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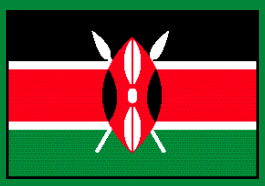
# Drawers of Water II

30 years of change in domestic water use & environmental health in east africa

## Kenya country study

by **Munguti Katui-Katua**



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DFID Department for International Development
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## Collaborators

The **International Institute for Environment and Development (IIED)** (www.iied.org) is an independent, non-profit organisation that seeks to promote sustainable patterns of world development through policy research, advisory services, networking and public information. Established in 1971, IIED advises policy makers and practitioners and supports and collaborates with Southern specialists and institutions working in similar areas. Focusing on the linkages between economic development, environmental change and human needs, the Institute has research programmes in a number of areas critical to advancing knowledge and understanding of sustainable development issues.

**Community Management Training Services (CMTS) (EA)** is a limited liability consulting company based in Nairobi, Kenya, specialising in water supply, sanitation, health and hygiene issues. For over a decade, members of CMTS have advised and provided technical and institutional support to government agencies, NGOs, CBOs and international organisations across Africa, including AMREF, The World Bank and the World Health Organisation Members of CMTS conduct participatory appraisals, social assessments, and large-scale household surveys on a range of subjects. They also facilitate community-based planning and development processes and broker viable institutional partnerships between local groups, government departments and donor agencies.

**The African Medical and Research Foundation (AMREF)** (amref.kco@amref.org) is Africa's largest indigenous health charity, and for 44 years in partnership with local communities, governments and donors, has worked to research and alleviate Africa's health problems. AMREF's mission is to improve health care among disadvantaged communities in Sub-Saharan Africa by helping them establish their own self-sustaining health systems. Through its work on water and sanitation, AMREF aims to sustain improved water supply, personal hygiene and sanitary environments in poor rural and peri-urban areas through integrated health promotion and education activities, in collaboration with government and non-governmental agencies.

## Sponsors

Funding for this project was made possible through the generous support of the Department for International Development (DFID) of the UK, the Ministry of Foreign Affairs (DGIS) of The Netherlands, the Swedish International Development Cooperation Agency (Sida), Sweden, and The Rockefeller Foundation, USA.

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# Glossary

**AHF** African Housing Fund
**CAO** Chief Administrative Officer
**CPAR** Canadian Physicians for Aid and Relief
**DANIDA** Danish Agency For International Development
**DDC** District Development Committee
**DFID** Department for International Development, UK
**DFRD** District Focus Strategy for Rural Development
**DGIS** Ministry of Foreign Affairs, The Netherlands
**DOW** Drawers of Water
**DOW I** Original Drawers of Water study by White, Bradley & White
**DOW II** Repeat Drawers of Water study
**DP** Democratic Party
**FA** Field Assistant
**FGD** Focus Group Discussion
**FINNIDA** Department for International Development Cooperation of Finland
**GDP** Gross Domestic Product
**IDA** International Development Agency
**IIED** International Institute for Environment and Development
**IMF** International Monetary Fund
**KANU** Kenya African National Union
**NARC** National Rainbow Coalition
**NGAGAKA** Ngandori, Gaturi, and Kagaori
**NGO** Non-Governmental Organisation
**NORAD** Norwegian Agency for Development Cooperation
**NWSC** National Water and Sewerage Corporation
**PLA** Participatory Learning and Action
**PRA** Participatory Rural Appraisal
**Sida** Swedish International Development Cooperation Agency
**SRO** Senior Research Officer
**UNDP** United Nations Development Programme
**UNICEF** United Nations Children Education Fund
**WHO** World Health Organisation



# Preface

Back in the 1960s there seemed few facts available about water supply in Africa and almost none from the users' standpoint. There were no set ways to investigate the questions, nor was it clear what the key questions were. A geographer and a sociologist, keen to investigate household decision making over water, were introduced to a medical researcher with a Land Rover and this led to a detailed survey of 20 or so households in each of 34 communities to get a first cut at answers to an array of questions about domestic water use in the three countries of East Africa: Kenya, Tanzania and Uganda.

The findings of this research eventually were published in several journal articles and in the book *Drawers of Water: Domestic Water Use in East Africa*. Some of the results were unexpected, but their main value was to open up an area for future research and policy formulation. Subsequent work has been more focused and detailed in addressing specific questions but the broad picture has not been lost. Domestic water, even in rural areas, became for over a decade an increased focus of attention, and governments claimed to be making many improvements.

Against this background, Dr Munguti Katui-Katua of Community Management and Training Services, Kenya, along with his colleagues Dr John Thompson of the International Institute for Environment and Development, London, Professor Mark Mujwahuzi of the Institute of Resource Assessment at the University of Dar es Salaam, and Professor James Tumwine of Makerere Medical School, Uganda, sought to carry out a follow-up study nearly three decades later. It required much perseverance as funding agencies were initially not keen, but eventually with a dedicated group of young and able field

assistants, a 30-year follow-up was achieved, replicating the methodology and sites of the original work.

The results are beginning to appear, and it is possible to see the diversity of changes that have occurred. Some are sobering – improvements have not occurred in some areas – and others were unanticipated. That a simple change in technology, from the '*debe*' to the plastic can, has affected the gender distribution of water-carrying by enabling men to carry water on a bicycle and thereby avoid the ridicule that would have been the consequence of a *debe* as head-load, was unexpected.

The rarity of long-term longitudinal studies is well known, and this unique 30-year follow up of the same sites will contribute a wealth of new knowledge to water supply and use for developing countries. Moreover it provides a tool for further research on the process of change. It is possible now to select communities where the changes are dramatic and to focus the search for explanations of process on these. The question 'why?' rather than simply 'how much?' is now being addressed, and *Drawers of Water II* will surely stimulate both interest in domestic water use and a much richer level of understanding and explanation of what we originally referred to as one of mankind's most basic transactions with nature.

**Gilbert F White and David J Bradley**
Boulder and London 2002



# Acknowledgements

This study would not have been undertaken without the vision and unstinting efforts of Dr. John Thompson of the International Institute for Environment and Development (IIED), London, whose fascination with Drawers of Water goes back two decades. In his sojourn, he found me and I agreed to join in his dream of carrying out a comprehensive, repeat study of domestic water use and environmental health in East Africa – Drawers of Water II. Thank you, John, as this study marks a milestone in my career as a water professional.

I am indebted to my Research Assistants, Joyce Musuvi, Peter Mutevu, Regina Wamuri, David Gitonga, Kesi Kisia and Philip Arap Kibet for the quality of their work in the original study sites, and for being patient when financial and administrative bottlenecks slowed us down. Joyce, Peter, Regina and Gitonga continued to carry further research using participatory methods. I am grateful for their excellent work.

As this study progressed, I came to treasure and learn a great deal from my erudite colleagues Professor Mark R. Mujwahuzi of the Institute of Resource Assessment at the University of Dar es Salaam, Tanzania, and Professor James K. Tumwine of the Department of Paediatrics and Child Health at Makerere Medical School, Uganda. Their academic excellence, generosity and good humour made this project a great learning experience for me. Moreover, we, together with John, came to feel part of one large 'DOW II' family during the course of this challenging research.

I would like to pay special tribute to Professor Gilbert F. White of the University of Colorado, USA, and Professor David J. Bradley of the London School of Hygiene and Tropical Medicine (LSHTM), two of

the original authors of Drawers of Water, who took time off from their busy schedules to join our team and share many insightful moments on several occasions. Without their advice and support this work would never have been undertaken, let alone completed. Similarly, I appreciate the contributions of Professor Sandy Cairncross of LSHTM, Dr. Jan Olof Drangert of Linköping University, Sweden, and Dr. Eliab Some, formerly of the African Medical and Research Foundation (AMREF), for their invaluable inputs.

Special thanks must also go to the team at IIED, London, who assisted with the research design and statistical analysis, especially Ina T. Porras, Dr. Nick Johnstone, Libby Wood and Kathryn Jones.

In Kenya, we thank AMREF Kenya Country Office for their logistical support in the field and for providing logistic and administrative support in the early stages of the study.

Thanks also go to all the donors who generously supported this study. These include the Department for International Development (DFID), UK, The Ministry of Foreign Affairs (DGIS), The Netherlands, the Swedish International Development Cooperation Agency (Sida), and The Rockefeller Foundation's Regional Office for East and Southern Africa and its Bellagio Study and Conference Centre, Italy.

Finally, I am especially grateful to the "Wananchi" (the local men, women and children) – the drawers and users of water – in all the study sites of Kenya who gave us their time, ideas and information, and who helped us understand 30 years of change in domestic water use and environmental health.

**Munguti Katui-Katua**
Director
Community Management and Training Services (EA)
Nairobi, Kenya 2003



# Executive Summary

This study presents the findings of a large-scale, longitudinal, cross-sectional study of domestic water use and environmental health in Kenya, based on the landmark book Drawers of Water: Domestic Water Use in East Africa by Gilbert F White, David J Bradley and Anne U White (University of Chicago Press, 1972). That remarkable study reported the results of a multidimensional research effort spanning 34 communities in Kenya, Tanzania and Uganda in the late 1960s. Given the quality and breadth of its analysis, Drawers of Water (DOW I) remains one of the most comprehensive and compelling accounts available on household water use in Africa.

In 1997, nearly three decades after White, Bradley and White published their pioneering study, a team of African, European and North American scientists returned to the original Drawers of Water research sites in Kenya, Tanzania and Uganda to assess key trends and changes in domestic water use and environmental health. This work, referred to below as 'Drawers of Water II' or 'DOW II', involved more than 1,000 sample households and two phases of intensive survey and participatory research over two years. In addition, the original Drawers of Water dataset was carefully checked and recomputerised to allow for a full multivariate statistical comparison of the water/health situation in the late 1960s versus the late 1990s. The data analysis and write-up took a further two years to complete and the final results are now emerging.

This paper concentrates on changes in domestic water use over three decades in 12 rural and urban sites that reflect the diversity of environments, living conditions and water service levels found in Kenya. These sites are: Karuri (2 sites), Kiambaa, Makadara,

Manyatta, Masii, Mathare Valley, Moi's Bridge (formerly Hoey's Bridge), Mukaa, Mutwot, Pangani, and Parklands[1]. Changes in domestic water use are examined in terms of mean per capita water use levels and household water use at site and country level. This new study situates these results in the wider policy context by taking into account the numerous shifts in national policies, strategies and guidelines related to water resources development and management since the first study was made in the late 1960s.

The findings reveal both positive and negative changes in water use, in terms of levels and types of use, reliability, access and cost. The results indicate that while measurable improvements have been achieved in some quarters, there have been significant declines in others. As populations continue to grow rapidly, placing added pressure on already over-stretched systems and services, the long-term prospects for increasing per capita water use in the region appear limited. Only concerted action by international external support agencies, in partnership with municipal and national governments, local communities and water service providers, will these trends be reversed or at least slowed.

## Main findings

(i) The major socio-economic activities in the sites have not changed drastically, except in Manyatta where a tremendous shift to cash crops (tea and coffee) has transformed the earning ability of the local people and ability to finance local water projects.

(ii) The mean daily per capita water use in piped sites has dropped from 121.6 litres in DOW I to 47.4 litres in DOW II. In addition, while the highest per capita water use in the original study was 177 litres in Parklands and lowest in Makadara with 26.28 litres, the highest in the repeat study was only 60.89 litres (Parklands) and lowest in Karuri 28 litres per day. Despite the decline, one can say there was a tendency towards parity at present, as the gap between the highest and lowest levels of mean per capita water use has narrowed considerably (although there remains significant variance across the sample population).

1 Changes in domestic water use and environmental health were also investigated in a 13th site, Spring Valley, a wealthy suburb of Nairobi. Researchers were prevented access to a number of sample households, however, which limited their ability to observe and measure water use activities in and around the home. Information on monthly household water use rates from the municipal service provider was also deemed unreliable. Given concerns about the reliability and validity of the data collected at Spring Valley, it was decided to exclude the site from this report.





(iii) On average, unpiped households experienced an increase in their mean daily per capita water use from 8.3 litres in DOW I to 22.3 litres in DOW II. Moi's Bridge (formerly Hoey's Bridge) made the most dramatic leap, recording a mean of 45 litres per capita per day (lcd) in the repeat study as opposed to only 6 lcd in the original study, a . In spite of the increase, unpiped households on average consumed less water per capita compared to piped households.

(iv) The cost of water has decreased for piped households from US$0.70 in DOW I to $ 0.4 in DOW II (US$ pcm) while unpiped households experienced an increase in cost from $0.8 to $0.97 over the same period.

(v) Women continue to be the main drawers of water, although there has been an increase in the number of males involved in drawing water. The increase of male participation in water collection is partly attributed to income generation and changes in the technology used to collect and carry water (bicycles, carts, etc.).

(vi) The determinants of water use have changed since DOW I. DOW II found that availability of water was the most important factor determining water use in piped households, while for unpiped households the cost of water was the most important factor for water use. Thus, as the cost per litre increased the expected quantity of per capita water use decreased.

(vii) Environmental degradation, land tenure and population pressure have impacted negatively on availability of water and have been responsible for loss of traditional water sources. In addition, private ownership of land has prevented some people from gaining access to existing water sources.

(viii) Unlike in DOW I, in DOW II it was found that the decision to settle in an area was no longer dictated by the availability of water sources. Instead people gained access to land first then looked for water later. Technological advances have made it much easier to develop new water sources.

(ix) In some rural sites, rain water harvesting was found to be practised by about 90 percent of households, while in urban sites households storing water had increased tremendously compared to DOW I. This behaviour is a direct response to increasing uncertainty and irregularity of supply and illustrates peoples appreciation for regularity of supply and availability of water.

(x) New methods and technologies in water collection and service delivery were evident in DOW II, such as water kiosks, vendors, trucking and storage, while hand dug /shallow wells and boreholes are increasingly being seen as alternatives or improvements to piped water supply.

(xi) Jerrycans have become the dominant vessels for water collection, displacing the tin debe and traditional gourd.

(xii) A disturbing trend was found in urban areas with deteriorating water supplies, whereby a number of households have reverted from piped to unpiped status, thereby making a step backwards. While such conditions underscore the inefficiency or collapse of municipal water systems, the situation has been aggravated by private developers who have little regard for basic infrastructure and amenities.

(xiii)There is increased role of non-governmental organisations, community-based organisations and the private sector in the development of water supplies, a factor that has improved not only availability but also sustainability in some sites.

(xiv) A very small percentage of households (4.5 percent) did not have access to latrines, thus throwing into doubt the standard of environmental health and personal hygiene for the general community in the event of contamination due to diarrhoea or cholera outbreak. All in all, the improvements in latrine use were impressive.

### Major Lessons

The findings of this study reveal a fascinating mixture of progress and decline. The overall situation has become marginally better for rural (unpiped) sites but on the other hand decline in water consumption has more than doubled in urban (piped sites). While it is appropriate to celebrate the tremendous progress in per capita water use in Manyatta and Moi's Bridge, one must at the same time sympathise with Mukaa, Masii and Mutwot where the change has been marginal. The per capita water use in these communities has remained lower than stated minimum standards necessary for hygienic and healthy living conditions. A number of factors are responsible for this disturbing situation where hope and despair go hand in hand in describing the changes in domestic water use and environmental health in Kenya over the past thirty years.

The general economic decline in the country has impacted negatively on the development of the water sector since the 1990s. The attendant strategies that have been identified and agreed with donors for implementation in the water sector have been frustrated by the slow pace of political and economic reforms. Moreover, the formulation and adoption of a revised water policy has taken too long and that has put the sector in an uncertain situation. This has led to mismanagement and decline in the performance of publicly financed water supplies especially in the urban areas.

In contrast, the role of community management as an alternative approach of improving water supplies has become more pronounced in the rural areas. With the support of NGOs, the private sector and Civil Society, communities have set up viable water projects, thus illustrating how 'the people can do it' through effective self-help initiatives. This spirit of 'Harambee' is responsible for improved situations as seen in Kiambaa, Karuri, Manyatta and Moi's Bridge.

The role of the private sector and enterprising individuals who have drilled private boreholes has helped alleviate the water supply problems. In spite of this progress, the fact that vending (manual or motor-based) is not regulated has potential for exploitation of the poor. Meanwhile, their services have come at a time of great need. This development shows that faced with a problem the people will devise alternative ways of providing water supply to customers

irrespective of whether a policy framework is in place to regulate the situation. Nevertheless, it is the duty of the state to respond positively with the necessary guidelines, and promote best practice.

Looking at the situation in Kenya, it can be stated that it is not always true that the intervention of international institutions improves the situation. The Nairobi City Council has received massive support from The World Bank in a bid to improve the water supply situation for the city but on the contrary water supplies have deteriorated. Other attendant considerations beyond financing, such as good governance, responsive and transparent management systems, an increased role of the private sector and broader stakeholder consultation in decisions affecting the water supplies, are equally important.

While some rural areas have made great strides in water supply, others have not been so lucky. This shows that NGOs and the public sector do not necessarily target the most disadvantaged communities in planning for project implementation. Conversely, the role of religious organizations has been the key intervening force in the water sector for some of these areas. The resources of these organizations and those of the beneficiary communities are however limited. These are genuine cases that require the support of the government and international NGOs.

Increased income levels in the community have a direct impact on improvements in water supply. Community management approaches are likely to be more successful if efforts are in place to improve the living conditions as seen in Manyatta and Moi's Bridge. People are aware of the benefits of improved health, and are increasingly beginning to see the link between water health and hygiene. Despite the impressive changes in latrine use, a few households both in rural and urban (informal) areas were found to have no latrines. Considering the potential danger of contamination of water supplies, there is room for improvements in environmental health education. Again, this confirms that knowledge is not necessarily accompanied by practice.





The increasing role of water vendors in the supply of water may be seen as a precursor of private sector participation. Their manual heritage of water containers is both strenuous and uneconomical in the long term. Efforts and actions are needed to recognise their important role in provision of water to households and more focused support could improve per capita use. They are now key stakeholders in the privatisation debate but this importance is often overlooked.

It is hoped that good practices identified in this study will form useful learning points to ensure better and more effective programming in the water sector. Within the next few years, the situation is unlikely to change for the better even if good water policies are instituted owing to the poor and declining economic performance of the country. What is clear is the fact that despite this limitation, government still has a major role to play in streamlining of the water sector. This will inevitably require the support and participation of external agencies, donors, the private sector and communities in the implementation of improved delivery of these services.

The Government of Kenya cannot escape the responsibility of playing a lead role in these efforts, in the foreseeable future. A change of focus in the long-term, is definitely desired such that the delivery of services is left to the player(s) who may be better suited to delivery in a more efficient, transparent and sustainable manner. Whether that role will be assumed by the private sector or a combination of Public-Private Partnerships, only time will tell. Suffice to say, that all partners will be best advised to give community participation a greater role in the improvements of water supplies, and a more elaborate position in decision making processes. The story of DOW I to DOW II is a tale that seems to imply the changes could have been more positive and the general situation more pleasant if we learned lessons from the past. Will this happen now?

### Policy Recommendations

The policy pronouncements by the Government over the years have not been adequately replicated in improvements on water supplies in the communities. This discrepancy between words and actions has prompted a number of recommended suggestions.

(i) Increased participation of stakeholders is an important element in the development and sustainability of community level water supplies, and necessary steps require to be instituted to empower the people and create capacities in order to promote ownership and sustainability.

(ii) The failure by municipalities to keep up with adequate supply of water to consumers calls for alternative institutions/systems within the spirit of stakeholder consultation to determine viable options.

(iii) There is need to acknowledge and promote rainwater-harvesting technologies among rural populations, as there is practice and the demand exists. This will release the demand pressure on other supplies.

(iv) Considering that storage of water has become more pronounced in the urban areas, it is necessary to provide technical advice and support towards construction and treatment of such water supplies. This will help safeguard against contamination.

(v) Water is an economic and social good. Efforts are required to link planning for water supply to other sectors such that improvements in income levels, could have a direct effect on water improvements as happened in Manyatta.

(vi) Environmental conservation education and watershed management are important and urgent interventions that the Government, NGOs and Civil Society, need to incorporate into all programmes to arrest the rapid declaration of water catchment areas.

(vii) National policy pronouncements need to take into account the disparities existing between different communities, and therefore a deliberate effort is necessary to reach out to communities in difficult circumstances where water per capita use is still too low. Fortunately, in these areas the communities are doing something about their situation, and require only additional financial and technical support.





(viii) The cost of water is an important determinant of water use. While market forces are left to determine the cost of water, it is important to ensure that the poor are not exploited by unscrupulous vendors and suppliers capitalizing on water scarcity. In this respect, liberalization of the water sector must be accompanied by relevant water development initiatives to ensure availability and regularity of service.

(ix) The dominant role of the public sector in water supplies is no longer tenable, and the increased role of the private sector, NGOs, Civil Society and individuals in water provision is a welcome development. But regulatory procedures are necessary to ensure greater benefits accrue to both the suppliers and the consumers in a manner that will help develop the sector.

(x) The emergence of water vendors is probably the early face of water enterprise. This development requires support through micro-finance as a way of both improving water supply, and contributing on the national goals of poverty reduction.

# **1** Introduction

## **1.1** Background

Since gaining independence in 1963, Kenya has consistently sought to address the priority problems of poverty, illiteracy and disease, which were seen as the main bottlenecks to economic development. The water sector first came to be viewed as a crucial vehicle for development in the early 1970s. Policy measures were put in place to address the problems of the sector by taking responsibility for water service provision away from local authorities and communities and giving it to central government.

This approach proved to be ineffective and uneconomic, however, and by 1986 – part way through the United Nations' International Drinking Water Supply and Sanitation Decade – dwindling resources and an economic slowdown led the Government of Kenya to reverse its previous policy decision and encourage local authorities and communities to take over the operation and maintenance of water services and supplies. Despite this shift, sustainability and improved coverage remained elusive, prompting the Government to formulate its Sessional Paper, Number 1 of 1999, on National Policy on Water Resources Management and Development. The paper has made poverty reduction its core objective and describes water management as a key catalyst for development.

Kenya's new water policy provides a framework in which desired clear and achievable targets are set and defines a number of important measures needed to guide the entire range of actions related to water. The basic elements addressed in the policy are water resource management, water supply and sewerage development, institutional arrangements and financing for water sector. The policy places responsibility for co-ordination across these sectors and actors upon the Ministry of Water Resources, but at the same time recognises the increasing need to involve other stakeholders as well. Unfortunately, as the findings of this report shows, there remains a wide variance between recent achievements in policy formulation and integration and actual delivery of water services on the ground. Whether the Government of Kenya and its public and private sector partners will be able to find effective and equitable means to deliver sustainable water management while balancing competing and sometimes conflicting demands for an already scarce resource is clearly one of the great challenges facing the country in the 21st Century.

## **1.2** Drawers of Water Revisited

This study reports the findings of a large-scale, repeat, longitudinal, cross-sectional study of domestic water use and environmental health in Kenya, based on the landmark book Drawers of Water: Domestic Water Use in East Africa (Gilbert F White, David J Bradley and Anne U White, University of Chicago Press, 1972). It concentrates on changes in domestic water use over three decades in 12 rural and urban sites reflect the diversity of environments, living conditions and water service levels found in the country. Changes in domestic water use are examined in terms of mean per capita water use levels at site and country level. The findings reveal both positive and negative changes in water use, in terms of levels and types of use, reliability, access and cost. The results indicate that while measurable improvements have been achieved in some quarters, there have been significant declines in others. As populations continue to grow rapidly, placing added pressure on already over-stretched systems and services, the long-term prospects for increasing per capita water use in the region appear limited. Only concerted action by international external support agencies, in partnership with municipal and national governments, local communities and water service providers, will these trends be reversed or at least slowed.

Drawers of Water was the first large-scale assessment of domestic water use and environmental health in Africa. The study looked at the use of water for consumption, hygiene and amenities in domestic life. It also examined the direct cost of water use in monetary terms as well as the social cost of water measured in energy and time

expenditure. Information on per capita and total household water use was recorded and factors affecting variations in use were assessed.

In 1997, a comprehensive reassessment of domestic water use and environmental health in East Africa was launched, building on the original Drawers of Water (DOW I) data from the late 1960s. By using the Drawers of Water data as its baseline, and employing a range of formal and participatory research methods to carry out detailed historical analyses of a spectrum of rural and urban communities, this study attempted to 'fill in the blanks' over the past three decades and chart the major trends and changes that have occurred in the domestic water and environmental health sectors in East Africa. Given the wide range of policies formulated and implemented, the multiplicity of programmes and projects initiated, and the diversity of institutional actors involved in water development in the region over the past 30 years, this research may be likened to a kind of 'archaeology' of water and health strategies and impacts, requiring the meticulous excavation and reassembling of the available evidence.

### Changes in Per Capita Water Use

#### A Story of Improvement and Decline

At a regional level, mean daily per capita water use has declined by 30 percent over the last three decades, from 61.4 to 39.6 litres. This is a reflection of the almost universal drop in water use by piped households in both rural and urban areas. While water use by unpiped households has almost doubled (rising from 11.0 to 19.7 litres), use by piped households has decreased by approximately 50 percent from 128.0 to 66.0 litres. Despite this decline, piped households continue to use over three times the amount of water consumed by unpiped households (during DOW I the ratio was 11:1 litres) (Figure 1).

In this study an attempt has been made to put into context the changes in domestic water use and environmental health that have taken place in the 12 rural and urban sites in Kenya over a 30-year period. The research is based on that were subject of the original Drawers of Water project in the late 1990s. We have taken into account the fact that these changes have many characteristics, including social, political,





economic, environmental and technological dimensions. The findings of the study have been placed in the development context that has been characterised by steady and impressive growth from Independence in 1963 through the mid-1970s, followed by economic decline and malaise over the past quarter century.

Although Drawers of Water I has not been acknowledged and utilised extensively in the East African region, or Kenya for that matter, the study has been globally attained attention as an important milestone in the field water and environmental health. There have been many initiatives to improve water supply and environmental sanitation in Kenya, dating back to the early 1970's. Despite these efforts that have had the support of major international donors, including The World Bank, UNDP, UNICEF, SIDA, FINNIDA, Netherlands AID, and NORAD, as well as a multitude of NGOs, the water and sanitation situation has remained to a large extent deplorable.

While this study does not provide all the answers, it has reignited a new interest in the performance of the water and sanitation sector. It further puts into focus the changes in per capital water use, explores the cost of accessing and use of water, looks at the technological issues and examines the policy framework.

## **1.3** Objectives

The objectives of this study are tied to the original study - DOW I and may be summarized as:

- Carry out a comprehensive repeat cross-sectional analysis of domestic water use and environmental health in Uganda based on DOW I,
- Reconstruct the history of domestic water use and environmental health changes and impacts in selected research sites.
- Assess the intra-household, intra-community and inter-community variations in domestic water use related to investments in water supply and environmental health systems and services.
- Examine the roles of local and external factors, policies and programmes.

- Through these findings to inform and influence national and international debates on water, health, poverty and policy through a series of workshops and formal and informal publications
- Outline a strategy for selecting several representative Drawers of water (DOW) field-sites for long term monitoring.

The objectives have to a great extent directed the pace and activities of the study. It is important to note that since the study as taken place over three years, there have been some changes in the policy framework in Kenya, and a lot more is still expected as the Private Sector takes a greater role, a fact that may not be adequately developed in this study.



# **2** Country Profile

## **2.1** Size and Population

Kenya measures 582,648 sq. kilometres, and borders Uganda to the West, Tanzania to the South, Indian Ocean to the East, Somalia to the North East, and Ethiopia and Sudan to the North. The population of Kenya has grown from about nine million people at independence in 1963, to 15.3 million in 1979, 21.4 million in 1989 and about 30 million in 1999. It reached an estimated 32 million by 2001 (Kenya Human Development Report 1999). Almost four fifths of the people


Figure 2.1 Map of Kenya with field sites

are located in rural areas and the majority of that are dependent on agriculture for employment.

## **2.2** Administration and Political Structure

The country is divided into eight provinces including Nairobi City. Each province is further divided into districts, which are composed of divisions and locations. By and large districts are occupied by distinct ethnic groups, just as are the smaller provinces. There are over 40 ethnic groups in Kenya, each with its own customs, traditions and cultural norms.

While provinces and districts are administered by high-ranking civil servants appointed directly by the President of Kenya, the divisions and locations are under lower level civil servants who chair all development committees. The administrative system is styled on the (British Empire) Colonial Administrative structures created and perfected by the former colonial powers, more renowned for control rather than facilitating development.

Politically, Kenya is a multi-party state with several large parties, and a multitude of smaller ones that are largely unrepresented in Parliament. The political climate became quite acrimonious after 1991, when Parliament appealed the one-party section of the Constitution and allowed multi-party elections. During the rest of the decade, the ruling KANU party, under pressure due to a failing economy, civil clashes and crumbling infrastructure, often exercised dictatorial controls to remain in power. In 2002, Mwai Kibaki of the Democratic Party (DP) and a member of the 15-party group National Rainbow Coalition (NARC), was elected the country's third president. Since then, President Kibaki and the NARC have been under pressure to root out corruption and deliver pro-poor growth and development.

This bumpy political landscape has led to the frustration of many Kenyans, who had hoped for a fair constitutional reform process to put the country on more democratic cause to development. Additionally, improvements in the economy, and for the other services such as water and sanitation have largely suffered from mismanagement and corruption.





## **2.3** Economic Performance and Prospects

Following independence in 1963, economic growth in Kenya reached an all time high of 6.6 percent per annum during 1964-73 period. The rapid growth was fuelled by successful rural development policies in the form of expansion of land under cultivation and a switch to high value crops that led to higher agricultural outputs. Growth was also spurred by import substituting industrialisation, which enjoyed access to the markets in Eastern Africa.

However, the rate of growth of the gross domestic product (GDP) declined to an average of 5.2 percent per annum during 1974 - 79, to 4.1 percent in 1980 - 85 and to 2.5 percent during 1990 - 95, and further to 1.6 percent in 1999.

A major setback was the slow growth rate of the dominant agricultural sector, which on average grew at a slower pace than overall GDP, during the past 30 years. The sectors growth rate reached an all time low of 0 growth in 1990-95, it recovered to a growth rate of 4.4 percent in 1996, but again slumped to –1.2 percent in 1997. As a result, the share of agriculture in GDP declined to 36.6 percent during 1964 - 73 to 26.2 percent in 1990 -95, a level sustained to the end of 1999.

These figures underscore the grave danger posed and compounded by growing poverty in the country. The number of poor people increased from 3.7 million in 1972-73 to 11.5 million in 1994, reaching approximately 15 million in 1999. Some districts in the country had an incidence of poverty as high as 84 percent according to 1994 statistics. Data on expenditure (income) distribution for 1994 shows, that the bottom 20 percent of the rural population in Kenya received only 3.5 percent of the income whereas the top 20 percent captured more than 60 percent of income. The average income of the bottom 60 percent of the population falls below the rural poverty line.

## **2.4** Public Utilities: Water and Sanitation

### **2.4.1** Water

Clean water is a basic need and a foundation for improvement of the well-being of individuals and communities. Water is used for

domestic, irrigation, livestock, wildlife and hydropower generation purposes. The 1992 National Water Master Plan projected the water demand for Kenya to the year 2010 and highlighted significant shortfalls in water supply for domestic and agricultural uses.

Poor quality of water is identified as a problem in both rural and urban areas and water collection remains a significant burden for women - the traditional drawers of water. In 1994, 45 percent of Kenyans had access to safe water, with 93 percent of the urban population in planned areas, 54 percent of the population in planned urban slum settlements and only 33 percent of the rural population having access.

It is important to note that these figures over estimated access since a large population of the poor urban residents in Kenya live in informal, unplanned and unincorporated areas that are either under-served or unserved by public utilities. Nairobi alone is known to harbour approximately 2 million poor people in slum areas, that is 60 percent of its population.

Only 12 percent of the plots in Nairobi slums have water connections, and residents depend on a few communal with points and vendors, who charge more than three times the rates charged by the water utility.

### 2.4.2 Sanitation

Adequate sanitation is a prerequisite for the prevention of environmental pollution as well as waterborne and other infectious diseases, thus contributing to peoples well being. The Ministry of Health had estimated the coverage of adequate sanitation at 45 percent in 1990 and 46 percent in 1997.

The main victims of poor sanitation in urban areas are the residents of slum and squatter settlements where the incidence of illness was estimated to reach as high as 76 percent (WHO/UNICEF. 2001[1]). About three-quarters of the illnesses in slum and squatter settlements are related to overcrowding and poor sanitation.

[1]WHO/UNICEF. 2001. Access to Improved Drinking Water Sources - Kenya. WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation: Coverage Estimates 1998-2000. Geneva: WHO and New York: UNICEF.





Data on sanitation for households with piped water shows that 62 percent use pit latrines and 26 percent have water closet plus flush. It should be noted that sewage systems in major urban areas are breaking down and local authorities seem to lack the capacity to maintain them.

## 2.5 Nation Policy and Development of Domestic Water Supply and Environment Health in Kenya

Developments in domestic water supply and environmental health in Kenya can be divided into three periods. The first period relates to the decade immediately following independence (1963 to 1971) when the policies, programmes and institutions that existed were, broadly speaking, extensions or modifications of colonial policies (Khroda, 1997 unpublished[2]). It is during this period that DOWI was conducted.

The second period, 1972 to the 1980's represents one in which, from policy perspective, domestic water supply and environmental health became central to the overall goal of socio-economic development of the country and innovative ways of project implementation were introduced. The establishment of the Ministry of Water by an Act of Parliament in 1974 demonstrated this recognition of the importance of water as a resource for socio-economic development.

The long term strategic vision behind the establishment of the Ministry of Water was that improved domestic water supply and environmental health would improve human health, increase the productivity of human resources in food production and increase the time available for other economic and leisure activities.

The third period, between 1981 and 1997, has also been greatly influenced by the policies and intervention of the United Nations and its affiliate institutions, bilateral agencies and NGO's in the water sector. This intervention has led to focus attention on, and mobilise, resources for domestic water supply and sanitation programmes. The "Harambee" spirit which means "lets pull together" took root during the same period and became a major source of local mobilization of domestic resources for water supply development. Nearly 30 percent of all water supply projects have been financed through the Harambee initiative.

[2]Khroda, G.O. 1998. National Policy Studies of Domestic Water Supply and Environmental Health in Post-Colonial Africa. London: International Institute for Environment and Development and Nairobi: African Centre for Technology Studies.

The District Focus Strategy for Rural Development (DFRD) was initiated in 1983 with the purpose of decentralising water supply polices from central government to the districts as a tool for rural development. Unfortunately, DFRD did not achieve much because it lacked financial resources and the Government did not decentralise its powers on water policies in a real sense. However, it did increase the co-ordination between the different sectors, donors and the NGO community involved in district water supply and sanitation projects. It also provided for limited community participation in the planning, implementation and management of water and sanitation projects. In a way the DFRD may be credited with district and regional water projects that were popular in 1980s.

The present strategy for the District Development Committee (DDC) emphasises full community participation in water supply projects at a rural level. However, in practice this does not happen as the legal framework, within which community groups could have effective control over their activities, is lacking. This is not the case in urban areas where, due to the failure of large-scale capital intensive urban water supply projects, there has been a shift towards small-scale community managed water projects in the last one and a half decades of the 20th century.

The current direction of domestic water supply policy in Kenya is determined by a number of factors, including: 1) the challenges of operation and maintenance of urban and rural water supplies; 2) the development of water resources in arid and semi-arid areas; 3) pollution and depletion of groundwater sources; and 4) deterioration of infrastructural facilities. These problems are being tackled through the development of appropriate technology and community-managed water resources. The Water Act is being revised to reflect a shift in policy to this end.

Whether this shift will bear fruit, only time will tell. Meanwhile, the declared government statement "water for all by the year 2000" which was popular with politicians and government officials in the 1980's and early 1990's seems to have been shelved. The clamour for making another specific target has lost steam and the new catchword is Kenya's march towards "industrialisation by the year 2020". It is important to note that the Water Act was launched for national adoption and implementation in 1999.





## **2.6** Study Sites

In order to gain the best understanding possible of the domestic water use and environmental changes that have taken place in the past 30 years, DOW II study revisited the same research sites studied during DOW I. In Kenya a total of 12 sites were studied, six situated in rural areas and six in urban areas.

### **2.6.1** Rural Sites

#### **2.6.1.1** Mutwot

Mutwot is situated in Nandi District, along the Eldoret -Kisumu road. It lies on 340E Longitude, 100N Latitude, and at an altitude of 1800 metres on a plateau characterised by small hills. Mutwot is occupied by the Nandi, a sub-Kalenjin ethnic group. Economically, the Nandi are still a livestock owning community with a settled way of life. The common breed of cattle is produced through cross-breeding the traditional stock with exotic breeds. Inhabitants also keep goats and sheep on a small-scale.

In addition to keeping livestock, the Nandi grow maize and wheat in large plantations for commercial purposes. The timber industry is another major source of income; wattle trees, cypress and blue gum being the common species. Small-scale businesses are a main preoccupation in the retail market centres of Mutwot and Mosoriot. A number of people are employed in transport, owning public service vehicles which link Mutwot to neighbouring towns like Kisumu, Eldoret and Kapsabet.

Mutwot is situated in an area of high rainfall and hence has several water sources including wells, streams and rivers. Wells are the dominant water source and a good number have been fitted with handpumps. The Mutwot River is mainly used for watering cattle, washing clothes and bating, although some families without wells use water from this river for drinking.

The river is slowly drying up due to environmental degradation on its banks and in its catchment area. Families with corrugated iron-roofed houses collect rainwater and store it in tanks for drinking purposes for they consider it to be pure. Only a few households have piped water, which is managed by the Ministry of Water Resources and pumped from the Kipkarren River, 10 kms away.

### 2.6.1.2 Moi's Bridge (Hoey's Bridge)

Moi's Bridge is in Trans-Nzoia District, along the Eldoret-Kitale road. It is occupied by several ethnic groups, including the Luhyas, Nandi and Kikuyu, but Luhyas are predominant. Like Mutwot, Moi's Bridge is a plateau area.

The people of Moi's Bridge are farmers and grow maize in big farms (up to 10,000 acres) for domestic and commercial purposes. Wheat is also grown on a large-scale. It is worth noting that this area was previously occupied by large-scale farmers. Dairy cattle are kept to supplement crops.

People living in the town centre practice small-scale business. The area is well served with good tarmac roads for transporting agricultural produce from the farms to industry and other markets. There is also a major grain storage facility serving the region. Moi's Bridge receives a high level of rainfall throughout the year and as a result does not experience water shortages. The common water sources are wells and boreholes, protected from agents of pollution. Almost all the households interviewed had their own well within the compound from which water was obtained using hand pumps. Rivers are used for watering animals and for vegetables. Others have made small-scale dams for their animals.

Of the unpiped sites studied, Moi's Bridge had the highest average per capita water use as majority of the people had access to water from their own wells. This finding is in contrast to that of Drawers of Water I, when it was found to have the lowest usage. On the lower part of Moi's Bridge, residents have benefited from a piped water project, funded by Sida in 1983.





| Site Number | Number of Households | Location | Slope per km² | Land use | Ethnic group | Water Sources |
|---|---|---|---|---|---|---|
| 11 | 21 | Kiambaa | 3-5° | Plantation farming and mixed farming Residential area | Kikuyu | Handpump wells streams, springs and Dama |
| 13 | 32 | Mukaa | 3-12° | Subsistence | Kamba | Springs, streams, shallow water, dams, standpipe and rain harvesting |
| 14 | 30 | Masii | 3-5° | Mixed Farming tea, coffee and livestock | Kamba | Dams, springs, rivers, boreholes and rain harvesting |
| 15 | 8 | Manyatta | 3-12° | Plantation farming & livestock maize and wheat | Embu | Springs and streams |
| 16 | 32 | Moi's Bridge | 0-3° | Plantation farming and livestock maize and wheat Residential areas / small business | Mixed Luhya Nandi and Kikuyu | Handpump wells Streams |
| 17 | 26 | Mutwot | 0-5° | Residential area / small scale business | Nandi | Stand pipe |

**Table 2.1** Description of Sampled Unpiped Rural Sites

| Site Number | Number of Households | Location | Slope per km² | Land use | Ethnic group | Water Sources |
|---|---|---|---|---|---|---|
| 18 | 1 | Mathare | 3-5° | | Urban Africans | Standpipe |
| 41* | 5 | Makadara | Less than 3° | | Urban Africans | |
| 12 | 11 | Karuri | Less than 3° | Subsistence farming | Mixed but Kikuyu are dominant | Standpipe |

**Table 2.2** Description of Unpiped Urban Sites

*This site was considered 'piped' during Drawers of Water I, therefore it is not used when directly comparing DOW I and DOW II values.

### 2.6.1.3 Manyatta

Manyatta is in Embu District, on the slopes of Mt. Kenya. It is between Longitude 310-360 E and spans an altitude of 1650 to 1850 metres. It is occupied by the Embu people who are predominantly farmers, growing cash crops like tea, coffee and macadamia nuts. Tea is the dominant cash crop. Livestock is also kept but on zero-grazing. Vegetables are grown along the rivers for domestic use and the surplus is sold in the nearby markets.

Due to its location on the slopes of Mt. Kenya, Manyatta has a good water supply (since gravity causes the water to flow from the mountain). With the help of agencies like Sida and the Ministry of Water Resources, the community have tapped this water source and supply it to households. Unlike in 1967 when Manyatta was unpiped, more than three quarters of all households interviewed had piped water connections. Manyatta has thus had the greatest achievement in terms of changing from unpiped to piped. The piped water is managed by the community through a set of user-committees. Other water sources are springs and streams.

Three quarters of sample households in Manyatta have piped water supplies, which they use for watering livestock as well as domestic purposes

### **2.6.1.4** Kiambaa

Kiambaa is situated in Kiambu District, about 50 kilometres north east of Nairobi city. It is occupied by the Kikuyu and is predominantly a farming community. The main source of income is coffee grown in large plantations. Food crops like maize, beans and potatoes are grown on a small-scale for domestic use and if there is a surplus, are sold in nearby markets. Dairy cattle are kept but are zero-grazed. Vegetables are grown by those living near rivers and those with piped water connections. Transport is another source of income for people who own public service vehicles which ply between Kiambaa and Nairobi and other neighbouring towns.

Kiambaa is within the former White Highlands and receives abundant rainfall throughout the year. There are several water sources including rivers, streams, springs and dams. The common water sources are hand-pumped wells. Some households have piped water which is pumped from a dam and the consumers pay a flat rate of Ksh.100 per month.

There are several rivers, e.g. the Rui-Ruaka, from which those living nearby fetch water for domestic use.

Roof catchment is another source of water supply; rain water is collected and stored in tanks and drums for drinking. Due to its proximity to Nairobi City, Kiambaa enjoys a good infrastructure network, especially roads.

### **2.6.1.5** Masii

Masii lies approximately 80km to the south east of Nairobi, along the Machakos-Kitui road, in the dry areas of Machakos District. Masii is occupied by the Kamba who are mainly subsistence farmers, growing food crops like maize, beans and cow peas. Oranges are the major cash crop and are sold at the Masii market and in other towns like Machakos and Nairobi. Coffee is grown in a few parts of Masii. People living near streams also grow vegetables. To supplement farming, dairy cows are kept, but on zero-grazing. Milk is sold to the Masii Co-operative Society. Some people operate small businesses like shops, handicraft, repair work and water vending in the town centre.

Masii has the best housing of all the rural sites, comprising permanent stone houses, frequently served with electricity and telephone services. However, little has been done in terms of developing water services.

Masii is situated in a dry area with rainfall that is below average. Due to this, water shortages during the dry season are a major problem. For the last 30 years, almost nothing has been done by the government or NGOs to improve water supply. People still use the natural water sources (dams, springs and rivers) they were using during DOW I. A few households use boreholes. Dams are the dominant water source and each village has its own dam. The dams are perennial.

The majority of residents use rainwater, which is collected and stored in large brick tanks for domestic use. Otherwise, they still walk long

distances (3 to 4 kms) in search of water, which is of poor quality anyway. In a way, Masii provides a good representation of the general findings of this study - a mixture of success and failure in an intriguing sense that often cannot be described without recourse to a combination of interdisciplinary factors.

#### 2.6.1.6 Mukaa

Mukaa, like Masii is situated in a dry area, 80 kilometres from Nairobi, along the Salama-Nunguni road off the Nairobi-Mombasa Highway. Mukaa is a hilly area and is occupied by the Kamba who depend on subsistence and cattle farming for their livelihood. Food crops including maize, beans and peas are grown. Coffee is grown by a few people who sell it to a cooperative society. The timber industry provides income for those living on the Kilungu hills.

Those living along the streams, e.g. the Kaketa Stream, use stream water to grow vegetables and French beans. In the market centres, people operate small businesses like water vendoring, shops, bars, restaurants, repair work and private health centres.

As was the case 30 years ago, the residents of Mukaa continue to use natural water sources (springs, streams, and dams). These sources are not protected from agents of pollution. However, there has been considerable development in rainwater catchment. Almost all the households interviewed use rainwater, but lack big storage tanks and hence the water collected only lasts three months after rains. With the erratic rainfall seasons, this source is not reliable.

Self-help groups have been digging shallow wells to supplement natural sources during dry periods but the water is salty. A major donor funded water project (Kilimanjaro) managed by the National Water Conservation and Pipeline Board passes through the area, but local people were said to have been denied access to this.

### 2.6.2 Urban Sites

A total of six urban sites were studied, five located in Nairobi and one, Karuri is in Kiambu District. In Nairobi, the City Council is the sole provider of piped water to these sites.





| Site Number | Households | Location | Housing density | Ethnic group | Water Source |
|---|---|---|---|---|---|
| 11 | 9 | Kiambaa | - | Kikuyu | Piped water |
| 13 | 3 | Mukaa | - | Kamba | Rain water harvesting |
| 14 | 2 | Masii | - | Kamba | Rain water harvesting |
| 15 | 24 | Manyatta | - | Embu | Piped water |
| 17 | 6 | Mutwot | - | Nandi | Piped water |

**Table 2.3** Description of Sampled Piped Rural Sites*

*All these sites (plus Mathare Valley Site 18 in following table) were considered 'unpiped' sites during DOW I and therefore are not used when directly comparing DOW I and DOW II values.

| Site Number | Households | Location | Housing density | Ethnic group | Water Source |
|---|---|---|---|---|---|
| 18 | 29 | Mathare | very high | Urban African | Piped water |
| 31 | 21 | Karuri | medium high | Urban African but Kikuyu are dominant | Piped water |
| 38* | 36 | Spring Valley | very low | Europeans Asians and few African | Piped water |
| 39 | 26 | Parklands | medium low | Asian and Africans | Piped water |
| 40 | 30 | Pangani | medium high | African and Asians | Piped water |
| 41 | 20 | Makadara | high | Urban African | Piped water |

**Table 2.4** Description of Sampled Piped Urban Sites

*Spring Valley was not included in the comparison since it was not possible to obtain collaboration from households in that site during the field surveys.

#### 2.6.2.1 Mathare

Mathare is on the eastern side of Nairobi. It is a slum area with unplanned housing settlement. It is densely populated with a correspondingly high density of housing. The population comprises Africans of mixed ethnic groups who are generally poor and unemployed. Some residents work in the industrial area as labourers while the majority operate small-scale informal businesses.

The houses are made of mud and tin roofs, are dirty and overcrowded with poor sanitation. The rooms are very small and residents share facilities such as toilets. Due to the high level of poverty and unemployment, Mathare experiences a high level of crime.
The City Council, with assistance from NGOs, has provided private water to the area, which is sold at water kiosks. Some houses do have direct water connections. The water supply is, however, erratic and poorly organised.

### 2.6.2.2 Pangani

Pangani is near Mathare but, in contrast to the latter, has well-planned housing. It contains a medium to high density of housing. Asians are the main inhabitants, followed by Africans. African families occupy small rooms and share facilities (e.g. water, toilets and bathrooms), while Asian families occupy individual houses with garages and servant quarters.

The residents of Pangani are predominantly businessmen and women, professionals and government officials. In terms of water provision Pangani enjoys a good supply of water compared with Mathare and Makadara.

Pangani has well-planned, modern housing catering to professionals and civil servants

### 2.6.2.3 Parklands

Parklands is a prosperous area, situated on the northern side of Nairobi City. It is occupied by a majority of Asians, followed by Europeans and Africans. The residents are high income earners, working as government officials, directors of big companies and running businesses.

Parklands has a medium to low housing density with large clean houses and flower gardens, lawns, garages and servant quarters. Families live in individual houses and there is no sharing of facilities. Each house has several taps (ranging from three to eight) plus several bathtubs and water heaters. Some households filter the water they receive from the City Council because they perceive it to be of low quality. The estate has a good drainage and waste disposal system. Water consumption is high due to the existence of flower gardens, lawns, cleaning of houses and cars. Almost all residents have private cars.





### 2.6.2.4 Spring Valley

Spring Valley is on the northern side of Nairobi and borders Parklands. It has a very low housing density, with houses comprising half-acre compounds or more. Spring Valley is occupied by Europeans, Asians and a few wealthy Africans. It contains houses for the staff of Embassies, international NGOs and the United Nations. Most houses are privately owned. Spring Valley is clean with a well-planned drainage and garbage disposal system.

The housing structures resemble those of Western Europe and have flower gardens, garage, lawn and big servant quarters. Landscaping is a pronounced feature in the residential area. Houses have many water taps (up to 17) with swimming pools, bathtubs, heaters and automatic water sprinklers. The estate is well supplied with water from the City Council. However, some households filter the water to improve its quality while others use mineral water for drinking. In order to supplement their high consumption, several households buy additional water from private tankers.

Some households enjoy regular supplies of piped water in wealthy areas such as Spring Valley

### 2.6.2.5 Karuri

Karuri is situated in Kiambaa Division of Kiambu District, 20 kilometres from Nairobi City. The majority of residents are Kikuyu. Karuri town offers residence to people working in Nairobi and its

surrounding towns. The majority of residents are businessmen and -women, and others are professionals. Some young men work in the transport sector as drivers and touts in public service vehicles. Others run businesses in Karuri town, such as shops, bars, vegetables selling, operating garages for repair work and water vending.

Karuri is served with piped water from a borehole run by the Karuri Town Council. Water is pumped to connected households who pay a flat monthly rate. The supply is, however, erratic. There are also private bore-holes which provide water to residents at a fee of Ksh.5 per 45 litre jerrican. To supplement the water from bore-holes, people collect rain water for drinking.



## Site Maps

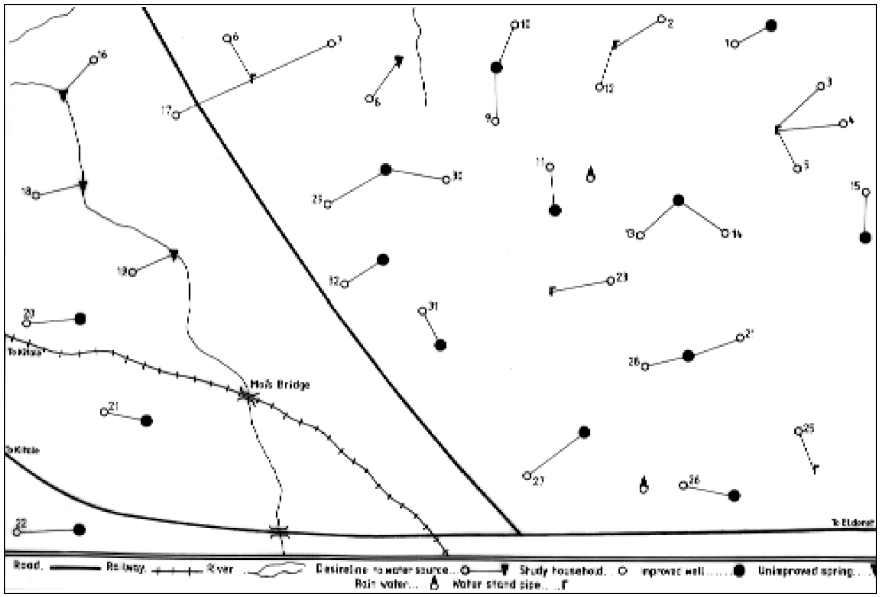



**Figure 2.2** Moi's Bridge (Hoey's Bridge)

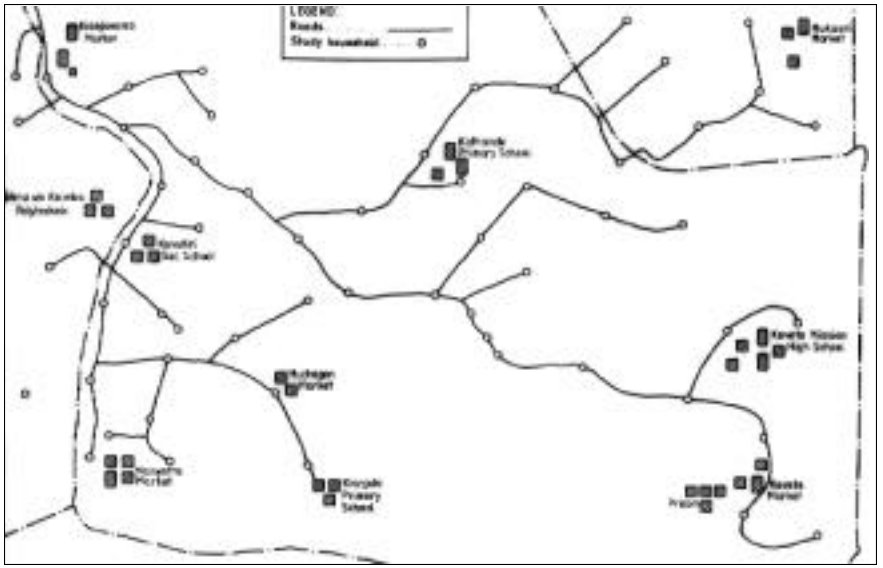


**Figure 2.3** Manyatta

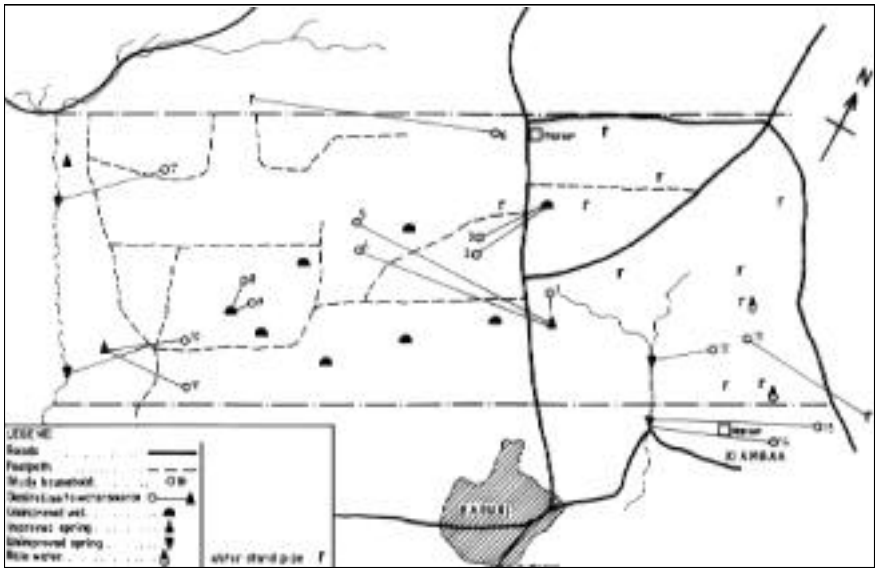



Figure 2.4 Kiambaa

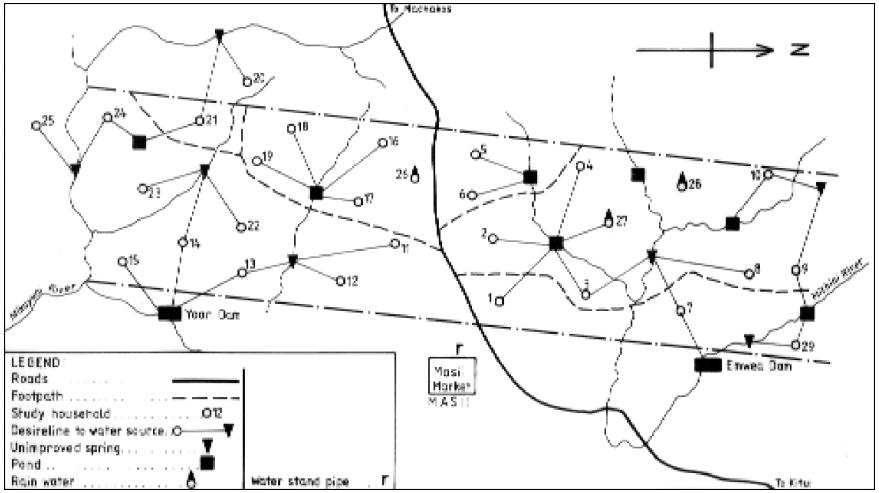



Figure 2.5 Masii

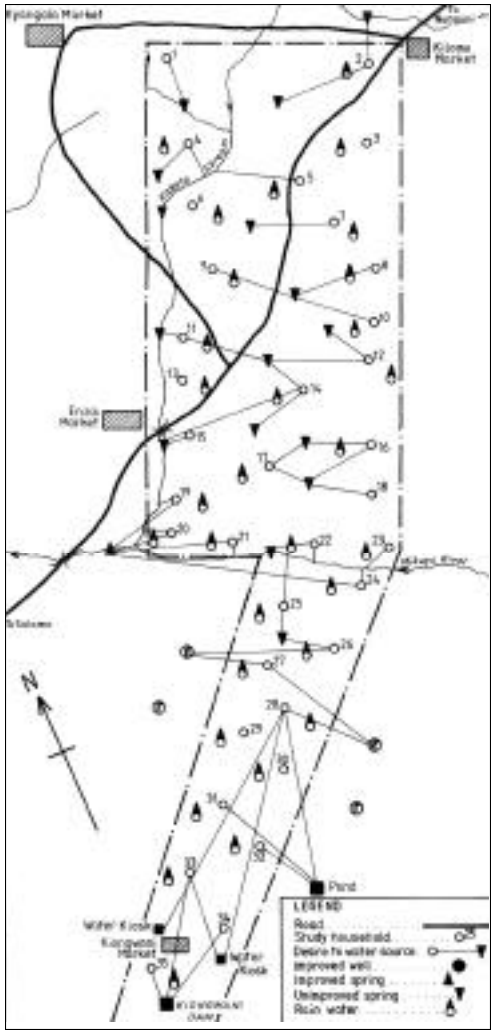



Figure 2.6 Mukaa

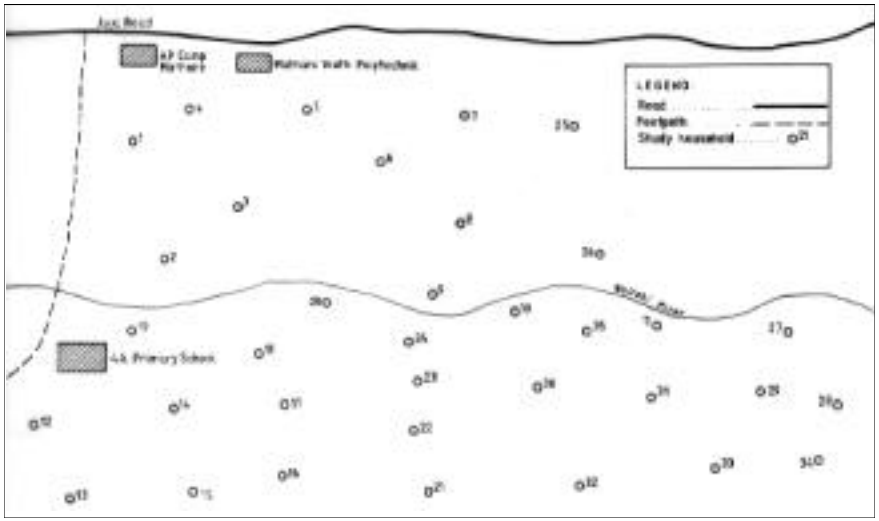



Figure 2.7 Mathare

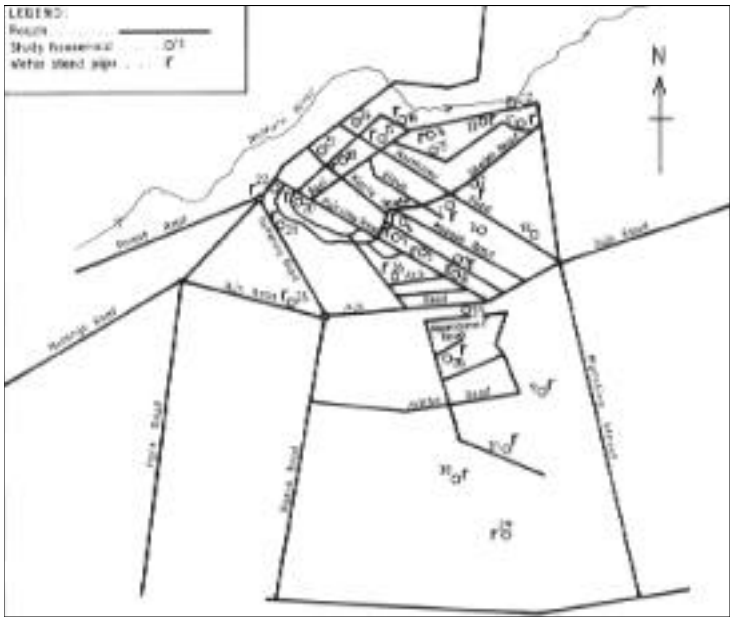



Figure 2.8 Pangani



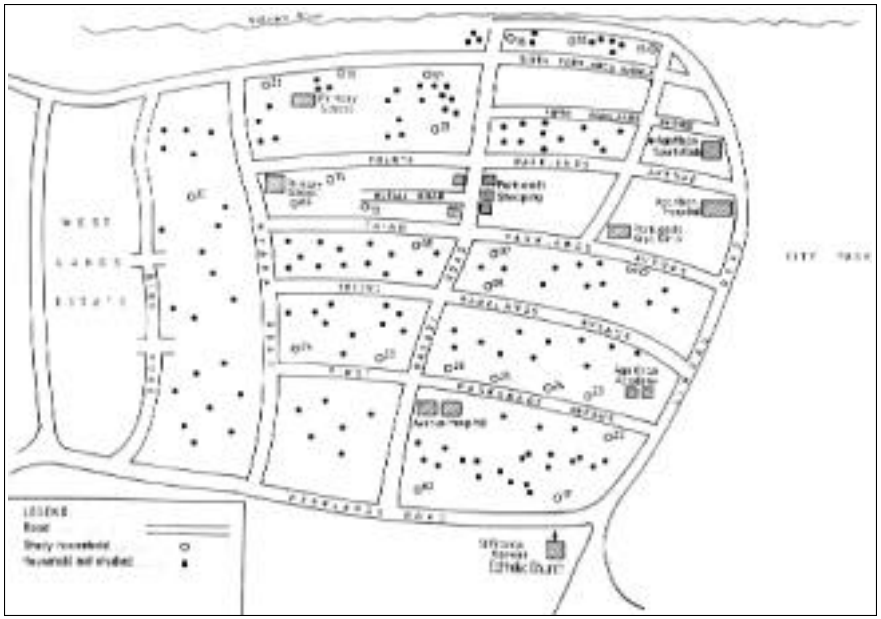



Figure 2.9 Parklands


Figure 2.10 Spring Valley

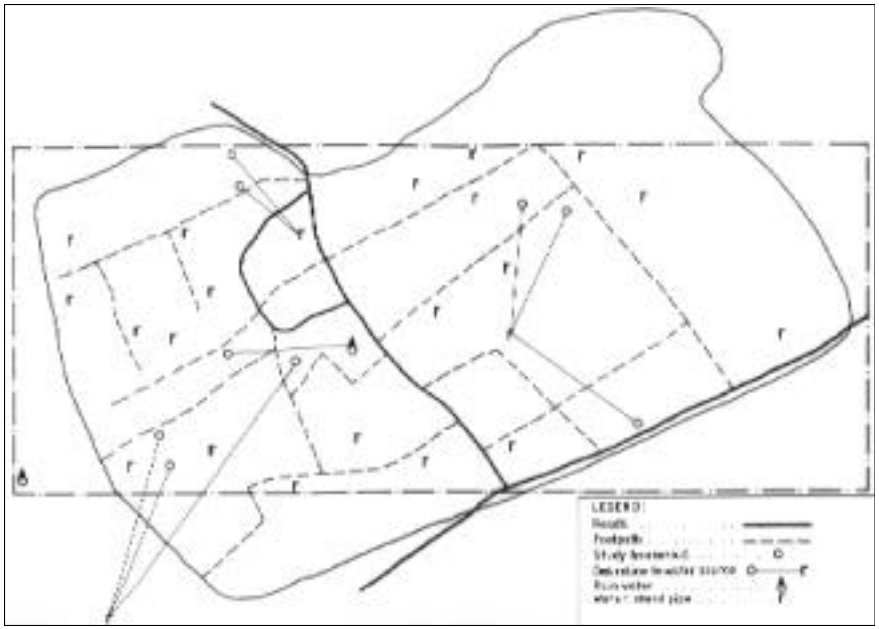


Figure 2.11 Karuri

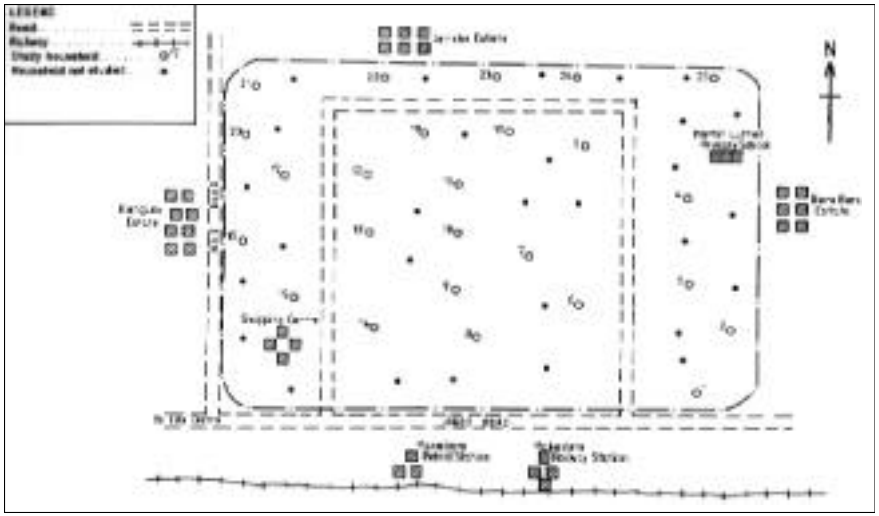


Figure 2.12 Makadara



# 3 Methodology

## 3.1 Field Survey Methods

The original Drawers of Water study used particular techniques for the recruitment of field assistants and collection of data, and also for deciding what data was to be collected in each household. DOW II set out to apply the same methods used in DOW I to the extent possible.

In DOW I, 13 undergraduate students from the University of East Africa (Makerere) who spoke the local languages found at the field sites conducted the interviews, measurements and observations on water use. In DOW II, however, the field assistants were university graduates from a range of disciplines drawn from the three countries. As in DOW I, the field assistants in DOW II returned to their home areas where they had knowledge of the local language, culture and environment. In both studies, fieldwork was conducted over a period of three months at a specific time of year; DOW I from April to June 1967, and DOW II from May to July 1997. This period falls shortly after the rains, a factor that was considered crucial as it meant that there would be an abundance of potential sources from which users could obtain their water. In Drawers of Water I and II, field assistants were trained by senior researchers and memorized survey questions. In the field, they conducted semi-structured interviews, made observations, measured the distance and slope to water sources and completed site description forms after interviews. For each household, data were collected on domestic water use, household characteristics, sources of water and conditions of use.

## 3.2 Field Methodology in Rural Unpiped Areas

In DOW II, depending on the availability of proper maps, sampling was carried out in one of two ways. Where maps were available, e.g.

Kiambaa, Karuri and Manyatta sampling was similar to DOWI and a selected sample of households, using a grid of 21 to 27 cells over an area of three square miles, was taken. A point within each cell was selected by using co-ordinates of random numbers. The household nearest the point was then chosen for the interview, and selection systematized from that first household.

In cases where it was not possible to obtain proper maps, the field assistants referred to the maps used in DOW I to help in identifying the study area. For example, a feature (e.g. a river, market etc) from the 1966 map would be identified and then the field assistants would try to find out whether that feature still existed. Once identified, the feature would be used to designate the boundaries of the study area. A point within these boundaries would then be chosen as the starting point. Interviewing began with the household nearest to this point, and a further random sample of households from this point selected until 30 to 35 households had been interviewed.

The choice of starting point was based on accessibility to it in relation to central facilities like markets, churches, health centres, water sources and general conveniences. Having identified this point, in some sites - like Mukaa, Moi's Bridge, and Mutwot - the field assistants went further and counted all the households in the identified area. Every tenth household was then selected for interview and observation.

In Masii, on the other hand, sampling was done with the assistance of a contact person who listed the names of the people within the identified boundaries. The field assistant then chose at random one household from the list as a starting point and then every tenth household.

In all cases, the respondent requested to speak with the main drawer of water. If the drawer was not at home, the field assistant returned later at a time convenient to the respondent. In cases where the selected respondent refused to talk to the field assistant, the household was substituted with the immediate neighbour.





In addition to completing the questionnaire, the field assistant had to stay in the household from morning to evening in order to observe and document all the uses of water and trips to the source. While this elaborate data collection procedure was useful for the study teams, often the owners of the households felt restricted while others bluntly said that it interfered with their freedom and confidentiality. However, they tolerated the researchers.

## **3.3** Data Collection in Piped Areas

The sampling method used in DOW II was the same as that used in DOW I. As with the unpiped survey, in four of the five sites in Nairobi (within areas of similar housing density), systematic random sampling was used with every tenth household selected, beginning at an arbitrary point. Different questionnaires were used for households with and without piped water, the questionnaire for the latter being much longer.

In anticipation of reluctance to participate in interviews (as often encountered with urban residents), the field assistants were issued with an introductory letter to show to respondents. A formal letter of this kind lends credibility to the researcher as well as providing respondents with a clear explanation of the study. While this method of introduction was accepted at most sites, it was not sufficient in Spring Valley where the field assistant was turned down in almost all households visited. Thus, in Spring Valley an alternative method had to be adopted which involved sending letters to the selected sample of 36 households, outlining the objectives of the study and requesting them to avail themselves for interview at a time convenient to them.

AMREF telephone numbers were included in the letters so that people who wished to could call and fix an appointment with the field assistant. With the help of an AMREF vehicle, the letters were then delivered to the various households. This revised method worked well.

## **3.4** Field Observations

In both rural and urban sites, sensitive questions, which could make respondents uncomfortable or embarrassed, were avoided where possible. Data on sensitive issues, e.g. number of children,

possession of latrine, and hygienic state of the latrine/toilet, were instead collected through observation. Such question areas had been explored in detail during training and field assistants were asked to exercise their own judgement given that they would be interviewing people from their own communities and ethnic groups.

In the urban piped sites, to enable calculation of the cost of water per litre, metre readings covering three months were obtained from the Nairobi City Council and an average usage calculated. Although this information was very useful to the field assistants in calculating the cost per litre, the billing system used by the City Council was highly unsatisfactory to consumers. Some consumers had inflated bills while others had not been billed for months despite requesting them. Obtaining accurate individual metre readings was made difficult in cases where households were renting blocks in new high-rise buildings in which rent was inclusive of water.

## **3.5** Participatory Research

The second phase of DOW II focused on the changes that have taken place in four out of the twelve sites. The sites selected for the participatory research were Mukaa, Manyatta, Mutwot (all rural) and Makadara (Nairobi-urban). Each of these four sites was selected purposely to allow for deeper qualitative analysis as to why particular positive or negative characteristics of change had occurred before DOW I (1966) and DOW II (1997). These changes were derived from the quantitative study in 1997.

In Mukaa, it was established that serious pressure had led to significant reduction in stream and spring flows. The mean per capita daily water use was found to be only 12 litres, and households had remained largely unpiped. Manyatta, on the other hand, was found to have an elaborate and well functioning privately managed, piped water system and effective community based water users association, thus transforming the site from unpiped site in DOW I, to a piped site in DOW II, and on an increase in per capita water use. The people appeared satisfied with the services and paid both connection and regular services fees.





Unlike Manyatta, Mutwot, which also lies in a prosperous agricultural area, had not realized any significant changes in domestic water use and environmental sanitation since 1966. Although various development interventions by the Government and NGOs have been put in place, the people have not organized themselves and hence have seen limited technological improvement in water supply. Most people still relied on traditional water sources with Mutwot River being the major source of water.

Some sites have seen only limited technological improvements in water supply in 30 years, such as parts of Mutwot

Finally, Makadara, the only urban site, was preferred as it epitomised the decline of urban infrastructure characteristic of Kenya in the 1990's. An increase in high-rise medium-density housing units that have replaced government owned blocks have occasioned a decline in the per capita water use. The site, in addition, suffers from regular water shortages, and some housing units have become unpiped.

### 3.5.1 Community entry and selection of study groups

In Manyatta, the team was preceded by the researchers from the area, who armed with a letter of introduction met the local administration. The letter was copied and with the Chief's invitation letter was sent out to churches and coffee/tea buying centres. The point-of-entry to the community were churches and organised coffee/tea buying centres where groups of local people met.

In Mukaa, the researchers for the area had little difficulty as the Chief (local administrator) on receiving the letter of introduction quickly took it upon himself to inform and mobilise the people for the necessary meetings. The situation was different in Mutwot where it was a lot more difficult to mobilise people due to thier rain involvement in planting at that time. However, the services of a respected retired chief of the area, messages were quickly spread to the community, with Mutwot market as the main communication centre. The youth were particularly useful in mobilising the people in Mutwot.

No one was served with the introduction letter in Makadara, as the administration in the area was perceived not to be so close to the people. The researchers instead elected to mobilise residents on their own, with limited support of kiosk owners and hawkers. The political situation in Nairobi did not help the situation and suspicions ran high on persons carrying out in research. The mobilisation of the people was in this context reasonably low key.

### 3.5.2 Getting going in the study sites

In almost all cases, the meetings with local informants began with a presentation of the DOW II phase I research findings, and always ended with people admiring and receiving photographs which had been taken during that period. This seemed to establish greater rapport and trust, thus making further appointments easier.

During this introductory meeting a short question and answer session often ensued in which the study team clarified reasons for the second phase of the study. The community representatives with assistance from the researchers then drew a program of activities to cover the rest of the day, and if necessary the following day. It should be noted that the selection of villages and meeting dates were established prior to the arrival of the research team. This was done by the advance research team and the local leadership in each respective community.

In all cases, the meetings with the communities were determined by the local people in order to take into account their busy daily schedules. The meetings with various individuals and groups were always determined by the local people as the researchers resided in the area and were available any time as suggested. This flexibility ensured that the researchers and community members had time to interact informally and learn more from one another.

### 3.5.3 Participatory Research Techniques

The number of techniques and tools used in a community depended on the creativity of the research team, and on the type of data to be collected. There were many incidences where the community took control of the process, and with experience the researchers innovatively let go and changed to the next technique without disrupting the flow and enthusiasm. This way the data collection process remained dynamic and interesting to the people.

Women prepare a seasonal calendar of water availability and use in Makadara, Nairobi

The various participatory data collection tools and techniques used are listed below:

- Introduction group meeting
- Community maps
- Focus group discussions
- Pairwise ranking/priority setting
- Daily activity charts or daily routine
- Matrix scoring
- Venn (chapati) diagrams
- Transect walks
- Semi structured interviews
- Key informant interviews
- Time lines
- Time trends
- Seasonal calendars
- Flow diagrams
- Cause and effect diagrams
- Mini-case studies
- Informal discussions
- Observations
- Stories
- Songs

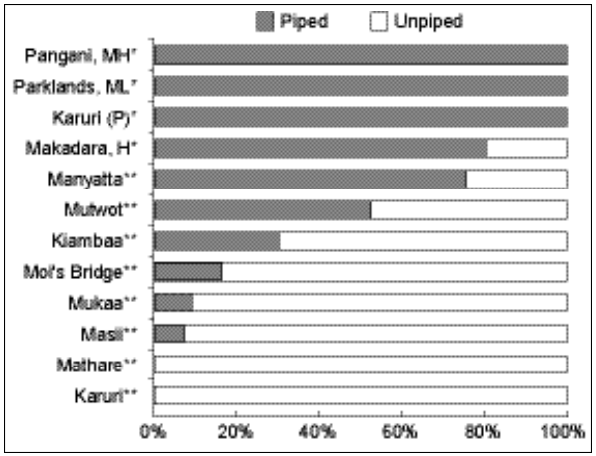
In addition to these data collection techniques, secondary data from public institutions, records, reports and other literature was collected to help clarify particular aspects. Of special interest to our team was the incidence of waterborne/related diseases recorded in the nearest public health centres.

We recognize the discrepancy that may exist since such figures do not necessarily reflect the actual local situation either due to under reporting or overestimation as participants come from far and wide. We considered this information nonetheless a good indication of the health situation.



# **4** Research Results and Discussion

Through observation at sites and analysis of the data collected, it has been clear that a number of changes have occurred over the past 30 years. These changes have not always been positive. One of the major changes is the existence of mixed types of water services at site level. One positive aspect is that some households living in sites considered as "unpiped" during DOW I now have access to piped water (Makadara, Manyatta, Mutwot, Kiambaa, and to a lesser extent, Moi's Bridge, Mukaa and Masii (Figure 4.1)).




* These sites were all piped during DOW I. * * These sites were all unpiped during DOW I.

**Figure 4.1** Drawers of Water II
Percentage of Piped and Unpiped Households in Sample

## **4.1** Socio-Economic Issues

Economically, there have not been significant changes in the majority of sites. Just like the time of DOW I, the major economic activities in Masii and Mukaa are subsistence farming and livestock keeping. Lack of grazing land, has resulted in a reduction in the number of livestock and people have turned to zero-grazing of dairy animals. In addition to the crops grown during DOW I, like maize and beans, new crops are grown which provide both food and cash. New crops include oranges in Masii, and vegetables and coffee in Mukaa. Manyatta has seen a tremendous shift to cash crops such as tea and coffee which have transformed the earning ability of the local people. This increase in cash farming may partly explain the changes from unpiped to piped water by a majority of the households interviewed in these areas.

Households in Mukaa use water for productive, as well as domestic purposes





Small businesses, which supplement income from agriculture, have sprung up in the market centres in practically all sites. Businesses include shops, repair work, welding, carpentry, curios, and water selling through vendors and kiosks. Social amenities and infrastructure in the rural areas have also improved. Primary and secondary schools, and health centres (private and public) have increased. Churches, mosques and other worship centres have also increased in number and some provide water supply to the community, e.g. the Masii and Kiongwani Catholic churches in the Masii and Mukaa sites respectively.

In Kiambaa, during DOW I subsistence and cash crop farming were the main economic activities. This still applies today, as coffee is now grown by both the wealthy individuals on a large-scale as well as on small-scale by the small farmers. It was also observed that the wealthy farmers, who have dug wells fitted with hand pumps, utilize the water for vegetable growing for domestic and commercial purposes. Some individuals have begun to sell water, using donkeys and hand-drawn carts. Since Kiambaa is well served with a good infrastructure network (including all weather roads), and due to its nearness to the city of Nairobi, transport has also become an important economic activity.

In Moi's Bridge and Mutwot, farming is the main occupation for most residents. Maize, beans and wheat, for domestic consumption and cash, are grown in large-scale in both areas. Livestock for dairy and beef are kept in large numbers. Small business in the market centre is a dominant activity. However, Mutwot market was found to be degenerating with many shops having closed down. Infrastructure in both areas is well organized with a tarmac road and feeder roads linking farmers with major towns. The town of Eldoret, which is near both sites, has grown tremendously in the recent past and now has a range of facilities, including an under utilized international airport, thereby offering great potential as a regional market and outlet for international trade.

## **4.2** Per Capita Water Use

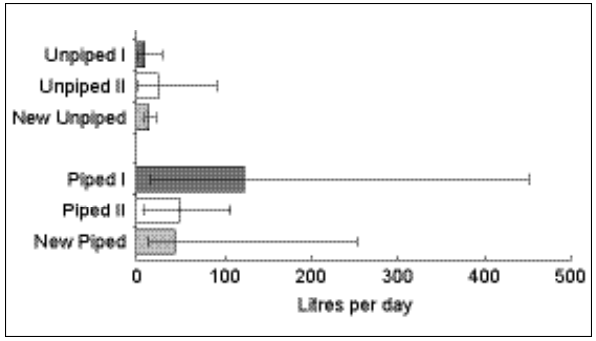
Per Capita water use differed greatly depending on whether or not the households had piped connections or not. At first glance, it is striking the way in which the levels of per capita water use have varied in Kenya since the original study in 1966 (Table 4.1). Piped households experienced a decline of over 60 percent its DOW I levels, from 121.6 to 47.4 litres per day. On the other hand, levels of water for unpiped households increased for 8.3 to 23.5 litres per day, almost three times as much its DOW I levels. During DOW II, the difference between water used by piped and unpiped households was significant though not as striking as in DOW I (Figure 4.2).

Table 4.1 Mean Per Capita Water Use in Kenya (litres / day)

| | | Mean | Std. Deviation | Minimum | Maximum | Valid Sample |
|---|---|---|---|---|---|---|
| **DOW II** | SS Piped | 47.4 | 20.6 | 5.0 | 106.0 | 97 |
| | SS Unpiped | 23.5 | 18.6 | 1.3 | 90.9 | 158 |
| | New Piped | 42.7 | 36.3 | 12.5 | 251.0 | 70 |
| | New Unpiped | 13.5 | 4.3 | 9.5 | 20.0 | 5 |
| | **Total** | **34.4** | **26.3** | **1.3** | **251.0** | **330** |
| **DOW I** | SS Piped | 121.6 | 88.5 | 14.2 | 451.0 | 70 |
| | SS Unpiped | 8.3 | 4.5 | 2.3 | 27.3 | 161 |
| | **Total** | **42.7** | **71.3** | **2.3** | **451.0** | **231** |

*Note: SS means "same sites as in DOW I". "New Piped" are households with piped water supply located in sites considered as unpiped during DOW I. Likewise, "New Unpiped" are unpiped households located in sites considered piped during DOW I.

Figure 4.2 Mean per capita water use in Kenya




* Note: Black line represents the difference between maximum and minimum values.





### **4.2.1** Per Capita Water Use in Piped Households

A total of 70 piped households were studied during DOW I, in four urban centres. The mean per capita water use was 121.6 litres with a standard deviation of 88.5. During DOW II study 97 households were studied in the same sites, where the per capita water use dropped to 47.4 litres with a standard deviation of 20.6. There is a remarkable drop in per capita water use in urban piped household of more than in 60 percent (Figure 4.3).

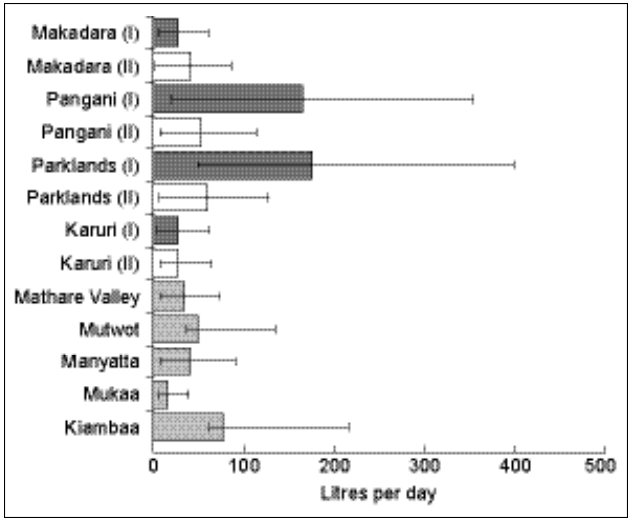



Figure 4.3 Piped Households: Mean Per Capita Water Use (litres / day)

* Note: Dark grey bars are DOW I observations; white bars are DOW II same sites, and light grey bars are newly piped households.

Several factors have caused this reduction, including population increases. Population in Kenya has more than doubled from DOW I to DOW II and the supply of water has been stagnant, a factor which has contributed to reduction in per capita water use. Poor maintenance of water infrastructure has resulted in high levels of water wastage through burst pipes reducing supply and then per capita consumption. These reasons have led once "piped households" during DOW I to become "unpiped" in DOW II.

Out of the four piped households in DOW I, Parklands had the highest daily per capita water use of 177 litres, followed by Pangani with 167 litres. Makadara had the lowest with 26.28 litres. In DOW II Parklands recorded the highest with 60.89 litres, followed by Pangani with 52.89 litres and Karuri showed the lowest per capita use of 28 litres per day.

### 4.2.2 Per Capita Water Use in Unpiped Households

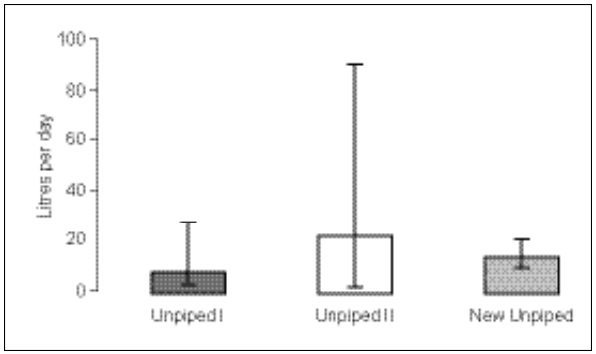
On average, households without piped water connection have experienced an increase in per capita water levels, from a low level of 8.3 to 23.5 litres per day (Figure 4.4). Moi's Bridge recorded the highest consumption levels, 45 litres per person, and Mukaa the lowest, 9.3 litres per person. Compared to DOW I of 1966, where 162 unpiped, household were interviewed the mean daily per capita water use was as low as 8.3 litres. With a Standard Deviation of 4.44 in 1966, Mathare had the highest per capital water use of 11.32 litres followed closely by Kiambaa with 11.08 litres. Masii had the lowest consumption of 6.9 litres per person (Figure 4.5).

There have been significant changes in per capita water use since Drawers of Water I, with some sites having slight increases (e.g. Mukaa and Masii) while other have witnessed tremendous increases (e.g. Moi's Bridge, Manyatta, Kiambaa and Karuri).

Masii had the lowest per capita water use of all study sites, but technical assistance from a local NGO is helping address storage problems

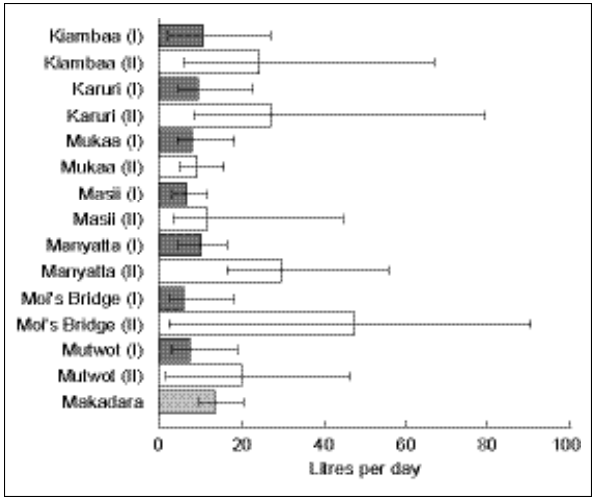







Note: Dark grey bars are DOW I observations; white bars are DOW II same sites, and light grey bars are newly piped households.

Figure 4.4 Average Per Capita Water Use, DOW I-DOW II (litres / day)




* Note: Dark grey bars are DOW I observations; white bars are DOW II same sites, and light grey bars are newly piped households.

Figure 4.5 Average Per Capita Water Use by Site, DOW I-DOW II (litres / day)

## **4.3** Cost of Water

The nature and complexity of the costs faced by households in East Africa to obtain water differ greatly, especially when water source comes into play. Households with piped water supply simply pay a fee to the service provider, which could be a block or flat rate, a proportional rate (according to consumption), or a residential rate.

The direct cost of water is a more complex situation for households without water connection. It usually involves a direct cash price paid at the source, as well as the time and energy expended in travelling to and from the source, queuing for water and carrying it home. In addition there is the opportunity cost of activities that individuals could be doing if they were not collecting water which, as we discussed before, could be two hours everyday for those drawers collecting water from kiosks.

Converting these costs into a comparable cash value is difficult. In Drawers of Water I, a cash value was derived through estimating the amount of energy used by each household, determining the amount of a staple food (maize) required to supply this energy and then calculating the price required to purchase that amount of food. This method has been repeated for Drawers of Water II to enable comparison of cost for unpiped households during DOW I and II, and although it is not perfect, it provides an idea of the relation of the cost with respect to the cost for piped water supply. . As it will be shown in the next sections, on average, the cost of water increased for households with piped connections and decreased for those without them (Figure 4.6). Monetary values from DOW I were converted into 1997 equivalents using the US dollar deflator. Although we recognize the limitations of this approach, it was the best available one since similar figures for Kenya (and the rest of East Africa) were not readily available.





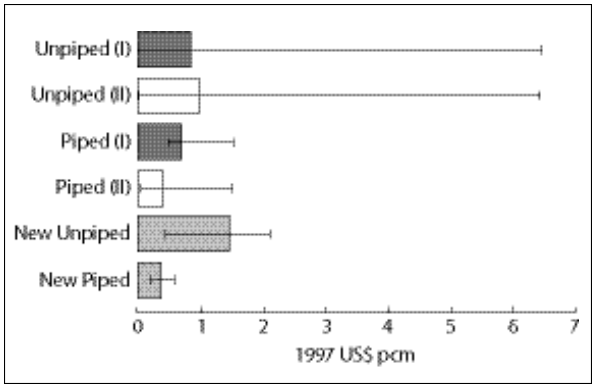



**Figure 4.6** Cost of Water (1997 US Dollars per cubic metre)

The methodology developed by Drawers of Water I to estimate the cash price of water for unpiped households has a number of shortcomings. For example, the opportunity cost of time is not included, and the use of the average price of staple food masks seasonal and inter-household variation.

* The dark line represents the difference between minimum and maximum values. Dark bars represent DOW I sites, white bars represent DOW II sites.

### **4.3.1** Piped Households

On average, households with piped water connections experienced a decrease in the average cost of water, from 0.7 US Dollars pcm during DOW I to 0.38 US Dollars pcm during DOW II. Households living in Karuri experienced the largest decrease, from 1.25 to 0.41 US Dollars pcm. The cost was approximately the same in Parkands, but decreased in Pangani and Makadara (Table 4.2).

| | | Mean | Minimum | Std. Deviation | Maximum | N |
|---|---|---|---|---|---|---|
| Karuri | DOW I | 1.25 | 1.02 | 1.54 | 0.18 | 15 |
| | DOW II | 0.41 | 0.06 | 0.79 | 0.21 | 16 |
| Parklands | DOW I | 0.53 | 0.52 | 0.58 | 0.01 | 16 |
| | DOW II | 0.46 | 0.10 | 1.52 | 0.39 | 25 |
| Pangani | DOW I | 0.56 | 0.52 | 1.28 | 0.14 | 30 |
| | DOW II | 0.39 | 0.17 | 0.49 | 0.08 | 28 |
| Makadara | DOW I | 0.58 | 0.58 | 0.58 | 0.00 | 9 |
| | DOW II | 0.30 | 0.12 | 0.51 | 0.13 | 18 |
| **Total** | **DOW I** | **0.70** | **0.52** | **1.54** | **0.31** | **70** |
| | **DOW II** | **0.38** | **0.06** | **1.52** | **0.22** | **148** |

**Table 4.2** Piped Households: Cost of Water (1997 US Dollar pcm)

### 4.3.2 Unpiped Households

As explained at the beginning of Section 4.3, obtaining the real cost of water for unpiped households is a very tricky and complicated matter. In order to compare values, the social cost of water was initially converted into the calories expended carrying water. This value included the trip from the house to the source and back carrying the load, and the time involved waiting at the source. The energy requirements were also adjusted for gender, age, body weight and container size.

Households in Mutwot paid the lowest cost for water as many have built their own wells or use those of their neighbours

Although the total calorific expenditure per household nearly doubled since DOW I (267.12 in 1967 and 421.9 in 1997), this change is largely due to the increase in water use, which involved more trips to the source. In fact, the average amount of calories spent to carry each litre of water did not significantly changed in Kenya since DOW I and even decreased, from 6.1 to 5.67 calories per litre.





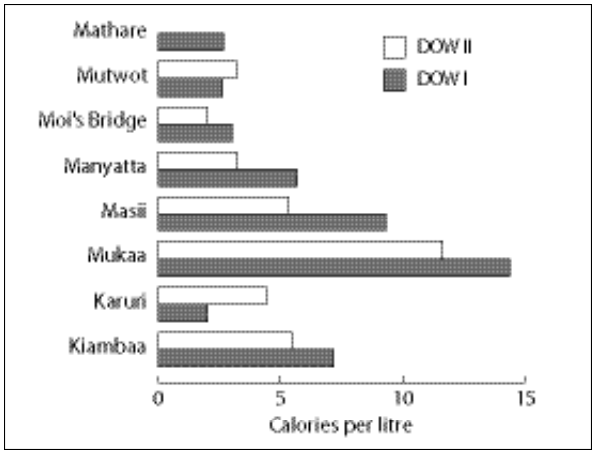



**Figure 4.7** Unpiped Households: Caloric Cost of Carrying Water (calories / litre)

* Note: Dark grey bars are DOW I observations; white bars are DOW II same sites, and light grey bars are newly piped households.

The long journey home: Mukaa and Masii recorded the highest energy expenditure in both studies

Mukaa and Masii recorded the highest energy expenditure both in DOW I and DOW II, using up to 14 calories per litre of water (Figure 4.7). The high requirement of energy is the result of walking long distances to the source. In fact, during Drawers of Water I households in these sites would have walked on average one kilometre (per trip) for water. Also, some of natural water sources near homestead used in

1966 dried up due to drought forcing people to cover longer distances. Population pressure and poor land uses has caused serious soil erosion making the slopes to water sources very steep hence high calorific expenditure.

Once the energy requirement was established, it was converted into a cash price by estimating the amount of a staple food (maize) required to supply this energy and then calculating the price required to purchase that amount of food (Table 4.3).

Households in Mutwot paid the lowest cost, approximately 0.2 US Dollars pcm, especially because sources were free (wells and springs), and relatively near-by. The cost per litre was considerably higher for households living in urban areas (Figure 4.8).

| | DOW I | DOW II |
|---|---|---|
| **Urban and Rural** | | |
| Cost of water (1997 US$ pcm) | 0.84 | 0.97 |
| Calories per Litre (energy)* | 6.11 | 5.67 |
| Time per Litre (minutes)* | 0.53 | 0.35 |
| Distance per Litre (meters)* | 16.53 | 7.00 |
| **Urban** | | |
| Cost of water (1997 US$ pcm) | 1.43 | 1.42 |
| Calories per Litre (energy) | 2.60 | 4.42 |
| Time per Litre (minutes) | 0.28 | 0.48 |
| Distance per Litre (meters) | 9.95 | 5.42 |
| **Rural** | | |
| Cost of water (1997 US$ pcm) | 0.76 | 0.93 |
| Calories per Litre (energy) | 6.33 | 5.77 |
| Time per Litre (minutes) | 0.54 | 0.34 |
| Distance per Litre (meters) | 16.94 | 7.12 |

**Table 4.3** Unpiped Households, average cost in 1997 USA Dollars, calories, distance and time ( DOW I and DOW II)

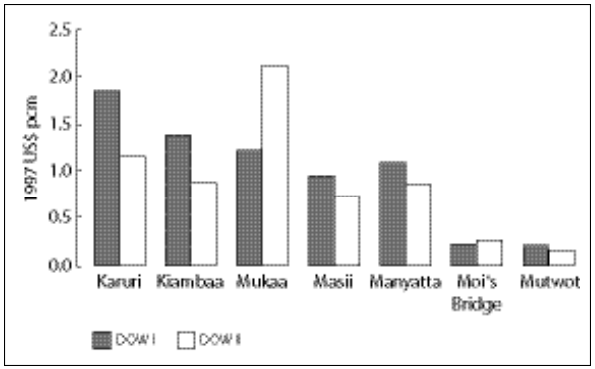



**Figure 4.8** Cost of Water for Unpiped Households by Site (USA Dollars pcm)



## 4.4 Primary Drawers

The issue of who draws water is closely related to gender roles, the responsibility of drawing water, for many years has been women's role. This is confirmed by the two studies in both cases (DOW I and II) women were the main drawers of water, followed by female and children (Table 4.4). There has been an increase in the number of males involved in drawing water from two in 1996 to nine in 1997 as illustrated by the table below.

**Table 4.4** Primary Drawers (Percent of Unpiped Households)

| | DOW II | DOW I |
|---|---|---|
| Female adult. | 43.4 | 82.2 |
| Female + children. | 34.0 | 8.3 |
| Children. | 1.3 | 1.9 |
| Male adult. | 5.7 | 1.3 |
| Male + female. | 8.8 | 3.8 |
| Male + female + children. | 6.9 | 0.6 |
| **Total** | **100** | **100*** |

*includes 2 percent for porter and vendors

## 4.5 Range of choice

Households without access to piped water supply rely on different sources to obtain their water than those with piped supplies. These sources range from unprotected springs and streams to standpipes, hydrants and private or independent vendors, and can be grouped into three broad categories:

1. Unimproved sources, such as springs, seeps, streams, rivers and lakes
2. Improved sources, such as wells (pumped or hand-pumped), and pipes from neighbours and/or buildings that serve as a water source.
3. Standpipes, kiosks and hydrants: These could be either public or private and might charge for the water.
4. Other paid sources, like vendors or independent providers, who deliver water directly to the home at a price.

In general, unimproved sources tend to be highly seasonal, leaving households prone to water shortages during certain times of the year. The positive aspect of these sources is that they are generally common-pool resources, meaning that local residents have usufruct rights to the water (i.e. the right to use the water at no charge, provided

[1]Many scholars have made the erroneous assumption that most common-pool resources are open-access resources. This is because it is difficult to exclude potential beneficiaries from them. If left as open-access resources where everyone is able to appropriate the resources freely, they will soon fail from overuse. The successful common property management systems that have evolved to maintain and regulate such facilities have established some form of property rights to these systems that are complex and change over time. Each operates under different rules adapted to local conditions. For more on this subject, see Meinzen-Dick, R., A. Knox, and M Di Gregorio, eds. 2001. Collective Action, Property Rights, and Devolution of Natural Resource Management: Exchange of Knowledge and Implications for Policy. Feldafing, Germany: Zentralstelle für Ernährung und Landwirtschaft, Food and Agriculture Development Centre. Ostrom, E., R. Gardner, and J Walker, eds. 1994. Rules, Games, and Common-Pool Resources. University of Michigan Press: Ann Arbor; Ostrom, E. Governing the Commons: The Evolution of Institutions for Collective Action; and Berkes, F. ed. 1989. Common Property Resources: Ecology and Community-Based Sustainable Development. Belhaven Press: London.

the source remains undamaged through such use)[1]. The negative aspect of these sources is that they are usually open to contamination and therefore carry health risks.

Many urban households depend heavily on sometimes expensive kiosks and vendors for their daily water supplies

Improved sources tend to be a better alternative in terms of quality, accessibility and, to a degree, reliability. They are, however, susceptible to technical failures and in the Kenyan context are often used by a large number of households. Standpipes or kiosks are very common in urban areas, and although water is generally of good quality, some work only at certain times during the day or are over-crowded; thus, users frequently encounter lengthy waiting times at the point of collection. While reliable and a good way to save time spent collecting water, private vendors tend to be the most expensive in monetary terms and may be prohibitively expensive for poorer households. Furthermore, it is usually these susceptible groups who are left dependent on these expensive water sources.

The most important factor determining the principal water source is location (rural or urban). During DOW I, urban households depended heavily on kiosks (or paid standpipes) and vendors, and on unprotected water sources such as springs or streams in rural areas (with the exception of Mutwot). There is no major change in water sources between DOW I and DOW II, with the exception that the majority of households in Kiambaa and Hoey's Bridge used protected water sources during DOW II.





### 4.5.1 Water Sources

As it has been mentioned, several water sources in use during DOW I are still being used today, e.g. springs, rivers and dams standpipes in Mukaa, Masii, Manyatta and Kiambaa (Table 4.5). However, more and improved sources have also developed. For example, rain harvesting has been enhanced especially in the dry areas, e.g. Masii and Mukaa where the technology used for harvesting and storing water has improved to the extent that water harvested can serve households from one rainy season to the next. Protected wells and hand pumps, which were not common as sources of water in DOW I, have increased to such an extent that in Kiambaa, Moi's Bridge and Mutwot they are now the main sources of water for majority of households.

Analysis of the data indicates that, as a water source, vendors seem to be a minority. However, from observation, water vending and kiosks did appear to be the major sources of water for the majority of the market dwellers especially in Masii, Mukaa, Kiambaa and Karuri.

| Site | DOW II | DOW I | Changes |
|---|---|---|---|
| Kiambaa | Well, hand-pumped | Spring or seep | Positive change |
| Mukaa | Springs | Stream, river and springs | No change |
| Masii | Reservoir/dams | Stream, reservoir and dams | No change |
| Moi's Bridge | Well, hand-pumped | Spring, wells and hand pumps | Positive change |
| Karuri [unpiped] | Water kiosks | Water kiosks | No change |
| Manyatta[unpiped] | Springs | Springs or seep and streams | No change |
| Mutwot[unpiped] | Well, handpump and stream | Well, hand pump streams/rivers | No change |
| Makadara* | Water kiosks | Piped | Positive change |
| Mathare | Vendor | Water kiosks | Negative change |

Table 4.5 Main Water Sources by Site, DOW I-DOW II

* Makadara (5 households) was considered 'piped' during DOW I, therefore we do not include it for direct comparison between DOW I and DOW II.

### 4.5.2 Sources with 'Favourable Water Quality'

The existing range of water sources were used differently in different sites and by different household depending on their quality (Table 4.6). Comparatively, during DOW II communities in the study sites had more than two sources with good quality water according to their perspective. In DOW I however the studied unpiped households had a maximum of 2 sources with favourable water quality.

| | Mean | Maximum | Minimum | N |
|---|---|---|---|---|
| DOW II | 2.53 | 5 | 1 | 161 |
| DOW I | 0.21 | 2 | 0 | 14 |

Table 4.6 Number of Favourable Water Quality Sources for Unpiped Households

## **4.6** Determinants of Water Use

In order to investigate whether determinants of per capita water use have changed over the last three decades, a multivariate regression analysis was performed. The analysis used DOW I as a baseline and estimated the best fitting model. This model was then applied to the DOW II data, allowing thus for direct comparison across time. Due to major differences between the groups, the analysis was done separately for piped and unpiped households.

### 4.6.1 Piped Households

Table 4.7 extracts the most important variables that determine per capita water use in Kenya. In 1967 the quantity of per capita water used was mostly determined by two factors. The first one was whether or not the household belonged to the Kikuyu ethnic group, whose members tended to use less water than other groups such as Asian-African individuals. The proportion of children was highly significant, and it shows that increases in the proportion imply decreases in per capita water use. Unexpectedly, the results also show that per capita water use decreases as the number of taps in the household increases, but special attention should be drawn here since there was not enough variability in the data to provide strong results. Whether or not the household has electricity and the number of rooms, used as proxies for wealth had the expected effect and show that per capita water use increases with wealth. Other variables such as 'hours of service' and 'water used for gardening' were not included in the regression analysis since there was not variation in the data (nearly all households received 24-hour service and almost none recorded using water for gardens).

**Table 4.7** Determinants of Per Capita Water Use-Piped Households

| DOW I | | | DOW II | | |
|---|---|---|---|---|---|
| **Name** | **Effect** | **Estimated Coefficient** | **Name** | **Effect** | **Estimated Coefficient** |
| Kikuyu Ethnic [b] | Negative | –1.79 | Hours of Service[a] | Positive | 0.59 |
| Percent of Children in Household | Negative | –0.76 | Number of Taps[a] | Positive | 0.16 |
| Number of Taps[a] | Negative | –0.14 | Household has Electricity [b] | Negative | –0.25 |
| Household has Electricity [b] | Positive | 0.24 | Years of Education[a] | Positive | 0.40 |
| Number of Rooms[a] | Positive | 0.18 | Household Uses Water for Gardening [b] | Positive | 0.17 |

a) the natural logarithm was used to facilitate elasticity estimates. b) Variable is in Dummy Form (Yes, No).
No evidence of heteroskedasticity was found.





During DOW II availability of water was the most important factor when determining water use. Number of hours of service and water taps were positive and highly correlated with per capita water use. Unexpectedly the electricity dummy appears to be negatively correlated, but the results also show that higher education levels in the household result in higher per capita consumption. The same applies for households who use water for gardens.

### 4.6.2 Unpiped Households

During DOW I per capita water use for unpiped households was strongly determined by location and ethnicity (Table 4.8). Those households living in urban areas were more likely to use more water and those belonging to the Kikuyu ethnic group were less likely to use more water than other ethnic groups. The number of rooms, used as a proxy for wealth, was positively correlated with higher levels of per capita water use, as was the fact that households used rainwater during the year. Although less important but still statistically significant, the number of household members and the proportion of children implied lower levels of per capita water use. Cost of water and years of education were not significant at all and their estimated coefficients were nearly zero.

**Table 4.8** Determinants of Per Capita Water Use – Unpiped Households

| DOW I | | | DOW II | | |
|---|---|---|---|---|---|
| **Name** | **Effect** | **Estimated Coefficient** | **Name** | **Effect** | **Estimated Coefficient** |
| Site is Urban [b] | Positive | 0.66 | Cost per Litre (US Cents) [a] | Negative | –0.29 |
| Kikuyu Ethnic [b] | Negative | –0.55 | Household uses rainwater during the year [b] | Negative | –0.35 |
| No. of Rooms [a] | Positive | 0.25 | No. of Household Members [a] | Negative | –0.34 |
| Household uses rainwater during the year [b] | Positive | 0.43 | Time per Trip [a] | Positive | 0.07 |
| Time per Trip [a] | Positive | 0.06 | Distance per Trip [a] | Negative | –0.06 |
| No. of Household Members [a] | Negative | –0.17 | Percent of Females in Household | Positive | 0.62 |
| Percent of Children in Household | Negative | –0.33 | No of Rooms [a] | Positive | 0.17 |

a) The natural logarithm was used to facilitate elasticity estimates. b) Variable is in Dummy Form (Yes, No).
No evidence of heteroskedasticity was found.

By DOW II the cost of water was the most important factor to determine per capita water use. As the cost per litre increased the expected quantity of per capita water use decreased. Per capita water use decreased for households reporting to use rain-water and for increasing number of household members. Distance to the source was negatively related to water use, although time per trip showed an unexpected positive correlation. Still statistically significant and positively correlated with per capita water use is the proportion of females in the household and the number of rooms (as proxies for wealth).



# **5** Environmental Issues

To allow for analysis and comparison, the study sites have been divided into the same criteria (based on ecological characteristics and housing density) as in DOW I. Mukaa and Masii are classified as hilly and cool; Kiambaa, Manyatta and Karuri as lying on similar elevated slopes; and, Moi's Bridge and Mutwot as situated on a high plateau. On the other hand in the urban areas Mathare and Makadara fall within very high and high density areas respectively, Parklands and Pangani under medium low and medium high respectively, while Spring Valley falls within a low density area.

## **5.1** Variations in Water Availability

A good example of the impact of environmental change is shown by disappearance of the Kitooni Dam which used to supply water to the majority of the Masii community residents. During the study, residents reported that the construction of the Machakos-Kitui road partly led to this extinction since most of the soil was dumped on the dam site. What was a major public source of water has now turned into a private farm.

## **5.2** Environmental Degradation and Population / Contamination

Incidences of depletion or reduction in water sources were found in Mukaa and Mutwot. In these areas, it was reported that population pressure combined with a lack of adequate farming land has resulted in intensive agriculture along the riverbeds and catchment areas.

Interviewees in both sites expressed concern that the Kaketa River in Mukaa and the Mutwot River were on the verge of disappearing as a consequence and were ostensibly contaminated. The Mathare slum settlement in Nairobi has been greatly polluted by factories, poor sanitation and cultivation upstream.

Environmental degradation caused by agricultural intensification is leading to the depletion of water resources in Mutwot and Mukaa

## **5.3** Population Pressure, Water Availability and Use

During DOW I, settlement patterns were described as scattered and linear, with people living along the water sources. The country had just emerged from many years of colonial rule, during which settlement was strictly controlled, and ethnic Africans were restricted to what were known as Native Areas (or Reserve as they were popularly known). Land was communally owned with particular clans of people living together. Water sources were mainly natural and communal with people drawing water from springs, rivers, dams or seeps. Thirty years later, it is evident from DOW II that this has changed.

The findings of DOW II clearly demonstrate that population pressure, land adjudication and subdivision, lack of appropriate development initiatives and environmental changes have brought about serious effects on the water sources in almost all sites visited. Land adjudication and subdivision for example have led to changes in ownership, as is evident in Masii and Mukaa where once communal land and water sources are now individually owned. Private ownership has led to the neglect of the water sources, resulting in a reduction in the amount, or total disappearance, of water coming from them.

In Karuri, Kiambaa, Moi's Bridge and Manyatta, sources that were used at the time of DOW I have been put under a lot of pressure due to the increase in population and sub-division of farms. These pressures have led to people devising new sources, such as individual hand-dug wells, bore holes and stand pipes.

Unlike in DOW I, in DOW II it was found that due to the scarcity of land, decisions to settle in an area are not dictated by the availability of water sources. Instead, the motto is "land first"; water is obtained through other forms of abstraction or catchment.

## **5.4** Health And Sanitation Issues

### **5.4.1** Changes In Water Use and People's Physical Well-being

Data on the effect of changes in water use on people's physical well-being was derived through discussion and observation. Additional information was also obtained through the review of various reports and documents both at district and national levels.

Whereas some sites reported an increase in the amount of water used per day, others reported a decrease depending on climatical zone. During the study, it had been assumed that all the sites visited were on the onset of the long rains, but this was not the cases in Mukaa and Masii. These sites were experiencing dry spells due to rain failures, while Mutwot and Moi's Bridge were experiencing an early rainy season. This was explained by patterns of seasons such that during the dry spells, water use per day fell considerably while in the wet seasons it increased. For example, in Mukaa and Masii during the dry seasons people walk for long distances in search of water. This limits water use to an extent that people opt not to bathe on a daily basis which potentially has a negative effect on their health and hygiene, as this could lead to skin infections like scabies or eye infections.

On the other hand, during rainy seasons when water is plentiful, there is no limit in use, because new water sources come up in form of seeps, pools or small dams. However, these sources are not protected and, due to the resulting contamination, disease outbreaks, e.g. bilharzia, diarrhoea, typhoid and amoebae-related infections, are common.

In rural areas, rainwater harvesting was found to be common among a majority of the households interviewed. The water harvested was said to be pure and hence preserved for drinking only. Rainwater when well stored can have a significant positive effect on health. In the study, the incidence of diarrhoea was not widely reported. It seemed that over the last 30 years people have been sensitized on the importance of general hygiene. Water boiling was reported and observed in some households. However it is open to speculation as to how widespread the practice is within households since converting knowledge into practice is always problematic. In spite of this, improved health behaviour has gone a long way in curbing some of the water-related diseases which were common during DOW I.

The use of unprotected sources in sites such as Masii lead to increased incidences of water-related diseases

### 5.4.2 Changes In Sources / Services and Peoples Physical Well being

**Rural Sites**. The type of water sources prevalent during DOW I are still in use today – dams and kiosks in Masii; springs, rivers and streams in Manyatta, Mutwot and Mukaa; and wells /boreholes in Kiambaa, Karuri and Moi's Bridge.

Other water sources such as rainwater harvesting, water kiosks, vending, trucking, standpipes and hand-dug wells have been introduced in different sites. In some sites there have been notable improvements in water sources and service levels while in others there appear to have been none. In DOW II, rural sites with improved water sources and service levels include Mutwot, Manyatta, Moi's Bridge and Kiambaa, whereby competition for water is not common in majority of the households.

In Manyatta, the Ngandori Water Project, which gets water from Mt. Kenya, has played a major role in improving water supply in the area. In this site, 26 out of 32 households interviewed had individual water connections. Similarly in Mutwot, where the African Housing Fund has been carrying out some commendable work in improving the existing wells, an improvement was noted. The organization provides technical support and manpower for installing handpumps. The main water source for households without access to these handpumps is hand-dug wells located within compounds.

The situation in Moi's Bridge is not very different from that in Mutwot. Many residents own boreholes and shallow wells which are sealed with concrete to protect them from contamination. For those who can afford them, hand pumps have been installed to ease the burden of drawing water. A water project which started in 1983 with support form Sida has gone a long way in improving the water service levels for majority of the residents. This project operates by gravity force, thus supplying water to the residents in the lower part of the area at low cost.

In the other rural sites of Masii and Mukaa, water shortages still exist. In Masii, there are only two perennial dams, one river and a kiosk in the market centre. Water from the dam is used for almost all domestic purposes except drinking. Respondents reported that the kiosk is not a major source since many people are put off by the queuing and rationing that takes place. The river is thus the major source of water and is used for all domestic purposes. Water is obtained by scooping from small water holes on the river bed. However, over the last 30 years, sand harvesting has been on the increase thus leading to a reduction in the amount of water in this river.

Some rural sites have experiences significant improvements in sources and service levels

During the dry seasons, when some of the holes dry up, people walk long distances along the river in search of water. Waiting time at the source increases during this season as people wait for the water to seep up to the surface. Given this situation, the conditions in Masii can be said to have become worse over time. Sharing of water facilities is common and people still walk for very many kilometres in search of water.

A deteriorating situation was also evident in Mukaa, as the Kaketa Water Project which aimed at supplying the community with piped water has been grounded. People in Mukaa still walk along the steep slopes in search of water. From the interviews, it was reported that majority of the people in Mukaa cannot afford to take a shower daily because of lack of water.

**Urban Sites**. In the urban sites, such as Makadara, water sources are slowly shifting from piped to unpiped. The sharing of facilities has almost doubled since DOW I such that 6 to 10 people share a tap. Private housing developers have built new units which have put more pressure on the existing water supply system. Piped water supply services were often found to be erratic. For example, people living in the high-rise buildings could only draw water from their taps at night, while in other houses water service hours were limited to a few hours per day. One respondent explained that only minimal washing and cleaning could be undertaken in the plot because rationing forced people to store and economise on water.



In the other urban sites, including Spring Valley, Parklands and Pangani, the level of water service was slightly different with the majority of people having individual connections. Although still far from satisfactory, the water supply in Mathare has also improved. This is largely due to NGO intervention.

### 5.4.3 Status and Use of Latrines / Toilets

There have been major changes in the use of latrines since DOW I. In 1967, very few households had pit latrines and instead relied mainly on bushes and streams for human waste disposal. Diseases such as diarrhoea, cholera, and bilharzia were common during the rainy seasons when water sources got contaminated by human faeces. In DOW II, the majority of households interviewed were found to have pit latrines with some families having clean ventilated pit latrines.

**Latrines in Unpiped Sites.** Of the 166 households interviewed in rural unpiped sites, only 8 households did not have a latrine (Table 5.1). The increased use of latrines has gone a long way towards improving hygiene behaviour and reducing environmental health risks in the communities (Table 5.2).

| Site | Yes | No | Total |
|---|---|---|---|
| Kiambaa [unpiped] | 21 | 0 | 21 |
| Karuri [unpiped] | 11 | 0 | 11 |
| Mukaa [unpiped] | 31 | 1 | 32 |
| Masii [unpiped] | 29 | 1 | 30 |
| Manyatta [unpiped] | 8 | 0 | 8 |
| Moi's Bridge [unpiped] | 32 | 0 | 32 |
| Mutwot [unpiped] | 20 | 6 | 26 |
| Nairobi-Mathare Valley [unpiped] | 1 | 0 | 1 |
| Nairobi-Makadara, High [piped] | 5 | 0 | 5 |
| **Total** | **158** | **8** | **166** |

* Makadara (5 households) was considered 'piped' during DOW I, therefore we do not include it for direct comparison between DOW I and DOW II.

**Table 5.1** Households who Possess their Own Latrine (Observation) - Kenya, DOW II

| State | Frequency | Valid Percent |
|---|---|---|
| No faecal matter present on latrine floor. | 109 | 69.0 |
| Small amount of faecal matter present on latrine floor. | 49 | 31.0 |
| **Total** | **158** | **100.0** |

**Table 5.2** Hygienic State of Latrines in Unpiped Households (Observation) - Kenya, DOW II

**Latrines in Piped Sites.** In piped households, only 9 of the 206 households interviewed did not have a toilet (Table 5.3). These were mainly located in Mathare, which is a slum settlement. However, it was reported that the occupants of these households have access to communal toilets run by the City Council. The latrines operated by the city council were generally in a bad state (Table 5.4). The households without access in Karuri and Manyatta used a neighbouring latrine and the bush respectively. The tables below explains the status of latrines in both piped and unpiped.

| Site | Yes | No | Total |
|---|---|---|---|
| Kiambaa [unpiped] | 9 | 0 | 9 |
| Karuri [unpiped] | 20 | 1 | 21 |
| Mukaa [unpiped] | 3 | 0 | 3 |
| Masii [unpiped] | 2 | 0 | 2 |
| Manyatta [unpiped] | 23 | 1 | 24 |
| Mutwot [unpiped] | 6 | 0 | 6 |
| Nairobi-Mathare Valley [unpiped] | 22 | 7 | 29 |
| Nairobi-Makadara, High [piped] | 20 | 0 | 20 |
| Nairobi-Spring Valley, Very low [piped] | 36 | 0 | 36 |
| Nairobi-Parklands, Medium Low [piped] | 26 | 0 | 26 |
| Nairobi-Pangani, Medium high [piped] | 30 | 0 | 30 |
| **Total** | **197** | **9** | **206** |

**Table 5.3** Proportion of Households who Possess their Own Latrine (Observation) - Kenya, DOW II

| State | Valid Percent |
|---|---|
| No faecal matter present | 83.1 |
| Small amount of faecal matter | 16.4 |
| Large amount of faecal matter | 0.5 |

**Table 5.4** Hygienic State of Latrines (Observation) - Kenya, DOW II

## 5.5 Technological Issues

Rapid industrial and technological growth, as well as development in educational strategies in the water sector, have opened up new opportunities for improvements in the quality and quantity of water supply.

### 5.5.1 Water Collection: Technologies, Vessels and Changes

In DOW I, the common mode of collecting water in rural unpiped sites was by scooping from dams, springs, rivers and streams, and filling gourds and pots. Although this is still practised, the gourds and pots have been replaced by plastic containers. The majority of the households interviewed had metal roofs with gutters for harvesting rainwater, with metallic and brick storage tanks. In some households the rainwater is stored and served to the family throughout the year, e.g. in Mukaa and Masii. Of the 166 households interviewed in rural unpiped areas, at last 70 percent reported use of rainwater.

In DOW I, people with boreholes and wells were using simple pulleys and tins tied with a rope to lift the water. In many cases, this tedious method has been replaced with pumps and water generators. In urban sites with piped water, households without connections obtained water from kiosks which were less than 50 metres from their households, or bought from vendors who deliver to their homes.

### 5.5.2 Water Storage: Technologies, Vessels and Changes

Commendable changes have taken place in water storage methods since DOW I. In DOW II, all those households interviewed, in both piped and unpiped sites, were found to be storing water. The method of storage differed between sites and households within sites. In DOW I, the common water storage facilities were pots and gourds which could only store a maximum of 60 to 80 litres. This has changed with time and during DOW II study few households were found to be using these containers.

Some areas have experienced significant technical advances in water storage, such as Masii

As a result of technological and industrial advancement in Kenya, new storage facilities are being manufactured and promoted like plastic and

metal tanks which can store thousands of litres of water. Stored water can be preserved for long periods of time by treating with chemicals like chlorine. This treatment of stored water has reduced water scarcity and incidences of water-related diseases. In piped households, water was stored for use in the event of interruptions or disconnection.

### 5.5.3 Water Supply Services: Technologies, Performance, Changes

Water supply is an area where new techniques are being applied. In DOW I, the common mode of collecting water was human labour, with women carrying water containers on their backs or heads, and men on their shoulders. This made drawing water a tedious task. Moreover, since several long trips over steep slopes and windy footpaths had to be made to the sources, drawers spent a large part of their day collecting water.

Since DOW I, new modes of transporting water have been improvised including hand-drawn carts, oxen- and donkey-drawn carts, wheelbarrows, bicycles and vehicles, all which have made the work of drawing water easier and less time consuming. These modes of transport have not, however, eliminated the possibility of water contamination.

Since DOW I, new technologies have been introduced including donkey- and oxen-drawn carts, hand-drawn carts, wheelbarrows, bicycles and vehicles, all of which have made the work of carrying water easier and less time consuming





Contamination is particularly problematic with water sold through vendors since it was reported that these vendors do not mind about the cleanliness of water.

Many NGO's and churches have assisted rural communities, such as Manyatta and Mutwot, by bringing water closer to the homesteads through constructing dams or boreholes and pumping the water to nearby stand pipes. As a result, we can talk of piped households in these sites which were unpiped 30 years ago.

New methods of supplying water have also resulted in the emergence of water selling businesses (vendors and kiosks) in market and town centres, in both the rural and urban sites. This has improved the standard of living of those who rely on water selling as their source of income. In addition, all of these new technologies and innovations have reduced water shortages and improved levels of hygiene and sanitation in the communities.

# **6** Institutional Factors

Considerable changes in water policy and hence the roles played by different institutions, have taken place in the past 30 years. This section considers the role of the public and private sectors, as well as that of civil society groups in water supply provision in light of these changes.

## **6.1** The Role of the Public Sector

Since DOW I, various government policies in favour of privatization and altering the distributional priorities of water supply have been initiated. The policy of supplying every household with piped water by the year 2000, although no longer achievable, has prompted the Government of Kenya to liberalize water supply. Ten years ago, private drilling of boreholes and wells was not common but this has now changed with people drilling their own boreholes and supplying their neighbours at a fee.

Three decades on, problems with water shortages force people to draw water from unprotected sources in places like Mukaa





However, the Government has not done well in rural areas in terms of water supply. People in areas like Masii and Mukaa still walk long distances (up to 3 kms) in search of water. In these sites, the problems of water shortage experienced during DOW I persist and are worsening because of population increase and environmental degradation.

In the urban centres on the other hand, the Government is the main provider of water. The Nairobi City Council, with assistance from the World Bank, IMF and bilateral donors has done a fairly good job in providing water, despite complaints about City Council services being substandard. City Council officials are often accused of corruption thus frustrating the collection of water bills, taking too long to repair burst water pipes, and rationing water supply in some areas.

## **6.2** Role of Private Sector in Water Supply Provision

Private initiatives in water supply are most pronounced in the rural areas of Kenya. This is a result of Government laxity in supplying piped water to rural areas. Increased community awareness of the benefits of having sufficient good quality water has led people to invest in the water sector. For example, sites like Masii and Mukaa have experienced an increase in rain harvesting. In fact, nearly all households interviewed used rainwater, although a lack of funds for constructing larger tanks constrained the amount they were able to tap.

Water selling, through kiosks and vendors, is another area which attracts individual investment. Many people in both rural and urban centres engage in water selling for their main source of income.

In Masii, water vending is a booming business and is mainly done by primary school male drop outs who in dry seasons charge up to ksh.20 for a 20-litre jerrican. Only one water kiosk which existed at the time of DOW I still remains and this is now under the control of the County Council.

In Mukaa both women and men work as water vendors in market centres. Here, a 20-litre jerrican costs from ksh.3 to 5 depending on the distance from the market centre to the water source. There are two

water kiosks - one is owned by Kiongwani Water Cooperative Society while the other is owned by Kiongwani Mission - and water is sold at ksh.2 per 20-litre jerrican. In Kiambaa water is available from standpipes and sold at ksh.4 per 35 litres.

In Mutwot, 1995 a private organization, African Housing Fund (AHF), was drilling wells for the community. The company provides technical support and manpower, i.e. drilling and installing water pumps. It also provide loans to those who could prove that they were able to pay by depositing a fee of ksh.15,000. After qualifying, the company would then sink the well and install the pump. The total amount given to an individual was ksh.50,000. The majority of the people cannot afford this fee and only few wealthy people have managed to utilize this facility.

In Manyatta, an organization called NGAGAKA [Ngandori, Gaturi, and Kagaori] Water Consumers' Association controls the distribution of piped water from the slopes of Mount Kenya. The community members pay for private water connections and now the majority of households have piped water.

In Moi's Bridge, most residents have their own boreholes served with concrete to protect them from contamination. To draw water from these boreholes, people use containers tied with a rope. Some have installed hand pumps to ease the work of drawing water.

## **6.3** Role of Civil Society Groups

To supplement natural sources and government effort in water supply, civil society groups are doing a commendable job in rural areas, notably religious-based organizations. In Manyatta, NGO intervention in the water sector has helped the community to tap water from the slopes of Mount Kenya. These NGOs, with the help of community participation, have been able to build treatment tanks and lay distribution pipes to the villages. On completion of the project, the management was handed over to NGAGAKA Water Consumers Association which is operating as a community-based organization. Water in Manyatta is no longer a scarce commodity.





In Kiambaa, the community members have mobilized themselves and constructed a dam from one of the perennial streams. Water is pumped from the dam to the household. In Masii to supplement water from the only river and few old dams, the community has been forced to dig nine dams in order to collect surface run off water.

The same thing has happened in Mukaa where community self-help and women groups have been formed with the objective of increasing and improving water supply. With government assistance, the community has drilled two hand pumped boreholes.

Water from these boreholes is used during dry seasons. During the rainy seasons, people use natural sources like springs, rivers and streams and when these dry up, they start using the boreholes.

The Catholic Church in Mukaa has done a lot in the water sector. It initiated a project of building tanks for rainwater harvesting and provided technology and materials for tank construction while the community provided labour. However, the majority of Mukaa's residents did not benefit from this project. The priest, who was director of the project, was transferred and the management committee mismanaged the funds and started charging for the construction. This demoralized the community and the project stalled.

The few who are lucky enough to have water tanks in their homesteads do not experience serious water shortages. It was noted, however, that the water provided through the Mission is on the lower side of the settlement, and would require substantial investment to pump to households up in the hills. The church has also installed a standpipe within the compound. which is connected with piped water from Kilimanjaro Water Project (controlled by Kenya Water Pipeline and Conservation Board).

In summary, with the intervention of civil society groups (NGOs and the Church), the water sector in rural areas has gone a long way in improving access to water. However, a lot more is needed and for majority of rural residents, water is still a scarce commodity.

# 7 Appendix

## Appendix 1. Summary Statistics for Piped Sites

| | | Total | Karuri | Parklands | Pangani | Makadara |
|---|---|---|---|---|---|---|
| Percent of Households | DOW I | 22.8 | 4.8 | 5.1 | 9.6 | 3.2 |
| | DOW II | 27.8 | 6.0 | 7.4 | 8.6 | 5.7 |
| Average Years of Education | DOW I | 10.6 | 14.1 | 10.3 | 9.9 | 7.3 |
| | DOW II | 12.0 | 12.0 | 13.3 | 11.9 | 10.6 |
| Average Per Capita WU (litres) | DOW I | 121.6 | 28.5 | 176.9 | 167.3 | 26.3 |
| | DOW II | 47.4 | 28.4 | 60.9 | 52.9 | 41.6 |
| Average total water in household (litres) | DOW I | 934 | 193 | 1165 | 1237 | 934 |
| | DOW II | 240 | 148 | 334 | 274 | 162 |
| Average cost of water (1997 US$/m$^3$) | DOW I | 0.70 | 1.25 | 0.53 | 0.56 | 0.58 |
| | DOW II | 0.40 | 0.41 | 0.46 | 0.39 | 0.30 |
| Receive 24-hour supply (percent of households) | DOW I | 87.5 | 0 | 100 | 100 | 100 |
| | DOW II | 80 | 24 | 100 | 93 | 90 |
| Principal alternative source if piped system breaks | DOW I | Well | Well | Well | Stream | Hydrant |
| | DOW II | Kiosk | Kiosk | Kiosk | Well | Vendor |
| Reported diarrhoea incidence during the previous week (% households) | DOW I | 0 | 0 | 0 | 0 | 0 |
| | DOW II | 12.4 | 9.5 | 7.7 | 3.3 | 35.0 |



## Appendix 2. Summary Statistics for Unpiped Sites

| | | Urban | Rural | Karuri | Mathare Valley | Kiamaiko | Mukuru | Masii | Manyatta | Moi's Bridge | Mutwot |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Percent of Households | DOW I | 18.3 | 46.6 | 9.6 | 8.7 | 6.2 | 7.5 | 7.8 | 5.5 | 9.8 | 9.8 |
| | DOW II | 12.1 | 45.2 | 11.1 | 1.0 | 6.4 | 9.7 | 9.1 | 2.4 | 9.7 | 7.9 |
| Average Number of Years of Education | DOW I | 0.3 | 4.9 | 7.6 | 0.3 | 7.1 | 4.8 | 5.0 | 5.4 | 3.2 | 4.1 |
| | DOW II | 10.0 | 9.9 | 10.3 | 7.0 | 9.1 | 10.1 | 11.2 | 10.6 | 10.2 | 8.2 |
| Average Equipment Index | DOW I | 3.1 | 3.3 | 4.0 | 3.1 | 3.5 | 3.3 | 2.8 | 3.6 | 3.1 | 3.5 |
| | DOW II | 12.5 | 7.3 | 13.0 | 7.0 | 10.3 | 5.9 | 6.1 | 8.6 | 8.7 | 5.6 |
| Average Per Capita WU (litres) | DOW I | 11.3 | 8.2 | 9.3 | 11.3 | 11.1 | 8.2 | 6.9 | 10.4 | 6.1 | 7.7 |
| | DOW II | 22.9 | 22.3 | 22.3 | 29.8 | 24.6 | 9.3 | 12.0 | 29.8 | 45.3 | 20.5 |
| Average Cost (1997 US$/m$^3$) | DOW I | 1.43 | 0.76 | 1.87 | 0.93 | 1.39 | 1.23 | 0.97 | 1.11 | 0.22 | 0.21 |
| | DOW II | 1.42 | 0.93 | 1.16 | 4.29 | 0.83 | 2.14 | 0.75 | 0.83 | 0.28 | 0.16 |
| Principal Water Source | DOW I | Hydrant | Spring,stream | Kiosk | Kiosk | Spring | Stream | Stream | Spring,Stream | Spring,Stream | Well,Hydrant |
| | DOW II | Kiosk | Spring,stream | Kiosk | Vendor | Well | Spring | Reservoir | Spring,Stream | Well | Well,other |
| Average Time per Trip (Minutes) | DOW I | 11.0 | 17.6 | 13.5 | 11.0 | | 25.9 | 25.1 | 16.1 | 13.1 | 11.7 |
| | DOW II | 33.1 | 24.9 | 36.1 | 0.0 | 19.5 | 26.1 | 30.5 | 20.8 | 36.8 | 7.3 |
| Average Distance to Water Source (Meters) | DOW I | 384.0 | 554.9 | 233.0 | 384.0 | 811.3 | 1012.9 | 1007.1 | 305.9 | 249.9 | 205.1 |
| | DOW II | 400.3 | 445.5 | 436.6 | 0.0 | 513.0 | 637.4 | 636.5 | 242.2 | 370.2 | 98.0 |
| Average Number of Trips | DOW I | 2.9 | 2.6 | 2.9 | 2.9 | 2.6 | 2.5 | 3.3 | 3.4 | 1.9 | 2.2 |
| | DOW II | 3.4 | 4.4 | 3.7 | 0.0 | 3.9 | 2.9 | 2.8 | 5.9 | 7.8 | 4.5 |
| Diarrhoea Incidence in Previous Week | DOW I | 26.3 | 23.8 | 10.0 | 44.4 | 0.0 | 13.0 | 100.0 | 29.4 | 6.7 | 0.0 |
| | DOW II | 0.0 | 22.1 | 0.0 | 0.0 | 4.8 | 12.5 | 50.0 | 50.0 | 0.0 | 34.6 |

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Notes



Notes

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