Irrigation in shamba						
Irrigation on homestead garden						
Others, Specify						

Questions as regards sources of water and water collection tasks BEFORE the water project

16.Did you collect water for the household?_____

17.If no, who did?

_____

18.If yes, who else did?_____

Questions about water use, collection before the water project?

19. What is the total daily requirement of water in your household for various activities?

How much time do you spend each day to collect water?_____

How do you transport water?_____

Activities	Source of water for activities		Place where activity occurs		Daily requirement (20 lts cans)	
	Dry	Wet	Dry	Wet	Dry	Wet
Drinking/cooking						
Bathing						
Washing clothes						
Washing utensils						
Water for livestock						
Water for cleaning/smearing the house						
Water for Toilets/Sanitation						
Irrigation in shamba						
Irrigation on homestead garden						
Others, Specify						

Questions about Perceived changes in life after the improved access to water

20. Describe benefits of water on:

- Probe Health and personal hygiene

- Probe Agricultural production:

- Probe Time Savings, What do they do in time saved?

- Probe Perceived change in water quality

- Probe More time/less time for some activities

- Probe Other benefits:

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