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JAPAN INTERNATIONAL COOPERATION AGENCY

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THE ARTESIAN AREA STUDY
ON
THE NATIONAL WATER MASTER PLAN
IN
THE HASHEMITE KINGDOM OF JORDAN

FINAL REPORT

MAIN REPORT

November 1998

NIPPON KOEI CO., LTD.
KOKUSAI KOGYO CO., LTD.

JAPAN INTERNATIONAL COOPERATION AGENCY

THE MINISTRY OF WATER RESOURCES
THE REPUBLIC OF KENYA

THE AFTERCARE STUDY ON THE NATIONAL WATER MASTER PLAN IN THE REPUBLIC OF KENYA

FINAL REPORT

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LIST OF REPORTS

1. EXECUTIVE SUMMARY
2. MAIN REPORT
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PREFACE

In response to a request from the Government of the Republic of Kenya, the Government of Japan decided to conduct a Aftercare Study on the National Water Master Plan in the Republic of Kenya and entrusted to study to the Japan International Cooperation Agency (JICA).

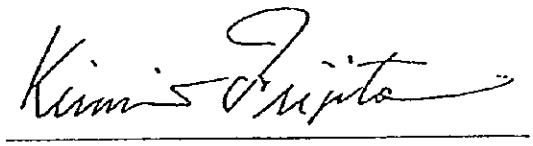
JICA selected and dispatched a study team headed by Mr. Hirofumi Sadamura of Nippon Koei Co., Ltd. and consist of Kokusai Kogyo Co., Ltd. to Kenya, two times between November 1997 and October 1998. In addition, JICA set up an advisory committee headed by Masayuki Watanabe, Development Specialist, Institute of International Cooperation of JICA between November 1997 and October 1998, which examined the study from specialist and technical points of view.

The team held discussions with the officials concerned of the Government of Kenya, and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of this project and to the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Kenya for their close cooperation extended to the study.

November, 1998



Kimio Fujita
President
Japan International Cooperation Agency

November, 1998

Mr. Kimio Fujita
President
Japan International Cooperation Agency
Tokyo, Japan

Dear Sir,

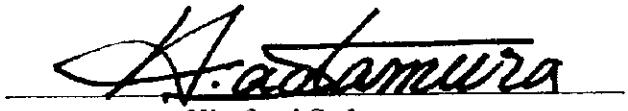
LETTER OF TRANSMITTAL

It is with great pleasure that we submit to you the Final Report of the Aftercare Study on the National Water Master Plan in the Republic of Kenya completed by our Study Team with cooperative efforts of the Ministry of Water Resources of the Government of Kenya and other parties concerned. The report has been prepared for the Government of Kenya for consideration in implementing the future water supply and sewerage development projects in Kenya.

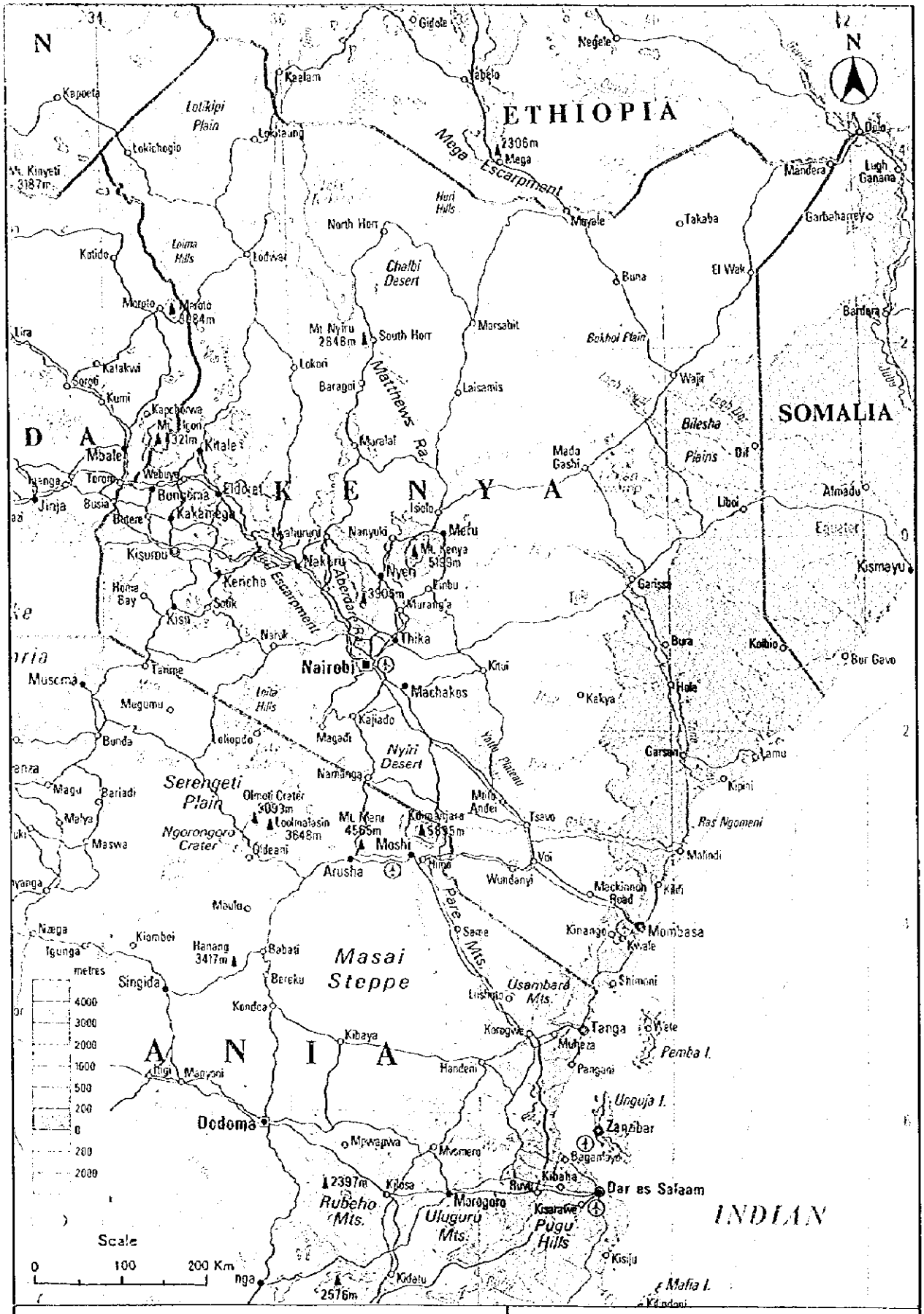
The report consists of four volumes of Executive Summary, Main Report, Supporting Report and Data Book. The Executive Summary presents the outline of the study results and the Main Report give the summary of all the study results, especially implementation program of the future water supply and sewerage development projects and priority projects. The Supporting Report describes the sectoral study results of socioeconomy, water supply development plan, sewerage development plan, water resources development plan, law and public administration and project evaluation to support the Main Report. The Data Book compiles useful reference data relevant to the Study.

Taking this opportunity, all the members of the Study Team would like to express their heartfelt gratitude to the personnel from JICA, JICA Advisory Committee, Ministry of Foreign Affaires, Ministry of Construction, Ministry of Welfare, Embassy of Kenya and JICA Kenya Office and Kenyan officials from Steering Committee comprised of relevant government agencies and Technical Sub-committee of Ministry of Water Resources who extended the kind assistance and cooperation for the entire study period to the Study Team. The Study Team hopes that the results of this study contribute to the future implementation of water supply and sewerage projects in Kenya and to socioeconomic development of Kenya.

Yours faithfully,



Hirofumi Sadamura
Team Leader
The Aftercare Study on the National Water Master Plan



THE AFTERCARE STUDY ON THE NATIONAL WATER MASTER PLAN	LOCATION MAP
JAPAN INTERNATIONAL COOPERATION AGENCY	

THE AFTERCARE STUDY ON THE NATIONAL WATER MASTER PLAN

MAIN REPORT

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ABBREVIATIONS

AG	Attorney General
AFW	Accounted for Water
ASAL	Arid, Semi-Arid Lands
CBS	Central Bureau of Statistics
CSRP	Civil Service Reform Programme
CSS	Computer Service Section of MOW
DAO	District Agricultural Officer
DC	District Commissioner
DCO	District Commissioner's Office
DDC	District Development Committee
DDP	District Development Plan
DO	District Officer
DRSRS	Department of Resource Surveys & Remote Sensing
DTO	District Treasury Office
DWB	District Water Board
DWE	District Water Engineer
DWO	District Water Office
EAMD	East Africa Meteorological Department
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross Domestic Product
GIS	Geological Information System
GOJ	Government of Japan
GOK	Government of Kenya
GRDP	Gross Regional Domestic Product
GTZ	German Agency for Technical Cooperation
HRD	Human Resource Development
IBRD	International Bank for Reconstruction and Development
ICDC	Industrial and Commercial Development Corporation
IDA	International Development Association
ILUS	Integrated Land Use Survey
IPC	Investment Promotion Center
IRS	Integrated Rural Survey
JICA	Japan International Cooperation Agency
KBS	Kenya Bureau of Standard
KIRDI	Kenya Industrial Research & Development Institute
KIU	Kenya Industrial Estates Limited
KMD	Kenya Meteorological Department
KPLC	Kenya Power and Lighting Co.
KPTC	Kenya Posts and Telecommunicatio Corporation
KS	Kenya Standard
KSS	Kenya Soil Survey
KTDA	Kenya Tea Development Authority
KVDA	Kerio Valley Development Authority
KWAHO	Kenya Water and Health Organization
Kshs	Kenya Shillings
K£	Kenya Pounds (20 Kenya Shillings)
LA	Local Authority
LBDA	Lake Basin Development Authority
LU	Livestock Unit
MCSS	Ministry of Culture and Social Services
MLRRWD	Ministry of Land Reclamation, Regional and Water Development (presently MOWR)
MOA	Ministry of Agriculture
MOE	Ministry of Energy
MOED	Ministry of Education
MOENR	Ministry of Environment and Natural Resources
MOF	Ministry of Finance
MOH	Ministry of Health
MOHANH	Ministry of Home Affairs and National Heritage
MOI	Ministry of Industry
MOL	Ministry of Labour
MOLA	Ministry of Local Authorities
MOLD	Ministry of Livestock Development
MOLG	Ministry of Local Government (presently MOLA)
MOLH	Ministry of Lands and Housing
MOMDE	Ministry of Manpower Development and Employment
MOP	Ministry of Planning
MOPND	Ministry of Planning and National Development
MOPW	Ministry of Public Works

MORD	Ministry of Region Development
MORST	Ministry of Research, Science and Technology
MOSM	Ministry of Supplies and Marketing
MOTC	Ministry of Transport and Communication
MOTW	Ministry of Tourism and Wildlife
MOWR	Ministry of Water Resources
MPND	Ministry of Planning and National Development
MWR	Ministry of Water Resources
NCC	Nairobi City Commission
NCPB	National Cereals and Produce Board
NEAP	National Environmental Plan
NES	National Environment Secretariat
NGO	Non-Governmental Organisation
NIB	National Irrigation Board
NMWP-I	National Master Water Plan (Stage I)
NWCPC	National Water Conservation and Pipeline Corporation
NWMP	National Water Master Plan
NWP	National Water Policy
O&M	Operation and Maintenance
OECD	Organization for Economic Cooperation and Development
OECF	Overseas Economic Cooperation Fund
OP	Office of the President
PC	Provincial Commissioner
PIP	Public Investment Programme
PIU	Project Implementation Unit
PPCSCA	Presidential Permanent Commission on Soil Conservation and Afforestation
PSC	Public Service Commission
PSP	Private Sector Participation
RTPC	Rural Trade and Production Center
RWSDP	Rural Water Supply Development Project
SDD	Social Dimensions of Development
SOK	Survey of Kenya
SWAP	Surface Water Extraction Permit
SWPD	Special Water Programmes Division (MWR)
TARDA	Tana and Athi Rivers Development Authority
UC	Urban Centre
UDD	Urban Development Department (MOLA)
UFW	Unaccounted for Water
UNDP	United Nations Development Programme
UNEP	United Nation Environment Programme
UNESCO	United Nations Educational, Scientific, and Cultural Organization
UNICEF	United Nations International Children's Emergency Fund
UNIDO	United Nations Industrial Development Organization
UNPEP	United Nation Population Fund Programme
USAID	United States Agency for International Development
UWASAM	Urban Water and Sanitation Management
WAB	Water Apportionment Board
WDD	Water Development Department (MWR)
WHO	World Health Organization
WID	Women in Development
WRA	Water Resources Authority

ABBREVIATION OF MEASURES

Length

mm	=	millimeter
cm	=	centimeter
m	=	meter
km	=	kilometer

Area

ha	=	hectare
m^2	=	square meter
km^2	=	square kilometer

Volume

1, lit	=	liter
m^3	=	cubic meter
m^3/s, cms	=	cubic meter per second
MCM	=	million cubic meter
m^3/d, cmd	=	cubic meter per day

Weight

mg	=	milligram
g	=	gram
kg	=	kilogram
t	=	ton
MT	=	metric ton

Time

sec	=	second
hr	=	hour
d	=	day
yr	=	year

Money

Kshs.	=	Kenya shilling
KL	=	Kenya pound
US$	=	U.S. dollar
US¢	=	U.S. cent

Energy

Kcal	=	Kilocalorie
KW	=	kilowatt
MW	=	megawatt
KWh	=	kilowatt-hour
GWh	=	gigawatt-hour

Others

%	=	percent
o	=	degree
'	=	minute
"	=	second
°C	=	degree Celsius
cap.	=	capital
LU	=	livestock unit
md	=	man-day
mil.	=	million
no.	=	number
pers.	=	person
mmho	=	micromho
ppm	=	parts per million
ppb	=	parts per billion
lpcd	=	litter per capita per day

CHAPTER 1 INTRODUCTION

1.1 Background of the Aftercare Study

The Republic of Kenya has a wide area of 583,000 km^2, of which 83% are characterised as arid and semi-arid regions and 2% are lakes. The remaining 15%, or 89,000 km^2 are arable land, on which the majority of 26,700,000 (mid-1995, World Bank 1997) population in the country root their living basis. Because of diversified geographic and climatic conditions, available water resources in the country are generally limited. To gear up socio-economy nationwide, new water resource development is of vital importance and considered urgent.

Responsibility for planning, development and management of water resources have been diversified into many governmental agencies of the relevant sectors. Overall coordination has been lacked, resulting in conflict between water users, inefficient water supply services and an emerge of a number of the non-registered water users.

To tackle these issues, the Government of the Republic of Kenya (hereinafter referred to as "the GOK") has requested the Government of Japan (hereinafter referred to as "the GOJ") to prepare a master plan for development of water resources in the country in June 1989. In response to the request, the GOJ has carried out the study in the period from January 1990 to May 1992, entrusting the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA"). The study has looked over six sectors of domestic and industrial water supply, sewerage, agriculture and irrigation, wildlife and livestock, hydropower, river and flood control, for formulating the National Water Master Plan in Kenya upto a target year of 2010 (hereinafter referred to as "NWMP"). NWMP has proposed the most appropriate and effective national framework for planning and developing water resources.

NWMP has been considered to be important milestones for implementation of comprehensive water resources development in the country. In line with NWMP, several projects have been implemented by assistance of international financing agencies and NGOs. Most of the projects proposed in NWMP, however, have been delayed for implementation due mainly to financial constraints and institutional weakness of the GOK.

To meet the national target of supplying potable water to whole nationals as early as possible, community water supply schemes have been intensively introduced and developed under a financial aid from the international financing agencies, harambee and NGOs. Majority of these schemes supplies untreated water to the customers. Such schemes however do not charge for water, resulting in ineffective operation and management. Furthermore, an overlap of the service areas is creating problems of reducing customers in the public water supplies.

Since 1996, the GOK started to work out a national water policy to ensure sustainable development of the nation and enhance social welfare of the public and completed it in 1998. The principles of this policy are introduced in Chapter 3 of this report.

In consideration of the above facts, the GOJ dispatched a project formation mission to Kenya in April 1996 and affirmed needs of "the Aftercare Study of the National Water Master Plan in the Republic of Kenya" (hereinafter referred to as "the Aftercare Study"). This was appreciated by GOK and its implementation was requested to the GOJ. The GOJ dispatched a Preparatory Study Team to Kenya to confirm the Scope of Work for the Aftercare Study in May 1997 and the Scope of Work was concluded between the GOJ and the GOK on 20 May 1997.

1.2 Objectives and Objective Areas of the Aftercare Study

1.2.1 Objectives of the Aftercare Study

The objectives of the Aftercare Study are;

1) to review the development plans of water supply and sewerage proposed in NWMP and establish new implementation programmes,

2) to make recommendation on strengthening of law, organisation and institution for project implementation, and improvement of management, operation and maintenance of the project, and

3) to transfer the technology on the planning of water supply and sewerage development through the Aftercare Study.

1.2.2 Objective Areas of Water Supply and Sewerage Schemes Development

The objective areas of water supply and sewerage scheme development are as follows:

1) The water supply is classified into urban and rural water supply schemes and development plan should be established accordingly.

2) The urban water supply schemes should be studied on a basis of urban centre. The number of urban centres is defined at 141, each of which has a population more than 5,000 in the year 2010. (Refer to **Figure – 1.2.1**)

3) Planning of the rural water supply schemes should be based on district unit for the existing rural water supply schemes. The number of districts is to be 50 reflecting administrative set-up as of January 1996, of which the latest district maps are available.

4) The sewerage scheme planning was initially focused on 30 urban centres. Additional urban centres will however be considered if identified an urgent need by year 2010. (In particular 10 urban centre are finally added on.)

1.3 Scope of the Aftercare Study

(1) Study Area and Target Year

The Study covers in principle the whole area of the Republic of the Kenya (see also Section 1.2.2). The target year for development planning is 2010.

(2) Phasing

The Study is was done in two phases and each phase was subdivided into work done in Kenya and work done in Japan:

1) Phase I: Basic Study

   i) Preparatory Work in Japan
   ii) First Work in Kenya

2) Phase II: Review of the National Water Master Plan

   i) First Work in Japan
   ii) Second Work in Kenya
   iii) Second Work in Japan

(3) Contents of the Study

1) Preparatory Work in Japan

   i) Review of data and information
   ii) Establishment of work plan and method
   iii) Preparation of Inception Report

2) First Field Work in Kenya

   i) Presentation and discussion on Inception Report
   ii) Collection and analysis of relevant data and information
   iii) Field reconnaissance
   iv) Grasping present conditions of water resources
   v) Grasping present status of water supply and sewerage systems
   vi) Establishing basic strategy of the Study
   vii) Establishing criteria for planning
   viii) Field survey (entrusted to local consultant)
   ix) Establishing macro-framework for the review of the National Water Master Plan
   x) Preliminary study on strengthening plan of organisation and institution
   xi) Preliminary study on improvement plan of operation and maintenance
   xii) Preliminary study on implementation plan

xiii) Preparation of Progress Report
xiv) Confirmation on details of seminar for technology transfer

3) First Home Work in Japan

i) Formulation of implementation plan
ii) Planning on organisation and institution strengthening
iii) Planning on operation and maintenance improvement
iv) Project evaluation
v) Phasing of implementation plan
vi) Selection of priority projects
vii) Preparation of Draft Final Report
viii) Preparatory work for seminar for technology transfer

4) Second Field Work in Kenya

i) Submission, presentation and discussion on Draft Final Report
ii) Conducting seminar/workshop for technology transfer

5) Second Home Work in Japan

i) Preparation of Final Report

1.4 Organisation for Execution of the Aftercare Study

JICA organised the Study Team and Advisory Committee, for the successful and efficient performance of the Study. The Advisory Committee is to technically support the Study Team. GOK appointed the Ministry of Water Resources (MWR) as the executing agency of the Study and organised a Technical Committee from the key staff of MWR and a Steering Committee by the representatives of the government organisations concerned. **Table - 1.4.1** presents the members of the Study Team, the Advisory Committee, the Technical Committee, and the Steering Committee.

The Study Team would like to express their deep appreciation to Mr. E. K. Mwongera, Permanent Secretary of MWR for his constant efforts and advises for smooth implementation of the study.

Also the Study Team extends their heartfelt thanks to all members of the Advisory Committee, the Technical Committees and the Steering Committee for their continuous support, assistance and advice in the course of the Study.

1.5 Related Studies and Survey

1.5.1 Related Studies in the Past

There are a number of water supply and sewerage projects being studied and designed in Kenya, most of them are individual projects or schemes. There are, however, two comprehensive studies for water supply and sewerage developments which were performed on a nationwide or district wide basis:

(1) National Water Master Plan (NWMP)

NWMP was established by MWR in July 1992 under a technical cooperation programme of JICA.

NWMP collected and processed various data and information on water resources in Kenya and finally built up a National Water Resources Database (NAWARD).

(2) Water Resources Assessment and Planning

WRAP was initiated in 1981 and is continuing in phases under assistance of the Government of Netherlands. WRAP aims at developing capabilities and methodologies for: (i) systematic and regular water resources assessment at regional or catchment level, (ii) rational development and effective management of water resources, and (iii) facilitating rural water supply in selected districts; by providing basic water resources data. To date, WRAP has been completed for 14 districts, out of 63 districts in 4 phases.

Under WRAP IV, a detailed inventory of water resources was made, including water usage and river flow rates. Also under WRAP IV, effective water development plans were established.

1.5.2 Water Resources Database

A Water Resources Database Section was established within MWR in 1993 with the following objectives:

1) To implement the recommendations on development and updating of NAWARD

2) To further develop the Water Resources Database and to speed decisions taking on all policy matters with regards to collection, storage, analysis and release of water resources data and information

3) To coordinate the establishment of Catchment and District Water Resources Data and Information Centres

The Water Resources Database Section is divided into three units: (i) The Water Resources Documentation Centre, (ii) NAWARD, (iii) Geographical Information Systems (GIS) & Digital Cartography Centre. Among them NAWARD is the core and provides such surface water and groundwater water resources data as listed below:

Available Data from NAWARD

Section	Type of Data	Number of Data
Surface Water	Water level	16,703 stations
	Current meter gauging	27,812 samples
	Rating curves	1,175 samples
Water Quality	Pollution	1,155 samples
	Water supplies	1,817 samples
	Monitoring	3,266 samples
	Boreholes	2,353 samples
Groundwater	Boreholes	10,724 samples
Water Rights and Assessment	Water permits and authorities	8,448 registration

Source: Water Resources Information, Water Rights & Assessment Section, Water Resources Database Unit, MWR, September 1996.

Note: As of December 1997, the number of data for water quality boreholes and groundwater boreholes was 2,545 and 10,778, respectively.

NAWARD is an important and precious tool for water resources development planning in Kenya ; therefore, it needs to provide data and information as accurately as possible. Further, in spite of MWR's tremendous effort, has not been built up a complete inventory of water supply and sewerage projects in Kenya. NAWARD could be expanded to include such inventory; therefore, the required resources should be allocated as earlier as possible to accomplish this objective.

1.5.3 Survey on Socio-Economy, Water Supply and Sewerage Sectors

The Study covers the whole area of the Kenya.

To supplement the existing data and information, the Study Team survey the socio-economy, water supply and sewerage sectors. An outline of the survey is summarised below:

Outline of Survey on Socio-Economy, Water Supply and Sewerage Sectors

Work Item	Surveyed Samples
Survey on Socio-economy - Survey on Economy - Household Survey on Water Use and Sanitation	 - Data collection and analysis mainly at Nairobi. - At selected 14 districts and 39 urban centres.
Survey on Water Source	- At selected 158 urban centres. - At selected 70 rural water supplies in 14 districts.
Survey on the Existing Urban and Rural Water Supply Systems	- At selected 158 urban centres and 14 districts respectively.
Survey on the Existing Sewerage Systems	- At selected 31 urban sewerage systems in 20 districts, and 100 non-sewered sites in 5 districts.
Water Quality Analysis for the Existing Sewerage Systems	- At selected 31 urban sewerage systems in 20 districts.

Source: The Aftercare Study Team

The details of the above works are explained in the Specifications in the Data Book. The work was started at the end of December 1997 and completed in March 1998.

CHAPTER 2 PRESENT PHYSICAL AND SOCIO-ECONOMIC CONDITIONS IN THE STUDY AREA

2.1 Physical Conditions

2.1.1 Land, and Topography

Kenya lies approximately between latitudes 50°20'N and 4°40'S and between longitudes 33°50'E and 41°45'E, and has a territorial area of 582,646 km^2.

The territorial area is divided into water area of 11,230 km^2 and land area of 571,416 km^2. Of the land area, approximately 490,000 km^2 (86% of the land area) is classified as arid and semi-arid land (ASAL), which has few soil or water resource but supports over 25% of the human population and over half of the livestock production in the country at the present. The remaining area of about 81,000 km^2 is classified as profitably usable lands, sustaining a substantial portion of Kenyan economy and human population.

Kenya is characterised by tremendous topographical diversity, ranging from glaciated mountains to a true desert landscape. The elevation varies greatly from sea level at the Indian Ocean to 5,199 m at the Batian Peak of Mt. Kenya.

2.1.2 General Geology

Kenya is underline by three major geological eras ranging from Pre-Cambrian to Cenozoic.

The Pre-Cambrian system is represented by volcanic rocks, igneous rocks and metamorphic complexes and covers mainly western and central parts of the country.

The Paleozoic - Mesozoic system consists of mainly sedimentary rocks including limestone underlain by basalt at the lowest part of the succession. The system covers the northeastern area bordering Ethiopia and Somalia, and southeast coastal area.

The Cenozoic system is divided into three sub-systems: (i) Tertiary sedimentary and large volume of volcanic rock, (ii) Pleistocene coral reefs, sandstone intercalated by pyroclastic lava, and (iii) Recent alluvial deposit, evaporite and volcanic ash. The volcanic rock of the system covers the major part of the Rift Valley and Recent (Quaternary) deposit does mainly in the vast area of the eastern part of the country.

2.1.3 Hydrogeology

The hydrogeological conditions are as shown in **Figure - 2.1.1** and as summarised in **Table - 2.1.1** respectively. There are three major hydrogeological areas in Kenya. They are (i) volcanic rocks (Patterns 3 and 4), (ii) Pre-Cambrian metamorphic basement rocks (Pattern 5) and Pre-Cambrian intrusive rocks (Pattern 9), and (iii) Sedimentary rocks (Patterns 1, 2, 6, 7, 8).

(1) Volcanic Rock Area

Volcanic rocks cover about 26% of the country, more widely in Western Kenya.

The lithology varies considerably and includes phonolites, trachytes, tuffs and basalts. Groundwater is mostly stored in the old weathered surfaces of older formations (mainly the metamorphic basement rocks) below lava flows and in layers between successive lava flows. Fractures, faults, fissures, and joints are also suitable sites for groundwater storage.

The aquifers are confined. Yield, depth to aquifers, and static water level vary considerably. The average yield of a well is about 7.5 m^3/hr with a standard deviation of about 6.5 m^3/hr; average depth to the main aquifer is about 94 m with a standard deviation of about 58 m, and average artesian pressure is about 45 m.

The groundwater is generally of bi-carbonate type with low total dissolved solids (TDS) or low electric conductivity. There are local pockets with high fluoride content that are believed to be of volcanic and fumarolic origin.

(2) Pre-Cambrian Metamorphic Basement Rock and Intrusive Rock Area

The Pre-Cambrian rocks are widely distributed in the central, western and northwestern parts of Kenya and cover about 17% of the country.

Granites, gneisses, schists and sediments dominate the lithology. These rocks are deeply weathered in places although the extent of weathering differs. Groundwater occurs at rather deep level in locations where faults and fractures are distributed.

The aquifers in the basement area are rather confined. Yield, depth to aquifers, and static water level vary within rocks. The average yield is about 4.5 m^3/hr, the average depth to main aquifer is about 55 m and the average artesian pressure is about 31 m.

Quality of the confined groundwater is generally hard at moderate electric conductivity.

In the upper parts of the basement rocks, unconfined groundwater occurs locally at depths varying from a few to several tens of meters where the basement rocks are weathered and fractured. The water level fluctuates considerably and may dry up in the dry season.

(3) Sedimentary Rock Area

The sedimentary rock area accounts for about 55% of Kenya, predominantly in its eastern, northwestern parts and around Lake Victoria. The rocks range in age from Paleozoic to Cenozoic and are composed of sands, clays, sandstones, shales, and limestones.

The average depth to aquifers is about 54 m with a standard deviation of about 48 m. The artesian pressure is lowest (about 20 m), but the specific discharge is highest at about 0.32 m^3/hr/m among aquifers in Kenya.

1) Quaternary sediments

The Quaternary sediments area accounts for almost one-third of the country, ranging essentially from the Tanzanian border to the Ethiopian border, and as far as longitude 38° E. Alluvial, lake and beach sands, coral reefs, and limestones dominate the lithology. The sediments are loose and permeable.

The aquifers are generally shallow and unconfined. The success ratio of borehole drilling is very high.

A serious problem in groundwater development in Quaternary sediment area is occurrence of salt water. The origin of the saline water is believed to be due to accumulation of solute evaporate minerals within the sediments which have not been removed by groundwater circulation. However, saulty groundwater in the coastal areas is believed to be caused by the seawater intrusion.

2) Older sedimentary rock area

The older sediments are distributed in the southeastern and northeastern corners of the country. The three major sedimentary rocks, sandstones, limestones, and shales dominate the lithology.

The aquifers are mostly confined and deep in depth. Considerable faulting and folding are believed to have occurred and the groundwater occurs in syncline parts of the folds, and fractured parts of faults. The water quality is generally of a chloride type.

2.1.4 Drainage System

Kenya's drainage system is relatively simple. All the main rivers are consequent on the great dome formed by the Central Highlands or on the southern foothills of the Ethiopian highlands, and the country could be divided into five drainage areas as shown in **Figure - 2.1.2**. They are the Lake Victoria, Rift Valley, Athi Tiver and Coast, Tana River, and Ewaso N'giro and North areas with drainage areas of 46,229, 130,452, 66,837, 126,026, and 210,226 km^2 respectively.

Characterised by climatic and geographic conditions, rivers in ASAL areas run out seasonally when occurring heavy storm rainfall. The perennial flows are normally observed only in the following major rivers :

Major Perennial Rivers in Kenya

Rivers	Drainage Area	Catchment Area (km^2)	Length of River (km)
Mara	Lake Victoria Basin	8,967	270
Nzoia	Lake Victoria Basin	12,709	334
Yala	Lake Victoria Basin	3,280	219
Sondu	Lake Victoria Basin	3,481	170
Kuja	Lake Victoria Basin	6,919	221
Malewa	Lift Valley Basin	1,716	75
Kerio	Lift Valley Basin	13,816	559
Suam-Turkwell	Lift Valley Basin	20,468	390
Athi-Galana-Sabaki	Athi River and Coast Basin	37,689	688
Rare	Athi River and Coast Basin	8,176	243
Tana	Tana River Basin	88,754	979
Ewaso N"giro (North)	Ewasa N'grio and North Basin	74,365	752
Ewaso N"giro (South)	Ewasa N'grio and North Basin	8,722	287
Total		289,062	

Source: NWMP Sectoral Report (B), Hydrology, July 1992.

2.1.5 Lakes and Springs

(1) Lakes

Kenya has a number of lakes of different water types as shown below:

Major Lakes in Kenya

Lakes	Elevation (m)	Area (km^2)	Type of Water
Victoria (Kenyan part)	1,133	3,755	Fresh
Turkana	375	6,405	Fresh
Naivasha	1,884	210	Fresh
Baringo	975	129	Fresh
Bogoria	991	34	Saline
Nakuru	1,758	52	Saline
Elementaita	1,776	21	Saline
Jipe	701	39	Fresh
Magadi	579	104	Saline

Source: Statistical Abstract, 1996, CBS.

Of those 9 lakes, only Lake Victoria has an outlet and the other lakes have no outlet. Lake Nakuru and a part of Lake Turkana are designated as the national park and the former is the first registered area under Ramsar Convention in Kenya. There are however increasing concerns about water quality and hydrologic phenomena on some lakes as described in Supporting Report III.

(2) Springs

It is believed that there are a large number of springs in the country and they are important sources of water supply for various sectors. According to "Welfare Monitoring Survey II, 1994, Basic Report, CBS" (the Welfare Monitority Survey II) springs sustain 15% of the total households in Kenya in terms of safe water supply. Unfortunately there is no inventory presenting exactly the locations of and discharges from the springs. Major springs are Mzima, Njoro Kubwa, Noltresh, and Kikuyu and their features are reported in Supporting Report III.

2.2 Climate

2.2.1 General Climate

The climate in Kenya is primarily controlled by the movement of the Inter Tropical Convergence Zone (ITCZ) and by topographic relief, especially elevation. The south monsoon is predominant during the period from April to May or to June in the low elavation areas east of 38°. The northeast monsoon contrary becomes dominant from October to December.

The country is divided into three climatic regions, namely, (i) Equatorial and Monsoon Variety, (ii) Northern and Southern Tropical and Continental and Monsoon Variety, and (iii) Northern and Southern Tropical Continental Semi-Desert and Desert as shown in **Figure - 2.2.1**. More details of climate in Kenya is provided in Supporting Report IV.

2.2.2 Air Temperature and Relative Humidity

In general the coast and Rift Valley areas are characterised by hot and humid climate throughout the year, while the central highland areas are favoured with cool and dry weather.

Air temperature varies largely from below the freezing point at snow-capped peak in Mt. Kenya to over 40°C in low altitude arid areas in the north and northeast. The mean annual temperature is at about 20°C in Nairobi and it is more than 30°C in Lodwar.

Relative humidity is almost constant throughout the country and the year. It is in a range of 60 - 80% at 09:00 hours and in a range of 40 - 70% at 15:00 hours.

2.2.3 Evaporation

The evaporation largely varies from location to location, from minimum 1,215 mm/year at Kimakia to as much as 3,846 mm/year at Lokori.

2.2.4 Rainfall

There are two rainy periods for most parts of the country in a year. In general, "Long Rain" period lasts from March to May and "Short Rain" remains from October to November.

The isohyetal map is shown in **Figure - 2.2.2.** Although the annual rainfall is about 620 mm on the average over the country, it is unevenly distributed throughout the country and varies largely from year to year. The annual rainfall is the lowest in Lake Turkana area, being less than 200 mm and the highest, 1,800 mm in Kakamega area in Western Kenya. Nearly a half of the country receives the annual rainfall less than 400 mm.

2.2.5 Drought and Flooding

Kenya experienced a severe drought and contrary serious flooding from 1996 to 1998.

It was reported that there was very scarce rainfall in the Short Rain Period in 1996 and "Long Rain Period" in 1997, especially over the Central, Northern and North Eastern Provinces.

Soon after the long spell of the drought period, the unusual rains caused by the El Nino weather phenomenon started from September 1997 and lasted until end of April 1998. It resulted in flooding various parts of the country, including Nairobi and Mombasa. Raging floods have caused loss of human lives and livestock, displacement of thousands of people, damage to infrastructure, and outbreak of killer diseases.

According to the government sources, it is quite clear that given the magnitude and extent of the destruction, it is the biggest national calamity that Kenya has ever faced and the Government will spend over Kshs 8 billion over the next five years on the infrastructures. The damage to infrastructure will be felt by all sectors of the economy for many years to come.

2.3 Surface Water Resources

2.3.1 Data Sources

The previous two studies, NWMP and WRAP present extensive and valuable data and information as well as analytical results regarding the surface water resources in the country. It was, therefore, pre-determined upon consultation to the Technical Committee that the Study refers to such data, information and analytical results in order to proceed with the Study rationally and efficiently and to maintain the consistency in nature and accuracy of the studies.

This section summarises the surface water resources in Kenya. More detailed data are compiled in the Supporting Report IV and Data Book.

2.3.2 Existing Stream Flow Gauging Network

The stream flow gauging is under the responsibility of the Hydrology Section of MWR. As of 1991, there are 399 stream flow gauging stations under operation. Their distribution by the drainage area is shown below:

Number of Stream Flow Gauging Stations in Kenya

Drainage Area	No. of Gauging Station		
	In-operation	Abandoned	Total
Lake Victoria	114	115	229
Rift Valley	50	103	153
Athi River and Coast	74	149	223
Tana River	116	89	205
Ewaso N"giro and North	45	68	113
Total	339	524	923

Source: NWMP, Sectoral Report (B), Hydrology, July 1992.

A large number of stream gauge stations have been abandoned in the past. It is the most desirable to collect and accumulate various hydrologic data as accurately as possible at strategic locations of the rivers to develop rational and effective surface water management as a whole.

2.3.3 Low Flows of Perennial Rivers

Among the various hydrological data and analytical results presented in NWMP, the dimensionless flow duration curves and quantity of surface runoffs of the perennial rivers were of particular important to the Study Team.

(1) Annual Mean Runoff of Perennial River

The runoffs of the rivers are substantial among the water resources in the country. The mean annual runoffs of the perennial rivers have been estimated by NWMP at 19,691 x 10^6 m^3/year as shown in the table below:

Average Annual Mean Runoff of Perennial Rivers

Drainage Area	Catchment Area of Perennia River	Total Annual Mean Runoff (10^6 m^3)	Annual Man Runoff per Unit Area (m^3/km^2)
Lake Victoria	41,306	11,672	282,570
Rift Valley	51,062	2,784	54,510
Athi River and Coast	53,955	1,152	21,340
Tana River	95,989	3,744	39,000
Ewaso N" giro and North	12,107	339	28,000
Total	254,419	19,691	77,390

Source: NWMP, Sectoral Report (B), July 1992.

Surface water resources largely vary from one river basin to another and this characteristic is more clearly seen in **Figure - 2.3.1** which shows the contour lines of annual mean annual runoff over the country. The rivers in ASAL run out only when occurring heavy storm rainfall; therefore there is no perennial flows in such rivers.

(2) Dimensionless Flow Duration Curves

In the dimensionless flow duration curve, vertical coordinate is expressed as a percentage of daily runoff against the annual mean runoff and horizontal coordinate shows a time scale of the year. Thus, by knowing only the annual mean runoff of the river under consideration, daily runoff at any dependability can be obtainable.

Especially in Kenya, the unregulated surface runoff of the rivers is the most predominant water source for potable water supply and for this purpose a large number of run-of-river intake facilities have been constructed. To facilitate the water resources development planning for increased water demand, 174 stream gauge stations were selected and their dimensionless flow duration curves have been quoted from NWMP. They are compiled in the Data Book.

2.3.4 Flood Flow Characteristics of Perennial Rivers

NWMP had elaborated the analysis of flood flow characteristics for every drainage areas and had particularly worked out (i) relationship between the ratio of probable floods of various return periods to the mean annual flood and the return period, and (ii) relationship between the catchment area and the mean annual flood. Such relationships had been developed from flood records available for 39 stations for Drainage Area 1, 9 stations for Drainage Area 2, 7 stations for Drainage Area 3, 15 stations for Drainage Area 4, and 8 stations for Drainage Area.

Figures - 2.3.2 and **2.3.3** present a relationship between the return period and the ratio of probable flood to mean annual flood and a relationship between magnitude of mean annual flood and catchment area, respectively. By using those two charts, magnitude of flood flow at any probability at any location or the river can be obtainable from the catchment area of the river under consideration.

2.3.5 Water Quality

The Water Quality and Pollution Control Section of MWR is responsible for implementation of a nation wide water quality monitoring programme and its monitoring network consists of 120 monitoring points over all the major rivers, lakes, and springs. The existing monitoring points are classified into two groups as follows:

(1) "Reference points" are located in the upper catchment of the major rivers to provide baseline data on natural water quality.

(2) "Impact points" are sited near pollutant load discharge points and at the downstream reach of such points to assess the self-dilution capability of the rivers.

The programme calls for sampling four times a year namely, January - February, April - May, June - July, and October - November at the respective location.

According to NWMP, water quality of rivers and lakes in general is reported as summarised below. Detailed observation records are presented in Data Book.

(1) Rivers

Electric Conductivity is 100 - 250 micro S/cm, but occasionally reaches 350 - 500 micro S/cm. Alkalinity is generally neutral to slightly alkaline. Caustic concentration is low, but some rivers show higher concentration of iron and manganese than those set forth in Kenyan Drinking Water Guideline.

In view of the drinking should be used will be recommendable. However, in some rivers, a relatively high concentration of fluoride has been detected which will be a major problem for supplying drinking water.

(2) Lake

The alkaline - saline lakes are not possible sources for potable water supply. Of the freshwater lakes, Lake Victoria is currently the main source of potable water supply schemes in Kisumu and other areas on lake shore. NWMP has pointed out concerns about depletion of lake level, deterioration of water quality, adverse effect of fauna and flora, etc. on major lakes.

2.3.6 Sediment Loads

NWMP developed a preliminary relationship between the suspended load concentration and the discharge, which is expressed by the following mathematical equation:

$$Qs = aQ^b$$

where,

Qs : Suspended load concentration (ppm)
Q : River discharge (m^3/sec)
a, b : Constant

The relationship had been developed for 36 stream gauging stations. Details are shown in Supporting Report IV. The suspended load should be measured continuously and periodically to analyse more accurately the amount and long-term tendency of the suspended loads to effect the watershed management and conservation of the lakes.

2.3.7 Estimate of Available Surface Water Resources by District

Unregulated surface runoffs of rivers and groundwater are the main sources of water supply for rural population and livestock. The rural and livestock water supplies are to be planned on a basis of a district unit. On the premise that the unregulated surface waters of the rivers will continuously play a predominant role in future supply, the available surface water resources for the respective district was estimated in line with the following approach :

(1) Definition of Available Surface Water Resources

Reliable flow at a given site of a given river is defined to be a 90% dependable flow deducted by river maintenance flow. If one district extends over a couple of river basins, the available water resources is the summation of the reliable flows of the rivers concerned.

(2) 90% Dependable Flow

A 90% dependable flow is obtainable from flow duration curve of the nearest stream gauging station of the river in the district concerned.

(3) River Maintenance Flow

The river maintenance flow is to preserve aqua-ecology of river and assumed to correspond to the recorded daily minimum runoff of the river concerned.

(4) Surface Water Resources of Seasonal Rivers

The rivers in ASAL areas run out seasonally during heavy storm rainfall, meaning reliable surface runoff is not available throughout the year.

The available surface water resources are estimated for the respective district in accordance with those principles as presented in **Table - 2.3.1.**

2.4 Groundwater Resources

2.4.1 Data Sources

As with surface water resources, the assessment of the groundwater resources also widely referred to the outputs of NWMP and WRAP. The Study Team intensively reviewed these studies in light of the latest data available in NAWARD and have identified the following facts in the process of data analysis:

1) The coordinates, water struck level, water rest level etc. of boreholes are not properly recorded for a considerable number of data,
2) Measurement units of various parameters seem not to be unified,
3) Boreholes in the field are not necessarily recorded, and
4) The current status as to "operational" or "abandoned" appears not to have been updated.

A more detailed report is provided in Supporting Report IV. Data input into the database should be made with utmost care and the database itself should be updated from time to time to provide accurate and latest data.

2.4.2 Features, Operation and Maintenance of Existing Boreholes

(1) Number of Existing Boreholes

There are 10,778 boreholes recorded in NAWARD as of December 1997, of which 8,448 boreholes are registered with water right. The number and density of the existing boreholes by district are as shown in **Table - 2.4.1.**

(2) Diameter of Casing

Casing pipe with the diameter of 140 - 160 mm is widely used, followed by 200 - 240 mm. As there are no significant technical problems in using casing pipes of the 152 mm (6 inch) or 203 mm (8 inch) diameter, these diameters could continuously be used for well construction.

(3) Depth of Boreholes

Depth of existing boreholes varies considerably depending on hydrogeological conditions. The average and range of the existing well depth are described in the subsection 2.1.3.

(4) Borehole Productions

From NAWARD, statistic of well production was obtained for two different casing diameters, 152 mm and 203 mm, as summarised below:

Production of Existing Boreholes

Casing Diameter (mm)	Data Nos.	Borehole Production (m^3/hour)		
		Average	Range	Standard Deviation
152	3,889	6.13	0 - 56.7	5.4
203	1,266	9.12	0 - 98.7	9.1

Source: NAWARD

The larger diameter the casing is, the more the well production will be.

(5) Operation and Maintenance Issues

A considerable number of existing boreholes had been abandoned. For instance, according to WRAP, of the entire boreholes 51% has been abandoned in Baringo, Kilifi, Kajiado, West Pokot and Marsabit Districts. The Aftercare considered it essential to highlight operation and maintenance matters of existing boreholes for a future development of groundwater. Further, according to WRAP, the main reasons are mechanical breakdown (28%) and lack of operation and maintenance funding (19%).

According to WRAP, there are 748 boreholes in Baringo, Kilifi, Kajiado and West Pokoto Districts, of which 284 boreholes are actually in use now. Of these boreholes, operation and

maintenance mode is clarified only for 196 boreholes, of which 90% is defined to be an owner-maintenance mode. This fact leads to conclusion that this mode is the desirable option in view of sustainability of borehole construction, operation and maintenance.

2.4.3 Features, Operation and Maintenance of Existing Dug Wells

(1) Number of Existing Dug Wells

In rural areas, dug wells (protected and unprotected) are one of the important sources of water supply. According to the Welfare Monitoring Survey II, dug wells sustains 14% of the total households in Kenya. Unfortunately, there are no statistics available regarding the number of existing dug wells in the country. WRAP inventory survey reports that there are 1,504 dug wells in Baringo, Kilifi, Kajiado, West Pokot and Marsabit Districts.

(2) Water Bailing Method

There are two methods for bailing water from a well. One is manual bailing and the other is pump bailing. Manual bailing is used for 80% of the wells. According to WRAP data for the above district, of wells using pump bailing, more than 90% is with hand pump.

(3) Operation and Maintenance Issues

The operation and maintenance mode is quite the same as that of the boreholes. The owner-maintenance mode is predominant, accounting for 96.1% of all wells.

2.4.4 Re-assessment of Groundwater Safe Production

(1) Borehole

As noted in subsection 2.4.1, the Study Team reviewed the concerned section of NWMP and WRAP and attempted to update safe groundwater production. The review of the two previous studies could be summarised as follows :

1) "Safe yield" obtained by NWMP appears to be the "safe yield" from the existing boreholes that are not always fully utilised in Kenya from various reasons. It seems that the results do not always reflect the hydrogeological conditions.

2) Hydrogeological factors appear to be inconsistent between WRAP and NWMP, causing difference in the estimated values of safe yield in the same studied areas.

The re-assessment elaborated on the following conditions:

1) Safe yield is defined as yield that can be ensured for a period of 20 years with the resulting drawdowns of wells not exceeding 15 m from the original static level.

2) To plan the subsequent water supply, safe groundwater production is to be estimated on a district basis.

3) The same mathematical model as adopted in NWMP is applicable to the present re-assessment. The hydrogeological parameters such as transitivity and storage capacity in NAWARD were averaged for each district, assuming that the averaged hydrogeological factors represent the average hydrogeological conditions in a district.

4) Initial yields in NAWARD were averaged for each district, assuming that the initial yield is the optimum yield for an average borehole in a district.

5) A borehole should be apart from other adjacent boreholes so that drawdown of the concerned borehole least influences the other adjacent boreholes. A distance was calculated from a borehole to a point where the resulting drawdown is not more than 0.1 m after 20 years operation. The averaged initial yield was used for this drawdown calculation.

6) Drawdown was calculated for six (6) different pumping hours: 4, 6, 10, 12, 18 and 24 hours per day. The calculated pumping volumes from a unit area (km^2) vary as a function of daily pumping hours and well density. Maximum pumping potential from a unit area was selected as the safe yield potential.

7) The maximum pumping potential was multiplied by a "safe yield factor"; the ratio of safe yielding boreholes against all boreholes to be considered.

The calculated results are shown in **Table - 2.4.2.** Safe production is estimated at 184.5 million m^3 per year for the whole country, ranging from 86.5 million m^3 per year in Mombasa District to 24.9 million m^3 per year in Garissa District. It is 8.5 million m^3 less than that of NWMP.

(2) Shallow Wells

NWMP defined 'a shallow well' to be a groundwater-producing-well which includes hand dug wells, and hand-drilled or machine drilled wells not exceeding 50 m in depth. It is understood from the text of NWMP that 'a shallow well' is to abstract unconfined water.

NWMP estimated the safe yield of shallow well at 426.1 million m^3/year over the country (see **Table - 2.4.2**). Although the potential appears to be larger than that of borehole, there are possible problems concerning the use of shallow wells such as:

1) Water quality may not be satisfactory due to contamination from domestic wastage in populated areas, pollution form agricultural chemicals and fertilisers in farmlands, saline water intrusion in coastal areas etc.

2) Shallow water is prone to dry up in dry seasons.

Shallow-well-option should be used only when alternative water sources are not available in the areas concerned.

2.4.5 Water Quality of Boreholes

The three parameters, EC, fluoride and iron, are most important for indicating water quality. There are only 628 water quality data of those three parameters and coordinates for boreholes. NWMP developed three different maps, illustrating area distribution of EC, iron and fluoride as shown in **Figures - 2.4.1, 2.4.2** and **2.4.3**. On the basis of these maps and NAWARD's data a general tendency is briefly described for the respective parameter as follows:

(1) EC (Electric conductivity)

EC value is high in the northeastern area such as Mandera and Wajir districts and coast area, and it is almost at the permissible level in Garissa district. In other areas, EC value is generally within the permissible level, though high EC is detected locally.

(2) Fluoride (F)

High concentrations of fluoride is flequently observed in and around Nairobi and Nakuru districts and partly in the areas around Mt. Kenya. In other areas, high fluoride is only sparsely observed, particularly in the northeast of the country.

(3) Iron (Fe)

High concentrations of iron is flequently observed in the Western province, Meru district, and in/around Nairobi and Nakuru districts. In other area, concentrations similar levels to that of fluoride are observed.

Among those parameters, fluoride is harmful to human health. Iron and salinity are factors that cause inconvenience or adverse aesthetic effect if the concentrations exceed certain levels. Hence, groundwater with a higher concentration of iron or high salinity can be used if an alternative water source is not available in the areas concerned.

2.5 Present Water Resources Development Situation

In Kenya, water abstraction from the rivers, lakes, springs, and groundwater is under jurisdiction of the Water Apportionment Board (WAB) of MWR.

As far as the surface water resources of the rivers are concerned, the water permit is issued under two different conditions; (i) under normal flow condition and (ii) under flood flow condition.

According to NWMP, the annual abstractions from the surface water and groundwater resources are reported as summarised below:

Present Surface Water Abstraction

Drainage Area	Drainage Area (km^2)	Total Abstraction (10^6 m^3/year)	Abstraction per Unit Area (m^3/km^2/year)	Ratio to Annual Mean Runoff (%)
Lake Victoria	41,306	254.3	6,156	2.2
Rift Valley	51,062	46.8	917	1.7
Athi River and Coast	53,955	133.1	2,467	11.6
Tana River	95,989	595.4	6,203	15.9
Ewaso Ngiro and North	12,107	42.1	3,477	12.4
Total	254,419	1,071.7	4,212	5.4

Source: NWMP, Main Report, Volume 1, July 1992.

Present Groundwater Abstraction

Drainage Area	Drainage Area (km^2)	Total Abstraction (10^6 m^3/year)	Abstraction per Unit Area (m^3/km^2/year)
Lake Victoria	46,229	9.34	202.0
Rift Valley	130,452	11.67	89.5
Athi River and Coast	66,837	27.76	415.3
Tana River	126,026	4.79	38.0
Ewaso Ngiro and North	210,226	42.10	200.3
Total	579,770	57.21	98.7

Source: NWMP, Main Report, Volume 1, July 1992.

The surface water abstraction volume is for normal flow condition.

The total abstraction quantities of the surface water and groundwater correspond to only 5.4% of the annual mean runoff and 9% of the safe groundwater production by boreholes, respectively. From these figures, it is concluded that there still remains great potential in the surface water and groundwater resources in the country.

2.6 Administrative Division

2.6.1 Central Government

Administrative division of Kenya comprises provinces, districts, divisions, locations, and sub-locations, and their boundaries have been changed year after year. According to the latest information obtained, the number of districts as of 1997 is 63. It was, however, hardly possible to confirm the latest boundaries of the 63 administrative districts, although the Study Team made the best efforts with assistance from MWR. Eventually, as noted in the subsection 1.2.2, it was

finally determined that the Study shall be based on the boundaries of the 50 administrative districts obtained from "Kenya Administrative Boundary Map (Survey of Kenya, January 1996)". The administrative divisions adopted are presented in **Figure - 2.6.1** and **Table - 2.6.1**, and summarised in the table below.

Administrative Division in Kenya, 1996

Province	Number of Districts	Number of Divisions	Number of Locations	Number of Urban Centres
Nairobi	1	8	29	1
Central	5	25	129	36
Coastal	6	27	114	22
Eastern	10	44	175	42
North Eastern	3	21	64	15
Nyanza	6	34	164	24
Rift Valley	15	70	344	58
Western	4	27	80	17
Total	50	256	1,099	215

Source: The 1989 Population Census and Kenya Administrative Boundary Map, January 1996, SOK.

The urban centres are defined as all "city councils, municipal councils, town and county councils, all district headquarters, and "towns and trading centres" having a minimum population of 2,000 and potential for future growth", according to the 1989 Population Census. They number 215 as shown in **Table - 2.6.2**. Of these urban centres, The 141 urban centres with projected populations more than 5,000 by 2010 were selected as the objective area of urban water supply for the Study.

2.6.2 Local Authorities

Local authorities are classified as: city council, municipal council, town council, and county council.

To do the Study rationally and effectively, the same coding system as that adopted by NWMP was used.

Coding System of Administrative Divisions

Administrative Unit	Code
Province	Three digits (100 – 900)
District	Double digits(10 – 90)
Division	Single digits (1 – 9)
Location	First decimal (0.1 – 0.9)

For urban centres, a serial number is used with initial of "U".

2.7 Socio-Economic Conditions

2.7.1 Population

(1) Population and Regional Distributions

The historical population trend of Kenya and its regional distribution by province was obtained from the Central Bureau of Statistics, and presented in **Table - 2.6.1** and in the table below.

Population and Distribution by Province, 1991 - 1998

(Unit: 1,000)

Province	1991		1992		1993		1994		1995		1996		1997		1998		Average Annual Growth Rate
	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%	Pop.	%	
Nairobi	1,564	6.4	1,635	6.5	1,708	6.6	1,782	6.7	1,857	6.7	1,932	6.8	2,009	6.9	2,086	7.0	4.2%
Central	3,403	13.9	3,481	13.8	3,559	13.7	3,636	13.6	3,712	13.5	3,782	13.4	3,853	13.3	3,919	13.2	2.0%
Coast	2,031	8.3	2,086	8.3	2,142	8.2	2,195	8.2	2,250	8.2	2,303	8.1	2,353	8.1	2,404	8.1	2.4%
Eastern	4,177	17.1	4,298	17.0	4,412	17.0	4,536	16.9	4,653	16.9	4,767	16.9	4,882	16.8	4,994	16.8	2.6%
North-Eastern	585	2.4	603	2.4	621	2.4	640	2.4	657	2.4	674	2.4	692	2.4	708	2.4	2.8%
Nyanza	4,311	17.6	4,428	17.5	4,542	17.5	4,655	17.4	4,767	17.3	4,876	17.3	4,983	17.2	5,087	17.1	2.4%
Rift Valley	5,555	22.7	5,763	22.8	5,976	23.0	6,190	23.1	6,405	23.3	6,621	23.4	6,836	23.6	7,055	23.7	3.5%
Western	2,850	11.6	2,942	11.7	3,036	11.7	3,128	11.7	3,219	11.7	3,311	11.7	3,403	11.7	3,492	11.7	2.9%
NATIONAL	24,476	100.0	25,236	100.0	26,001	100.0	26,762	100.0	27,520	100.0	28,266	100.0	29,011	100.0	29,745	100.0	2.8%

Source: Kenya Population Census 1989, Analytical Report Volume VII, April 1996, Central Bureau of Statistics.

Population increased significantly at an annual growth rate of 2.8% during the period from 1991 to 1998, having a total population of 29.7 million by 1998. When looking at a growth rate by province, Nairobi province had the highest growth rate at 4.2% followed by Rift Valley province at 3.5%.

(2) Population Density

The historical trend of population density from 1991 to 1998 by province is presented in the table below. More detailed information is given in Supporting Report I.

Population Density by Province, 1991 – 1998

(Unit: 1,000)

Province	Area	1991		1992		1993		1994		1995		1996		1997		1998	
	(km²)	Pop.	Density	Pop.	Pop./km²	Pop.	Pop./km²	Pop.	Pop./km²	Pop.	Pop./km²	Pop.	Pop./km²	Pop.	Pop./km²	Pop.	Pop./km²
Nairobi	693	1,564	2.257	1,635	2.359	1,708	2.465	1,782	2.571	1,857	2.680	1,932	2.788	2,009	2.899	2,086	3.010
Central	13,235	3,403	0.257	3,481	0.263	3,559	0.269	3,636	0.275	3,712	0.280	3,782	0.286	3,853	0.291	3,919	0.296
Coast	84,313	2,031	0.024	2,086	0.025	2,142	0.025	2,195	0.026	2,250	0.027	2,303	0.027	2,353	0.028	2,404	0.029
Eastern	154,354	4,177	0.027	4,298	0.028	4,417	0.029	4,536	0.029	4,653	0.030	4,767	0.031	4,882	0.032	4,994	0.032
North Eastern	126,186	585	0.005	603	0.005	621	0.005	640	0.005	657	0.005	674	0.005	692	0.005	708	0.006
Nyanza	12,507	4,313	0.345	4,428	0.354	4,542	0.363	4,655	0.372	4,767	0.381	4,876	0.390	4,983	0.398	5,087	0.407
Rift Valley	182,412	5,555	0.030	5,763	0.032	5,976	0.033	6,190	0.034	6,405	0.035	6,621	0.036	6,836	0.037	7,055	0.039
Western	8,285	2,850	0.344	2,942	0.355	3,035	0.366	3,128	0.378	3,219	0.389	3,311	0.400	3,403	0.411	3,492	0.421
NATIONAL	581,786	24,676	0.042	25,236	0.043	26,001	0.045	26,762	0.046	27,520	0.047	28,266	0.049	29,011	0.050	29,745	0.051

Source: Kenya Population Census 1989, Analytical Report Volume VII, April 1996, Central Bureau of Statistic.

Note: Area given in Atlas is 582,646 km²

Of the eight provinces, Nairobi province has the highest population density at 3,010 persons/km², and the lowest is in North Eastern province at only 6 persons/km² where is classified into ASAL.

(3) Urban Population

The 1989 population of the each urban centre is given in **Table - 2.6.2.** The size of population of the urban centres varies widely ranging from the smallest population of 186 in Kambu Town Centre (Makueni District) to the largest population of 1,324,570 in Nairobi (Nairobi District) in 1989.

2.7.2 Macro Economy

An overview of Kenyan economy in terms of GDP is summarised in the table below.

The economy of Kenya has been and is still largely dependent agriculture and tourism, having approximately 29% and 15% of GDP on average, respectively. These two key sectors have largely contributed to earning foreign exchange. In terms of annual average growth rate of GDP, the tourism and agriculture sectors achieved the highest annual growth rate of 28.6% and 19.9%, respectively, while the national average was 17.7% per annum.

GDP per capita achieved Kshs 773.63 in 1996.

Historical Trend of Gross Domestic Products (GDP), 1992-1996

(Unit: K£ million)

Description	1992		1993		1994		1995		1996		Annual Growth Rate	Average Share 1992-1996 (%)
	GDP	%	GDP	%	GDP	%	GDP	%	GDP	%		
A. Non-Monetary Economy	491.89	4.3	522.45	3.7	560.86	3.3	602.14	3.1	648.70	3.0	7.2%	15.4
B. Monetary Economy	10,910.64	95.7	13,662.96	96.3	16,342.38	96.7	18,603.65	96.9	21,218.85	97.0	18.1%	96.5
B-1 Enterprises and Non-Profit Institutions	9,033.73	79.2	11,407.34	80.4	13,908.15	82.3	15,627.65	81.4	17,945.97	82.1	18.7%	81.1
Agriculture	3,016.01	26.5	4,168.45	29.4	5,292.10	31.3	5,778.12	30.1	6,233.00	28.5	19.9%	29.1
Forestry	140.44	1.2	168.08	1.2	190.48	1.1	203.54	1.1	223.85	1.0	12.4%	1.1
Fishing	45.16	0.4	53.89	0.4	62.98	0.4	61.93	0.3	68.37	0.3	10.9%	0.4
Mining and Quarrying	30.28	0.3	35.22	0.2	35.68	0.2	36.21	0.2	37.06	0.2	5.2%	0.2
Manufacturing	1,230.73	10.8	1,419.68	10.0	1,807.76	10.7	1,945.55	10.1	2,282.23	10.4	16.7%	10.4
Building and Construction	579.60	5.1	655.20	4.6	742.80	4.4	799.18	4.2	879.02	4.0	11.0%	4.5
Electricity and Water	100.33	0.9	126.90	0.9	164.06	1.0	191.13	1.0	208.01	1.0	20.0%	0.9
Trade, Restaurants and Hotels	1,517.10	13.3	1,920.65	13.5	2,400.81	14.2	3,238.00	16.9	4,144.76	19.0	28.6%	15.4
Transport, Storage and Communications	908.70	8.0	991.91	7.0	1,262.95	7.5	1,515.64	7.9	1,713.84	7.8	17.2%	7.6
Finance, Insurance, Real Estate and Business Service	1,081.34	9.5	1,398.17	9.9	2,015.65	11.9	2,295.52	12.0	2,646.16	12.1	25.1%	11.1
Ownership of Dwellings	658.42	5.8	716.69	5.1	764.86	4.5	814.00	4.2	935.10	4.3	9.2%	4.8
Other Services	368.65	3.2	477.87	3.4	578.11	3.4	693.73	3.6	818.60	3.7	22.1%	3.5
Less: Imputed Bank Service Charges	-643.03	-5.6	-725.37	-5.1	-1,410.09	-8.3	-1,944.90	-10.1	-2,245.03	-10.3	-	-7.9
B-2 Procedures of Government Services	1,722.34	15.1	2,075.04	14.6	2,223.10	13.2	2,728.79	14.2	2,985.71	13.7	14.7%	14.1
B-3 Private Households (Domestic Services)	154.57	1.4	180.58	1.3	211.13	1.2	247.21	1.3	287.17	1.3	16.7%	1.3
C. Gross Domestic Products	11,402.53	100.0	14,185.41	100.0	16,903.24	100.0	19,205.79	100.0	21,867.55	100.0	17.7%	-
D. Population (million)	25.24	-	26.00	-	26.76	-	27.52	-	28.27	-	-	-
E. GDP Per capita (K£)	451.84	-	545.57	-	631.61	-	697.88	-	773.63	-	14.4%	-

Source: Economic Survey 1997, Central Bureau of Statistics

2.7.3 Public Expenditure

(1) Central Government

The historical trend of the central government's public expenditure during the five fiscal years from 1992/93 to 1996/97 is summarised in the table below.

The public expenditure basically composes of recurrent expenditure and development expenditure. At a national level, recurrent expenditure accounts for approximately 78% of the total expenditure, and development expenditure takes up merely 22%, on average in those five fiscal years. These figures vary quite largely according to each ministry. Focusing on development expenditure, the share of the appropriation-in-aid to total expenditure averaged approximately 54%, which is considered quite high. This situation simply substantiates the fairly poor financial basis of the country and capabilities of the government in financing and implementing all the necessary development projects their own funds.

Historical Trend of Public and Expenditure of Kenyan Government, 1992/93-1996/97

(Unit: K£ million)

Description	1992/93		1993/94		1994/95		1995/96		1996/97		Average
A. GDP at Factor Cost	11,402,520	-	14,185,410	-	16,903,240	-	19,205,790	-	21,865,550	-	-
B. National Public Expenditure	5,757,614	100.0	8,112,967	100.0	9,472,069	100.0	9,544,698	100.0	10,072,679	100.0	-
Recurrent Expenditure	4,425,046	76.9	6,558,087	80.8	7,359,345	77.7	7,572,938	79.3	7,821,953	77.7	78.5
Net Expenditure	(4,309,392)	(97.4)	(6,391,560)	(97.5)	(7,034,749)	(95.6)	(7,137,005)	(94.2)	(7,451,081)	(95.3)	(96.0)
Appropriation-in-Aid	(115,654)	(2.6)	(166,527)	(2.5)	(324,596)	(4.4)	(435,933)	(5.8)	(370,872)	(4.7)	(04.0)
Development Expenditure	1,332,568	23.1	1,554,880	19.2	2,112,744	22.3	1,971,760	20.7	2,250,726	22.3	21.5
Net Expenditure	(677,410)	(50.8)	(731,731)	(47.1)	(939,181)	(44.5)	(880,705)	(44.7)	(1,017,509)	(45.2)	(46.4)
Appropriation-in-Aid	(655,158)	(49.2)	(823,149)	(52.9)	(1,173,563)	(55.5)	(1,091,055)	(55.3)	(1,233,217)	(54.8)	(53.6)
Ratio of Net Expenditure to GDP (%)	5.9	-	5.2	-	5.6	-	4.6	-	4.7	-	5.2
Ratio of Appropriation-in-Aid to GDP (%)	5.7	-	5.8	-	6.9	-	5.7	-	5.6	-	6.0
C. Capital Expenditure	423,710	100.0	566,670	100.0	745,170	100.0	890,360	100.0	1,052,630	100.0	-
Gross Fixed Capital Formation (GFCF)	(384,790)	(90.8)	(465,300)	(82.1)	(687,340)	(96.1)	(812,100)	(91.2)	(979,140)	(93.0)	(90.7)

Source: Development Estimates and Estimates of Recurrent Expenditure, 1992/93-1997/98
Economic Survey 1997 Central Bureau of Statistics

(2) Local Authorities

As of 1997, there are 165 local authorities. The financial situations of local authorities are summarised in the table below.

Historical Trend of Revenue and Expenditure of Local Authorities 1992/93-1996/97

(Unit: K£ million)

Description	1992/93	1993/94	1994/95	1995/96	1996/97	Average
Revenue (A)	165.15	211.59	240.49	244.82	261.04	-
Expenditure	118.25	157.65	204.44	236.26	273.25	-
Surplus	46.90	53.94	36.05	8.57	-12.21	-
Capital Revenue	362.15	102.07	132.93	96.98	148.50	-
Capital Expenditure (B)	437.02	178.86	210.69	165.29	238.19	-
Gross Fixed Capital Formation (GFCF) (C)	425.91	171.36	200.57	149.08	228.87	-
- GFCF Ratio (C / B)	97.5%	95.8%	95.2%	90.2%	96.1%	94.9%
Overall Deficit (D)	-27.97	-22.85	-41.71	-59.74	-101.90	-
- Deficit Ratio (D / A)	-16.9%	-10.8%	-17.3%	-24.4%	-39.0%	-21.7%

Source: Economic Survey 1995, 1996 and 1997, Central Bureau of Statistics

In the past five years of 1992/93 to 1996/97, there has always been financial deficit, which is averaged at approximately 22% of the current revenue. The way to cover an overall financial deficit are unknown. However, provision of local infrastructure by their own funds largely depends on obtaining external funds to finance it.

2.7.4 Household and Per Capita Incomes

The mean monthly household income and annual per capita income by province is shown in the table below.

Overview of Income Status by Province, Per Capita and Household

Province Name	Mean Household Size	Annual Per Capita Income		Mean Monthly Household Income						
		Percapital[2] Income (Kshs)	National Average (Index=100)	Total Income (Kshs)	Non Agriculture Income			Agriculture Income		
					Wages (Kshs)	Others (Kshs)	Share (%)	Agriculture (Kshs)	Crops (Kshs)	Share (%)
Nairobi	3.7	62,565	228	16,789	13,557	2,795	97.4	436	2	2.6
Central	5.3	22,262	81	9,268	4,489	1,572	65.4	1,604	1,603	34.6
Coast	5.3	32,547	119	9,393	6,034	1,625	77.4	1,028	1,206	22.6
Eastern	5.8	16,809	61	6,572	3,046	1,138	63.7	1,812	577	36.3
North-Eastern	6.1	25,504	93	9,931	3,283	1,926	52.5	4,678	44	47.5
Nyanza	5.0	19,666	72	6,750	2,920	1,457	64.8	1,712	652	35.2
Rift Valley	5.3	30,585	112	12,241	4,863	1,262	50.0	3,892	2,225	50.0
Western	5.8	20,364	74	7,659	3,602	1,158	62.1	1,792	1,107	37.9
NATIONAL	5.2	27,403	100	9,696	4,941	1,497	66.4	2,108	1,149	33.6
- Urban	4.0	51,009	186	17,673	11,266	2,456	77.6	2,534	1,418	22.4
- Rural	5.6	21,305	78	5,130	3,307	1,250	88.8	463	111	11.2

Source: Welfare Monitoring Survey II Basic Report 1994, Central Bureau of Statistics

Notes: Per capita income – Annual Household Incomes / Household Size

The mean monthly income of urban households (Kshs 17,673) is three times larger than rural households (Kshs 5,130). On an national average, the share mean monthly household income obtained from non agricultural activities was 66.4% while the agricultural income accounts for 33.6%.

CHAPTER 3 WATER SUPPLY AND SANITATION SECTOR BACKGROUND

3.1 Present Situation of Water Supply and Sanitation Sector

3.1.1 National Target and Policy

(1) National Development Plan

In 1974, the national objective for water development activities was to provide water of acceptable quality to all the urban and rural population by the year 2000. In order to realise this objective, the then Ministry responsible for water development embarked on the task of taking over: i) the government constructed water supplies, ii) county council water supplies, iii) settlement schemes water supplies and iv) self-help water supply schemes. However, it will be impossible to achieve this objective due to a number of constraints including scarcity of qualified manpower and financial resources and many problems associated with implementation.

The Government, in the 1989-1993 Five-Year National Development Plan, has launched its more practical target for increasing the population having access to water in the rural areas from 26% to 50% by 1993 and in the urban areas from 75% to 95% by 1993. In line with this policy, the NWMP adopted the development target for provision of safe and reliable water within a reasonable distance to all the population by the year 2010.

The Welfare Monitoring Survey II indicates that 90% of the population in urban areas have access to safe water, while merely 35% of the population in rural areas have access. The majority of the population particularly, those residing in rural areas still depend on unsanitary water despite efforts exerted by the water sector.

The Government, in the 8th National Development Plan (1997-2001), clarified its intention to push development towards agricultural and industrial activities in the coming decades to improve the living standards of the Kenyan and create employment opportunities for the rapidly increasing labour force. The Plan, recognising needs for an adequate and reliable supply of clean water as essential input to all sectors of economy, suggests urgent rehabilitation and augmentation of many existing schemes which are currently inoperable due to managerial, technical and financial problems.

(2) National Water Policy

The Government prepared the National Water Policy in 1998, addressing the following four important aspects:

1) Water Resources Management:

To preserve, conserve, and protect available water resources and allocate them in a sustainable, rational and commercial manner.

2) Water Supply and Sewerage Development:

To supply water of good quality and in sufficient quantities to meet the various needs while ensuring safe disposal of wastewater and environmental protection.

Development of water supplies in the urban areas will be accompanied by corresponding sewerage development systems to handle wastewater. In particular, wastewater from industrial sectors will be properly treated before discharging it into natural river courses. Strict water quality standards will be established to protect all water bodies receiving wastewater.

3) Institutional Framework:

To establish an efficient and effective institutional framework to achieve systematic development and management of the water sector.

4) Financing of the Water and Sanitation Sector

To develop a sound and sustainable financing system for effective water resources and management, water supply, and sanitation development.

As stated in the Policy, the basic objective of the National Water Development is to provide water in sufficient quantity and quality and within a reasonable distance so as to meet the needs of human beings, agriculture, livestock, and industry. To achieve this objective the department in-charge of water within the MWR applies the strategy of supporting and coordinating all water projects and programmes in urban and rural areas. This support concentrates on the ongoing water developments as a priority to assure timely completion. The department also concentrates its activities in the rehabilitation of existing water facilities in order to improve their utilisation and coverage, focuses on management of water resources in the country, and encourages the private sector to participate more in water conservation, and work with ministries of health and local authorities to monitor dangers of pollution of rivers and open water bodies so as to protect the water users and the environment.

3.1.2 Accessibility to Safe Water and Sanitation

(1) Accessibility to Safe Water

The Welfare Monitoring Survey II provides valuable data as to access to safe water and main water sources for the respective district as summarised in the table below:

Distribution of Households with Access to Safe Water and Main Water Sources by Province

Province Name	Access to Safe Water		Main Sources of Water									
	Access Ratio %	National Average (Index=100)	Piped Water %	River %	Lake/Pond/ Dam %	Roof Catchment %	Protected Spring %	Unprotected Spring %	Protected Well %	Unprotected Well %	Borehole %	Others %
Nairobi	96.2	214	95.6	2.6	-	-	-	-	0.5	-	-	1.2
Central	45.5	101	36.2	35.3	0.9	3.8	1.8	5.3	3.7	3.2	7.0	2.7
Coast	59.2	132	56.2	11.6	12.4	0.1	0.3	0.7	2.5	5.2	8.6	2.2
Eastern	35.1	78	29.3	37.4	4.6	0.5	2.1	8.1	3.2	9.2	4.0	1.4
North-Eastern	16.9	38	12.7	13.5	33.8	-	0.7	3.9	3.4	15.7	13.9	2.3
Nyanza	28.1	63	9.2	24.8	10.2	3.0	10.1	22.2	5.8	9.3	5.1	0.3
Rift Valley	41.6	93	25.0	32.4	4.1	7.0	2.6	9.9	6.9	6.1	3.9	1.9
Western	42.9	96	14.0	9.1	0.0	4.3	14.1	17.0	10.6	9.4	18.1	3.5
NATIONAL	44.9	100	32.1	24.9	5.3	3.2	4.5	10.2	5.1	6.7	6.3	1.8
- Urban	93.3	208	90.2	3.1	0.0	0.3	0.4	0.7	2.3	0.7	0.7	1.4
- Rural	32.5	72	17.3	30.5	6.6	3.9	5.6	12.6	5.8	8.2	7.7	1.9

Source: Welfare Monitoring Survey II Basic Report 1994, Central Bureau of Statistics

In terms of the accessibility, urban areas have quite a high ratio of 93.3% where the most main source of water is piped water. On the other hand, the accessibility ratio is very low for rural areas (32.5%) where the most used main source of water is surface runoffs of the rivers.

(2) Accessibility to Sanitation

Access to sanitation is basically defined as those who have reasonable access (either at home, neighbour or communal facility) to sanitary means of excreta and waste disposal including outdoor latrines. The Welfare Monitoring Survey II shows the following survey results.

Distribution of Households by Access to Sanitation, Type of Toilet and Province

Province Name	Access to Sanitation		Type of Main Toilet					
	Access Ratio %	National Average (Index=100)	Pit %	V.I.P %	Bucket %	Water Closet %	Pour Flush %	None %
Nairobi	98.2	122	39.6	4.6	-	26.6	27.4	1.8
Central	99.3	124	90.8	2.3	0.2	2.9	3.2	0.7
Coast		93	63.6	1.8	-	7.0	2.3	25.4
Eastern	74.6	95	71.5	3.4	0.4	0.3	1.1	23.4
North-Eastern	25.4	32	21.3	1.4	2.0	0.7	-	74.6
Nyanza	72.0	90	66.4	2.3	-	1.8	1.6	28.0
Rift Valley	71.9	89	65.3	1.8	0.2	1.4	3.1	28.1
Western	93.1	116	85.8	2.3	-	3.2	1.9	6.9
NATIONAL	80.4	100	68.6	2.5	0.2	4.5	4.6	19.6
- Urban	97.6	121	50.7	5.0	0.5	20.5	20.8	2.4
- Rural	75.9	94	73.2	1.9	0.1	0.4	0.4	24.1

Source: Welfare Monitoring Survey II Basic Report 1994, Central Bureau of Statistics

In urban households, 50.7% of the urban household still relied on pit latrines, while 41% had access to waterborne sanitation. In the rural areas, 24.1% of the households had no access to sanitation.

3.1.3 Mode of Present Water Supply Services

There are a number of water undertakers in Kenya as discussed in Section 3.3, and according the National Development Plan 1997 - 2001, there were 1,779 water supply projects in 1994 as shown in the table below:

Number of Water Supply Project by Water Undertaker

Operator/Supplier	Number of Water Supply Projects
Ministry of Water Resource	579
National Water conservation and Pipeline Corporation	188
Community Water Supplies	339
Self-helps Schemes	243
Local Authorities	164
Non Governmental Organisations	266
Total	1,779

Source: National Development Plan, 1997-2001

931 water supply schemes are operated by public organisations such as MWR, NWCPC and Local Authorities which are responsible for operating, maintaining and managing the water supply schemes. Communities, various institutes, and NGOs operate and maintain their own water supply systems. The existing water supply projects and conditions are reported in detail in Supporting Report II.

3.1.4 Mode of Present Sanitation Services

Local Authorities (LA), under the responsibility of MOLA, provide sewerage or the safe disposal of sewage and industrial effluent into public sewers in municipalities and urban areas. In Kenya there are 38 sewage treatment facilities located in 30 sewage urban centres. The location of urban centres with public sewerage systems is shown in **Figure - 3.1.1.**

Sewerage development is under the responsibility of MOLA, although MWR also has some regulatory and advisory functions. MOLA's current strategy for sewerage development is to complete on-going projects in large urban centres and focus on the development of basic infrastructure (including sewage) in smaller urban centres throughout the country in order to curb rural-urban migration.

The existing sewerage system and sanitary conditions are reported in more detail in Supporting Report III.

3.1.5 On-going and Planned Water Supply Projects

(1) On-going Projects

According to the MWR Status Report, 34 urban and 544 rural water supply projects, were under stage of implementation in 1992, as summarised in the table below. There are a number of projects still under construction, construction actually started 10 years ago. About 47% of the projects shows progress of more than 50%. Main reason for this delay is a lack of the funds to complete the work.

By completion of those ongoing projects, about 3.7 million people are designed to benefit from the piped water supply systems. To complete the projects, however, a huge amount of funds, Kshs 8.9 billion, will be required as shown in the table below:

Province	UWS Projects under Implementation		RWS Projects under implementation			Total Amount Required for Project Completion (Kshs million)		
	MWR	NWCPC	MWR	NWCPC	Others	MWR	NWCPC	Others
Central	4	0	37	28	12	406.7	318.7	69.1
Coastal	0	12	18	44	2	57.7	81.7	0.8
Eastern	3	0	28	128	15	980.8	491.8	48.7
North East.	4	0	15	0	0	353.3	0	0
Nyanza	0	0	26	5	11	205.3	1.9	34.6
Rift Valley	9	0	105	36	9	674.1	255.2	80.9
Western	2	0	10	10	5	4,633.7	69.2	110.6
Total	22	12	239	251	54	7,311.6	1,218.5	344.7

Source: MWR Water Supply Projects and Schemes Status report in 1996.
Note: Others include RDF, MOA, NGO, Institution and Community (including S/H) water supply schemes.

Detailed inventory and the present status of ongoing projects are compiled in the Supporting Report II.

(2) Planned Designed Projects

21 urban water supply projects and 437 rural water supply projects are under planning/design stage as shown in the table below:

Province	UWS Projects under Investigation, Planning and Design			RWS Projects under Investigation, Planning and Design				Estimated Costs (Kshs million)		
	MWR	NWCPC	Design Population	MWR	NWCPC	Others	Design Population	MWR	NWCPC	Others
Central	1	2	23,002	27	46	10	861,652	1,504.8	177.0	1.0
Coastal	3	2	82,000	16	10	1	294,797	207.8	1,888.3	0.1
Eastern	2	0	75,000	22	37	16	830,610	328.2	249.6	210.0
North East.	1	0	50,000	14	0	0	227,500	96.5	0	0
Nyanza	4	0	70,125	32	2	8	1,270,339	5,615.7	2.5	5.7
Rift Valley	2	1	104,000	65	72	25	1,955,704	2,490.4	1,141.8	1,572.1
Western	3	0	227,300	15	15	4	1,292,170	628.7	44.6	0
Total	16	5	631,427	191	182	64	6,732,772	10,872.1	3,503.9	1,788.9

Source: MWR Water Supply Projects and Schemes Status report in 1996.
Note: - Others include RDF, MOA, NGO, Institution, Community (S/H).

By the implementation of those planned schemes, a further 7.4 million people are designed to be benefited by piped water. Of all the projects listed in the table, 4% are already under implementation and 38% under investigation and planning. The remaining 58% are in the process of design works and/or completed their design. Detailed inventory and present status of these projects are discussed in more detail in the Supporting Report II. An estimated Kshs 16.2 billion is required for the implementation of all those projects.

3.1.6 On-going and Planned Sewerage Projects

The "Public Investment Programme 1997-2001" (PIP), identifies 21 sewerage development projects. Four priority projects have now been completed, and two will be commissioned in late 1998. The remaining 15 projects are awaiting donors' assistance.

A review of District Development Plans (DDP) identifies a total of 29 on-going and planned sewerage projects (7 of these projects are also identified in the PIP). Of the remaining 22 projects, none have been completed, one is under construction and 21 projects await funding from GOK.

On-going and Planned Sewerage Projects

Description	Projects under Investigation/Design	Projects under Implementation	Projects Completed	Total
PIP	12	3	6	21
DDP	15	3	4	22
Total	27	6	10	43

Source: PIP, DDP

3.1.7 Water Carrying Burden to Women

Women in Kenya are traditionally responsible for collecting water for domestic use. The burden of this activity can be seen differently over the country according to the geographic settings. In rural area, it is not only time but also workload of water carrying that physically burdens women. The table below indicates the water carrying situations of women in the country.

It is specially noted that in the North Eastern Province over 30 % of the households spend more than two hours fetching water every day.

This activity does serious harm to women's health and the effects are summarised in the table below.

Distribution of Households by Time Taken for Water Carrying by Province

Province Name	Less than 5 Min.		6-30 Min.		31-60 Min.		61-120 Min.		More than 121 Min.	
	Wet Season	Dry Season	Wet Season	Dry Season	Wet Season	Dry Season	Wet Season	Dry Season	Wet Season	Dry Season
	%	%	%	%	%	%	%	%	%	%
Nairobi	84.8	83.2	15.2	16.2	-	0.6	-	-	-	-
Central	43.8	34.8	46.1	52.1	7.5	9.8	2.1	2.4	0.4	0.9
Coast	38.1	33.4	47.1	34.6	10.7	14.3	3.1	7.5	0.9	10.2
Eastern	19.8	13.8	53.8	41.3	19.0	20.6	5.7	13.7	1.6	10.6
North-Eastern	15.8	17.7	42.9	27.0	16.0	14.5	6.0	7.7	19.2	33.1
Nyanza	22.8	16.5	59.7	50.9	14.4	18.5	2.8	8.3	0.1	6.0
Rift Valley	31.6	22.5	53.1	48.6	11.7	15.8	3.2	8.6	0.4	4.5
Western	19.8	14.0	63.2	58.5	13.8	20.1	3.1	6.0	0.1	1.3
NATIONAL	33.9	27.4	50.2	44.8	11.9	15.1	3.1	7.3	0.9	5.5
- Urban	77.0	73.6	20.8	21.9	1.3	3.3	0.6	0.7	0.2	0.4
- Rural	22.8	15.5	57.8	50.6	14.6	18.1	3.8	9.0	1.1	6.8

Source: Welfare Monitoring Survey II Basic Report 1994, Central Bureau of Statistics

Major Health Effects of Water Carrying

Outline of Major Causes and Effects
• Burdens by Long-Distance Water Carrying Water carrying requires women to have a substantial amount of energy, but most face shortfalls in available food, particularly in rural areas. This condition usually causes the women to become malnutrition, therefore making them more susceptible to disease such as energy-sapping anaemia during pregnancy.
• Burdens by Methods of Water Carrying Most frequently used method is to carry water on their backs with a head strap, which usually causes women to have headaches and backaches. The backaches sometimes further cause deformation of the spine which obstructs the birth canal of women, and puts both mother and child at risk during childbirth.
• Accidents during Water Carrying Women often face the accidents during the task on water carrying, major types of which are slipped discs, paralysis, injury to carried children, broken backs and even strangulation by the head strap.

Source: Women and the Transport of Water

3.1.8 Assistance by Donors to the Sector

Many bilateral and multilateral donors have extended support to various projects and programmes in the water and sanitation sector. The current major activities of these donor countries/agencies are summarised in Supporting Reports II and IV.

The donor's strategies could be concluded as follows:

(1) To attain sustainable development of water and sanitation projects, they tend to support decentralisation of management and operation to the local communities and the private sectors in the form of commercialisation and privatisation of water and sanitation schemes.

(2) Coordination between donor countries are being carried out (refer to Section 3.7).

(3) Most donors are paying far more attention to institutional and operational aspects of the schemes rather than investment on physical facilities.

(4) In sharp contrast to the many water supply development projects in Kenya, there has been only limited activity by donors in sewerage development. More recently donors have recognised that improving water supply conditions also creates a corresponding need to provide adequate means for wastewater disposal. Most donors now included sanitation and wastewater disposal as an integral part of their water sector development strategy.

3.2 Related Sectors and Programmes

3.2.1 Public Health and Hygiene Conditions

Provision of safe and portable water, as one of the basic human needs is an important role of the government to save a vulnerable population who are suffering from waterborne diseases. The table below shows an overview of type of sickness in the country by province including the water-related diseases such as diarrhoea and malaria.

Distribution of Population by Type of Sickness by Province

Province Name	Vomit/Diarrhoea		Fever/Malaria		Cough/Cold	Wound/Injury	Measles	Skin Rash	Eye Infection	Others
	Case Population %	National Average (Index=100)	Case Population %	National Average (Index=100)	Case Population %	Case Population %	Case Population %	Case Population %	Case Population %	Case Population %
Nairobi	6.4	68.1	47.8	92.8	23.7	2.6	-	4.6	2.4	12.3
Central	6.3	67.0	34.6	67.2	35.7	5.1	0.4	4.8	1.4	11.8
Coast	17.7	188.3	51.1	99.2	51.1	4.1	0.7	1.6	0.8	8.7
Eastern	7.7	81.9	47.1	91.5	27.7	4.1	0.2	2.1	2.0	9.1
North-Eastern	5.7	60.6	52.7	102.3	15.1	4.3	1.3	2.1	4.6	14.2
Nyanza	10.0	106.4	59.4	115.3	13.3	2.9	1.9	2.2	1.8	8.6
Rift Valley	9.1	96.8	50.1	97.3	22.9	3.2	0.6	2.6	1.8	9.7
Western	9.4	57.9	57.9	112.4	16.1	3.9	1.2	2.5	1.0	7.9
NATIONAL	9.4	100.0	51.5	100.0	21.0	3.6	0.9	2.6	1.6	9.4
- Urban	10.4	110.6	50.9	98.8	20.4	2.4	0.2	3.0	1.7	11.1
- Rural	9.2	97.9	51.6	100.2	21.1	3.8	1.0	2.6	1.6	9.1

Source: Welfare Monitoring Survey II Basic Report 1994, Central Bureau of Statistics

The major cause of morbidity in the country is fever/malaria, which is one of the water-related diseases and averaged at 51.6% of the total morbidity population. An incident of vomit/diarrhoea as an another water-related disease is ranked the third, accounting for 9.2% of the total morbidity population.

3.2.2 Women in Development

Women in development (WID) is the integration of women into social and economic development. The extent of a considerable and favourable effects on WID by a development project is largely dependent on social and cultural backgrounds, and also social and economic activities of women where the development project is considered to be planned and implemented. The participation of

women in water supply and sanitation projects has a significant impact particularly on achieving the sustainability of operating, managing, and maintaining the water supply and sanitation schemes in the rural areas, which normally provides several major benefits such as welfare, economy, health, and benefits.

3.2.3 Poverty Alleviation Programme

The Social Dimensions of Development (SDD) is a priority policy that the Government has established to effectively alleviate poverty in the country where 46% of the total population is still living below the poverty line. To ensure a dynamic and interactive SDD programme, the proposed strategy advocates that all the key stakeholders effectively participate in the conceptualisation, implementation, monitoring and evaluation. In the programme, it is importantly addressed that, at the local level, the SDD programme is to be highly strengthening the coordination and partnerships among the key stakeholders in the delivery of the SDD programme including the governments, NGOs, the private sector, the donors, the community-based-organisations and the other civic organisations.

3.2.4 Arid and Semi-Arid Land Development Plan

ASAL comprises over 80% of Kenya's total land surface and has more than 25% of the population and over half of the livestock of the country. The majority of ASAL population is pastoralist although the semi-pastoral and farming communities are becoming more important. Some of the new farmers are migrants to recently opened irrigation and settlement schemes.

The Government established "Development Policy for the Arid and Semi-Arid Lands" in 1992. The goal of this policy is to improve the standard of living of the ASAL population by integrating ASAL into the mainstream of the national economy and social development in an environmentally sustainable manner, in accordance with the national goal to create employment, generate income and attain food security.

The policy emphasises water supply as one of the ASAL's nine key priority areas for interventions.

3.2.5 National Environmental Action Programme

The National Environment Action Plan (NEAP) formally adopted by GOK in June 1994 sets the framework to deal with the crucial urban and coastal environmental problems needed to be urgently addressed. The major concern of NEAP is particularly placed on reflecting the environmental management to an operation programme of policy, legislative and institutional actions.

3.2.6 National Tourism Development Master Plan

The National Tourism Development Master Plan (NTDMP) was prepared in 1996 under technical assistance of JICA. According to NTDMP, the priority tourism zones (TRs) are Turkana TR, Western TR, Northern TR, Tana Basin TR, Central TR, Eastern TR, and Masailand TR.

NTDMP includes a five-year action programme to implement basic infrastructures for tourism development. The infrastructure projects related to water supply and sanitation are summarised in the table below. All the projects listed in the five-year action programme are at community level where most major tourism points are located. NTDMP assumes that water supply and sewerage could be absorbed by the public service in urban areas.

Five-Year Action Programme for the National Tourism Development Master Plan, 1996-2000
- With a Focus on Water Supply and Sewerage Development Projects –

(Unit for Investment Costs: K£ million)

Project Name	Priority Tourism Development Area	Project Description	Total Investment Costs & Schedule 1996-2000						Completion Target Year	
			1996	1997	1998	1999	2000	Total	Before 2000	After 2000
Water Supply Projects			0.1	0.3	0.6	0.8	0.8	2.6		
Karen Town Community	Central Tourism Region	Incremental Capacity: 1,052 m³/d	-	-	-	-	-	-	X	
South Limuru Community		Incremental Capacity: 7,222 m³/d	-	-	-	-	-	-	X	
Mt. Elgon Community	Western Tourism Region	Incremental Capacity: 388 m³/d	-	-	-	-	-	-	X	
Lake Baringo Community		Incremental Capacity: 980 m³/d	-	-	-	-	-	-		X
Shimoni Community	Coastal Tourism Region	Incremental Capacity: 1,158 m³/d	-	-	-	-	-	-		X
Funzi Bay Community		Incremental Capacity: 273 m³/d	-	-	-	-	-	-		X
South Diani Community		Incremental Capacity: 3,800 m³/d	-	-	-	-	-	-	X	
Gazi Bay Community		Incremental Capacity: 525 m³/d	-	-	-	-	-	-	X	
North Mamburi Community		Incremental Capacity: 614 m³/d	-	-	-	-	-	-		X
Watamu Enlargement		Incremental Capacity: 700 m³/d	-	-	-	-	-	-	X	
North Watamu Enlargement		Incremental Capacity: 700 m³/d	-	-	-	-	-	1)		X
West Lamu Community		Incremental Capacity: 301 m³/d	-	-	-	-	-	-	X	
Sewerage Projects			0.5	0.9	3.1	4.5	4.7	13.7		
Karen Town Community	Central Tourism Region	Sewered Area: 35 ha	-	-	-	-	-	-		X
		Sewered Area: 60 ha	-	-	-	-	-	-		X
Mt. Elgon Community	Western Tourism Region	Sewered Area: 9 ha	-	-	-	-	-	-		X
Lake Baringo Community		Sewered Area: 33 ha	-	-	-	-	-	-		X
Shimoni Community	Coastal Tourism Region	Sewered Area: 43 ha	-	-	-	-	-	-		X
South Diani Community		Sewered Area: 160 ha	-	-	-	-	-	-	X	
Gazi Bay Community		Sewered Area: 18 ha	-	-	-	-	-	-	X	
North Mamburi Community		Sewered Area: 25 ha	-	-	-	-	-	-		X
Watamu Enlargement		Sewered Area: 800 ha	-	-	-	-	-	-	X	
West Lamu Community		Sewered Area: 10 ha	-	-	-	-	-	-		X

Source: The Study on the National Tourism Master Plan in the Republic of Kenya (Volume 1: Master Plan), JICA 1995.
Note: Investment Costs for sewerage projects include waste disposal projects.

3.2.7 District Development Plan 1997-2001

A District Development Plan (DDP) 1997-2001 was prepared for each district, in line with preparing the Eighth National Development Plan 1997-2001. Unfortunately, of the total of 60 DDPs, only 39 DDPs were made available for the Study.

In the 39 DDPs, there are a total of 1,026 priority projects listed by MWR and MOLA including both on-going projects (452 projects) and newly proposing projects (574 projects), which accounts for approximately 44% and 56% to the total, respectively. Of all the projects, 648 projects are water-related including 602 water supply projects, 39 sewerage projects, and 7 water & sewerage projects. Water supply projects were found to be most dominant, accounting for approximately 93% of the total water-related.

3.3 Water Supply and Sanitation Sector Administration

3.3.1 Organisations Concerned

The organisations chiefly involved in the water supply sector are:

1) MWR through its Water Development Department WDD), and its provincial and district water offices, and the regulatory agencies such as the Water Apportionment Board, the Catchment Boards, and the District Water Boards,
2) NWCPC through its regional organisation,
3) Municipal Councils when acting as water undertakers,
4) MOLA when supervising the activities of LA water undertakers,
5) District Development Committees,
6) NGOs and urban community groups, and
7) MCSS, as mobiliser of community groups.

The organisations chiefly involved with the provision of sewerage and sanitation services are:

1) Local authorities, responsible for administering the City of Nairobi, 44 municipalities, 60 county councils, and 59 town councils;
2) MOLA, which is responsible for all activities of local authorities;
3) MWR WDD), which has certain technical responsibilities in the subsector;
4) MOH;
5) NWCPC, on certain development projects only.

3.3.2 Functions and Authorities of Public Organisations in Water Supply

The functions and authorities of public organisations in water supply are as follows:

(1) MWR

MWR has overall responsibility for the "proper and orderly water resources management including assessment, conservation, development, and protection of the environment from degradation," and the enforcement of the Water Act, for which the Minister has very wide powers. The functions of MRW are:

1) Water development and water supply,
2) Control of water catchments,
3) Water resource management,
4) Water quality and pollution control, and
5) Water conservation.

These functions are executed through WDD which comprises a headquarters in Nairobi and a national field network of 6 provincial offices, and 64 (50 for the purpose of this Study) District

offices (see **Figure - 3.3.1**). In country training is undertaken at the Kenya Water Institute. There is also a modest research facility.

The field offices of WDD are responsible for planning and developing, operating and maintaining MWR water supply schemes, and for water regulation throughout Kenya. Their performance is crucial for satisfactory water supply to the consumer, generation of revenue, and control of water abstraction. Currently, MWR operates about 375 schemes (309 rural), as well as having responsibility for policy, sectoral planning and regulation.

The Water Apportionment Board, supported by 6 Catchment Boards and 64 District Water Boards, is mandated to authorise, supervise and control the use of water nationwide. The effectiveness of these bodies is unknown. They receive, apparently, no official funding and minimal support from MWR.

(2) NWCPC

NWCPC was set up in 1988 under the State Corporation Act, Legal Notice No. 270 (the Study Team was unable to see this document). It was set up with a specific mandate which included: supplying water in bulk to undertakers; developing (major) water projects; and promoting efficiency in operations for existing water projects. Its long-term objective is to "manage water supplies professionally to ensure sustainability of systems at an affordable level." NWCPC has a Board of Directors but it is only semi-autonomous, MWR having supervisory responsibilities through Board membership and the Minister's powers. There are five departments, one dealing with the operation of 45 bulk and retail supply schemes and major pipelines administered through five regions, another (Development Services) responsible for planning and implementing (with much donor assistance) capital projects - seven under construction, eight in the planning and design stage. Despite the existence of Development Services, the US$43 million Mombasa and Coastal Water Supply Project is run by a PIU in Corporate Services responsible nominally for business planning and monitoring.

(3) Municipalities

There are 10 municipalities acting as water undertakers (and sewerage system operators) including Nairobi. Some source their own water; others like Nakuru receive a bulk supply from NWCPC for which they pay. The nine outside Nairobi are being upgraded through GTZ assisted Urban Water and Sanitation Management (UWASAM) Project with the object of making them self-sustaining, operationally and financially. The Project has provided extensive training and TA in technical areas, management, procurement, finance and accounting, and establishing separate water and sanitation departments. Three of the W&S Departments have been corporatised for greater operational and financial autonomy; others are planned to follow.

(4) MOLA

MOLA is administratively responsible for all activities of the present 164 local authorities, including water and sanitation. The lightly staffed Water and Sanitation Section of the Urban Development Department (see **Figure - 3.3.2**) attempts to provide technical assistance in design

and implementation, operation and maintenance for the water sector. MOLA and MOF deals with accounting, budgeting and funding for all LAs.

(5) District Development Committees (DDCs)

DDCs have been set up in each district under the Office of the President to ensure that development projects meet local needs. The DDC establishes development priorities, reviews all proposed projects (including local authorities') against these, monitors its technical committees and project progress.

(6) Non-Governmental Organisations (NGOs) and Community Schemes

It is estimated that at least 60 of the more than 400 NGOs working in Kenya are in water supply. Many NGO projects employ MWR staff as advisers during development and afterwards. Many projects are not notified to MWR. The smaller schemes, some without external assistance, have management and technical problems, and little money. Tariff structures do not exist and therefore repairs are done on an emergency basis. Most community schemes wish to remain independent of GOK, but would accept funding.

(7) MCSS

MCSS helps to mobilise and train community groups to operate their own water supply, but is very short of field staff.

3.3.3 Functions and Authorities of Public Organisations in Sewerage and Sanitation

(1) Local Authorities

Local authorities under the Local Government Act, are required and empowered to carry out a number of functions related to the provision and operation of sewerage and sanitation services in their areas. These include:

1) Establishment and maintenance of sewerage and drainage works;
2) Fixing and collecting charges for the use of sewers, sewerage works or drains;
3) Regulation of sewerage and drainage works;
4) Compelling the construction of private drains and the connection of these to public drains or sewers;
5) Making by-laws regarding matters for which it is responsible.

(2) MOLA

The Minister has power over every local authority to ensure that it carries out its duties and responsibilities as required by law, including taking over its duties when the local authority is in default. MOLA also has to exercise control over local authority expenditure, by reviewing and agreeing estimates for recurrent and development expenditure and submitting these to central government for funding.

(3) MWR

MWR has, under the Water Act, no role leading or coordinating the development or operation of sewerage or sanitation; its legal responsibilities are limited to the control of polluters, by monitoring and applying penalties. However, within the MWR organisation there are three divisions which undertake significant sanitation activities: Technical Planning and Design, Construction, and Operations and Maintenance, although not in any lead capacity. They are more a technical resource in sanitation available on request for many agencies. WDD's Applied Water Research Branch is stated to include sanitation among its research subjects, but there is no mention of sanitation in the detailed listing of research duties at Section level. Finally, MWR's Kenya Water Institute offers, either now or in the near future, several courses for sewerage managers and supervisors, and operators, but little on treatment technology.

(4) MOH

Under the Public Health Act, MOH carries the ultimate responsibility for the health of the people. As such it has to ensure that measures are taken to prevent pollution of water which the public has a right to use; that includes monitoring all methods in use for sewage disposal. It has powers to compel improvements in these areas, through its nationally and locally based health inspectors.

(5) NWCPC

NWCPC is currently involved in two sewerage development projects, one in Mombasa where it is water undertaker to the city, and in Nakuru. These activities do not appear in Legal Notice 270 of the State Corporations Act under which it was established or in its mission statement.

3.3.4 Urban Water and Sanitation Management Project

It is GOK policy for municipalities to assume responsibility for their own water supply and sewerage facilities as soon as they can be made sufficiently capable.

In pursuit of this policy, the Urban Water and Sanitation Management (UWASAM) Project, jointly funded by GOK and GTZ and based in UDD, is upgrading the performance of nine selected LAs, and will extend the lessons learned to others. Extensive training in management, billing and customer relations, finance and accounting, procurement and stores was also given. Later, LAs were helped to establish separate Water & Sanitation Departments. However, these were found to be unsatisfactory for the achievement of financial independence for a number of reasons, including:

1) poor management of system and service,
2) high water losses,
3) application of unrealistic tariffs,
4) low efficiency in billing and revenue collection,
5) inadequate maintenance of the utilities,
6) difficulty of recruiting and retaining staff, and

7) utilisation of some water and sewerage revenue for other purposes.

By the end of 1996, several LAs had decided to attempt the commercialisation of their water and sewerage services, and during 1997 formalities were completed for the establishment of the new companies, to be registered under the Companies Act. Also, a project team has advised several LAs on ways of generating more non-water revenue for LAs, to make less painful the separation of the water and sewerage account from the main LA accounts.

The project is now in its fourth phase (January 1997 to December 1999) during which established W&S companies will be consolidated in three selected LAs (Eldoret, Kericho and Nyeri Municipalities). In addition, the remaining six municipalities (Thika, Nyahururu, Kisumu, Nakuru, Kitale, Nanyuki), which are also water undertakers, will in turn be brought up to the standard needed for incorporation. Other towns such as Embu, Kakamega, Muranga, Machakos, Kisii, and Bungoma, not at present water undertakers but the project is helping them to be, are to be improved as the first three municipalities have been. By these means, the work of UWASAM is being progressively extended to an increasing number of municipalities, either to prepare them as water undertakers for greater autonomy and better operational and financial performance, or to become water undertakers.

3.4 Legislation Related to Water Supply and Sanitation Sector

3.4.1 National Water Policy

The National Water Policy is summarised in subsection 3.1.1.

Institutionally, it is policy for Ministries in the sector to divest direct service provision (to autonomous departments within local authorities, for example) and retain regulatory and enabling functions, supporting private sector participation and community management of services, and strengthening local institutions. MWR should define roles for, and coordinate, all actors in the sector. Legislation should support this policy as far as possible.

3.4.2 Laws and Regulations

GOK has enacted many laws concerning water supply and sewage disposal and has proposed some environmental legislation. The most important of these in the context of this Study are the following:

(1) The Water Act (Cap 372), the main water law, was last revised in 1972 and an amendment is now being prepared. The Act gives the Minister wide powers to control the abstraction and use of water through the Water Apportionment Board and six Catchment Boards, and several other bodies which have not existed for many years. Procedures and conditions are clearly set out for obtaining, varying, and cancelling permits for various types of abstraction. The Minister's powers for appointing water undertakers are also provided for, although he has no default powers over local authority undertakers. There is limited provision for pollution prevention also. There is no direct mention of sewage.

(2) The National Water Conservation and Pipeline Corporation Order (Legal Notice No. 270, June 24, 1988) established NWCPC to improve, manage, and develop water projects nationally. More specifically, it was to supply water in bulk or otherwise with emphasis on efficiency and cost recovery, and to develop water supplies. Sewage is not mentioned. Neither is how NWCPC is to relate to other water institutions.

(3) The Mombasa Pipeline Board Act (1957) was proscribed in the early 1980s and should be repealed. The Board's responsibilities were taken over by NWCPC.

(4) The Irrigation Act established and specified the National Irrigation Board which is responsible for developing, controlling and improving national irrigation schemes in areas designated by MWR.

(5) The Tana and Athi Rivers Development Authority Act establishes TARDA to advise on the institution and coordination of development projects in the two basins.

(6) The Kerio Valley Development Authority Act and The Lake Basin Development Authority Act establish authorities to plan and coordinate the implementation of development projects in each catchment area.

(7) The Agriculture Act (Cap 318) promotes agricultural development according to sound practices of land management and stresses the need for conservation of the soil and its fertility. The Act, thus, indirectly emphasises the importance of preventing soil erosion and the resulting contamination of surface water.

(8) The Local Government Act (Cap 265) was set up in 1963 and revised in 1986 to provide for the establishment of authorities for local government and definition of their functions. The Act provides that every local authority (municipal, town and urban council) may establish, maintain, and regulate sewerage and drainage works within or outside its area. It may also compel the construction of private drains and their connection to public drains or sewers, and may fix charges for the use of sewerage and drainage facilities. Regarding water, any local authority may undertake the supply of water within its area and may establish works for the purpose although it is not stated that such a supplier of water is a water undertaker under the Water Act.

(9) The Public Health Act (Cap 242) requires local authorities to take all measures necessary to prevent and deal with outbreaks of disease. Therefore, the Act gives every local authority wide powers to deal with unsatisfactory water supplies, wastewater and sewage disposal, and water pollution, outside its area if necessary. Powers are available for local authorities and others to control the standard of treated effluent and to control industries liable to pollute water courses;

(10) The Environmental Management and Coordination Bill 1996 is based on the principle that every person in Kenya is entitled to a clean and healthy environment and has the duty to safeguard it. The Bill deals with: administration (eg establishment of a National

Environmental Council, National Environmental Management Authority and Provincial and District Environmental Committees and Action Plans); environmental quality standards (eg for water, air, waste); obligatory environmental impact assessments; environmental restoration orders; inspection, analysis and records; funding; and the powers to make regulations. It is not known when the Bill will be submitted to Parliament for approval.

3.5 Financial Management of Water Supply and Sanitation Sector

3.5.1 Overall Public Expenditure

The public expenditure on water supply and sewerage by MWR and MOLA is shown in the table below.

In MWR and MOLA, the development expenditure largely exceeds the recurrent expenditure. The share of development expenditure of MWR averaged 68.2% to the total expenditure in the years of 1992/93 to 1996/97, and the share of MOLA is 88.4%. These figures are quite high compared to the national level (21.5%). The appropriation-in-aid of MWR and MOLA takes up more than a half of the development.

Public Expenditure on Water Supply Sector, 1992/93-1996/97

(Unit: K£ million)

Item	1992/93		1993/94		1994/95		1995/96		1996/97		Average
A. Ministry of Water Resources (MWR)	122.060	100.0	141.735	100.0	257.123	100.0	261.928	100.0	266.349	100.0	-
Recurrent Expenditure by MWR	38.018	31.1	51.063	36.0	74.767	29.1	83.572	31.9	82.135	30.8	31.8
Net Expenditure	(34.885)	(91.8)	(45.976)	(90.0)	(69.533)	(93.0)	(77.723)	(93.0)	(75.001)	(91.3)	(91.8)
Appropriation-in-Aid	(3.133)	(8.2)	(5.087)	(10.0)	(5.234)	(7.0)	(5.849)	(7.0)	(7.134)	(8.7)	(8.2)
Development Expenditure by MWR	84.042	68.9	90.672	64.0	182.356	70.9	178.356	68.1	184.214	69.2	68.2
Net Expenditure	(33.870)	(40.3)	(42.388)	(46.7)	(65.552)	(35.9)	(78.347)	(43.9)	(77.396)	(42.0)	(41.8)
Appropriation-in-Aid	(50.172)	(59.7)	(48.284)	(53.3)	(116.804)	(64.1)	(100.009)	(56.1)	(106.818)	(58.0)	(58.2)
Share of Water Supply and Sewerage Development Expenditure in MWR (%)	69.3	-	70.3	-	82.2	-	81.8	-	92.7	-	79.2
Development Expenditure for Water Supply and Sewerage Sector by MWR	58.240	100.0	63.698	100.0	149.857	100.0	145.875	100.0	170.754	100.0	-
Net Expenditure	(27.042)	(46.4)	(36.085)	(56.7)	(56.964)	(38.0)	(68.181)	(46.7)	(71.050)	(41.5)	(45.9)
Appropriation-in-Aid	(31.198)	(53.6)	(27.613)	(43.3)	(92.893)	(62.0)	(77.694)	(53.3)	(99.704)	(58.4)	(54.1)
B. Ministry of Local Authorities (MOLA)	93.706	100.0	109.339	100.0	156.089	100.0	101.408	100.0	199.359	100.0	-
Recurrent Expenditure by MOLA	9.002	9.6	11.020	10.1	16.659	10.7	14.010	13.8	27.221	13.7	11.6
Net Expenditure	8.924	99.1	10.961	99.5	16.600	99.6	13.946	99.5	27.156	99.8	99.5
Appropriation-in-Aid	0.078	0.9	0.059	0.5	0.059	0.4	0.064	0.5	0.065	0.2	0.5
Development Expenditure by MOLA	84.704	90.4	98.319	89.9	139.430	89.3	87.398	86.2	172.138	86.3	88.4
Net Expenditure	(20.499)	(24.2)	(19.156)	(19.5)	(30.388)	(21.8)	(38.661)	(44.2)	(40.987)	(23.8)	(26.7)
Appropriation-in-Aid	(64.205)	(75.8)	(79.163)	(80.5)	(109.042)	(78.2)	(48.737)	(55.8)	(131.151)	(76.2)	(73.3)
Share of Water Supply and Sewerage Development Expenditure in MOLA (%)	81.7	-	87.6	-	83.2	-	89.0	-	92.0	-	86.7
Development Expenditure for Water Supply and Sewerage Sector by MOLA	69.197	100.0	86.092	100.0	116.025	100.0	77.753	100.0	158.427	100.0	-
Net Expenditure	(11.783)	(17.0)	(9.613)	(11.2)	(28.752)	(24.8)	(35.681)	45.9	(33.727)	(21.3)	(21.0)
Appropriation-in-Aid	(57.414)	(83.0)	(76.479)	(88.8)	(87.273)	(75.2)	(42.072)	(54.1)	(124.700)	(78.7)	(76.0)

Source: Development Estimates and Estimates of Recurrent Expenditure, 1992/93-1997/98
Economic Survey 1997 Central Bureau of Statistics

3.5.2 Public Expenditure by Water Supply and Sanitation Sector

Having examined an overall situation of the public expenditure of MWR and MOLA, it is essential to look at the allocation of the development expenditure by sub-sector.

(1) Water Supply Sector

The following summary table presents the development expenditure of MWR and MOLA for the water supply sector.

MWR has provided a large amount of subsidy to NWCPC, which takes up approximately 60 % of MRW's the development expenditure, although NWCPC is established as a state corporation and has its own revenue income. Excluding the development expenditure spent for NWCPC, rural water supply has the highest share of 17.3%. In MOLA, 70.9% of development expenditure is allocated for water supply and sewerage sector.

Development Expenditure on Water Supply Sector
by MWR and MOLA and Project Type, 1992/93-1996/97

(Unit: K£ million)

Item	1992/93		1993/94		1994/95		1995/96		1996/97		Average
Ministry of Water Resources (MWR)	122.060	100.0	141.735	100.0	257.123	100.0	261.928	100.0	266.349	100.0	-
Water Development	2.885	5.0	1.272	2.0	28.607	19.1	21.999	15.1	32.454	19.0	12.0
Net Expenditure	(0.502)	(17.4)	(0.482)	(37.9)	(4.867)	(17.0)	(2.683)	(12.2)	(6.525)	(20.1)	(20.9)
Appropriation-in-Aid	(2.383)	(82.6)	(0.790)	(62.1)	(23.740)	(83.0)	(19.316)	(87.8)	(25.929)	(79.9)	(79.1)
Training of Water Development Staff	0.155	0.3	0.095	0.1	1.120	0.7	2.737	1.9	0.594	0.3	0.7
Net Expenditure	(0.155)	(100.0)	(0.095)	(100.0)	(0.120)	(10.7)	(0.137)	(5.0)	(0.094)	(15.8)	(46.3)
Appropriation-in-Aid	(0.000)	(0.0)	(0.000)	(0.0)	(1.000)	(89.3)	(2.600)	(95.0)	(0.500)	(84.2)	(53.7)
Rural Water Supply	15.446	26.5	12.074	19.0	24.768	16.5	17.298	11.9	21.237	12.4	17.3
Net Expenditure	(7.456)	(48.3)	(5.328)	(44.1)	(18.135)	(73.2)	(15.188)	(87.8)	(18.887)	(88.9)	(68.5)
Appropriation-in-Aid	(7.990)	(51.7)	(6.746)	(55.9)	(6.633)	(26.8)	(2.110)	(12.2)	(2.350)	(11.1)	(31.5)
Self Help Water Supply	0.078	0.1	0.040	0.1	0.164	0.1	0.056	0.0	0.031	0.0	0.1
Net Expenditure	(0.078)	(100.0)	(0.040)	(100.0)	(0.164)	(100.0)	(0.056)	(100.0)	(0.031)	(100.0)	(100.0)
Appropriation-in-Aid	(0.000)	(0.0)	(0.000)	(0.0)	(0.000)	(0.0)	(0.000)	(0.0)	(0.000)	(0.0)	(00.0)
Urban Water Supply and Sewerage	4.990	8.6	3.892	6.1	4.855	3.2	3.080	2.1	5.033	2.9	4.6
Net Expenditure	(4.875)	(97.7)	(3.777)	(97.0)	(4.655)	(95.9)	(1.980)	(64.3)	(2.153)	(42.8)	(79.5)
Appropriation-in-Aid	(0.115)	(2.3)	(0.115)	(3.0)	(0.200)	(4.1)	(1.100)	(35.7)	(2.880)	(57.2)	(20.5)
Special Water Programmes	6.070	10.4	3.616	5.7	5.580	3.7	3.307	2.3	4.844	2.8	5.0
Net Expenditure	(1.272)	(21.0)	(0.641)	(17.7)	(0.940)	(16.8)	(0.827)	(25.0)	(1.909)	(39.4)	(24.0)
Appropriation-in-Aid	(4.798)	(79.0)	(2.975)	(82.3)	(4.640)	(83.2)	(2.480)	(75.0)	(2.935)	(60.6)	(76.0)
Water Conservation and Pipeline Corporation	28.616	49.1	42.709	67.0	84.763	56.6	97.398	66.8	106.561	62.4	60.4
Net Expenditure	(12.704)	(44.4)	(25.722)	(60.2)	(28.083)	(33.1)	(47.310)	(48.6)	(41.451)	(38.9)	(45.0)
Appropriation-in-Aid	(15.912)	(55.6)	(16.987)	(39.8)	(56.680)	(66.9)	(50.088)	(51.4)	(65.110)	(61.1)	(55.0)
Ministry of Local Authorities (MOLA)	93.706	100.0	109.339	100.0	156.089	100.0	101.408	100.0	199.359	100.0	-
Local Authorities Water Supply Schemes	61.818	89.3	79.367	92.2	65.982	56.9	41.841	53.8	98.465	62.2	70.9
Net Expenditure	(9.603)	(15.5)	(8.018)	(10.1)	(24.221)	(36.7)	(21.269)	(50.8)	(22.565)	(22.9)	(27.2)
Appropriation-in-Aid	(52.215)	(84.5)	(71.349)	(89.9)	(41.761)	(63.3)	(20.572)	(49.2)	(75.900)	(77.1)	(72.8)

Source: Development Estimates and Estimates of Recurrent Expenditure, 1992/93-1997/98
Economic Survey 1997 Central Bureau of Statistics

(2) Sanitation Sector

The following summary table illustrates the sanitation expenditure of MOLA for the period from 1992/93 to 1996/97

Public Expenditure on Sanitation Sector, 1992/93-1996/97

(Unit: Kℓ million)

Item	1992/93		1993/94		1994/95		1995/96		1996/97		Average
Ministry of Local Authorities (MOLA)	93.705	100.0	109.339	100.0	156.689	100.0	101.408	100.0	199.539	100.0	-
Recurrent Expenditure by MOLA	9.002	9.6	11.020	10.1	16.659	10.7	14.010	13.8	27.221	13.7	11.6
Net Expenditure	8.924	99.1	10.961	99.5	16.600	99.6	13.946	99.5	27.156	99.8	99.5
Appropriation-in-Aid	0.078	0.9	0.059	0.5	0.059	0.4	0.064	0.5	0.065	0.2	0.5
Development Expenditure by MOLA	84.704	90.4	98.319	89.9	139.430	89.3	87.398	86.2	172.138	86.3	88.4
Net Expenditure	(20.499)	(24.2)	(19.156)	(19.5)	(30.388)	(21.8)	(38.661)	(44.2)	(40.987)	(23.8)	(26.7)
Appropriation-in-Aid	(64.205)	(75.8)	(79.163)	(80.5)	(109.042)	(78.2)	(48.737)	(55.8)	(131.151)	(76.2)	(73.3)
Share of Water Supply and Sewerage Development Expenditure in MOLA (%)	81.7	-	87.6	-	83.2	-	89.0	-	92.0	-	-
Development Expenditure for Water Supply and Sewerage Sector by MOLA	69.197	100.0	86.092	100.0	116.025	100.0	77.753	100.0	158.427	100.0	-
Net Expenditure	(11.783)	(17.0)	(9.613)	(11.2)	(28.752)	(24.8)	(35.681)	(45.9)	(33.727)	(21.3)	(24.0)
Appropriation-in-Aid	(57.414)	(83.0)	(76.479)	(88.8)	(87.273)	(75.2)	(32.072)	(54.1)	(124.700)	(78.7)	(76.0)
Local Authorities Sewerage Schemes	7.379	10.7	6.725	7.8	50.043	43.1	35.912	46.2	59.962	37.8	29.1
Net Expenditure	(2.180)	(29.5)	(1.595)	(23.7)	(4.531)	(9.1)	(14.412)	(40.1	(11.162)	(18.6)	(24.2)
Appropriation-in-Aid	(5.199)	(70.5)	(5.130)	(76.3)	(45.512)	(90.9)	(21.500)	(59.9)	(48.800)	(81.4)	(75.8)

Source: Development Estimates and Estimates of Recurrent Expenditure, 1992/93-1997/98
Economic Survey 1997 Central Bureau of Statistics

Of the total development expenditure, the expenditure for sanitation sector accounts only for 29.1% on average, since a large part of the expenditure is spent for water supply sector (70.9%). Of development expenditure appropriation-in-aid takes up approximately 76% on average.

3.5.3 Public Investment Programme, 1997/98 - 1999/2000

Although there might have been needs to implement a large number of the projects, it is quite necessary to consider more effective and rational way of investing in the projects, in line with the strategies set forth in "Public Investment Programme (PIP), 1997/98 - 1999/2000". The programme sets forth ministries' strategies, policies and programmes in parallel with the National Development Plan.

(1) Core Projects

Out of a total of 313 projects listed by MWR and 56 projects by MOLA. There are 18 water-related projects listed by MWR and 8 water/sewerage projects by MOLA. These core projects are further grouped into GOK-funded projects, external fund projects, and new projects.

(2) Investment Costs

The investment costs for all PIP projects by MWR and MOLA are shown in the tables below:

Summary of Investment Costs for Public Investment Programme by MWR, 1997/1998 – 1999/2000

(Unit: 1,000 Kshs)

Project	No. of Projects	Costs/ Project	GOK Fund	External Fund				Estimated Costs
				External Grant		External Loan		
Water Related Core Projects (A)	18	20,361	176,172	52,380	(27.5%)	137,945	(72.5%)	366,497
			48.1%	51.9%				100.0%
Total Core Projects	27	24,599	219,486	58,380	(13.1%)	386,313	(86.9%)	664,179
			33.0%	(67.0%)				100.0%
Water Related PIP Projects (B)	201	9,526	714,499	870,413	(72.5%)	329,867	(27.5%)	1,914,779
			37.3%	62.7%				100.0%
Total PIP Projects	313	8,279	1,239,492	602,148	(44.5%)	749,685	(55.5%)	2,591,325
			47.8%	52.2%				100.0%

Summary of Investment Costs for Public Investment Programme by MOLA, 1997/1998 – 1999/2000

(Unit: 1,000 Kshs)

Project	No. of Projects	Costs/ Project	GOK Fund	External Fund				Estimated Costs
				External Grant		External Loan		
Water Related Core Projects (A)	8	83,171	53,870	9,500	(1.6%)	602,000	(98.4%)	665,370
			8.1%	91.9%				100.0%
Total Core Projects	24	41,992	66,297	339,513	(36.1%)	602,000	(63.9%)	1,007,810
			6.6%	(93.4%)				100.0%
Water Related PIP Projects (B)	30	25,642	90,945	9,500	(1.4%)	668,800	(98.6%)	769,245
			11.8%	88.2%				100.0%
Total PIP Projects	56	21,006	116,472	364,087	(34.4%)	695,800	(65.6%)	1,176,359
			9.9%	90.1%				100.0%

3.6 Tariff Billing and Collection

3.6.1 Prevailing Tariff System

MWR and NWCPC tariff, which is the same for both bodies, is compared with those of Nairobi City Council, three other municipality water undertakers, and those of the three UWASAM municipalities of Eldoret, Kericho and Nyeri which are participating in the commercialisation project.

Water Tariff Structure by Major Water Undertakers

Category	Volume Scale (m^3)	MWR NWCPC Basic Rate (Index=100)	Local Authorities with Water Department (Under the Municipal General Account)								GTZ/UWASAM Project (Commercialisation Pilot Towns)					
			Nairobi		Kisumu		Nakuru		Kitale		Nyeri		Kericho		Eldoret	
			Rate	Index	Rate	Index	Rate	Index	Rate	Index	Rate	Index	Rate	Index	Rate	Index
Domestic	0-10	12.00	12.00	100	18.00	150	11.50	96	10.00	83	14.00	117	22.00	183	9.70	81
	11-20	18.00	18.00	100	20.00	111	12.00	67	9.00	50	19.60	109	22.50	125	19.30	107
	21-40	23.00	27.00	117	23.00	100	16.65	72	9.00	39	22.40	97	24.00	104	25.70	112
	41-60	35.00	34.00	97	26.00	74	16.65	48	9.00	26	25.20	72	24.00	69	25.70	73
	Over 60	45.00	34.50	77	33.00	73	26.70	59	10.00	22	28.00	62	26.00	58	38.60	86
Government/ Institution	0-10	12.00	12.00	100	20.00	167	44.00	367	10.00	83	21.00	175	22.00	183	9.70	81
	11-20	15.00	18.00	120	22.00	147	43.50	290	9.00	60	26.60	177	22.50	150	19.30	129
	21-40	23.00	27.50	120	25.00	109	38.00	165	9.00	39	30.80	134	24.00	104	25.70	112
	41-60	35.00	34.50	99	30.00	86	16.20	46	10.00	29	35.00	100	26.00	74	38.60	110
	Over 60	45.00	34.50	77	37.00	82	16.20	36	15.00	33	42.00	93	28.00	62	48.30	107
Commercial/ Industry	0-10	12.00	12.00	100	20.00	167	44.10	368	14.00	117	21.00	175	88.50	738	23.20	193
	11-20	18.00	18.00	100	24.00	133	38.00	211	16.00	89	26.60	148	30.00	167	34.00	189
	21-40	23.00	27.50	120	28.00	122	38.00	165	18.00	78	30.80	134	30.00	130	34.80	151
	41-60	35.00	34.50	99	32.00	91	16.20	46	22.00	63	35.00	100	32.00	91	48.30	138
	Over 60	45.00	34.50	77	39.00	87	16.20	36	22.00	49	42.00	93	32.00	71	54.10	120
Latest Year Amended		1997/8	1997/8		1996/7		1995/6		1994/5		1996/7		1996/7		1996/7	

Source: Water Tariff of Water Undertakers, Ministry of Local Authorities

The flat rate tariff, ie where no meter is installed or operational, is Kshs 160 per month.

It is instructive to compare the eight tariff structures above against the analysis carried out by NWCPC's own tariff study in 1995. That study concluded, from an analysis of a wide range of international tariffs, that a progressive rising block tariff was best suited to the needs of Kenya (and NWCPC), and that tariff rates should be set to satisfy an attainable revenue target, such as to cover operating and maintenance costs or to cover O&M costs plus depreciation plus a contribution to reserves at an agreed percentage rate of new capital works. The study recommended that NWCPC tariffs be set on a regional basis, and should be fixed in real price terms for an agreed period, say five years, during which adjustments for inflation would be made annually. When compared with the above criteria, none of the existing structures conforms.

While tariff values can and should vary between municipalities and perhaps regions of a decentralised major undertaker such as NWCPC, structures should conform to the same general logic. The existing structures do not. They should be reviewed in the light of this principle.

The bulk or wholesale water tariff from a bulk supplier such as NWCPC to a water undertaker such as a municipality is currently Kshs 10/m^3 (which is, in 1998, not up to the Kshs 11.7/m^3 recommended by the 1995 NWCPC tariff study). This is much less than the cost of own production even where low cost water resources are available, as in Kisumu, for example. It is, therefore, surprising that municipal councils are tending to develop their own water sources rather than buy from regional or national providers, which would be more economical.

It is in the economic interest to provide water to the consumer as cheaply as possible. There needs to be more cooperation between NWCPC and the municipalities to ensure this.

3.6.2 Tariff Billing and Collection

The billing and collection system summarised here is that used in the MWR districts, but is similar for the municipal water undertakers. In four of the five NWCPC regions meter reading is conventional and billing is manual. Coastal Region has a computerised billing system which is being extended to other regions.

In MWR, the District Water Office (DWO) reads the installed water meters at the month end, then prepares water bills based on the readings taken which are distributed to consumers at the beginning of the following month. Consumers should pay the due water charges within the same month to the District Treasury Office (DTO), which is administratively under the control of the District Commissioner's Office (DCO). DWO can disconnect the water supply to such consumers if they do not pay. Reconnection results in further charges.

Revenue is then transferred to the MOF as are all other public charges in the country, and fully refunded to MWR.

MWR then allocates, after adjustment, the revenue to each DWO, to be used exclusively for the operation and maintenance of the water supply systems. The amount each DWO receives (as a proportion of the amount submitted) therefore varies from district to district, according to the adjustment applied by MWR. This adjustment results in each district receiving between 65% and more than 100% of the water revenue collected, depending on its prosperity. This is to balance surpluses with deficits within each province.

Operation and maintenance costs of DWO exclude salaries of engineers and administrative officers but include those of subordinate staff.

Current major problems relating to meter reading, billing, and collecting revenue are:

1) An unacceptably large number of consumers being provided with water at a flat rate, due to water meters not being installed or being broken. This results in a large increase in water consumption, and in wasted water;
2) Existence of illegal connections;
3) Lack of serviceable meters;
4) Lack of, or inadequate maintenance of meters;
5) Inefficient meter reading and billing, and bill distribution;
6) Many consumers unwilling to pay because of their dissatisfaction with water supplies.

3.7 Donors Coordination Meeting

Donor support continues to be important to the sector and to GOK. To improve coordination and thereby maximise the effectiveness of donor assistance, it was decided in 1996 to streamline

the arrangements by adopting a Programme Approach among donors. The following coordination framework was adopted:

1) A General Coordination Group, to be facilitated by the World Bank and UNDP;
2) Programme Coordination Groups, under the leadership of the relevant GOK ministry. These would address programme-specific issues, coordinate activities and maximise utilisation of resources;
3) Working Groups, to be formed temporarily under the direction of Programme Coordination Groups for the resolution of specific issues. There would not be too many of these groups and they would be wound up when their work was done.

The first meeting of the Water Supply and Sanitation Programme Coordination Group (WSSPCG) was held in November 1996. From this meeting the Group created three working groups:

1) Policy, Regulations and Resources Management Working Group;
2) Rural Water Supply and Sanitation Projects Working Group;
3) Urban and Peri-urban Water and Sanitation Projects Working Group.

Each WG has identified and prioritised issues to be addressed under its agreed TOR. Some progress has been made in addressing these issues. For example, the Urban and Peri-urban Water and Sanitation Projects WG has selected commercialisation and private sector participation as a priority issue and has formed a study team to produce specific recommendations for Kenya.

However, there are potential problems. To be productive, the multiplicity of subject areas and groups will themselves require considerable coordination, both within and between programme groups, particularly in view of the overlapping TORs. Furthermore, it appears that some key players in the sector such as MOLA, MOH, NCC, NGOs and MOENR have not been taking part; without them the process will not be effective.

3.8 Operation and Maintenance Staff Training Facilities

The Kenya Water Institute (KEWI) is the main body responsible for training personnel employed by MWR, local authorities and other organisations in the water sector. The Institute offers diploma and certificate courses in water technology as well as numerous shorter courses. It has seven teaching departments in: water engineering; water resources; planning, Marketing and coordinating; mathematics, science and computer use; operation and maintenance; mechanical and electrical engineering; and management and general studies.

The present organisational scale of KEWI is as below.

1)	Administrative staff	90 persons
2)	Teaching staff	60 persons
3)	Number of trainees	250 persons/year
4)	Number of trainees by course	20 - 50 persons/year

The Institute has recently received donor support from GTZ and France. GTZ is helping KEWI to reorganise to achieve a greater degree of autonomy, and to extend the curriculum, improve staff training, and provide additional training equipment.

Following a needs assessment, carried out by the project, it was discovered that that Institute should offer more flexible curriculum, rather than limit itself to certificate and diploma courses, it was found that informal, shorter courses that satisfy unique requirements of clients were more in demand. The Institute now offers more such courses on commercial basis with emphasis on the customers' needs. Among those who have already benefited from the new-approach courses of the Institute are:

1) Borehole Operators in Kajiado and Marsabit/Moyale
2) NWCPC Personnel at Malindi, Mombasa and Nyeri
3) Ministry of Water Resources Personnel of Machakos District

Some of the cadres of personnel trained so far were:

1) Borehole operators
2) Meter readers
3) Billing and Revenue Clerks
4) Water Supply Operators
5) Chemical and Pump Attendants
6) Water Guards
7) Line Patrollers, Meter Readers and Pipe Fitters

Other refresher courses were covering:

1) Operation and Maintenance and Appurtenances
2) Installation and Servicing of Water Meters
3) Burst and Leakage Repair
4) Connection and Installation of Service Lines

The project will place more emphasis on practical and all-round training so that the multi-discipline graduates could handle entire operations within their stations rather than the specialised type that encourage over-staffing in these schemes. This will be achieved through training the trainers and hands-on training on the equipment.

France, through the Kenya/France Development Co-operation Task Force on Human Resource Development (HRD) in the Water Sector, has prepared, and is presumably executing, a two-year Action Plan for human resources development.

Activities in the Action Plan include setting up a central HRD unit and training management information system, developing existing ministerial HRD units, and preparing and implementing prioritised training programmes. In this training are management, technical and special programmes, improving collaboration with other training institutions, and training instructors

according to the needs of the expanded training programme. Unfortunately, where courses do not exist, the Action Plan does not say when courses which are to be "planned" or "developed" are likely to be available, which makes planning future training very approximate.

Ultimately a range of courses is promised in KEWI and other Kenyan institutions for management, district water engineers, and various staff in Water Resource Management, Planning and Construction, Operation and Maintenance (from MWR and municipalities).

3.9 Summary of Sector Development Problems and Constraints

(1) Financial Aspects

1) Short of allocation for public expenditure;
2) Greater portion of sector investment depending on appropriation-in-aid;
3) Great amount of subsidy to NWCP, which is financially an independent state corporation.

(2) Institution

1) Weak regulation of the sector (water pollution, water abstraction, water quality, tariffs) and the institutions in it; eg Nairobi Water and Sewerage Department;
2) MWR, responsible for policy formulation, strategy, development planning and implementation, and regulation, is also the country's largest water undertaker;
3) Fragmented management and apparent lack of recognition for the sewerage and sanitation subsector;
4) Lack of logic and clarity in the roles and limits of responsibility between the main actors in the water supply and sewage sector;
5) Separation of the management of water supply from sewerage systems;
6) Weak performance of most Local Authorities in the sustainable management of water and sewerage services.

(3) Legislation

1) Poor implementation of acts and regulation;

i) The existence of many responsible agencies not well coordinated, and many laws;
ii) Staff shortages, a lack of "enforcement philosophy" and motivation at all levels, and lack of experience of enforcement by officials;
iii) Inability to take prosecutions to subordinate courts. Currently, the AG has to initiate prosecutions under the Water Act, which may account for the almost total absence of prosecutions under the Act over the past 35 years.

2) Significant shortcomings of the Water Act;

i) The need to remove several long defunct bodies from the Water Act, for example Water Resources Authority and Regional Water Committees, and to add new ones, such as the District Water Boards; the need to repeal the Mombasa Pipeline Board Act and similar defunct legislation;
ii) Many provisions of the Water Act do not apply to non-gazetted or local authority undertakers;
iii) Control of groundwater and surface water abstraction, and pollution should be improved;

(4) Personnel Administration

1) The reported very low remuneration of the public sector in comparison with the private sector;
2) Recruitment, placement and transfer of senior and middle level staff by the Public Service Commission (PSC), without the approval of the managers involved;
3) Numerous staff shortages in key senior and middle level positions throughout the sector, particularly in unpopular field postings;
4) Lack of qualified tradesmen and trained operators at scheme level, particularly in the sewerage subsector.

(5) Tariff Structure and Collection

1) Inadequate customer service in the areas of: customer registration and records; meter installation, repair, and reading; billing and revenue collection: connection, disconnection and reconnection;
2) Tariffs too low, inappropriate tariff structures in some cases, and inadequate recovery from the commercial and industrial sector;
3) Excessive waste of water due to an absence of active leakage control;
4) Many public agencies failing to settle their bills for water supplied and sewerage services;
5) In non-commercialised municipalities, revenues accruing from water are being used to defray other unrelated costs.

(6) Operations and Maintenance

1) Lack of funds;
2) Lack of qualified staff;
3) Lack of facilities, equipment and cost.