Sectoral Report (C)
Water Supply

THE PROJECT
ON
THE DEVELOPMENT OF
THE NATIONAL WATER MASTER PLAN 2030
IN
THE REPUBLIC OF KENYA

FINAL REPORT
VOLUME – IV SECTORAL REPORT (1/3)

C: WATER SUPPLY

Abbreviation

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List of Abbreviations and Acronyms

ACA	:	Athi Catchment Area
AFD	:	Agence Francaise de Developpement
AfDB	:	African Development Bank
ASAL	:	arid and semi-arid land
B/C	:	Benefit and Cost
BOPA	:	Budget Outline Paper
CA	:	catchment area
CAAC	:	Catchment Areas Advisory Committee
CBO	:	community based organization
CBS	:	Central Bureau of Statistics
CPC	:	Community Project Cycle
Danida	:	Danish International Development Agency
DRSRS		Department of Resource Surveys and Remote Sensing
EIRR	:	Economic Internal Rate of Return
ENN	:	Ewaso Ng'iro North
ENNCA	:	Ewaso Ng'iro North Catchment Area
ESP	:	Economic Stimulus Programme
EU	:	European Union
F/S	:	feasibility study
FAO	:	Food and Agriculture Organization
FINNIDA	:	Finnish Department for International Development Cooperation
FY	:	Fiscal Year
GDP	:	Gross Domestic Product
GOK	:	Government of Kenya
GTZ	:	Deutsche Gesellschaft fur Internationale Zusammenarabeit
IFAD	:	International Fund for Agricultural Development
JICA	:	Japan International Cooperation Agency
JMP	:	Joint Monitoring Programme
KEWI	:	Kenya Water Institute
KfW	:	German Development Bank
KIDDP	:	Kenya Italian Debt Swap for Development
LSRWSS	:	Large Scale Rural Water Supply System
LU	:	livestock unit
LVN	:	Lake Victoria North
LVNCA	:	Lake Victoria North Catchment Area
LVS	:	Lake Victoria South
LVSCA	:	Lake Victoria South Catchment Area
MDG	:	Millennium Development Goals
MOFD	:	Ministry of Fisheries Development
MOLD	:	Ministry of Livestock Development
MTP	:	First Medium Term Plan (2008 – 2012) of Kenya Vision 2030
MWI	:	Ministry of Water and Irrigation
NIB	:	National Irrigation Board
NPV	:	Net Present Value

NRW	:	Non-revenue Water
NWCPC	:	National Water Conservation and Pipeline Corporation
NWMP	:	National Water Master Plan
NWRMS	:	National Water Resources Management Strategy
NWSS	:	National Water Services Strategy
O&M	:	Operation and Maintenance
PPIP	:	Pro-Poor Implementation Plan
RV	:	Rift Valley
RVCA	:	Rift Valley Catchment Area
SIDA	:	Swedish International Development Agency
SNV	:	SNV Netherlands Development Organisation
SO	:	support organization
SSRWSS	:	Small Scale Rural Water Supply System
SSWSS	:	Small Scale Water Supply System
SWAp	:	sector-wide approach
TCA	:	Tana Catchment Area
UC	:	Urban Centre
UN	:	United Nations
UNICEF	:	United Nations Children's Fund
UPC	:	Urban Project Cycle
USAID	:	United States Agency for International Development
UWSS	:	Urban Water Supply System
WAB	:	Water Appeal Board
WARIS	:	Water Regulation Information System
WaSBIT	:	Water Service Board's Investment Tool
WASREB	:	Water Services Regulatory Board
WDC	:	Water Resources Users Association Development Cycle
WHO	:	World Health Organization
WRMA	:	Water Resource Management Authority
WRUA	:	Water Resources Users Association
WSB	:	Water Service Board
WSC		Water Service Company / Water and Sewerage Company
WSP	:	Water Service Provider
WSSP	:	Water Sector Strategic Plan
WSTF	:	Water Services Trust Fund

Abbreviations 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
CM	=	cubic meter
MCM	=	million cubic meter
BCM	=	billion cubic meter
m^3/d, cmd	=	cubic meter per day
BBL	=	Barrel

Weight

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

Time

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

Money

KSh	=	Kenya shilling
US$	=	U.S. dollar

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
L/p/d	=	litter per person per day

NOTE

1. The National Water Master Plan 2030 was prepared based on the material and data provided from Kenyan Government and its relevant organisations during field surveys in Kenya carried out until November 2012. The sources etc. of the material and data utilised for the study are described in the relevant part of the reports.

2. The names of ministries and related organisations of Kenyan Government are as of November 2012.

3. Information to be updated

   The following information which is given in the report is needed to be updated properly:

   (1) Information on the proposed development projects

   The features and implementation schedules of the proposed development projects may be changed toward implementation of the project. After the subject projects were clearly featured for implementation, the project features and implementation schedules in this report should be updated.

   (2) Information on the water demand

   The water demand projected in this master plan should be revised when the large scale development plans, other than the projects proposed in this master plan, were formulated, as they will significantly affect to the water resources development and management.

4. Exchange rate for cost estimate

   The costs of the proposed development and management plans were estimated by applying the following exchange rate as of November 1, 2012.

EXCHANGE RATE
US$1.00 = KSh 85.24 = ¥79.98
as of November 1, 2012

CHAPTER 1 INTRODUCTION

This Sectoral Report C presents the results of the study on the water supply sector in Kenya. The objectives of the study are the following:

1) To clarify the present conditions of the water supply sector in Kenya,
2) To carry out population projection and water demand projection in 2030 and 2050, and
3) To prepare a project list and implementation plan of water supply systems to cover the water demand by 2030.

The development target is based on Kenya Vision 2030, the Water Service Strategic Plan 2009, and other relevant documents. This study does not intend to cover specific water supply schemes.

The work flowchart of the study is shown in Figure 1.1.1.

CHAPTER 2 CURRENT SITUATION OF WATER SUPPLY

2.1 Relevant Policies and Strategies

(1) General

Over recent years, a large number of government strategy and policy documents have been prepared. The most important documents applicable to the water supply and sanitation sector are the following:

a) Kenya Vision 2030
b) The National Water Services Strategy (NWSS), September 2007
c) Implementation Plan for the National Water Services Strategy, July 2008 (also known as the Pro-Poor Implementation Plan (PPIP))
d) Water Sector Strategic Plan (WSSP) 2009-14, April 2010
e) The Eight WSB Strategic Plans.

The key aspects of each of the above documents are summarised below.

(2) Kenya Vision 2030

Kenya Vision 2030 sets out the overall vision for the development of the country. It covers the period from 2008 to 2030 and aims to "transform Kenya into a newly industrializing middle-income country providing a high quality of life to its citizens by 2030". Kenya Vision 2030 is based on three pillars, namely economic, social and political, and is to be implemented in a series of successive five-year medium-term plans, the first of which covers the period 2008 to 2012.

The popular version of Kenya Vision 2030 refers to Kenya's expectation "to have met its Millennium Development Goals (MDGs) whose deadline is 2015". The document goes on to state that some of the goals have already been met and that "Kenya Vision 2030 spells out action that will be taken to achieve the rest."

The key MDGs applicable under this section of this study is "to halve by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation".

In the longer term, a key aim of Kenya Vision 2030 is to ensure that improved water and sanitation are available for all. Kenya Vision 2030 anticipates that more than half of the population are likely to be living in an urban environment by 2030. This is confirmed by the NWMP 2030 estimates.

Kenya Vision 2030 includes the following specific target projects:

a) Rehabilitation and augmentation of the Mzima pipeline;
b) Expand the coverage for Nairobi, Mombasa, Kisumu, Nakuru and Kisii;
c) Rehabilitation of water supplies in 26 medium sized towns; and
d) Rehabilitation and expansion of sewerage works in urban areas.

(3) The National Water Services Strategy (NWSS), September 2007

The NWSS was prepared in accordance with Section 49 of the Water Act 2002 and provides a review of the water supply and sanitation situation as it was in 2007. It recognizes that service coverage is poor and indeed has been going backwards. Furthermore, it sets out the background to the Water Act 2002 and describes the main provisions of the law.

The stated vision of the NWSS is:

"Assured water supply, sewerage services and basic sanitation for all Kenyans for improved health and wealth creation on an individual level and for the nation"

The mission is:

"To realise the goals of the MDG declaration and the Vision 2030 of the Kenyan Government concerning access to safe and affordable water and basic sanitation by responsive institutions within a regime of well-defined standards and regulation"

The NWSS sets out five key goals as follows:

a) Reach at least 50% of the underserved urban population with safe and affordable water by 2015 (MDG) and thereafter, move to access for all by 2030;
b) Reach through sustainable waterborne sewage collection, treatment and disposal systems 40% of the urban population and 10% of the rural population by 2015, and total coverage in all urban centres by 2030;
c) Increased access to safe and improved basic sanitation facilities particularly for the poor to 77.5% in the urban setting and 72.5% in the rural setting by 2015;
d) Achieve the MDGs by fast tracking affordable and sustainable access to safe water in the settlements of the urban poor; and
e) Reach at least 50% of the underserved population in rural areas with safe and affordable water by 2015 (MDG) and thereafter move to sustainable access for all by 2030.

In each case, the NWSS sets out the medium-term indicators for achievement, the challenges, the recent developments and the strategic response. The NWSS also sets a number of cross-cutting goals covering information systems, sector coordination, human rights and poverty alleviation, financing, gender mainstreaming, HIV/AIDS, environmental sustainability, and disaster management.

(4) Implementation Plan for the National Water Services Strategy, July 2008

Also known as the PPIP, this document was prepared to supplement the NWSS and specifically addresses the needs of the underserved population from a social standpoint. The PPIP sets out the actions to be undertaken by each of the key institutions created under the provisions of the Water Act 2002.

It should be noted that the PPIP is significantly more user-friendly and informative than the rather cumbersome NWSS. In order to aid dissemination to all stakeholders, the PPIP has been released in both full and popular formats.

(5) Water Sector Strategic Plan (WSSP) 2009-2014, April 2010

The vision of the WSSP is:

"A Kenya where water resources are protected, harnessed and sustainably managed to ensure availability and accessibility to all for the present and future generations, thereby increasing prosperity through effective and efficient use and a clean and healthy environment".

The WSSP aims to meet the demand tasks and challenges by:

a) Increasing the knowledge among sector stakeholders of the current challenges and changes in the sector;
b) Providing policy and regulatory guidance to stakeholders as to how the challenges should be met;
c) Providing a conducive environment for improved collaboration and coordination by stakeholders, ensuring that interventions pull in the same direction and resources are used effectively and efficiently;
d) Providing a structure for follow-up and evaluation that covers all aspects of water development and allows us to jointly adjust our combined efforts over time, as required by circumstances.

The WSSP is based on the adoption of integrated water resources management and guided by Kenya Vision 2030. It provides an excellent summary of the sector as it stands today and addresses all of the key issues. The WSSP targets sustainable and affordable access to safe water and sanitation to all, through the increased formalization of services including low income urban and rural areas, promoting sustainable operation through scheme clustering and improved access through the work of the WSTF.

(6) WSB Strategic Plans

Copies of the eight WSB Strategic Plans have been collected and reviewed. In general, the plans are vague and lack substance, and sanitation is poorly covered in comparison to water supply.

Through interviews conducted with the WSBs, it was clear that the plans were too ambitious and, as a result, have not been adhered to. Some WSBs indicated that their starting point, in terms of water supply coverage, was not as advanced as they had been led to believe. It therefore seems that their progress has been limited and they consider this to be an unfair reflection on their performance.

Most WSBs have rewritten their plans to end in 2012, and are writing new plans to cover the period 2013 to 2017 in order to tie in with Kenya Vision 2030.

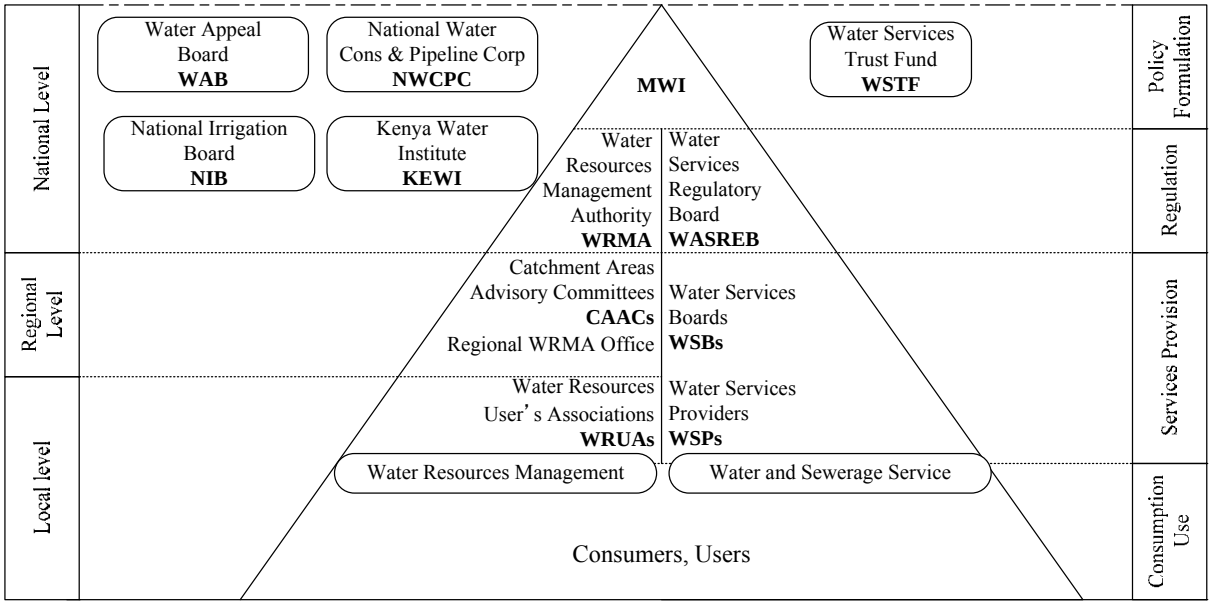
2.2 Relevant Organizations

(1) Background

At the time of the Aftercare Study (1998), it was evident that progress in the sector was being hampered by the poor institutional arrangements in place. Indeed it was noted that donors were paying significant attention to institutional and operational aspects as a precursor to further investment and this led the study to make several important recommendations regarding institutional change.

With the urgent need to accelerate social and economic development in Kenya, the government initiated a reform process that led to the passing, and subsequent implementation, of Act No. 8 of 2002 – Water Act, more commonly known as the Water Act 2002. The principal outcome of the Water Act 2002 was the reorganisation of the institutional arrangements under the MWI and the introduction of measures for the regulation and management of the country's water supply and sanitation services.

The following diagram (abstracted from the NWSS) clearly conveys the new institutional arrangements implemented under the Water Act 2002.



Source: WRMA, modified by JICA Study Team (As of November 2012)

Water Act 2002 Institutional Arrangements

The NWRMS published in January 2007 provides a clear definition of the roles and responsibilities of the key institutions created under the provisions of the Water Act 2002.

a) Ministry of Water and Irrigation (MWI)
   - Development of legislation, policy formation, sector coordination and guidance, and monitoring and evaluation.

b) Water Resources Management Authority (WRMA)
   - Planning, management, protection and conservation of water resources;
   - Planning, allocation, appointment, assessment and monitoring of water resources;
   - Issuance of water permits;

- Water rights and enforcement of permit conditions;
- Regulation of conservation and abstraction structures;
- Catchment and water quality management;
- Regulation and control of water use; and
- Coordination of the IWRM Plan.

c) Catchment Area Advisory Committees (CAACs)
- Advising the WRMA on water resource issues at the catchment level.

d) Water Resource Users Associations (WRUAs)
- Involvement in the decision making process to identify and register water users;
- Collaboration in water allocation and catchment management;
- Assisting in water monitoring and information gathering; and
- Conflict resolution and cooperative management of water resources.

e) Water Services Regulatory Board (WASREB)
- Regulation and monitoring of Water Services Boards;
- Issuance of licenses to Water Services Boards;
- Setting standards for provision of water services; and
- Developing guidelines for water tariffs.

f) Water Services Boards (WSBs)
- Responsible for efficient and economical provision of water services;
- Developing water facilities;
- Applying regulations on water services and tariffs;
- Procuring and leasing water and sewerage facilities; and
- Contracting water service providers.

g) Water Services Providers (WSPs)
- Provision of water and sewerage services.

h) Water Services Trust Fund (WSTF)
- Financing provision of water and sanitation to disadvantaged groups.

From the water supply and sanitation point of view, the most relevant organizations in the new institutional structure are the following:

a) WASREB,
b) Eight WSBs,
c) WSPs, and
d) WSTF.

Although not specifically indicated on the organization diagram, community-based organizations (CBOs) are one type of WSP and are critical to the water supply and sanitation sector, particularly in the rural areas. Furthermore, it is evident that the various multi- and bi-lateral agencies have a critical role to play in the sector.

Each of the above organizations and their role are discussed below in more detail.

(2) Water Services Regulatory Board

WASREB is primarily responsible for the regulation and monitoring of the WSBs and WSPs, the issuance of licenses to WSBs, the setting of standards for the provision of water services, and the development of guidelines for water tariffs. WASREB is a dynamic organization staffed by excellent professionals dedicated to bringing about transformation in Kenya's water sector.

It is evident that the WASREB has good political support and it is unlikely that there will be any significant interference in their regulation work. The response from the public is positive as they now have a vehicle through which to judge their service providers. It is very clear that WASREB is one of the key bodies leading culture change and improvement.

WASREB has a staff of only 25 people and this makes it very difficult to police all 122 WSPs. As a result, the WASREB is concentrating on the monitoring of the performance of the large WSPs as it is important to ensure that the large WSPs are functioning properly so that they can set an example to the smaller ones. Furthermore, the large WSPs provide the majority of water and hence they can have the maximum impact.

The WASREB points out that only the larger WSPs are in fact financially viable and are able to cover their costs. Most of the smaller WSPs are losing money and need support. The WASREB, therefore, considers that clustering is the way forward as together, individual schemes can benefit from the economy of scale.

The WASREB produces a very good performance report on the water services subsector termed IMPACT. The latest issue of IMPACT is Issue No. 3, which reports on performance during FY 2008/09. Issue No. 4 is under preparation, having completed the data collection phase. Through IMPACT, the WASREB has both praised good performing WSBs and WSPs but also sanctioned those that are underperforming. The WASREB has made powerful statements regarding the need for improvements and has, in some cases, revoked operating licenses. The WASREB reports that all major towns in Kenya now have a WSP. Table 3.1 of IMPACT Issue No. 3 indicates that the 77 listed WSPs serve a total of 221 towns.

Despite the introduction of Water Act 2002, compliance remains an issue as key people and organizations are reluctant to change their culture and to accept the separation of management and operations. They do not want to lose the opportunity to make money. The WASREB has been more critical of the WSBs than the WSPs. It seems that the boards have been slower to accept the required cultural change, and to understand that it is not their role to do the job of the WSPs. It is also apparent that there are communication issues between the WASREB, the WSBs and the WSPs.

To date it is evident that the WASREB has been concentrating on the supply of water and sanitation services and has not considered water quality in any great depth. This is beginning to change as concern has been mounting on issues such as high fluoride concentrations in the groundwater in some areas of Kenya.

(3) Water Services Boards (WSBs)

There are currently eight WSBs, as follows:

- Athi
- Coast
- Lake Victoria North
- Lake Victoria South
- Northern
- Rift Valley
- Tana
- Tanathi

The WSBs are responsible for efficient and economic provision of water services, developing water and sanitation facilities, applying regulations on water services and tariffs, procuring and leasing water and sewerage facilities and contracting WSPs, whereas it is the WSPs that are responsible for the actual provision of water and sewerage services. The eight WSBs are responsible for investment in the water sector. Indeed their licence is conditional on the submission and approval of a ten year plan. The WASREB is monitoring progress through annual visits.

The limits of the areas covered by the WSBs follow the boundaries of the "original" 46 districts but do not coincide with either the provincial boundaries or the water catchment boundaries. The extent of each WSB is indicated in Figure 2.2.1. The NWMP 2030 requires this study to prepare development plans on a catchment basis for the six WRMA catchments.

Service Areas of the WRMA and WSBs

WRMA Catchment Area	Water Service Boards
1) Athi	1) Athi
2) Ewaso Ngiro North	2) Northern
3) Lake Victoria North	3) Coast
4) Lake Victoria South	4) Lake Victoria North
5) Rift Valley	5) Lake Victoria South
6) Tana	6) Rift Valley
	7) Tana
	8) Tanathi

Source: JICA Study Team based on information from WRMA and WSBs

Furthermore, it is important to note that in a number of cases, the division boundaries between two WSBs overlap in a newly created county, and this may lead to institutional problems in the future. It is clear that the aforementioned facts will have to be taken into account during the formulation of the water supply and sanitation components of the NWMP 2030.

The estimated 2010 population, land area, and overall population density in each WSB service region are presented in the following table.

WSB Basic Information

WSB	Projected Population 2010	Area (km^2)	Density (population/km^2)
Athi	5,201,000	3,838	1,355
Coast	3,437,000	82,893	41
Lake Victoria North	6,772,000	16,477	411
Lake Victoria South	7,725,000	22,569	342
Northern	2,601,000	253,634	10
Rift Valley	4,696,000	116,121	40
Tana	4,315,000	19,169	225
Tanathi	3,778,000	66,614	57
Total	38,525,000	581,315	66

Source: JICA Study Team based on relevant information from WSBs

All WSBs have websites stating their visions, missions, strategic objectives, latest news, and contact details.

During the period from February to March 2011, open and frank discussions were held at each WSB. It is evident that all are experiencing similar challenges, as discussed in more detail in Subsection 5.2.7.

(4) Water Services Providers (WSPs)

The WASREB reported that there are currently 122 WSPs operating in Kenya. Although it should be noted that this number is changing on a regular basis, as:

a) New WSPs are being created in the rural areas through the work of the WSTF; and
b) Some WSPs, particularly those which are financially fragile and are struggling to operate, are opting to join with neighbouring WSPs in order to improve sustainability through the sharing of resources. This process is termed “clustering” and is being actively encouraged by numerous government organizations and donors.

IMPACT Issue No. 3 provides an in-depth report on the 77 WSPs that have supplied the required data through the Water Regulation Information System (WARIS). The WASREB has had numerous difficulties obtaining data from both the WSBs and WSPs, but it is understood that IMPACT Issue No. 4 will provide data on at least 100 WSPs. The data provided in Issue No. 3 for FY 2008/09 is reproduced in the Table 2.2.1. The key points to note include the following:

a) The total population served by the 77 WSPs is 8,053,989, which is approximately 21% of the country’s population in 2010;
b) The average percentage of the population served in each service area is 45%;
c) The average consumption is 65 L/person/day; and
d) On average, there are 7.5 persons per connection.

In order to assess the performance of the WSPs, the WASREB has established sector benchmarks and has adopted nine key performance indicators, as shown in the following table.

Sector Benchmarks

Indicator		Sector Benchmarks		
		Good	Acceptable	Not Acceptable
Collection efficiency		>90%	85-90%	<85%
Non-revenue water		<20%	20-25%	>25%
Water quality	Drinking quality	>95%	90-95%	<90%
	Compliance with residual Cl_2 test	>95%	90-95%	<90%
Hours of supply	Population > 100,000	21-24	16-20	<16
	Population < 100,000	17-24	12-16	<12
O&M cost coverage		>150%	100-149%	<100%
Metering ratio		100%	95-99%	<95%
No. of staff per 1,000 connections	Very large and large WSPs	<5	5-8	>8
	Medium and small WSPs (up to three towns)	<7	7-11	>11
	Medium and small WSPs (more than three towns)	<9	9-14	>14
Water coverage		>90%	80-90%	<80%
Sanitation coverage		>90%	80-90%	<80%

Source: IMPACT Issue No.3

The performance and ranking of each WSP are summarised in Table 2.2.2. Based on the examination of data, it is evident that there may be some reporting errors. For example, it seems very unlikely that NRW in Karimenu is really 93%. This reinforces WASREB's concerns regarding data quality.

(5) Water Services Trust Fund (WSTF)

The WSTF is a state corporation which was established under Section 83 (1) of the Water Act 2002. Its mandate is "to assist in financing the provision of water services to areas of Kenya which are without adequate water services". The WSTF is funded by the government in cooperation with the following development partners:

- The Swedish International Development Agency;
- The Danish International Development Agency;
- The European Union;
- The African Development Bank;
- The German Development Agency ;
- The German Development Bank; and
- The United Nations Children's Fund.

The WSTF, which specifically targets the poor, was established in March 2005. During the period of its first Strategic Plan (2005-2008), the following three funding systems or "windows" were set up:

a) The Community Project Cycle (CPC) – for rural water and sanitation projects;
b) The Urban Project Concept (UPC) – for urban water and sanitation projects; and
c) The Water Resources Users Association Development Cycle (WDC) – for water resources projects.

The CPC was developed to help even the poorest rural communities in Kenya to plan, build, operate and maintain their own water supply and sanitation facilities. The emphasis is very much on self-help but with strong support from the WSBs, and of course, the WSTF. The CPC promotes transparency,

community participation, and community capacity development. The stages in the cycle are as follows:

a) Pre Application – the WSBs and the WSTF select the 50 poorest locations;
b) Application – WSBs raise awareness of the facility and assist CBOs to apply;
c) Preparation – initial meetings, training, the registration of the CBO as a WSP and the preparation of the outline design for WSB checking and approval;
d) Design – an appointed support organization (SO) helps the community to develop detailed plans including cost estimates. Following community approval, the plans are forwarded to the WSB for review before submitting to the WSTF for approval. Once agreed, a contract is signed and funds are released to the CBO and SO;
e) Implementation – the construction proceeds with appropriate community involvement and training. Monitoring is conducted by the CBO management committee with the WSB and WSTF oversight;
f) Post Implementation – the WSB monitors the performance of the newly formed WSP, which may merge with another WSP, if preferred. Water tariffs are set to ensure the sustainability of the scheme.

Ownership of the facilities constructed should be transferred to the responsible WSB, but this does not always happen in practice as the communities tend to resent the WSB's involvement.

Although originally established to cater to poor rural communities, the mandate of the WSTF was expanded in July 2007 to include low income urban areas. The UPC is similar to the CPC but funds can only be accessed by registered WSPs. The concept consists of the following eight steps:

a) Launch of the call for proposals by the WSTF – Twice a year, WSPs are invited to submit proposals that will benefit the urban poor;
b) Collection of data by the WSP – Socioeconomic, technical, community participation, legal and gender information are required as part of the submission;
c) Preparation of project proposals by WSPs and WSBs – A detailed document prepared by the applicant WSP but with assistance from the relevant WSB;
d) Evaluation of proposals by the WSTF – Following a transparent procedure covering key issues such as sustainability, technical viability, the WSP's capacity and community participation;
e) Approval and award of projects by the WSTF – The best proposals are approved by the WSTF Board of Trustees and, subject to certain conditions, the first disbursement is made;
f) Project implementation by the WSP and WSB – A holistic and localized approach is adopted involving the community at all implementation sub-stages;
g) Operation of the project by the WSP – Customers are charged a tariff which is approved by the WASREB; and
h) Evaluation by the WSTF – Designed to involve the community and give feedback to improve the UPC process.

Again, any facilities constructed should be transferred to the WSBs.

In order to assist the UPC process, the WSTF have, with assistance from the GTZ and the UN Habitat, created MajiData, a system for storing data regarding the water and sanitation situation in poor urban

areas. The WSTF has prepared an excellent series of booklets and toolkits to guide potential applicants.

The WDC follows a similar concept to that of the CPC and the UPC but covers the wider issues of water resources management including water quantity and quality, stakeholder participation in water resources management, compliance with water and environmental regulations and the development of well-governed and self-reliant WRUAs.

The WSTF reported that in the period of its first Strategic Plan (2005 to 2008), over 192 water and sanitation projects in the rural areas have received funding from the WSTF which, once completed, will benefit over 1.4 million people.

(6) Donors

Since 2006, donors have been working together under a sector-wide approach (SWAp) and taking part in annual joint sector reviews and conferences. There are a large number of donors active in the water and sanitation sector in Kenya, as follows:

- African Development Bank (AfDB)
- Agence Francaise de Developpement (AFD)
- Danish International Development Agency (Danida)
- Deutsche Gesellschaft fur Internationale Zusammenarabeit (GTZ)
- European Union (EU)
- International Fund for Agricultural Development (IFAD)
- Italian Cooperation
- Finnish Department for International Development Cooperation (FINNIDA)
- German Development Bank (KfW)
- Japan International Cooperation Agency (JICA)
- Kenya Italian Debt Swap for Development (KIDDP)
- SNV Netherlands Development Organisation (SNV)
- Swedish International Development Agency (SIDA)
- The World Bank
- UN Habitat
- United Nations Children's Fund (UNICEF)
- United States Agency for International Development (USAID)

The roles of the donors are discussed in more detail in Subsection 5.2.6.

2.3 Current Situation

2.3.1 Overview

(1) General (Water Supply and Sanitation Coverage)

At the time of the Aftercare Study (1998), it was estimated that 53% of the population of Kenya was served by water supply schemes. This equated to 94% of the urban population and 44% of the rural

population. From in-depth discussions with key government officials and donor agencies, it is evident that there was very little progress in the water and sanitation sector in the period immediately following the completion of the Aftercare Study (1998). Indeed, in many regards the sector is seen as going backwards as facilities were not maintained and were allowed to fall into disrepair.

However, since the passing of the Water Act 2002 and the establishment of key institutions and agencies, it is clear that tremendous progress has been made in the water sector. The MWI Annual Water Sector Reviews for 2009 and 2010 show that since FY 2004, there has been a significant increase in the approved government budget, as shown in the table below.

Sector Investment

(Unit: KSh million)

Item	FY Budget					
	FY 2004/05	FY 2005/06	FY 2006/07	FY 2007/08	FY 2008/09	FY 2009/10
Recurrent	2,411	2,329	3,014	4,159	4,678	4,536.2
Development	4,224	8,524	9,325	13,206	18,197	23,252.9
Total	6,635	10,853	12,339	17,365	22,875	27,789.1

Source: 2009 and 2010 Annual Water Sector Review Reports

It should be noted that the above figures represent the MWI's total budget and should be broken down into water supply and sanitation, water resources management, irrigation, drainage and water storage, and land reclamation. In 2008/09, 83% of the development budget (KSh 15,025 million) was spent on water supply and sanitation, and in 2009/10, it was 72% or KSh 16,782 million.

There has also been a significant increase in investment from the donor community as confidence in the sector's institutional capacity grows. With the normal project cycle of study, design, tendering and implementation, it is taking time for this increased investment to produce quantifiable results but it is clear that the negative trend in the level of services provided has been reversed and the indications are that the situation is now steadily improving.

It is evident that there is still no effective means by which to establish the water supply and sanitation coverage in Kenya. It is therefore very difficult to establish how the country is performing in relation to either the MDGs or the national targets. This challenge is well-known within the water sector in Kenya and efforts are being made to find a solution through the introduction of improved data systems such as MajiData, which focuses on the poor urban areas, and the WSB's Investment Tool (WaSBIT), which compiles data at a sublocation level and is currently being pilot tested in three areas of the country.

(2) Current Situation of Water Supply

The WHO/UNICEF Joint Monitoring Programme (JMP) Water Supply and Sanitation Progress Report on Sanitation and Drinking Water 2010 Update is a useful indication of global, regional and country progress towards achieving the MDGs. The MDG target for water supply is to reduce the proportion of the population without sustainable access to safe drinking water from 23% in 1990 to 12% by 2015. The JMP report adopts the following definitions for improved and unimproved drinking water facilities:

JMP Definitions

Improved Drinking Water Source	Unimproved Drinking Water Source
• Piped water into dwelling, yard or plot • Public tap or standpipe • Tube well or borehole • Protected dug well • Protected spring • Rainwater collection	• Unprotected dug well • Unprotected spring • Cart with small tank or drum • Tanker truck • Surface water (river, dam, lake, pond, stream, canal, irrigation channel) • Bottled water

Source: JMP Report

In overall terms, the world is set to exceed the MDG for water supply with the currently projected figure of 9%. However, the majority of Sub-Saharan Africa is not on target to meet the water supply MDG as most countries have been reported as not within 10% of the required rate to meet the target. The situation in Kenya is better and was reported as "making progress but insufficient", and that the country is between 5% and 10% of the required rate to meet the target figure.

In Sub-Saharan Africa as a whole only 60% of the population have access to improved drinking water sources. While this figure is low, it should be noted that there is also a significant disparity between the urban (83%) and rural (47%) environments.

The JMP report estimated that in 2008, the population of Kenya was 38,765,000, of which 22% and 78% were in urban and rural areas, respectively. These estimates differ from the results of the 2009 Census both in terms of the total population (38,610,097 in 2009) and the urban/rural split (32% and 68%). The report provides the following estimates regarding access to drinking water in Kenya.

JMP Estimates of Access to Drinking Water

Facility	Urban (%)	Rural (%)	Total (%)
Piped in pipelines	39	40	40
Other improved	44	12	19
Improved total	83	52	59
Unimproved	17	48	41

Source: JMP Report

On the basis of the above total percentage figure and the JMP estimated national population of 38,765,000, it can be estimated that there remains about 15,890,000 people without access to improved water sources in Kenya. Organizations such as the WASREB and some donors argue that the JMP figures are too optimistic as they do not take account of key factors such as water quality, service hours and distance to/from the water source.

The 2009 Census presented a good opportunity to establish the status of water supply coverage but this has been missed as the presentation of the data collected does not allow the reader to identify the difference between the population receiving water from protected and unprotected sources. As indicated above, under the MDG definitions, people receiving water from protected sources count as having improved services, whereas the remainder do not.

The 2009 Census reported a total of 8,767,954 households in Kenya. Based on the 2009 Census data, the population and ratio of water connection to each drinking water source in 2010 were estimated as shown in the table below.

Drinking Water Source Connection in 2010

(Unit: million persons)

Drinking Water Source/ Evaluation	Piped by WSP	Spring/ Well/ Borehole	Water Vendor	Stream, lake, pond, others	Total
	Improved Source	Improved and Unimproved	Unimproved Source	Unimproved Source	
Urban Population	7.1 (54%)	3.1 (24%)	1.7 (13%)	1.2 (9%)	13.1 (100%)
Rural Population	4.1 (16%)	10.9 (43%)	0.5 (2%)	9.9 (39%)	25.4 (100%)
Total	11.2 (28%)	14.0 (37%)	2.2 (6%)	11.1 (29%)	38.5 (100%)

Source: JICA Study Team, based on Census 2009 data

Figures 2.3.1, 2.3.2, and 2.3.3 show the percentages of "Usage of surface water without treatment", "Connection of piped water supply", and "Usage of well, borehole and spring (individual basis)" in each district, respectively.

The definitions of "Improved" and "Unimproved" drinking water sources were based on the WHO/UNICEF JMP report. Water from unregistered water vendors and water from streams, lakes and ponds without proper treatment are categorized as unimproved drinking water sources. In addition, water from unprotected springs, wells or boreholes are also categorized as unimproved drinking water sources; however, the details of unprotected water resources are not known. Only 28% of the population have water service from registered WSPs, which are clearly improved drinking water sources. Unimproved drinking water sources shall be changed to improved water sources by 2030.

According to the Performance Report of Kenya's Water Service Sector, Issue No. 4, 2011, the current average unit water consumption of urban water supply is estimated as shown below.

Average Unit Water Consumption of Urban Water Supply, 2010

(Unit: L/person/day)

WSP	Nairobi	Mombasa	Kisumu	Nakuru	Eldoret	National Average
Average Water Consumption (except for NRW)	57	27	15	29	75	36

Source: JICA Study Team, based on the Performance Report of Kenya's Water Services, No. 4, 2011

The table below shows the design unit water consumption of urban water supply in Kenya, which is indicated in the MWI Design Manual.

Design Unit Water Consumption of Urban Water Supply in Kenya

Category		Design Unit Water Consumption (except for allowance for water loss)
High-class housing		200 L/person/day
Middle-class housing		120 L/person/day
Low class housing	:Individual connection	60 L/person/day
	:Non-individual connection	20 L/person/day

Source: MWI Design Manual

According to the Draft Water Bill 2012 (new Water Act), the minimum unit residential water demand is proposed at 25 L/person/day. The national average of current unit water consumption of 36 L/person/day is higher than the minimum requirement and the design amount for non-individual connection consumption, but it is much lower than the design amount for individual connection consumption of 60-200 L/person/day. In order to meet the requirements of individual connection consumers, the current water supply systems should have more capacity to supply water to the consumers.

The table below shows the NRW ratios in major WSPs, which are presented in the Performance Report of Kenya's Water Service Sector, Issue No. 4, 2011.

Record of NRW Ratios in 2010

WSP	Nairobi	Mombasa	Kisumu	Nakuru	Eldoret	National Average
NRW	42%	35%	50%	53%	25%	45%

Source: JICA Study Team, based on the Performance Report of Kenya's Water Services, No. 4, 2011

The national average of 45% means quite a high level of water losses as compared to the target level of 20%. For effective water use, it is required to reduce the NRW ratio of existing water supply systems.

2.3.2 Summary of the Existing Master Plan Studies and Progress of Identified Key Projects

(1) Introduction

In 1992, JICA prepared the Study on the National Water Master Plan (NWMP (1992)). A key output was the development plan and implementation plan for water supply and sanitation facilities until the target year of 2010. However, by 1996, it had become clear that progress was too slow and this led JICA to conduct the Aftercare Study on the National Water Master Plan (Aftercare Study (1998)) with the Final Report being issued in November 1998. The aim was to update the findings of the NWMP (1992) and to make recommendations for institutional strengthening.

Both the NWMP (1992) and the Aftercare Study (1998) are key documents in the formulation of the National Water Master Plan 2030 (NWMP 2030) and have therefore been thoroughly reviewed in order to identify the data, ideas and methodologies which remain applicable today.

(2) NWMP (1992)

1) General

The water supply and sewerage aspects of the NWMP (1992) were based on the 41 districts in place at the time. It is evident that water supply was the prime focus of the study and that sewerage was treated as a secondary issue. The objectives of the water supply section of the NWMP (1992) were the following:

a) To clarify the situation in the water supply sector;
b) To project the future domestic and industrial water demand; and
c) To examine possible measures for the development of water supply in the country.

It was not the intention of the study to cover specific water supply schemes.

The population in 1990 was reported at 22,749,122, of which 3,965,118 people were located in urban areas and 18,784,004 in rural areas. The Kenya Population Census 1989 defined urban as to include "all City Councils, Municipal Councils, Town and Urban Councils, all District Headquarters and all the towns and trading centres having a minimum population of 2,000 and potential for future growth".

The NWMP (1992) recognized the difficulty of determining the extent of water supply coverage in Kenya. In order to approximate the level of services being provided, the study referred to a demographic and health survey of 7,150 women carried out in 1989 which concluded that only 46.7% had access to a protected water source.

The main challenges facing the water sector at the time were reported to be the following:

a) Financial;
b) Water supply development; and
c) Operation and maintenance.

The structural adjustment of the economy taking place at the time, in combination with cost increases and higher operation and maintenance requirements led to a reduction in the levels of investment in the water sector. With the rapid rate of population growth, it was evident that the development of new water services could not keep up with the increasing water demand.

2) Water Supply

The Five-Year National Development Plan in place at the time covered the period from 1989 to 1993 and set the target of increasing the ratio of people having access to water in the urban area from 75% to 95%, and in the rural area from 26% to 50%. Taking into account the government's sector policy, the NWMP (1992) adopted target was the "provision of safe and reliable water within a reasonable distance to all the population in the year 2010". The study estimates of water demand (in thousand m^3/day) are presented in the following table.

NWMP (1992) Water Demand Estimates

(Unit: thousand m^3/day)

Category	Sub-category	Year		
		1990	2000	2010
Domestic	Residential	867.4	1,564.7	2,575.4
	Nonresidential	238.1	353.5	492.4
	Subtotal	1,105.5	1,918.2	3,067.8
Livestock	-	326.7	426.5	621.4
Industrial	-	218.7	377.5	494.0
Total		1,650.9	2,722.2	4,183.2

Source: NWMP (1992)

The daily water production in 1988 was estimated to be only 485,000 m^3.

The NWMP (1992) took the approach that the 158 identified urban town centres should be provided with "bulk" water supply schemes and that the remainder should be considered as rural. Some rural areas were to receive piped systems but the remainder were to be served by "spot" supplies such as groundwater or rainwater harvesting. The study adopted the following principles when considering urban water supply:

a) Reliance should not be placed on unregulated seasonal rivers;
b) The safe yield for surface water sources is that during the ten-year drought;
c) Groundwater supply is unreliable due to operation and maintenance costs and should only be used when there is either no other source or the demand density is low; and
d) Springs are an ideal source, if still available.

A water supply development plan up to 2010 was prepared for each urban centre based on 1:50,000 topographical maps. Cost estimates were prepared for each scheme.

The NWMP (1992) considered that it was not practical to formulate definitive water supply plans specific to each rural area but instead devised an approach based on the potential water resources available. Schemes were planned on a two-stage basis as follows:

a) Stage 1 to be implemented by 2000 - Provision of water sources within walking distance i.e., within 1 km in high potential areas and within 4 km in arid or semi-arid areas; and
b) Stage 2 to be implemented by 2010 – Provision of piped water supply systems with water treatment.

The NWMP (1992) recognized that while rapid implementation of the identified schemes was necessary, resources were limited and that an efficient and effective plan should be adopted. The order of priority was developed as follows:

a) Ongoing schemes – at the time of the study there were a large number of ongoing projects that were scheduled to be completed by around 1991;
b) Urban centres in tourism areas including Nairobi, Mombasa, Malindi, Lamu, Nakuru, Kericho, Kisumu and Marsabit;

c) District centres with priority being given to those with the worst existing supply capacity to the water demand ratio in 2000; and

d) Other urban centres with priority being given to those with a lower cost per m^3 of water.

The following key assumptions were made:

a) Unaccounted for water would be reduced to 20% by 2010;

d) The government's policy on full cost recovery would be achieved by 2000;

c) The government would implement a water saving policy; and

d) The country would be well-prepared for emergencies such as severe droughts.

An ambitious implementation plan was proposed covering the period up to 2010.

The proposed implementation plan for rural water supply was set to follow the two stage process described above. No priority was set for stage 1 works, although for stage 2 works, priority was given to those areas susceptible to water-borne diseases including Kwale, Mombasa, Kilifi, the Tana River and Lamu in the coastal area. Within each area, priority was given to the schemes with a lower cost per m^3 of water.

(3) Aftercare Study (1998)

1) General

The Aftercare Study (1998) focused on the water supply and sewerage aspects of the NWMP (1992) and had the following key objectives:

a) To review the provisions of the NWMP (1992) and prepare a new implementation programme;

b) To make recommendations for strengthening the law and related institutional aspects; and

c) To transfer technology regarding the planning of water supply and sewerage scheme development.

The general approach taken was to divide the water sector into urban and rural schemes and to prepare development plans accordingly. Urban water supplies were defined as systems serving a centre with a projected population of more than 5,000 in 2010. Based on this, a total of 141 urban centres were covered by the study. The planning of rural water supplies was based on the administration system in place in January 1996 and hence, covered 50 districts. The study focused on the provision of sewerage facilities for a total of 40 urban centres.

For background information, the Aftercare Study (1998) referred to the "Welfare Monitoring Survey II", which reported that 44.9% of the population had access to safe water (93.3% in urban areas and 32.5% in rural areas). The study reported that by 1994, there were 1,779 water supply systems serving Kenya, and noted that there was virtually no data available on any of the schemes and that an assessment of their performance was not possible at the time. In order to gain some idea of the present situation, the JICA Study Team conducted a survey in selected districts.

The Aftercare Study (1998) provides an inventory of the water supply systems covering the 141 urban centres, although it was noted that a number of the smaller centres did not in fact have any system. The study reported that most water treatment plants adopt the conventional chemical coagulation, flocculation, sedimentation, filtration and chlorination processes. It was noted, however, that chemical dosing was frequently omitted due to insufficient budget and that water quality control was rarely practised. It was also reported that only 37 water supply schemes had sufficient capacity to provide 24-hour storage and that, as a general rule, bulk water meters were not installed.

The Aftercare Study (1998) estimated that 80.4% of the population had access to sanitation (97.6% in urban areas and 75.9% in rural areas), although the survey did not differentiate between improved sanitation and unimproved sanitation and in fact includes all possible facilities in the analysis. If the current day categorization were to be applied, then it would be evident that the percentage coverage would have been considerably less.

At the time of the study, the sewerage facilities were the responsibility of the local authorities. It was reported that 30 urban centres were served and that a total of 1.8 million people living in the urban areas were covered with a sewerage system. This is equivalent to 28% of the urban population. The 30 urban centres with sewerage were served by a total of 38 wastewater treatment plants of which eight were conventional activated sludge and 25 were waste stabilization ponds.

2) Water Supply

Bearing in mind the poor progress achieved since the preparation of the NWMP (1992), the Aftercare Study (1998) downgraded expectations and set “more moderate targets”, which can be summarised as the following:

a) Increase the assumed 90% coverage in the urban areas (1998) to 95% by 2010;
b) Increase the assumed 35% coverage in the rural areas (1998) to 70% by 2010; and
c) Reduce NRW to less than 30% by 2010.

In defining whether the population was considered urban or rural, the Aftercare Study (1998) took a similar approach to that adopted by the NWMP (1992) in which a centre was considered urban if:

a) A town was nominated as an urban centre; and
b) A town was expected to have a population greater than 5000 by 2010.

As a result, 141 urban areas were selected and all other centres were considered rural and included in district water development schemes. The Aftercare Study (1998) did note that the 1989 census had identified 215 urban centres. However, 74 of these were too small in water supply terms to be considered urban.

The Aftercare Study (1998) estimated that the total population would reach 37.4 million by 2010, of which 11.5 million would be urban and 25.9 million rural. This was a reasonable estimate as the analysis conducted under the NWMP 2030 study estimates the actual 2010

population to be in the order of 38.5 million, of which 13.0 million was urban and 25.6 million rural.

The total potential water demand, in thousand m^3/day, was calculated as shown in the following table.

Aftercare Study (1998) Water Demand Estimates

(Unit: thousand m^3/day)

Category	Water Demand in 1995				Water Demand in 2010			
	UWS	LSRWS	SSRWS	Total	UWS	LSRWS	SSRWS	Total
Residential	612.2	208.8	110.1	935.1	1,554.0	401.9	421.6	2,377.5
Non-residential								
- Health facilities	4.6	5.0	6.4	16.0	8.9	7.1	9.4	25.4
- Schools	37.2	41.2	56.9	135.3	59.6	48.6	68.0	176.2
- Industry	142.5	26.8	31.8	201.1	383.4	60.8	55.5	499.7
Livestock	1.2	218.7	297.6	517.5	1.4	232.5	349.4	583.3
Total	801.7	500.4	502.8	1,805.0	2,007.3	750.9	903.9	3,662.0

Notes: UWS=Urban Water Supply, LSRWS=Large-Scale Rural Water Supply, SSRWS=Small-Scale Rural Water Supply
Source: Aftercare Study (1998)

As shown in the table above, it was expected that the water demand would increase from 1.8 million m^3/day in 1995 to almost 3.7 million m^3/day in 2010. The total figure is less than that what was estimated in the NWMP (1992), although it needs to be noted that the coverage targets under the Aftercare Study (1998) were reduced.

Rehabilitation works were proposed for all of the existing urban water supply systems, and included the replacement of damaged pipes, installation of chemical dosing equipment, fitting of bulk meters, and construction of additional storage capacity. Where new works were required, surface water sources were to be the predominant form of supply with groundwater generally being used in arid and semi-arid lands (ASALs).

The Aftercare Study (1998) assumed that conventional treatment methods would be adopted and that 24-hour storage would be provided for large schemes, and 12-hour storage for small schemes. No justification was provided for this variation in approach.

Construction costs were obtained from the ongoing projects and estimates were prepared for the newly identified works. The Aftercare Study (1998) also estimated the annual operation and maintenance expenditure based on the cost to produce a cubic metre of water in Japan adjusted to suit Kenya.

As indicated above, 141 urban centres were included in the study. Nairobi and Mombasa were deleted from the scope as they were both the subject of major donor assistance in the urban water supply subsector at the time. The remaining centres were assessed, and 20 were identified for priority rehabilitation works and eight for priority expansion works. The identified urban centres are as listed in the tables below.

Priority Rehabilitation Works for Urban Water Supply

01. Karuri	02. Msambweni	03. Lamu	04. Garsen	05. Hola
06. Karuri	07. Mwingi	08. Garissa	09. Rhamu	10. Bute
11. Eldas	12. Wajir	13. Ahero	14. Migori	15. Kajiado
16. Kilgotis	17. Cheptais	18. Maseno/ Luanda	19. Mbale	20. Vihiga/ Majengo

Source: Aftercare Study (1998)

Priority Expansion Works for Urban Water Supply

1. Msambweni	2. Tala and Kangundo	3. Wajir	4. Kisumu	5. Homa Bay
6. Narok	7. Luanda	8. Mbale		

Source: Aftercare Study (1998)

In the case of rural water supply, the Aftercare Study (1998) stated that priority should be given to the rehabilitation of existing facilities. The study noted that it was not possible to identify what rehabilitation works were required for small-scale water supply facilities, and therefore assumed that no public investment would be required.

Works were prioritized in accordance with the percentage of the population served and the extent of water shortages during the dry season. The following six districts were selected.

Priority Districts for Rural Water Supply

1. Kilifi	2. Kwale	3. Migori	4. Kipsigis	5. Narok	6. Transmara

Source: Aftercare Study (1998)

3) Legal and Institutional

One of the objectives of the Aftercare Study (1998) was to make recommendations for strengthening the law and related institutional aspects. Following a period of detailed study, the following recommendations were made:

a) Restructure organizations related to the water supply and sewerage sectors;
b) Improve personnel administration;
c) Regulate water undertakers and sewerage providers;
d) Amend legislation related to the water supply and sewerage sectors;
e) Improve law enforcement;
f) Improve the disparity between the budget and funds available;
g) Improve the investment method;
h) Revise tariff structures and rates in the water supply and sewerage sectors;
i) Improve tariffs, billing and collection; and
j) Improve operation and maintenance.

The Aftercare Study (1998) stressed that the lack of investment by the Kenyan government was a major obstacle for the implementation of the updated plan. The need for significant

foreign assistance was identified, but it was noted that donors were paying more attention to institutional and operational aspects as a precursor to further investment in the water sector.

According to information from the eight WSBs, the progress with the priority projects identified in the Aftercare Study (1998) are described below.

1) Urban Water Supply

Of the 20 centres selected for priority rehabilitation works to water supply systems, it was evident that works have only been carried out in Garissa and Mbale. Furthermore, of the eight centres identified for priority expansion works, progress has only been made in Kisumu and Mbale. Even in the case of Kisumu, the production capacity has only been increased to 45,500 m^3/day rather than the targeted 60,750 m^3/day.

2) Rural Water Supply

Six districts were given top priority for the development of rural water supply, but significant progress has only been made in Transmara, which is under the Lake Victoria South WSB.

2.3.3 Lake Victoria North Catchment Area

The current population in the LVNCA in 2010 was estimated at 6.96 million. Out of the 6.96 million, the urban population was at 1.53 million and the rural population at 5.43 million. The LVNCA has the highest population density area among six catchment areas. The population is not concentrated in a specific area and distributed over the catchment area. Based on data from the 2009 Census, the current situation of water connection in the LVNCA was estimated, as shown in the table below.

Current Situation of Water Connection (LVNCA)

(Unit: households)

Type	Piped by WSPs	Spring/Well/ Borehole	Water Vendor	Stream/Lake/ Pond/Others	Total
Urban	112,291 (31%)	189,805 (53%)	11,447 (3%)	45,877 (13%)	359,420 (100%)
Rural	56,315 (5%)	793,810 (70%)	4,815 (0%)	282,364 (25%)	1,137,304 (100%)
Total	168,606 (11%)	983,615 (66%)	16,262 (1%)	328,241 (22%)	1,496,724 (100%)

Source: JICA Study Team, based on Census 2009 data

The table above shows number of households of each water connection. Table 2.3.1 shows the estimated service population of each water connection, which is calculated by multiplying current population to the ratio of water connection shown in the table above.

Water provided by unregistered water vendors and water taken from streams, lakes, ponds without proper treatment are categorized as unimproved drinking water sources. Around 23% of the population get drinking water from such unimproved drinking water sources. Also, around 66% of the population get water from springs, wells or boreholes, which is the highest among six catchment areas. On the

other hand, unprotected wells and springs are also categorized as unimproved drinking water sources, but the utilization ratio of unprotected ones is not known.

It was projected that the urban population would increase by 6.18 million while the rural population would decrease by 0.77 million by 2030, as shown in Section 3.2.4. Hence, the total population would come to 12.36 million in 2030, as shown in the table below.

Projected Population (LVNCA)

(Unit: million persons)

Year	Urban Population	Rural Population	Total
2010	1.53	5.43	6.97
2030	7.71	4.66	12.36

Source: JICA Study Team, based on Census 2009 data

Currently, piped water supply covers 31% of the urban population in the LVNCA, although the target coverage ratio in 2030 is 100%. It is therefore required to implement large-scale urban water supply system developments to cope with the rapid growth of the urban population and achieve the target coverage ratio of 100%.

The total capacity of piped water supply system (UWSS + LSRWSS) in LVNCA is estimated at 145,000 m^3/day, which consists of 114,000 m^3/day of completed systems and 31,000 m^3/day of systems under construction. (Ref. Table 2.3.2) The total capacity of the UWSS is estimated at 135,000 m^3/day, which consists of 104,000 m^3/day of completed systems and 31,000 m^3/day of systems under construction. (Ref. Table 2.3.3). The breakdowns of the water supply systems in LVNCA are shown in Tables 2.3.4, 2.3.5 and 4.3.1.

As for registered WSPs in the LVNCA, six urban WSPs and three rural WSPs carry out water supply services. According to the Performance Report of Kenya's Water Services, No. 4, 2011 and the data from WSBs, the total capacity of piped water supply systems is 114,000 m^3/day, and the total service population is 477,000. (The service population estimated by using the data of the Census 2009 is around 0.77 million as shown in Table 2.3.3. There is a difference between the two estimates.) As the estimate based on these data, the average water supply amount per person is 239 L/person/day including NRW. It is much higher than the national average of urban water supply amount, which is 65 L/person/day including NRW (36 L/person/day excluding NRW). The WSPs in the LVNCA have enough capacity for the current service population; however, the NRW ratio is quite high. Out of seven urban WSPs, five WSPs have records of more than 50% of NRW. The current situation of the WSPs in the LVNCA is shown in Table 2.3.6.

2.3.4 Lake Victoria South Catchment Area

The current population in the LVSCA in 2010 was estimated at 7.36 million. Out of the 7.36 million, the urban population was at 1.85 million, and the rural population at 5.51 million. The population is concentrated in the Kisumu and Kisii areas. Based on data from the 2009 Census, the current situation of water connection in the LVSCA was estimated, as shown in the table below.

Current Situation of Water Connection (LVSCA)

(Unit: households)

Type	Piped by WSPs	Spring/Well/ Borehole	Water Vendor	Stream, Lake, Pond, Others	Total
Urban	104,572 (26%)	152,814 (38%)	30,135 (7%)	119,775 (29%)	407,296 (100%)
Rural	74,897 (7%)	479,585 (42%)	5,612 (1%)	590,477 (50%)	1,150,571 (100%)
Total	179,469 (12%)	632,399 (41%)	35,747 (2%)	710,252 (46%)	1,557,867 (100%)

Source: JICA Study Team, based on Census 2009 data

The table above shows number of households of each water connection. Table 2.3.1 shows the estimated service population of each water connection, which is calculated by multiplying current population to the ratio of water connection shown in the table above.

Water provided by unregistered water vendors and water taken from streams, lakes, ponds without proper treatment are categorized as an unimproved drinking water sources. Around 48% of the population get drinking water from such unimproved drinking water sources. Also, around 41% of the population get water from springs, wells or boreholes. On the other hand, unprotected wells and springs are also categorized as unimproved drinking water sources, but the utilization ratio of unprotected ones is not known.

It was projected that the urban population would increase by 6.14 million, while the rural population would decrease by 0.78 million by 2030, as shown in Section 3.2.4. Hence, the total population would come to 12.72 million in 2030, as shown in the table below.

Population Projected (LVSCA)

(Unit: million persons)

Year	Urban Population	Rural Population	Total
2010	1.85	5.51	7.36
2030	7.99	4.73	12.72

Source: JICA Study Team based on Census 2009 data

Currently, piped water supply covers 26% of the urban population in the LVSCA, of which the target coverage ratio in 2030 is 100%. It is therefore required to implement large-scale urban water supply system developments to cope with the rapid growth of the urban population and achieve the target coverage ratio of 100%.

The total capacity of piped water supply system (UWSS + LSRWSS) in LVSCA is estimated at 146,000 m^3/day, which consists of 89,000 m^3/day of completed systems and 57,000 m^3/day of systems under construction. (Ref. Table 2.3.2) The total capacity of the UWSS is estimated at 120,000 m^3/day, which consists of 63,000 m^3/day of completed systems and 57,000 m^3/day of systems under construction. (Ref. Table 2.3.3). The breakdowns of the water supply systems in LVSCA are shown in Tables 2.3.4, 2.3.5 and 4.4.1.

As for registered WSPs in the LVSCA, eight urban WSPs and one rural WSPs carry out water supply services. According to the Performance Report of Kenya's Water Services, No. 4, 2011 and the data from WSBs, the total water supply capacity is 89,438 m^3/day, and the total service population is 1,319,484. (The service population estimated by using the data of the Census 2009 is around 0.88

million as shown in Table 2.3.3. There is a difference between the two estimates.) As the estimate based on these data, the average water supply amount per person is 68 L/person/day including NRW. It is almost the same as the national average of urban water supply amount, which is 65 L/person/day including NRW (36 L/person/day excluding NRW). Also, it is almost the same as the design standard for water supply amount for non-individual connection. The WSPs in the LVSCA do not have enough capacity for individual connection consumers. High NRW ratios were recorded. Out of eight urban WSPs, three WSPs have records of more than 50% of NRW. The current situation of the WSPs in the LVSCA is shown in Table 2.3.7.

2.3.5 Rift Valley Catchment Area

The current population in the RVCA in 2010 was estimated at 4.86 million. Out of the 4.86 million, the urban population was at 1.41 million, and the rural population at 3.45 million. The population is concentrated in Nakuru area and Naivasha Area. Based on the 2009 Census data, the current situation of water connection of RVCA was estimated as shown below.

Current Situation of Water Connection (RVCA)

(Unit: households)

Type	Piped by WSPs	Spring/Well/ Borehole	Water Vendor	Stream/Lake/ Pond/Others	Total
Urban	193,308 (52%)	80,577 (22%)	69,476 (19%)	27,920 (7%)	371,281 (100%)
Rural	94,777 (14%)	248,142 (37%)	23,866 (4%)	298,846 (45%)	665,631 (100%)
Total	288,085 (28%)	328,719 (32%)	93,342 (9%)	326,766 (31%)	1,036,912 (100%)

Source: JICA Study Team based on Census 2009 data

The table above shows number of households of each water connection. Table 2.3.1 shows the estimated service population of each water connection, which is calculated by multiplying current population to the ratio of water connection shown in the table above.

Water provided by unregistered water vendors and water taken from streams, lakes, ponds without proper treatment are categorized as unimproved drinking water sources. Around 40% of the population get drinking water from such unimproved drinking water sources. Also, around 31% of the population get water from springs, wells or boreholes. Unprotected wells and springs are categorized as unimproved drinking water source, but the utilization ratio of unprotected ones is not known.

It was projected that the urban population would increase by 3.08 million, while the rural population would decrease by 0.49 million by 2030, as shown in Section 3.2.4. Hence, the total population would come to 7.45 million in 2030, as shown in the table below.

Population Projected (RVCA)

(Unit: million persons)

Year	Urban Population	Rural Population	Total
2010	1.41	3.45	4.86
2030	4.49	2.96	7.45

Source: JICA Study Team based on Census 2009 data

Currently, the piped water supply covers 52% of the urban population in the RVCA, though the target coverage ratio in 2030 is 100%. It is therefore required to implement large-scale urban water supply system developments to cope with the rapid growth of the urban population and achieve the target coverage ratio of 100%.

The total capacity of piped water supply system (UWSS + LSRWSS) in RVCA is estimated at 136,000 m^3/day, which consists of 98,000 m^3/day of completed systems and 38,000 m^3/day of systems under construction. (Ref. Table 2.3.2) The total capacity of the UWSS is estimated at 129,000 m^3/day, which consists of 91,000 m^3/day of completed systems and 38,000 m^3/day of systems under construction. (Ref. Table 2.3.3). The breakdowns of the water supply systems in RVCA are shown in Table 2.3.4, 2.3.5 and 4.5.1.

As for registered WSPs in the RVCA, nine urban WSPs and five rural WSPs carry out water supply services. According to the Performance Report of Kenya's Water Services, No. 4, 2011 and the data from WSBs, it was recorded that the total water supply capacity is 96,886 m^3/day, and the total service population is 777,309. (The service population estimated by using the data of the Census 2009 is around 1.36 million as shown in Table 2.3.3. There is a difference between the two estimates.) As the estimate based on these data, it he average water supply amount per person is 125 L/person/day including NRW. It is higher than the national average of urban water supply amount, which is 65 L/person/day including NRW (36 L/person/day excluding NRW). Out of seven urban WSPs, four WSPs have records of more than 50% of NRW. The current situation of the WSPs in the RVCA is shown in Table 2.3.8.

2.3.6 Athi Catchment Area

The current population in the ACA in 2010 was estimated at 9.79 million. Out of the 9.79 million, the urban population was at 6.51 million, and the rural population at 3.28 million. The population is concentrated in the Nairobi and Mombasa areas. Based on data from the 2009 Census, the current situation of water connection in the ACA was estimated, as shown in the table below.

Current Situation of Water Connection (ACA)

(Unit: households)

Type	Piped by WSPs	Spring/Well/ Borehole	Water Vendor	Stream/Lake/ Pond/Others	Total
Urban	1,150,553 (63%)	318,187 (18%)	304,906 (17%)	46,650 (3%)	1,820,296 (100%)
Rural	188,586 (28%)	223,687 (34%)	19,162 (3%)	237,075 (35%)	668,511 (100%)
Total	1,339,139 54%	541,874 22%	324,068 13%	283,725 11%	2,488,807 (100%)

Source: JICA Study Team based on Census 2009 data

The table above shows number of households of each water connection. Table 2.3.1 shows the estimated service population of each water connection, which is calculated by multiplying current population to the ratio of water connection shown in the table above.

Water provided by unregistered water vendors and water taken from streams, lakes, ponds without proper treatment are categorized as unimproved drinking water sources. Around 24% of the population get drinking water from such unimproved drinking water sources. Also, around 22% of the population get water from springs, wells or boreholes. Unprotected wells and springs are categorized as unimproved drinking water sources, but the utilization ratio of unprotected ones is not known.

It was projected that the urban population would increase by 11.22 million, while the rural population would decreased by 0.47 million by 2030, as shown in Section 3.2.4. Hence, the total population would come to 20.54 million in 2030, as shown in the table below.

Population Projected (ACA)

(Unit: million persons)

Year	Urban Population	Rural Population	Total
2010	6.51	3.28	9.79
2030	17.73	2.81	20.54

Source: JICA Study Team based on Census 2009 data

Currently, piped water supply covers 63% of the urban population in the ACA, and this ratio is the highest among the six catchment areas. However, it is required to implement large-scale urban water supply system developments to cope with the rapid growth of the urban population and achieve the target coverage ratio of 100%.

The total capacity of piped water supply system (UWSS + LSRWSS) in ACA is estimated at 709,000 m^3/day, which consists of 674,000 m^3/day of completed systems and 35,000 m^3/day of systems under construction. (Ref. Table 2.3.2) The total capacity of the UWSS is estimated at 699,000 m^3/day, which consists of 664,000 m^3/day of completed systems and 35,000 m^3/day of systems under construction. (Ref. Table 2.3.3). The breakdowns of the water supply systems in ACA are shown in Table 2.3.4, 2.3.5 and 4.6.1.

Around 54% of the population in the catchment area are supplied with water through pipes by registered WSPs. As for Nairobi and satellite towns, according to the Performance Report of Kenya's Water Services, No. 4, 2011 and the data from WSBs, 11 registered urban WSPs and seven registered rural WSPs manage the water supply systems to cover 2.96 million of the service population with 572,213 m^3/day of water supply capacity. The NRW ratio in the area is relatively lower than the other areas. Out of the 11 urban WSPs, only two WSPs have records of more than 50% of NRW. The current situation of the WSPs in Nairobi and satellite towns is shown in Table 2.3.9.

As for Mombasa and the surrounding coastal area, according to the Performance Report of Kenya's Water Services, No. 4, 2011 and the data from WSBs, the water supply system managed by registered WSPs covers 1.46 million of the service population. Table 2.3.10 shows six urban WSPs of which total water supply capacity is 87,520 m^3/day. The NRW ratio in the area is also relatively lower than the other areas. No WSPs have records of more than 50% of NRW. The current situation of the WSPs in Mombasa and the surrounding coastal area are shown in Table 2.3.10. Also, the situation of other areas in the ACA is shown in Table 2.3.11.

Two studies: "Feasibility Study and Master Plan for Developing New Water Sources for Nairobi and Satellite Towns" and "Water Supply Master Plan for Mombasa and Other Towns Within the Coast

Province" are still under implementation by the World Bank fund. The water sources development plans proposed or studied in these studies are same as those of NWMP 2030.

2.3.7 Tana Catchment Area

The current population in the TCA in 2010 was estimated at 5.74 million. Out of the 5.74 million, the urban population was at 1.04 million, and the rural population at 4.70 million. The urban population ratio is relatively low; therefore, the population growth is relatively low as compared with the other catchment areas. Based on data from the 2009 Census, the current situation of water connection in the TCA was estimated, as shown in the table below.

Current Situation of Water Connection (TCA)

(Unit: households)

Type	Piped by WSPs	Spring/Well/ Borehole	Water Vendor	Stream/Lake/ Pond/Others	Total
Urban	157,302 (58%)	44,163 (16%)	15,502 (6%)	54,700 (20%)	271,667 (100%)
Rural	314,306 (29%)	292,803 (27%)	32,568 (3%)	455,457 (42%)	1,095,134 (100%)
Total	471,608 (34%)	336,966 (25%)	48,070 (4%)	510,157 (37%)	1,366,801 (100%)

Source: JICA Study Team based on Census 2009 data

The table above shows number of households of each water connection. Table 2.3.1 shows the estimated service population of each water connection, which is calculated by multiplying current population to the ratio of water connection shown in the table above.

Water provided by unregistered water vendors and water taken from streams, lakes, ponds without proper treatment are categorized as unimproved drinking water sources. Around 41% of the population get drinking water from such unimproved drinking water sources. Also, around 25% of the population get water from springs, wells or boreholes. Unprotected wells and springs are categorized as unimproved drinking water sources, but the utilization ratio of unprotected ones is not known.

It was projected that the urban population would increase by 5.30 million while the rural population would decrease by 0.67 million by 2030, as shown in Section 3.2.4. Hence, the total population would come to 10.37 million in 2030, as shown in the table below.

Population Projected (TCA)

(Unit: million persons)

Year	Urban Population	Rural Population	Total
2010	1.04	4.70	5.74
2030	6.34	4.03	10.37

Source: JICA Study Team based on Census 2009 data

Currently, piped water supply covers 58% of the urban population in the TCA. The ratio is relatively high. Large-scale urban water supply system developments have been under implementation in order to meet the future water demand. It can be said that water supply system development is well advanced in TCA.

The total capacity of piped water supply system (UWSS + LSRWSS) in TCA is estimated at 255,000 m^3/day, which consists of 245,000 m^3/day of completed systems and 10,000 m^3/day of systems under construction. (Ref. Table 2.3.2) The total capacity of the UWSS is estimated at 106,000 m^3/day, which consists of 96,000 m^3/day of completed systems and 10,000 m^3/day of systems under construction. (Ref. Table 2.3.3). The breakdowns of the water supply systems in TCA are shown in Table 2.3.4, 2.3.5 and 4.7.1.

Table 2.3.12 shows the current situation of 11 urban WSPs and 18 rural WSPs, of which the total water supply capacity is 232,358 m^3/day. According to the Performance Report of Kenya's Water Services, No. 4, 2011 and the data from WSBs, 11 registered urban WSPs and 18 registered rural WSPs carry out water supply services, and the total water supply capacity is 232,358 m^3/day for a service population of 1.41 million. (The service population estimated by using the data of the Census 2009 is around 1.95 million as shown in Table 2.3.3. There is a difference between the two estimates.) As the estimate based on these data, the average water supply amount per person is 170 L/person/day including NRW. It is higher than the national average of urban water supply amount of 65 L/person/day including NRW (36 L/person/day excluding NRW). Out of 11 urban WSPs, four WSPs have records of more than 50% of NRW.

It should be mentioned that the water supply capacity of the rural WSPs is 130,972 m^3/day, which is larger than the capacity of the urban WSPs.

2.3.8 Ewaso Ng'iro North Catchment Area

The current population in the ENNCA in 2010 was estimated at 3.82 million. Out of this, the urban population was at 0.74 million, and the rural population at 3.08 million. Based on data from the 2009 Census, the current situation of water connection in the ENNCA was estimated, as shown in the table below.

Current Situation of Water Connection (ENNCA)

(Unit: households)

Type	Piped by WSPs	Spring/Well/ Borehole	Water Vendor	Stream/Lake/ Pond/Others	Total
Urban	69,641 (48%)	38,588 (26%)	18,893 (13%)	19,522 (13%)	146,644 (100%)
Rural	108,085 (20%)	241,254 (44%)	36,439 (7%)	162,083 (30%)	547,861 (100%)
Total	177,726 (26%)	279,842 (40%)	55,332 (8%)	181,605 (26%)	694,505 (100%)

Source: JICA Study Team based on Census 2009 data

The table above shows number of households of each water connection. Table 2.3.1 shows the estimated service population of each water connection, which is calculated by multiplying current population to the ratio of water connection shown in the table above.

Water provided by unregistered water vendors and water taken from streams, lakes, ponds without proper treatment are categorized as unimproved drinking water sources. Around 34% of the population get drinking water from such unimproved drinking water sources. Also, around 40% of the population

get water from springs, wells or boreholes. Unprotected wells and springs are also categorized as unimproved drinking water sources, but the utilization ratio of unprotected ones is not known.

It was projected that the urban population would increase by 1.02 million while the rural population would decrease by 0.43 million by 2030, as shown in Section 3.2.4. Hence, the total population would come to 4.40 million in 2030, as shown in the table below.

Population Projected (ENNCA)

(Unit: million persons)

Year	Urban Population	Rural Population	Total
2010	0.74	3.08	3.82
2030	1.76	2.64	4.40

Source: JICA Study Team based on Census 2009 data

The population growth is expected to be relatively low, due to the large proportion of arid area in ENNCA. Therefore, the scale of urban water supply system development is rather small than other catchment areas.

The total capacity of piped water supply system (UWSS + LSRWSS) in ENNCA is estimated at 39,000 m^3/day, which consists of 28,000 m^3/day of completed systems and 11,000 m^3/day of systems under construction. (Ref. Table 2.3.2) The total capacity of the UWSS is estimated at 32,000 m^3/day, which consists of 21,000 m^3/day of completed systems and 11,000 m^3/day of systems under construction. (Ref. Table 2.3.3). The breakdowns of the water supply systems in ENNCA are shown in Tables 2.3.4, 2.3.5 and 4.8.1.

According to the Performance Report of Kenya's Water Services, No. 4, 2011 and the data from WSBs, the water supply system managed by the registered WSPs covers 0.49 million service population, and nine urban WSPs and three rural WSPs have a total water supply capacity of 40,500 m^3/day. (The service population estimated by using the data of the Census 2009 is around 0.99 million as shown in Table 2.3.3. There is a difference between the two estimates.) As the estimate based on these data, the average water supply amount per person was estimated at 82 L/person/day including NRW. It is almost same level of the national average of urban water supply amount of 65 L/person/day including NRW (36 L/person/day excluding NRW). The NRW ratio is relatively high. Out of nine urban WSPs, four WSPs have records of more than 50% of NRW. The current situation of the WSPs in the ENNCA are shown in Table 2.3.13.

2.4 Ongoing Projects and Existing Plans

The MWI provided a copy of their internal donor matrix dated November 2009 and updated in 2010. The schemes in the matrix, particularly on the water supply and sanitation sector, are provided in Table 2.4.1. While this provides useful background information, it lacks significant technical details. Table 2.4.2 shows the existing water supply systems, Table 2.4.3 shows the list of ongoing construction projects for water supply system development, and Table 2.4.4 shows the projects proposed and planned by the WSBs.

2.5 Operation and Maintenance Issues

From discussions with the WSBs, it was evident that only few WSPs are able to provide water for 24 hours per day basis. The key challenges are water availability and the high cost of power supply. Even in Tana, where water is generally more available, only three of the 24 WSPs (Nyeri, Meru and Embu which rely on gravity-fed supplies) have 24-hour water supply. It is generally recognized that the intermittent nature of system operations is contributing to water quality issues.

The WSBs reported that majority of the water supply and sewerage systems are in need of rehabilitation. There are a number of clear exceptions, such as Nyeri and Kisumu, but systems are dilapidated. Filters and chemical dosing equipment are in poor condition and the treatment plants are overloaded as more water is being forced through than desirable resulting in water quality issues.

With the increasing levels of catchment degradation, problems are being experienced due to the silting of dams and increased water turbidity. Some WSBs reported that chemical use in water treatment is increasing in order to cope with the worsening raw water quality.

As shown in Table 2.2.2, the percentage of NRW is high. However, it should be recognized that the quoted figures are only very rough estimates as:

a) There are very few production meters in place;
b) There are very few bulk meters in the distribution system;
c) There are insufficient customer connection meters (estimated at 40%) and many of those that are in place do not function; and
d) Many connections are rated as "flat rate" for billing purposes and the water accounting system assumes that such connections use 10 m^3 per month when in reality significantly larger volumes are used. One test recorded a usage of 87 m^3 for a flat rate connection.

Most WSB managers consider that the bulk of the NRW is due to commercial losses rather than physical losses, although it was recognized that many of the pipe networks are indeed very old. It is also evident that there are a significant number of illegal connections, and in many cases, the water is being used for irrigation.

In the past, there was political pressure to expand the coverage of the water distribution systems. This means that today, there are many areas that have pipes but no water, yet it is understood that these areas are included in the statistics as being covered.

2.6 Challenges and Key Issues

(1) Low Ratio of Water Supply Development Against the Targets

It is evident that the previous targets set for future water supply and sanitation coverage have not been met. The NWMP (1992)'s adopted target was the "provision of safe and reliable water within a reasonable distance to all the population in the year 2010", although under the Aftercare Study (1998) this was downgraded to 95% coverage in the urban areas and 70% coverage in the rural areas by the same year. The current study estimates for actual water supply coverage are still 64% in the urban areas and 38% in the rural areas (46% overall).

(2) Rapid Increase of Urban Population

The future national population projected for this study indicated an urban population of 46 million (68% of total), growing from 13 million (34%) in 2010. In order to achieve one of the targets, which is to have 100% coverage of the urban population with piped water supply, it is required to develop large-scale piped water supply systems for the new urban population.

(3) Insufficient Water Saving and High Level of NRW

Little mention is made of either water saving measures or the reuse of treated wastewater in the government's strategy or sector planning documents reviewed, with discussions being limited to overall philosophy rather than detailed measures. The potential for water reuse is, however, included in the terms of reference for the recently commenced bulk water supply study for the Athi WSB under AFD and World Bank funding. It is good to note that the Athi WSB has already recognized that they have "no choice" in the matter.

The NRW levels are very high in Kenya and in many cases exceed 60%. It is very clear that priority needs to be given to leakage reduction as a precursor to obtaining high investments. Consideration needs to be given to limiting investments to those areas which have achieved a reduction in NRW to a certain threshold level.

It is good to note that water harvesting is becoming a serious consideration, and as climate change proceeds, it is essential that this potential resource is fully exploited.

(4) Need of Rehabilitation of the Existing Water Supply System

As stated in Subsection 5.2.5, the WSBs reported that majority of the water supply and sewerage systems are in need of rehabilitation. The systems have been dilapidated. Filters and chemical dosing equipment are in poor condition and the treatment plants are overloaded.

Furthermore, it is more practical and economical to maximize the use of existing facilities through rehabilitation instead of new development in order to sufficiently serve the increased demands of water supply.

CHAPTER 3 PRESENT AND FUTURE WATER DEMANDS

3.1 General

Chapter 3 presents the current and future situations of the population, economic indices and water demand. The current situations have been estimated, based on data from the 2009 Census and other available official data. The conditions in 2030 are projected based on Kenya Vision 2030. The projections are used for the planning conditions of the NWMP. The conditions in 2050 are projected based on official information and some assumptions by the JICA Study Team. The projections are used as reference values in the study.

(1) Population Projection

The total national population (urban and rural population) of Kenya in 2030 was projected in Kenya Vision 2030. However, Kenya Vision 2030 does not show population projections by each urban centre, district and county. These projections were carried out in the study, and were used for planning the conditions of the NWMP 2030. The total national population (urban and rural population) of Kenya in 2050 was projected by the United Nations World Urbanization Prospects (2011 version), and it is used as a reference value in the study.

(2) Economic Indices Projection

The projection of GDP was presented in Kenya Vision 2030, which was published in 2007, and in 2012, the Kenya Vision 2030 Office modified the projection of GDP growth by 2030. The projection of GDP from 2030 to 2050 was assumed by the Study Team.

(3) Water Demand Projection

The following five types of water demands were projected for 2030 and 2050:

1) Domestic Water Demand

The domestic water demand includes residential water demand, institutional water demand and commercial water demand. The residential water demand was estimated based on the projected population and the unit water demand given in the "Guidelines for Water Allocation (WRMA, 2010)[1]". The institutional and commercial water demands were calculated by considering the proportion of the residential water demand.

2) Industrial Water Demand

The industrial water demand was estimated considering the proportion of the residential water demand and the economic growth rate.

[1] Ref. Sectoral Report (H) 2.3.1 (7) 5).

3) Livestock Water Demand

The livestock water demand was estimated considering the projected number of livestock units and the unit water demand given in the "Guidelines for Water Allocation (WRMA, 2010)".

4) Wildlife Water Demand

The wildlife water demand was estimated considering the projected number of wildlife and the unit water demand.

5) Inland Fisheries Water Demand

The inland fisheries water demand was estimated considering the projected area of fish ponds and the unit water losses from evaporation and percolation.

The irrigation water demand projection is presented in Sectoral Report (E).

3.2 Population Projection

3.2.1 Base Data

The latest available information regarding population and its distribution is the 2009 Census. Thus, the study will be formulated based on such data.

Population distribution and composition is one of the most basic information required in formulating a water resources development plan. There are two main composition categories that are central to the plan. These are urban and rural population. The split is required in order to assess the service levels of water supply in both rural and urban areas as these are distinctly different in Kenya.

There are also two main distribution categories that are critical to the development of the plan: spatial distribution by administrative boundary, and spatial distribution by basin/catchment boundary. The former is required for the assessment of the present and future water demands in order to develop the water supply services plan while the latter is for calculation of water balance and water resources management plan.

Based on the 2009 Census the population data is distributed based on provinces, districts, divisions, locations, and sublocations.

(1) Administrative Distribution

Currently, planning and implementation of water supply services are facilitated through the WSBs, which include multiple districts under their area of operations and the overlap of boundaries is minimal. As such, it is considered that assessment of population data at district level is sufficient for assessment of future water demand and the development of water services plans per board. The water sector in Kenya though is undergoing further changes following the implementation of the new 2010 Constitution. The future of the WSBs is uncertain, and plans to devolve water supply services to each county are under consideration. The 2009 Census does not provide data as distributed by county, therefore the district boundaries will be used. Counties similarly with WSBs include multiple districts

within their boundaries, therefore a redistribution of the water demand per county will be possible in the future. Some adjustments on districts that cross over county boundaries may be required, but this are not considered as major revisions based on current information.

(2) Basin Distribution

For the water resources development plan, water demand distribution per river basin and river sub-basin is required. Domestic water demand was calculated directly in relation to population. Since neither the 2009 Census nor other sources provide basin population data, this study overlaid the sub-basin boundaries and available province, district and division boundaries. It was identified that districts were too large compared to the size of the sub-basins, therefore, the river basin domestic water demand will be estimated on the basis of the division population distribution from the 2009 Census data. The basin distribution will employ the ratio method to redistribute the division population derived water demand into the sub-basins. The methodology to be adopted is as follows.

If a division falls wholly within a sub-basin boundary, 100% of the urban and rural demands would be assigned to that sub-basin. In the case that a division crosses over two or more sub-basins, then (i) the urban demand will be allotted as a % depending on the urban spread within the sub-basin, and (ii) the rural population will be distributed proportionally to the division part area that is included in the sub-basin. Some adjustments will be required for (i) urban areas that cross sub-basin boundaries and (ii) areas that are known not to have any population.

3.2.2 Planning Horizon

In order to prepare projections, it is necessary to define the planning horizon for the study by setting the target years. In this study, the target years are dictated by various factors such as the following:

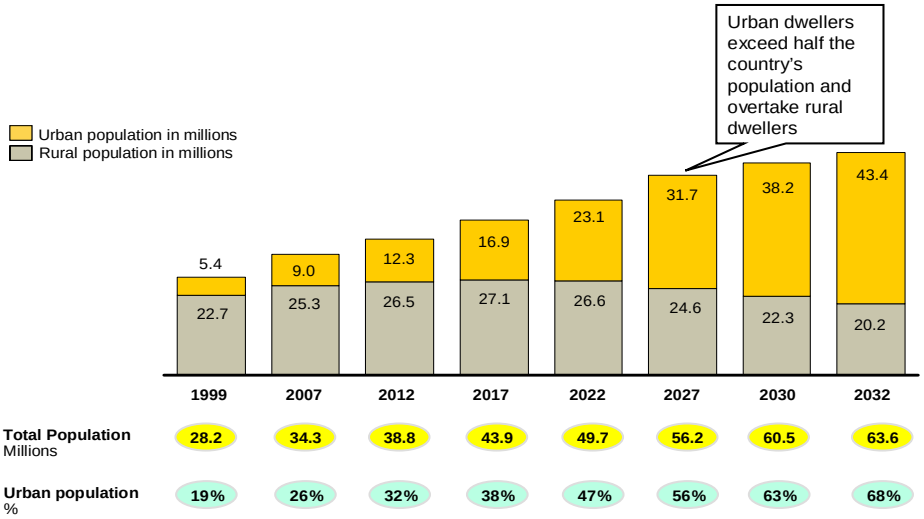
- Standards and design criteria for water supply systems,
- Conformity with national and regional strategies and development plans, and
- The scope of works of this master plan.

Following a review of the above factors, it was determined that the planning horizon will be as follows:

- Year 2010: This is the base year of the study.
- Year 2030: This is the target year for the NWMP 2030 in line with Kenya Vision 2030, and the general practice of adopting a 20-year look-ahead for this type of studies.
- Year 2050: This is to allow an additional/extended 20-year planning horizon required in assessing longer term climate change effects on the country's water resources.

3.2.3 Population Projection

Kenya Vision 2030 presents the future population up to 2032 using the 1999 Census results as the base year. The figure below has been extracted from the Kenya Vision 2030 document and shows the projected population figures.



Note: * Based on projections from 1999 National Census
Source: CBS

Population Projection by Kenya Vision 2030

Comparison of the 2009 Census results and the Kenya Vision 2030 projections shows that the population projection in 2012 in Kenya Vision 2030 of 38.8 million has already been reached in 2009 (38.6 million). This indicates either an underestimation of the Kenya Vision 2030 projection or erroneous results of the latest census.

The full results of the latest census were not available at the time of this analysis but the census report highlighted some anomalous results in eight districts, wherein the data indicating a rate of increase was higher than the population dynamics (births, deaths, etc.). Age and sex profiles deviated from the norm, and significant growth was observed in household size without the accompanying growth in the number of households (refer to the 2009 Census). Eight anomalous districts were extracted and their population results were compared with results from the 1999 Census as projected to 2009, using Kenya Vision 2030's growth rates.

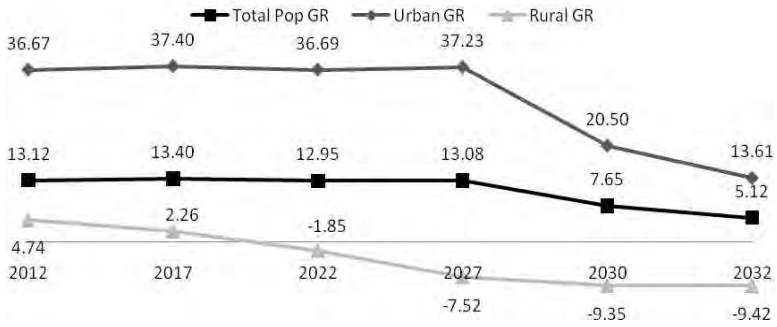
Correction of Census 2009 Population

Districts	2009 Census Population	1999 Census Population Projected to 2009*	Difference
Lagdera	245,123	207,966	37,157
Wajir East	224,418	145,964	78,454
Mandera (Central, East, West)	1,025,756	321,062	704,694
Turkana (Central, North, South)	855,399	564,075	291,324

Note: * Based on Kenya Vision 2030 growth rates
Source: JICA Study Team, based on Census 2009

Based on the 1999 Census projected to 2009, Mandera should have a total population of 321,062 as opposed to 1,025,756. This is a difference of 704,694 people. Similarly, Turkana has a difference of 291,324, Lagdera with 37,157, and Wajir East with 78,454. The total difference is 1.112 million. This indicates that the 2009 Census population should be approximately 37.5 million (38.61 million – 1.112 million), which closes the gap with Kenya Vision 2030.

Following this correction, the 2009 Census population is still ahead of Kenya Vision 2030; however, it is believed that the residual difference was probably due to an underestimation of the Kenya Vision 2030 projection based on information from the MWI stating that family planning policies have not been effective in the last decade and an increase in birth rates has been observed. It is expected that the policies will be more efficient in the future and birth rates are expected to fall. Based on such information and assumptions, the study adopts the 2009 Census data as the base year, adjusted for the anomalies in eight districts, and projects this data based on the Kenya Vision 2030 growth rates presented below.



Note: Projections for Years 2010 and 2011 utilised Yearly growth rates calculated from Kenyan Vision 2030

Average Population Growth Rate in Kenya Vision 2030

Projections beyond 20 years are not available and very difficult to predict. The population of 2050 is based on the result of UN World Urbanization Prospects (2011 Revision). The proportion of urban and rural population is same as the estimate of 2030 population estimate.

The table below summarises the national population projected based on the procedure mentioned above.

Population Projection for 2030 and 2050

(Unit: million persons)

Year	2009 (Census)*		2010		2030		2050	
Area	No.	%	No.	%	No.	%	No.	%
Urban	12.29	32.8	13.08	33.9	46.02	67.8	65.69	67.8
Rural	25.11	67.2	25.45	66.1	21.82	32.2	31.20	32.2
Total	37.40	100.0	38.53	100.0	67.84	100.0	96.89**	100.0

Note: *2009 Census Population adjusted for eight anomalous districts
**UN World Urbanization Prospects: The 2011 Revision

Source: JICA Study Team based on Kenya Vision 2030 and UN projection

3.2.4 Population Distribution Forecast

(1) General

Kenya Vision 2030 shows the forecast of the total population of Kenya; however, it does not show the population of each urban centre or district in Kenya. The study will estimate the population distribution in Kenya. It will show the urban population of each urban centre, and the rural population of each district and county.

(2) Population Growth Rate

Based on the population projection data of Kenya Vision 2030 and the UN World Urbanization Prospects, the population growth rates of Kenya were calculated, as shown in the table below.

Population Growth Rate in Kenya Vision 2030

(Unit: million persons)

Items	Population			Growth Rate	
	2010	2030	2050	From 2010 to 2030	2030 to 2050
Urban	13.08	46.02	65.69	351.8%	142.7%
Rural	25.45	21.82	31.20	85.7%	143.0%
Total	38.53	67.84	96.89	176.1%	142.8%

Source: JICA Study Team based on Kenya Vision 2030 and UN projection

The population growth rate will not be uniform in each area. For the population projection, population is divided into the following three groups:

- Urban population living in 137 major urban centres, which have more than 10,000 population in the 2009 Census (a list of the 137 urban centres is shown in Table 3.2.1)
- Urban population living outside the 137 urban centres
- Rural population

The planning population growth rate between 2010 and 2030 are set as below;

1) 137 Major Urban Centres

- As for Nairobi and Mombasa, the population projections and growth rates follow the reports of the "Feasibility Study and Master Plan for Developing New Water Sources for Nairobi and Satellite Towns (Draft), 2011" and the "Quarterly Management Progress Report, Coast Water Service Board, 2009". These growth rates were set much lower than the average population growth rate of the urban population of Kenya because Nairobi and Mombasa seem to have only limited space for development.
- As for the 25 developed urban centres located in the surrounding areas of Nairobi and Mombasa, a medium level of population growth rate of 6.5% was adopted. It is the same as the average population growth rate of the urban population.
- As for the 16 urban centres in arid areas, a low population growth rate of 1.0% was adopted because of the hard climate conditions in arid areas.
- As for Lamu, the forecast follows the existing development plan.
- As for other urban centres in the 137 major urban centres, a population growth rate of 8.0% was adopted because there seems to have more space for development than other urban centres.

2) Urban Population Outside the 137 Urban Centres

- As for urban population outside of the major 137 urban centres, a population growth rate of 7.8% was adopted. Such rate was determined considering the adjustment of the total population projection in 2030.

3) Rural Population

- For the overall rural population of Kenya, a uniform population growth rate of -0.9% was adopted.

The planning population growth rates between 2030 and 2050 are as shown in the table below.

Planning Population Growth Rate

Items	Urban Centres/ Area	Growth Rate between 2010 and 2030	Growth Rate between 2030 and 2050
Urban Population	1) Nairobi Mombasa	193.9% (3.2%/year) 281.9% (5.1%/year)	142.7% (1.7%/year)
	2) 25 Developed Urban Centres	375.3% (6.5%/year)	
	3) 16 Urban Centres in Arid Areas	123.2% (1.0%/year)	
	4) Lamu (having a large-scale development plan)	5,984.6%	
	5) The Other 93 of the 137 Major Urban Centres	503.4% (8.0%/year)	
	6) Urban Population Outside the 137 Major Urban Centres	486.5% (7.8%/year)	
	Average	351.8% (6.2%/year)	
Rural Population		83.5% (-0.9%/year)	143.0% (1.7%/year)
National Average		176.1% (2.7%/year)	142.8% (1.7%/year)

Source: JICA Study Team based on information from MWI and WSBs

(3) Result of Population Distribution

The results of population projection (2030) of 137 Urban Centres is shown in Table 3.2.1. The population projection, 2030 by each Catchment Area is shown in Table 3.2.2, and the population projection, 2030 by each County are shown in Table 3.2.3. The summary of population projection is shown in the table below;

Population Projection by Catchment Area

(unit: million persons)

Catchment Area	2010			2030			2050		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
LVNCA	1.53	5.43	6.96	7.71	4.65	12.36	11.00	6.66	17.66
LVSCA	1.85	5.52	7.37	7.99	4.73	12.72	11.41	6.76	18.17
RVCA	1.41	3.45	4.86	4.49	2.96	7.45	6.41	4.23	10.64
ACA	6.51	3.28	9.79	17.73	2.81	20.54	25.31	4.02	29.33
TCA	1.04	4.69	5.73	6.34	4.03	10.37	9.05	5.76	14.81
ENNCA	0.74	3.08	3.82	1.76	2.64	4.40	2.51	3.77	6.28
Total	13.08	25.45	38.53	46.02	21.82	67.84	65.69	31.20	96.89

Source: JICA Study Team (Prepared based on Tables 3.2.1 to 3.2.3.)

The population densities in Kenya in 2010 and as projected in 2030 are shown in Figures 3.2.1 and 3.2.2, respectively.

3.3 Economic Indices Projection

3.3.1 Base Data and Current Situation

The economic indices and GDP data are required to assist with the projection of mainly industrial water demand. GDP is widely considered as a parameter directly related to industrial growth and in turn, to the increase in water demand by the industrial sector.

GDP has increased from a weak 2.9% in 2003 to 7% in 2007 indicating a remarkable recovery. On average, real GDP expanded by 5.3%. Industrial output also expanded by about 5.3% in the same period in line with GDP. Kenya Vision 2030 sets a very ambitious plan aiming to achieve a 10% GDP on an annual basis up to 2030. The sector must, however, surmount some challenges, including high fuel prices, exchange rate risks, inadequate and unreliable power supply, world economic crisis, and global and regional instability.

The 2011 Budget Outlook Paper (BOPA) provides the most updated information on the country's current economic performance and will form the basis of the GDP projection under this study, in conjunction with the overall aim of Kenya Vision 2030 to achieve 10% GDP, if not by 2012, at least by 2030,.

3.3.2 GDP Projection

According to the BOPA, after a weak performance in 2008/09 wherein real GDP growth dropped to 2.1% from 7% in 2007, the Kenyan economy has been recovering and achieved a peak GDP of 5.1% in mid-2010. The paper expects real GDP to rebound to 2007 levels in the medium term and accelerate towards Kenya Vision 2030's target in the later years. In line with this statement, the medium-term GDP projection given in the paper showed that GDP would increase from 3.8% in the 2009/10 fiscal year to 6.8% in 2013/14.

Considering this situation, Kenya Vision 2030 indicated a revised projection of future economic growth rate, such that the 10% GDP growth would be gradually achieved by 2016, and stay as it is until 2023, before gradually decreasing from 2024. The projected GDP growth rate is as shown in the table below.

Projected GDP Growth Rate

Year	%	Year	%	Year	%	Year	%
2010	4	2016	10	2021	10	2026	9
2011	5	2017	10	2022	10	2027	9
2012	6	2018	10	2023	10	2028	8
2013	7	2019	10	2024	9	2029	8
2014	8	2020	10	2025	9	2030	8
2015	9						

Source: Kenya Vision 2030 Secretariat

It is not possible to carry out projections for the next 20 years in similar detail as above due to the lack of long-term data and unpredictable nature of relevant parameters. For this study, it was assumed that

following the implementation of Kenya Vision 2030, the Kenyan economy would have reached a level of relative maturity and with reference to current GDP rates of stable economies where a GDP rate of 4% per year is applied.

3.4 Domestic Water Demand

3.4.1 General

Domestic water demand is comprised of residential water demand, institutional water demand and commercial water demand. The results of the water demand projection for 2030 could be used for the purposes of conducting the water balance study for water resource development planning, and formulating water supply projects to meet the water demand in 2030. The water demand in 2050 is used for assessment of the vulnerability of water resources in the future considering the effects of climate change.

Water demand calculations basically follow the methodology set out in the MWI Design Manual for Water Supply in Kenya, October 2005. Such methodology is also given in the "Guidelines for Water Allocation (WRMA, 2010)". The calculations were carried out using data on population projection, unit water consumption ratio, ratio of institutional/commercial water use, and NRW ratio.

3.4.2 Present Water Demand

For the calculation of water demand in 2010, the population was estimated based on the 2009 Census, and the urban and rural water consumption rates, in L/person/day, were taken from the MWI Design Manual. The water consumption rates are given in the table below.

Design Water Consumption Ratio

(Unit: L/person/day)

Consumer	Urban Areas			Rural Areas		
	High-Class Housing	Medium-Class Housing	Low-Class Housing	High Potential	Medium Potential	Low Potential
People with individual connections	250	150	75	60	50	40
People without connections	-	-	20	20	15	10

Source: MWI Design Manual for Water Supply in Kenya

The MWI Design Manual states that the water consumption rates include an allowance of 20% for water losses through leakage and wastage. While this figure is appropriate for the design of future systems, it is evident that current losses are much higher than this. Therefore, for the calculation of the "at source" water demand in 2010, losses of 40% have been adopted.

In line with common international practice and bearing in mind the lack of raw data, institutional demand was calculated on the basis of 10% of the residential demand for both the urban and rural scenarios. A similar approach has been taken for commercial demand, although in this case, 15% was applied for the urban scenario and 10% for the rural scenario.

In line with the targets of Kenya Vision 2030, it was assumed that 100% of the population would be served with improved supplies by 2030 and this high standard would be maintained through toward

2050 and beyond. However, in the case of 2010, the demand projections have been carried out in two cases: Case-1 is for the population served by improved water supplies, i.e. those receiving water via a pipeline into the dwelling, yard or plot, a public tap or standpipe, a tube well or borehole, a protected dug well, a protected spring, in addition to Case-2 for 100% of the total population.

The results of calculation in the two cases are shown in the table below.

Two Cases of Present Domestic Water Demand

(Unit: MCM/year)

Item	Case-1: For Population Served by Improved Water Supplies	Case-2: For Total Population
Water Demand	681	1,186

Source: JICA Study Team

3.4.3 Future Water Demand

(1) Target Coverage Ratio

Kenya Vision 2030 aims to ensure that improved water and sanitation are available and accessible to all by 2030. Based on the policy of Kenya Vision 2030, Water Service Strategic Plan 2009 prepared by the MWI, the targets for water supply development plan of the NWMP 2030 were set as follows:

1) Increase coverage of improved supply to 100% in both urban and rural areas
2) Increase coverage of piped water supply by registered WSPs to 100% of the urban population
3) Increase unit water supply amount to suitable national standard levels
4) Decrease NRW rate to 20% for efficient water use

In order to achieve the above targets, the concrete target water connection for 2030 was set as shown in the table below together with the current conditions.

Current Condition and Target Level of Coverage of Water Supply

(Unit: million persons)

Year	Area	Piped by WSPs	Spring/Well/Borehole	Water Vendor	Stream, Lake, Pond, Others
2010	Urban	7.1 (54%)	3.1 (24%)	1.7 (13%)	1.2 (9%)
	Rural	4.1 (16%)	10.9 (43%)	0.5 (2%)	9.9 (39%)
	Total	11.2 (28%)	14.0 (37%)	2.2 (6%)	11.1 (29%)
2030	Urban	46.0 (100%)	0.0 (0%)	0.0 (0%)	0.0 (0%)
	Rural	4.7 (22%)	17.1 (78%)	0%	0%
	Total	50.7 (75%)	17.1 (25%)	0%	0%

Source: JICA Study Team based on Census 2009 data, Kenya Vision 2030 and Water Service Strategic Plan 2009

(2) Unit Water Demand of Domestic Water Use

The domestic water demand includes residential water demand, institutional water demand, commercial water demand, and water loss. (Hereinafter, the NRW ratio was used also as an approximation ratio of water loss). For water demand calculation, first of all, a unit water demand for residential use was assumed based on standard values in the "Guidelines for Water Allocation (WRMA, 2010)". In the draft of the new Water Act 2012, the minimum requirement of unit residential water

demand was set at 25 L/person/day, although some of the standard values are less than 25 L/person/day in the guidelines. In the water demand projection, the unit residential water demand was proposed at not less than 25 L/person/day. The table below shows the standard values and proposed unit water demands for residential use.

Standard Values and Proposed Values for Unit Residential Water Demand

(Unit: L/person/day)

Category		Standard Value (including allowance for water loss)	Standard Value (excluding allowance for water loss)	Proposed Value (excluding allowance for water loss)
Urban Population	High-Class Housing	250	200	200
	Middle-Class Housing	150	120	120
	Low-Class Housing			
	Individual Connection	75	60	60
	Non-individual Connection	-	20	30
Rural Population	Individual connection	High: 60 Medium: 50 Low: 40	High: 48 Medium: 40 Low: 40	High: 60 Medium: - Low: 40
	Non-individual connection	High: 20 Medium: 15 Low: 10	High: 20 Medium: 15 Low: 10	High: 30 Medium: - Low: 25

Note: Water loss was assumed at 20%.

Source: JICA Study Team, based on the Guidelines for Water Allocation (WRMA, 2010)

Following the "Guidelines for Water Allocation (WRMA, 2010)", the water demands were estimated for each category of water users in the urban and rural populations separately. However, there is not enough information on the percentage of future water users by category, such as high-, middle- and low-class housing, and individual and non-individual connections. The percentages of water users by category were assumed and the unit residential water demands were estimated by target area, as shown in the table below.

Assumed Unit Residential Water Demand by Target Area

Category		Unit Residential Water Demand for Each Category (L/person/d)	Percentage of Water Users in Each Target Area				
			UWSS 1)	UWSS 2)	LSRWSS 3)	SSRWSS 4)	SSRWSS 5)
Urban Population	High-Class Housing	200	6%	5%	-	-	-
	Middle-Class Housing	120	50%	30%	-	-	-
	Low-Class Housing						
	Individual Connection	60	22%	30%	-	-	-
	Non-individual Connection	30	22%	35%	-	-	-
Rural Population	Individual Connection						
	High Potential	60	-		65%	20%	
	Low Potential	40	-				20%
	Non-individual Connection						
	High Potential	30			35%	80%	
	Low Potential	25					80%
Estimate of Unit Residential Water Demand for Each Target Area			92 L/person/d	75 L/person/d	50 L/person/d	36 L/person/d	28 L/person/d

Note: The target areas are 1) Urban Water Supply for Nairobi, Mombasa and Kisumu, 2) Urban Water Supply, 3) Large-Scale Rural Water Supply, 4) Small-Scale Rural Water Supply, and 5) Small-Scale Rural Water Supply in Arid Area.
The percentage of water users in Target Area 1) were estimated based on the conditions of the Draft Feasibility Study and Master Plan for developing New Water Sources for Nairobi and Satellite Towns. The percentage of water users in other areas were estimated based on current situation.
Arid areas were categorized as low potential, while other areas were categorized as high potential.

Source: JICA Study Team, based on "Guidelines for Water Allocation (WRMA, 2010)"

In addition to the unit water demand for residential use, institutional water demand, commercial water demand and NRW were determined for projection of future domestic water demand of each urban centre and area, as shown in the table below.

Proposed Unit Water Supply Amount

Target Area	(a) Unit Water Supply Amount for Residential Water Use (L/p/d)	(b) Planning Ratio of Institutional & Commercial Water Use	(c) NRW Ratio	(d) Unit Water Supply Amount for Domestic Water Use (L/p/d)
1) Urban Water Supply for Nairobi, Mombasa and Kisumu	92	27%	20%	146
2) Urban Water Supply	75	27%	20%	119
3) Large-Scale Rural Water Supply	50	22%	20%	76
4) Small-Scale Rural Water Supply	36	22%	20%	55
5) Small-Scale Rural Water Supply in Arid Area	28	20%	20%	42

Note: "Unit Water Supply Amount for Residential Water Use" is to meet "Estimate of Unit Residential Water Demand for Each Target Area"

Planning Ratio of Institutional and Commercial Water Demand is assumed, considering current situation and existing water supply development plans.

NRW ratio was used as an approximation of ratio of water loss.

"Unit Water Supply Amount for Domestic Water Use" was calculated as (d) = a x (1 + b)/(1- c)

Source: JICA Study Team based on Kenya Vision 2030 and the Water Service Strategic Plan in 2009

(3) Domestic Water Demand

The results of the domestic water demand calculation are presented in the table below.

Domestic Water Demand Projected

(Unit: MCM/year)

Catchment Area	2010		2030	2050
	Case-1	Case-2		
LVNCA	84	169	424	605
LVSCA	60	165	464	662
RVCA	59	129	264	377
ACA	223	519	941	1,344
TCA	231	146	343	490
ENNCA	25	58	125	179
Total	682	1,186	2,561	3,657

Source: JICA Study Team

As indicated in the table, the 2010 domestic water demands were estimated to be 681 MCM/year in Case-1 and 1,186 MCM/year in Case-2. Such figures have some difference with the 941 MCM/year projected in the Aftercare Study (1998). The difference seems to be reasonable because the Aftercare Study (1998) projection was based on 95% coverage in urban areas and 70% coverage in rural areas.

There is clearly a significant increase in water demand with time and this is the result of the consolidated impact of the significant increase in population, the increase in coverage to meet the aims of Kenya Vision 2030, improvements in housing standards and the increase in the number of

households with individual connections. The increase in the "at user" demand is higher than the increase in the "raw water" demand due to the projected decrease in water losses with time resulting from rehabilitation works and installation of new pipeline systems.

(4) Water Demand by Sub-basin

As stated above, the determination of water demands in 2010, 2030 and 2050 together with the water use in 2010 have been carried out according to the divisions defined in the 2009 Census. In order to utilize the results as input to the water balance study, it is necessary to convert the figures to be on a sub-basin basis.

This task was achieved by overlaying a map of the 204 sub-basins onto a map of the 158 census districts which also includes 137 major urban centres. There is a significant number with overlapping boundary lines between two or more sub-basins. In such cases it has been necessary to estimate the proportion of water demand in each sub-basin. For the urban water demand of the 137 major urban centres, allocation has been carried out through subjective assessment considering the locations of the key developed areas. In the case of the rural water demand, the allocation has been prorated according to area.

3.5 Industrial Water Demand

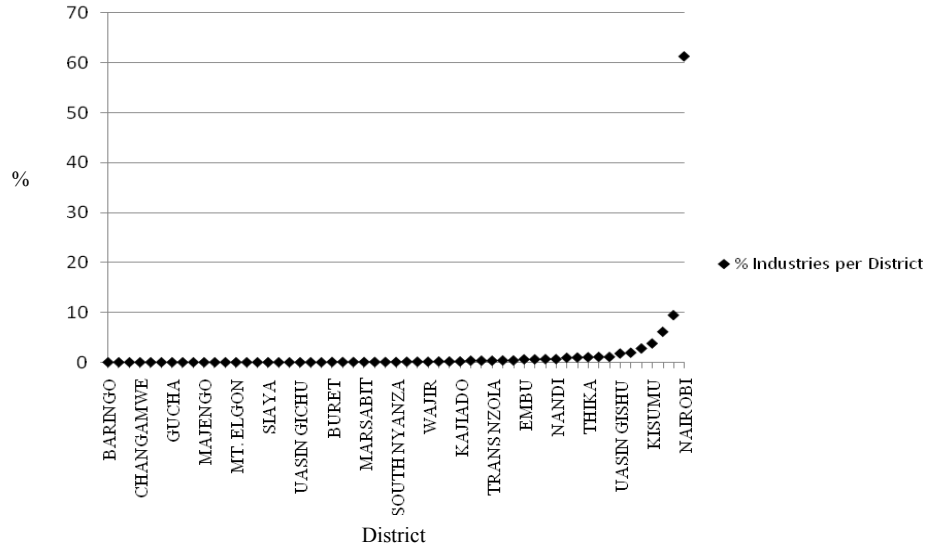
3.5.1 General

Data relevant to commercial and industrial activities were insufficient for carrying out analytical calculations of the present and projected water demand per district. A list of all major industrial firms registered in Kenya was provided by the Ministry of Industrialization; however, this was not a comprehensive list, and does not provide the exact location or the water source utilised.

Furthermore, water consumption rates of registered companies or the standards for different industry sectors were not available. Although there is a link between industry type and water use, previous studies have shown that industrial water use is strongly correlated to the type and size of operation, processes, materials and technology used and less dependent on the end product. Hence, the standard water use rates per type of industry are difficult to be allocated and sometimes misleading. The methodology for calculating the present and future industrial water demands is presented below.

3.5.2 Present Industrial Water Demand

Under this study the existing data on registered firms in Kenya was analysed to identify spatial variation of industrial activity. The number of firms per district was plotted as a % of the total number of registered firms in the country.



Source: Ministry of Industrialization

Spatial Variation of Industrial Activity

The results indicate that 61% of the country's industrial activity is concentrated in Nairobi, followed by Mombasa (9.5%), and other major urban centres, such as Nakuru (6.1%) and Kisumu (3.8%). The majority of districts have less than 1% industrial activity.

It is safe to assume that districts with high industrial activity will have a higher industrial water usage as a % of the population water demand. Based broadly on the methodology adopted in the Aftercare Study (1998) and the industrial activity analysis, 158 districts have been designated as having high, medium, low or non-activity levels, and grouped based on the criteria as shown in the table below.

Criteria of Industrial Activity Level

Industrial Activity	Criteria (% of Firms per District)	Area
High	>3%	11 districts
Medium	1% - 3%	16 districts
Low	0% - 1%	104 districts
No activity	0%	27 districts

Source: JICA Study Team

The names of districts in each industrial activity group are shown in Table 3.5.1. For each group, the following consumption rates as a percentage of urban water demand were applied in this study. It was noted that the percentages were adjusted from the Aftercare Study (1998) to account for the different approaches in the industrial activity grouping of the districts and the separation of commercial activities included under domestic.

Water Consumption Rate by Industrial Group

Industrial Group	% of Urban Water Demand
High Activity Group	25%
Medium Activity Group	15%
Low Activity Group	5%
No Activity Group	0%

Source: JICA Study Team

The present industrial water demand was calculated by multiplying the above rates with the urban domestic water demand. The current industrial water demand was estimated at 125 MCM/year.

3.5.3 Future Industrial Water Demand

The future water demand for 2030 was projected based on the premise that industrial water usage will increase in line with the growth of urban water demand. Industrial water demand up to 2030 was calculated using the same method of present water demand calculation. The year 2050 estimates assumed that the economy will have matured sufficiently and an average GDP value of 4% was applied as mentioned before. The results of the industrial water demand calculation are as summarised in the table below.

Projected Industrial Water Demand

(Unit: MCM/year)

Catchment Area	2010	2030	2050
LVNCA	6	19	42
LVSCA	10	41	90
RVCA	10	23	50
ACA	93	153	335
TCA	5	42	92
ENNCA	1	2	4
Total	125	280	613

Source: JICA Study Team

3.6 Livestock Water Demand

3.6.1 General

The 2009 Census provides livestock population data for the whole of Kenya and will be used as a basis for this projection. The data are only available at the district level, therefore, the analysis will be carried out at this level. The major water user species were identified and extracted from the 2009 Census including cattle, sheep, goats, and camels. In 2009, there were 17.5 million cattle, 17.1 million sheep, 27.7 million goats and 2.9 million camels. These are considerably larger numbers compared to the NWMP (1992) projections, indicating an increased water demand for livestock watering. Livestock development is an important part of the Kenyan economy and is central to ensuring food security.

3.6.2 Present Livestock Water Demand

There are many different forms of livestock. The livestock unit (LU) is used as a standard for the purpose of estimating water demand. According to the "Guidelines for Water Allocation (WRMA,

2010)", water consumption ratio is 50 L/head/day on the basis of LUs, and the following conversion factors are applied.

Livestock Unit

One grade cow	Equivalent to	1 Livestock Unit (LU)
Three indigenous cows	Equivalent to	1 Livestock Unit (LU)
15 sheep or goats	Equivalent to	1 Livestock Unit (LU)
Five donkeys	Equivalent to	1 Livestock Unit (LU)
Two camels	Equivalent to	1 Livestock Unit (LU)

Source: JICA Study Team, based on Guidelines for Water Allocation (WRMA, 2010)

The livestock population per district were then converted to LUs by multiplying the number of animals with the LU conversion factor above. The census shows the number of cattle, but does not classify the numbers of grade cow and indigenous cow, respectively. As data on proportion of grade cow and indigenous cow is not available, the following proportions are adopted in this study.

Proportion of Grade Cow and Indigenous Cow

	Grade Cow	Indigenous Cow
Non-Arid Area/ Semi Arid Area	50%	50%
Arid Area	0%	100%

Source: JICA Study Team

For calculation of the livestock water demand, the number of livestock was calculated only for cattle, sheep, goat and camel, while other livestock such as poultry, donkeys, pigs, etc., were assumed negligible. The number of livestock units in 2010 was estimated at around 14.0 million. The livestock water demand is shown in the table below.

Estimated Present Livestock Water Demand

Year	2010
No. Livestock (million LU)	14.0
Livestock Water Demand (MCM/year)	255

Source: JICA Study Team

About 255 MCM of water was required in 2010 to satisfy the livestock water demand for the existing livestock population. This is considerably more than the amount of 142 MCM predicted for 2010 in the NWMP (1992), highlighting the importance of ensuring adequate water availability for this sector.

3.6.3 Future Livestock Water Demand

The growth of livestock population varies depending on the demand for meat, desire of farmer to breed livestock and government policy. A simple projection methodology was employed for this study, namely, livestock population would increase in accordance with demand on milk and meat to ensure food security as a minimum. The future demand for milk, beef, and mutton and goat meat were calculated based on standard consumption rates (kg/person/year).

Standard Consumption Rates of Milk, Beef, and Mutton and Goat

(Unit: kg/person)

Product	Urban Consumption	Rural Consumption
Milk *	125	45
Beef **	12.47	6.23
Mutton and Goat **	2.41	1.20

Source: * Kenya Dairy Master Plan 2009
** FAO Livestock Sector Brief 2005

Current milk standard consumption data for rural and urban populations were available in the Kenya Dairy Master Plan 2009. Current consumption figures for beef or mutton and goat were not available in the MOLD. These meat consumption rates were calculated in the FAO Livestock Sector Brief 2005.

Meat Consumption Rates

Product	2005 Total Consumption (1,000 tons)	2005 Population	Consumption (kg/person)
Beef	294.9	31.54 million	9.35
Mutton and Goat	57	31.54 million	1.81

Source: FAO Livestock Sector Brief 2005

Consumption figures from other studies indicate a ratio of 2 for urban to rural beef consumption pattern. This provides the approximate urban consumption for beef 12.47 and 6.23 for rural, and similarly for mutton and goat 2.41 for urban and 1.2 for rural.

By applying per capita consumption rates and estimated human population for 2030, the annual growth rate of milk and beef consumption and hence, the required production were determined, as shown in the table below.

Production Projection of Milk, Beef and Mutton and Goat

Product	2009 Production (million tons)	Urban Consumption (kg/person)	Rural Consumption (kg/person)	Urban Population in 2030 (million)	Rural Population in 2030 (million)	2030 Production (million tons)	Average Annual Growth Rate toward 2030
Milk	4.326	125	45	46.02	21.81	6. 734	2.13%
Beef	0.32	12.47	6.23	46.02	21.81	0.710	3.86%
Mutton and Goat	0.084	2.41	1.20	46.02	21.81	0.137	2.36%

Source: JICA Study Team based on Kenya Dairy Master Plan 2009 and FAO Livestock Sector Brief 2005

The above methodology does not account for exports or imports, but ensure food security. Until 2002, the production and consumption of milk and beef were almost equal. The government in the last decade has been establishing strategies to improve the sector and an adjustment will be made to account for the objective of Kenya Vision 2030 for the development of the livestock sector. Although the livestock subsector is currently declining and only accounts for 6% of agriculture exports and 14% of agriculture GDP, it has potential for growth. Based on Kenya Vision 2030's goal to achieve an average growth rate of 7% across the agriculture sector, it was assumed that the implementation of Kenya Vision 2030 would have a positive impact especially on livestock exports in

the future and the projected average growth rate can be adjusted upwards by 0.42%, which is approximately the 6% relative contribution of the livestock exports in the 7% overall agriculture growth rates (refer to Kenya Vision 2030).

The livestock population was projected using the above average yearly growth rates up to 2030. As for the projection from 2030 to 2050, it was assumed that the increasing population would put additional pressure on food security and demand for livestock. Due to the lack of any long-term available data, the growth rate from 2030 to 2050 was estimated according to population growth in this 20-year period, which is 142.8% as shown in Section 3.2.4. The average annual growth rates were adjusted as follows.

Production Growth Rate of Milk, Beef and Mutton and Goat

Product	Average Annual Growth Rate	
	2010-2030	2030-2050
Milk	2.55%	--
Beef	4.28%	--
Mutton and Goat	2.78%	--
Average	3.20%	1.80%

Source: JICA Study Team, based on Kenya Vision 2030

The projected livestock population was then converted to LUs and multiplied by 50 L/LU/day to calculate the water demand as explained under the present water demand. The total water demand of livestock in Kenya is summarised in the table below.

The future livestock population was projected using the above average annual growth rates up to 2030 and 2050. The projected population was then converted to LUs and multiplied by 50 L/LU/day to calculate water demand, as explained under the present livestock water demand. The projected future livestock water demands in 2030 and 2050 are summarised in the table below.

Projected Future Livestock Water Demand

Year	2030	2050
No. of Livestock (head)	27.2	39.0
Livestock Water Demand (MCM/year)	497	710

Source: JICA Study Team

Projected Water Demand of Livestock

(Unit: MCM/year)

Catchment Area	2010	2030	2050
LVNCA	26	61	87
LVSCA	43	106	151
RVCA	70	123	175
ACA	25	59	85
TCA	34	69	99
ENNCA	57	79	113
Total	255	497	710

Source: JICA Study Team

The annual water demand of livestock in 2030 was estimated at 497 MCM compared to 2,560 MCM for domestic demand. Livestock water demand is approximately 19% of domestic water demand. This projection disregards land carrying capacity.

3.7 Wildlife Water Demand

3.7.1 General

Data relevant to wildlife populations were insufficient for carrying out analytical calculations of present and future demand per district. Following the data gathering activities exploring different available sources, it was decided that the data provided by the DRSRS would be utilised for this study as these represent the most comprehensive set of information on wildlife population. The data are a result of aerial surveys conducted from 2005 to 2011 in 11 districts across Kenya (Baringo, Garissa, Isiolo, Kajiado, Laikipia, Marsabit, Narok, Samburu, Taita, Tana River, and Turkana).

3.7.2 Present Water Demand

Water consumption for animals varies depending on the species as well as their surrounding conditions such as water availability or vegetation. Some mammals such as elephants and buffalos, require fairly large amounts of water frequently. Others such as giraffes sometimes live long without drinking water for a month if succulent vegetation is available. In order to assume the water consumption, the abovementioned species were grouped, i.e. Group A for species which require relatively much water, and Group B for those which require relatively less water.

Group A: Elephant, Zebra, Wildebeest, Kudu, Warthog, and Buffalo

Group B: Giraffe, Gazelle, Gerenuk, Impala, Hartebeest, Topi, Eland, Oryx, and Ostrich

Water consumption for one LU (450 kg) is 50 L/day, and that for elephants are said to be 140-270 L/day. Generally, the actual water consumption of wildlife has not been made clear. Accordingly, water consumption of respective species was assumed as follows:

- Water consumption of species is directly proportional to their average body weights.
- Species in Group A require water at a rate of about 50% of standard water consumption of 1 LU. Accordingly, the daily consumption was set at 5.0 L/100 kg-weight.
- Species in Group B require water at a rate of about 25% of standard water consumption of 1 LU. Accordingly, the daily consumption was set at 2.5 L/100 kg-weight.

Based on the above assumptions, the daily water consumption of respective species have been estimated as presented in the tables below.

Unit Water Consumption Rates for Wildlife

Group	Unit Water Consumption	Remarks	No. of Animals (head)	Water Consumption (m^3/day)
Group A	5 L/100 kg/day	About 50% of standard water consumption of 1 LU	698,040	348,671
Group B	2.5 L/100 kg/day	About 25% of standard water consumption of 1 LU	247,000	15,320

Source: JICA Study Team, based on data from DRSRS.

Based on the above estimated water consumptions and estimated numbers derived from DRSRS, the total annual wildlife water demand of major species in 2010 was estimated at 8.3 MCM (22,818 m^3/day) for a total of 945,040 heads as shown below.

Estimated Daily Water Consumption by Species

Group	Species	No. Animals (head)	Water Consumption (L/100 kg)	Average Weight	Unit Water Consumption (L/day/animal)	Water Consumption (m^3/day)
A	Buffalo	51,796	5	700	35	1,813
A	Elephant	18,825	5	7,500	375	7,059
A	Greater Kudu	390	5	195	9.75	4
A	Lesser Kudu	2,709	5	75	3.75	10
A	Warthog	5,187	5	65	3.25	17
A	Waterbuck	2,650	5	230	11.5	30
A	Wildebeest	506,494	5	425	21.25	10,763
A	Zebra Burchell	108,729	5	400	20	2,175
A	Zebra Grevy's	1,260	5	400	20	25
	Subtotal of Group A	698,040	--	--	--	21,896
B	Bushbuck	18	2.5	60	1.5	0
B	Eland	6,726	2.5	600	15	101
B	Gazelle Grants	80,005	2.5	55	1.375	110
B	Gazelle Thomsons	41,137	2.5	21	0.525	22
B	Gerenuk	12,749	2.5	38	0.95	12
B	Giraffe	18,437	2.5	1,000	25	461
B	Hunters Heartebeest	214	2.5	100	2.5	1
B	Impala	31,160	2.5	57	1.425	44
B	Kongoni	6,319	2.5	100	2.5	16
B	Oryx	8,685	2.5	250	6.25	54
B	Ostrich	27,202	2.5	90	2.25	61
B	Topi	14,348	2.5	110	2.75	39
	Subtotal of Group B	247,000	--	--	--	921
Grand Total		945,040	--	--	--	22,817

Source: JICA Study Team based on data from DRSRS

3.7.3 Future Water Demand

The wildlife demand was less than 0.5% of the total water demand in 2010. Additionally, it was assumed that the water demand of wildlife will remain constant in the future as efforts are made to

sustain the wildlife population in Kenya so that the proportion of the wildlife demand is expected to decrease more. The water demand was projected based on the data of 11 districts and no extrapolation was made for the rest of the districts. It seems that limited national reserves and national parks are carrying the majority of wildlife in Kenya, and the demand outside of major reserves and national parks seems negligible. Considering the conditions of major national reserves and national parks, the distribution of wildlife water demand is assumed as shown below.

Estimate of Distribution of Wildlife

Catchment Area	LVNCA	LVSCA	RVCA	ACA	TCA	ENNCA
Ratio	0%	40%	10%	30%	15%	5%

Source: JICA Study Team, based on data from DRSRS

The wildlife water demand for each catchment area is shown in the table below.

Projected Wildlife Water Demand

(Unit: MCM/year)

Catchment Area	2010	2030	2050
LVNCA	0.0	0.0	0.0
LVSCA	3.3	3.3	3.3
RVCA	0.8	0.8	0.8
ACA	2.5	2.5	2.5
TCA	1.2	1.2	1.2
ENNCA	0.4	0.4	0.4
Total	8.2	8.2	8.2

Source: JICA Study Team

It is assumed that wildlife will utilise only surface water, and not utilise any groundwater.

3.8 Inland Fisheries Water Demand

3.8.1 General

Fishery activities in Kenya were classified in two main categories: 1) marine fisheries, and 2) inland fisheries. The study concentrated on inland fisheries as the main user of fresh water resources.

Data on the number and area of existing and planned fishponds across the country were provided by the Ministry of Fisheries Development (MOFD) and will form the basis of the water demand projection. According to data, there were approximately 8,076 ponds in 2007. According to data in the NWMP (1992), the average area of fish ponds was estimated at around 528 m^2, so that the area of fish ponds was supposed to be around 4.26 km^2 in 2007.

Fish farming activities were expanded in 2009 under the Economic Stimulus Programme (ESP). The ESP was introduced through the 2009/10 budget entitled 'Overcoming Today's Challenges for a Better Kenya Tomorrow', which aims to stimulate the growth of the Kenyan economy through projects in key sectors such as education, health and sanitation, food production, environment, local government, industrialisation and fisheries. Under the ESP Phase I, 200 ponds per district in 140 districts were constructed in 2010. The total number of existing constructed ponds is approximately 36,000 ponds in 2010, of which surface area was estimated at 19.01 km^2.

3.8.2 Present Water Demand

Information about the water consumption amount or rate for fish farming in Kenya are not available. Hence, several assumptions were made to estimate such water demand.

- Data on the number and area of ponds as provided by the MOFD
- Pond depth: an average pond depth of 1 m
- Evaporation losses equal to 5 mm/day
- Percolation losses equal to 1 mm/day

Water demand for the ponds will be calculated as the amount of water required to compensate for evaporation and percolation losses. The year losses was estimated at 2.19 m/year (6 mm/day x 365 days) so that the present water demand is estimated at 41.63 MCM/year (2.19 m/year x 19.01 km^2)

3.8.3 Future Water Demand

As for the 2030 and 2050 projections, it has been hard to predict how the fish ponds will increase but it was estimated that the increasing population would put additional pressure on food security and demand more food resources. Due to the lack of any long-term available data, the development of fish ponds between 2010 and 2030 were estimated according to the population growth in that period, which is 176.1% as shown in Section 3.2.4. Similarly for the development between 2030 and 2050, it was estimated according to the population growth in that period, which is 142.8% as shown in the same section. The total areas of the fish ponds were estimated, as shown in the table below.

Development of Fish Ponds

(Unit: km^2)

Year	2010	2030	2050
Area of Fish Pond	19.01	33.48	47.80

Source: JICA Study Team, based on data from MOFD and ESP 2009.

Based on the data of fish ponds described in the Aftercare Study (1998), the distribution of fish ponds was estimated, as shown in the table below.

Distribution of Fish Ponds in 1992

Catchment Area	LVNCA	LVSCA	RVCA	ACA	TCA	ENNCA
Ratio	21.3%	20.5%	10.3%	15.8%	22.4%	9.6%

Source: JICA Study Team based on Aftercare Study (1998)

A summary of the water demand for inland fisheries is presented below and details by sub-basin are shown in Table 3.8.1.

Projected Inland Fisheries Water Demand

(Unit: MCM/year)

Catchment Area	2010	2030	2050
LVNCA	8.9	15.8	22.3
LVSCA	8.5	15.0	21.4
RVCA	4.3	7.8	10.8
ACA	6.6	11.6	16.6
TCA	9.3	16.4	23.5
ENNCA	4.0	7.0	10.0
Total	41.6	73.6	104.6

Source: JICA Study Team

It was assumed that inland fisheries will utilise only surface water, and not utilise any groundwater.

3.9 Summary of Future Water Demands

The table below shows the results of domestic, industrial, livestock, wildlife and inland fisheries water demand calculations for the present (2010), and the projections for years 2030 and 2050. The rates of increase for the periods 2010-2030 and 2030-2050 are also shown in the table.

Projected Future Water Demand (Excluding Irrigation Water Demand)

(Unit: MCM/year)

Sector	Year 2010	Year 2030	Rate of Increase (2010 to 2030)	Year 2050	Rate of Increase (2030 to 2050)
Domestic	1,186	2,561	216%	3,657	143%
Industrial	125	280	224%	613	219%
Livestock	255	497	195%	710	143%
Wildlife	8	8	100%	8	100%
Fisheries	42	74	174%	105	143%
Total	1,616	3,420	212%	5,093	149%

Source: JICA Study Team

CHAPTER 4 WATER SUPPLY DEVELOPMENT PLAN

4.1 General

(1) Goal of Water Service Level by 2030

Kenya Vision 2030 aims to ensure that improved water and sanitation are available and accessible to all. Based on the policy of Kenya Vision 2030, and the Water Service Strategic Plan, 2009, prepared by the MWI, the targets on water supply in Kenya by 2030 are as follows:

1) Supply safe and sufficient water by enhancing water supply capacities in both urban and rural areas.
2) Increase coverage of piped water supply by registered WSPs to 100% of the urban population.
3) Increase unit water supply amount to suitable national standard level.
4) Decrease the NRW rate to 20% for efficient water use.

The water supply development plan in the NWMP 2030 aims to meet the above targets.

(2) Coverage of Water Supply

As for the current situation, based on data from the 2009 Census, the population and ratio of water connection to each drinking water source were estimated, as shown in the table below:

Current Situation of Drinking Water Source Connection in 2010

(Unit: million persons)

Drinking Water Source/ Evaluation	Piped by WSP	Spring/ Well/ Borehole	Water Vendor	Stream, Lake, Pond, Others	Total
	Improved Source	Improved and Unimproved	Unimproved Source	Unimproved Source	
Urban Population	7.1 (54%)	3.1 (24%)	1.7 (13%)	1.2 (9%)	13.1 (100%)
Rural Population	4.1 (16%)	10.9 (43%)	0.5 (2%)	9.9 (39%)	25.4 (100%)
Total	11.2 (28%)	14.0 (37%)	2.2 (6%)	11.1 (29%)	38.5 (100%)

Source: JICA Study Team based on Census 2009 data

The definitions of “improved” and “unimproved” water sources were based on the JMP report as explained in Section 2.3.1. In order to achieve the goal described above, the target water connection in 2030 was set as shown in the table below.

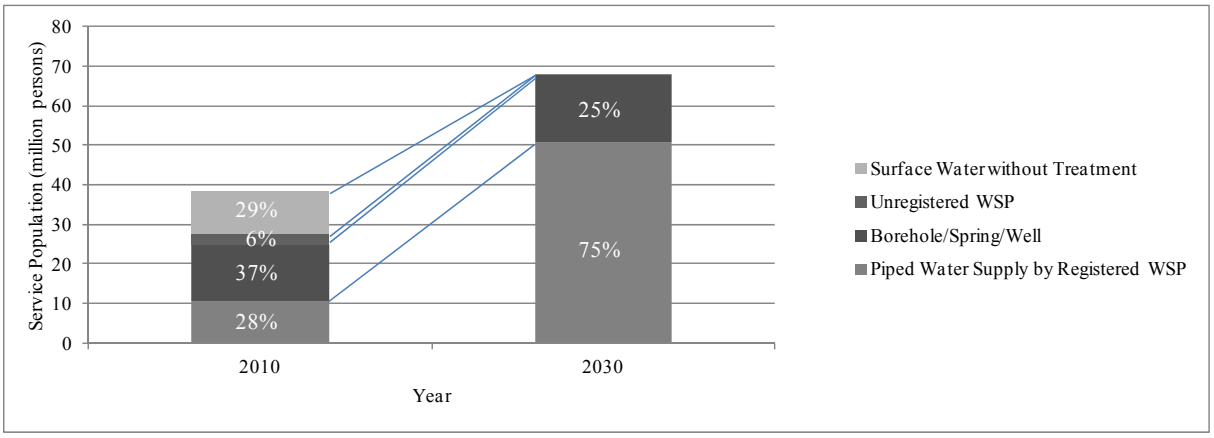
Target Conditions of Drinking Water Source Connection for 2030

(Unit: million persons)

Drinking Water Source/ Evaluation	Piped by WSP	Spring/ Well/ Borehole	Water Vendor	Stream, Lake, Pond, Others	Total
	Improved Source	Improved and Unimproved	Unimproved Source	Unimproved Source	
Urban Population	46.0 (100%)	0.0 (0%)	0.0 (0%)	0.0 (0%)	46.0 (100%)
Rural Population	4.7 (22%)	17.1 (78%)	0.0 (0%)	0.0 (0%)	21.8 (100%)
Total	50.7 (75%)	17.1 (25%)	0.0 (0%)	0.0 (0%)	67.8 (100%)

Note: A large share of the population of Kenya is expected to have one and alternative water sources. For example, even if people are connected to piped water supply, such people would still use private wells and/or rainfall harvest tanks.

Source: JICA Study Team (Ref. Subsection 3.4.3 (1))



Source: JICA Study Team (Ref. Subsection 3.4.3 (1))

Development Plan of Water Supply System

4.2 Overall Concept and Framework for Planning

Based on the basic conditions and targets aforementioned, the water supply development plan will be formulated with the following overall concept and framework:

(1) General Approach to increase the coverage of improved water supply to 100%

a) In this study, the water supply system for future development is considered as a combination of three types of water supply systems: 1) Urban Water Supply System (UWSS), which is a piped water supply system for major urban population and to be managed by a registered WSP, 2) Large-Scale Rural Water Supply System (LSRWSS), which is a piped water supply system for around 30-50 % of rural population in each catchment area with the remaining urban population, which is also to be managed by a registered WSP, and 3) Small-Scale Rural Water Supply System (SSRWSS), which consists of improved water sources for the remaining rural population and to be managed by individual, community or institution.

b) Access to unimproved water supply sources will be transferred to the above water supply system.

(2) Urban Water Supply

a) UWSS is for the following: 1) Residential water use of the urban population, 2) Commercial water use, 3) Institutional water use, and 4) Industrial water use in urban areas. It is planned to establish UWSS to cover 39.1 million urban population (2030) in 137 major urban centres,

which have more than 10,000 population in the 2009 Census. A list of the 137 major urban centres by catchment area is provided in Table 4.2.1.

b) The allocation plan of available water sources depends on the characteristics of the target area. Regarding the source of UWSS, surface water source is to be allocated first because of its cost effectiveness. However, considering the expected shortage of surface water in the near future, utilization of groundwater is also indispensable for urban water supply. It was initially proposed to utilize groundwater for 5% of the total required amount of water source in each urban centre. The water source allocation is finalized based on the results of the water balance calculation in the water resources development plan.

c) Basically, one UWSS was planned for each urban centre. However, in case that several urban centres will depend on the same water source, one UWSS is to be formulated for a group of urban centres.

(3) Rural Water Supply (LSRWSS and SSRWSS)

a) LSRWSS and SSRWSS are considered in 47 counties. The target rural population covered by LSRWSS is to be estimated by subtracting current piped water supply population from total rural population in the rural area of districts based on Census 2009.

b) Water sources of LSRWSS are to be determined after consideration of available surface and groundwater sources in each sub-basin. For arid areas, groundwater is the only water source, if certain surface water sources are not discovered.

c) Water sources of SSRWSS are supposed to be groundwater and spring water only.

(4) Rehabilitation of Existing Water Supply System

a) In order to reduce the NRW ratio for effective water use, it was proposed to carry out immediate rehabilitation of existing water supply systems. The rehabilitation works shall include replacement of unsuitable water pipes that appear to be leaking, and installation of suitable water meters.

b) It is not easy to achieve a 20% NRW ratio in Kenya, considering that the average current NRW ratio is 45%. It is a great challenge in the water sector in Kenya. New development projects are supposed to contribute to the reduction of the average NRW ratio because new systems would keep a low NRW ratio.

(5) Required Water Supply Capacity

a) Domestic water demand was calculated based on the MWI Design Manual for Water Supply in Kenya. The minimum unit residential water demand was set at 25 L/person/day, which is more than the requirement of the MWI manual, but was proposed in the Draft Water Bill 2012 (new Water Act). The required water supply capacities were planned to meet the calculated water demand. The details are described in Section 3.4.

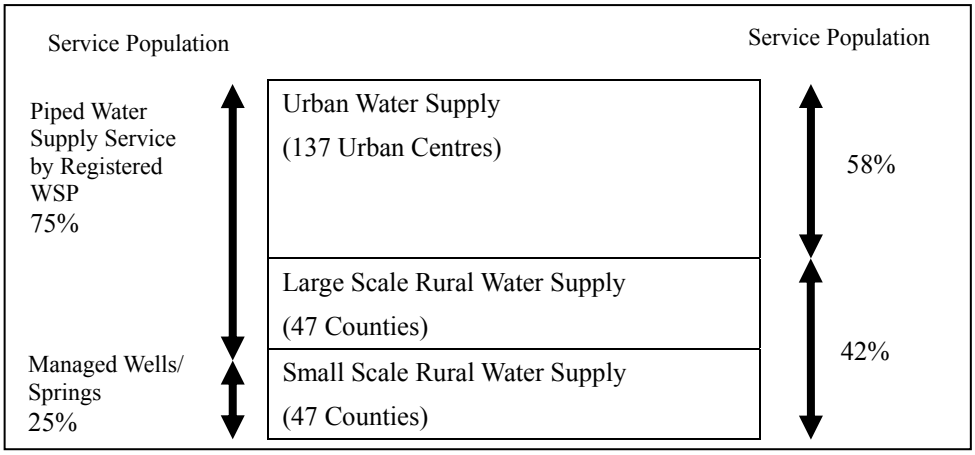


Diagram of the Water Supply System in 2030

Projected Future Domestic Water Demand in 2030

(Unit: MCM/year)

Catchment Area	Urban Water Demand			Rural Water Demand			Grand Total
	137 Major Urban Centres	Other Urban	Total	Large-Scale Rural Water Supply	Small-Scale Rural Water Supply	Total	
LVN	276	50	326	19	82	98	424
LVS	286	75	362	25	74	102	464
RV	154	50	204	15	44	60	264
Athi	825	54	878	23	40	63	941
Tana	213	41	254	36	53	89	343
ENN	45	31	76	12	37	49	125
Total	1,800	300	2,100	130	330	461	2,561

Source: JICA Study Team

4.3 Water Supply Development Plan for Lake Victoria North Catchment Area (LVNCA)

4.3.1 Development Strategy

(1) Basic Strategy

A large percentage of the population is using groundwater and spring water in the LVNCA. In addition, the surface water resources originating from Mt. Elgon and the Cherangani Tugen Hills have been abandoned in this area. The UWSSs are planned to get surface water with priority, and the rural water supply systems are planned to use groundwater with priority.

(2) Urban Water Supply

Based on the overall concept mentioned in Section 4.2, UWSSs are planned for 32 urban centres in the LVNCA. The water supply capacity required for UWSS in the LNVCA in 2030 is 782,000 m^3/day, against the current water supply capacity (including capacity under construction) of 135,000 m^3/day, so that the additional capacity of 647,000 m^3/day is to be developed by 2030. It is to be developed through the following three types of projects:

1) Rehabilitation of Existing UWSS

In order to achieve a 20% NRW ratio, water meters are to be installed for all households, and old pipes of the existing UWSSs of 20 urban centres, which have 135,000 m^3/day water supply capacity, are to be replaced. In addition, the rehabilitation includes replacement and repair of mechanical and electrical equipment in water treatment plants and pumping stations.

2) Expansion of UWSS

Expansion of UWSS is planned for the abovementioned 20 urban centres in order to meet the water demand in 2030. The total capacity of expansion is 556,000 m^3/day.

3) Construction of new UWSS

The construction of new UWSS is planned for 12 urban centres with no UWSS. The total capacity of the new construction is 91,000 m^3/day.

4) Incorporation of existing plans

According to data from WSBs, there are 12 plans of water supply development projects to cover nine UCs and surrounding areas in LVNCA, which have 45,000 m^3/day of total water supply capacity (Refer to Section 2.4). These plans are to be incorporated in NWMP 2030. The planned capacity could cover only 5% of the development capacities required in 2030. Feasibility studies have been carried out for only two projects. It is required to provide F/S reports of water supply development projects, which will cover the future water demand of each UC.

(3) Rural Water Supply

Based on the overall concept mentioned in Section 4.2, the rural water supply systems were planned to be developed as LSRWSS or as SSRWSS.

1) Development of LSRWSS

The LSRWSS is proposed mainly for areas with high population density or areas with difficulties of groundwater use on a personal or community basis. The LSRWSS is to be developed for 1.78 million residents in 11 counties in the LVNCA.

2) Development of SSRWSS

SSRWSS is proposed for 4.01 million residents in 11 counties in the LVNCA. This includes construction and improvement of boreholes, wells, and springs on personal and community basis. As this type of works is to be implemented on a personal and community basis, only the water demand projection was made for SSRWSS in this study.

(4) Water Source

1) Water Source of Urban Water Supply

Currently, the existing urban water supply systems are mainly dependent on surface water, and only 1% of the required water depends on groundwater. However, the dependence ratio of groundwater is expected to increase because shortage of surface water is expected in the near future. The dependence ratio of groundwater was tentatively set at 5%; however, it is to be finalized by area, as based on the results of the water balance calculation described in Sectoral Report (G) Water Resources Development.

2) Water Source of Rural Water Supply

The planning conditions for the LSRWSS and SSRWSS are set as shown in the table below. The conditions are to be modified based on the results of the water balance calculation.

Planning Ration of Each Type of Rural Water Supply System (LVNCA)

Area	Large-Scale Rural Water Supply System		Small-Scale Rural Water Supply System (Groundwater)
	(Surface Water)	(Groundwater)	
All Area	5%	5%	90%

Source: JICA Study Team assumed based on the current situation

For setting the planning conditions, the following were considered:

a) The current proportion of the LSRWSS (piped water supply) in the rural water supply system is estimated at 4%. The proportion of LSRWSS in 2030 is assumed to increase to 10% because of the future increase of population density and awareness of safe water.
b) The current dependence ratio of groundwater of the LSRWSS is estimated at 1%. Considering the shortage of surface water sources in the future, the target dependence ratio of groundwater is set at 50%. The policy promotes groundwater or spring water use as much as possible for the rural water supply system.
c) Currently, untreated surface water is being used for private and community basis; however, the use of surface water without proper treatment is planned to be decreased gradually and terminated by 2030. SSRWS is dependent on groundwater and spring water only.

4.3.2 Proposed Water Supply Development Plan

The proposed UWSS is presented in Table 4.3.1 and Figure 4.3.1, and the proposed LSRWSS and SSRWSS are in Tables 4.3.2 and 4.3.3, respectively.

The proposed water supply development plan for the LVNCA is outlined below.

Proposed Water Supply Development Plan (LVNCA)

Type of Project		Target Area	Target Capacity (m^3/day)	Target Population (million persons)
Urban Water Supply	Rehabilitation	20 Urban Centres	135,000	6.57
	Expansion	20 Urban Centres	556,000	
	New Construction	12 Urban Centres	91,000	
	Total	32 Urban Centres	782,000	
Rural Water Supply	LSRWSS	11 Counties	184,000	5.79
	SSRWSS	11 Counties	220,000	
	Total	11 Counties	404,000	

Source: JICA Study Team

Based on the above water supply development plan, the water supply situation in the LVNCA in 2030 would be as shown in the table below.

Water Supply Situation in 2030 (LVNCA)

Items		Urban Water Supply	Large-scale Rural Water Supply	Small-scale Rural Water Supply	Total
Service Population (million)	2010	0.77		4.59	5.36
	2030	6.57	1.78	4.01	12.36
Water Supply Capacity (m^3/day)	2010	135,000	10,000	144,000	289,000
	2030	782,000	184,000	220,000	1,186,000
Operating Body		Registered WSPs	Registered WSPs	Individual, Community, etc.	--
Target Towns/ Areas		32UC	11 Counties		--

Source: JICA Study Team (Figures for 2010 were prepared by reference to Section 2.3. Figures for 2030 were prepared based on Tables 4.3.1 to 4.3.3.)

In order to ensure water sources required for the water supply systems mentioned above, it is proposed to construct five new dams and expand one existing intra-basin water transfer system in LVNCA, as the result of the water balance study. (Ref. Sectoral Report (G), Section 4.4)

4.4 Water Supply Development Plan for Lake Victoria South Catchment Area (LVSCA)

4.4.1 Development Strategy

(1) Basic Strategy

The LVSCA is divided into three areas, Kisumu, Kisii, and the surrounding area, for UWSS planning considering the three areas' characteristics, as shown in the table below.

Areal Characteristics (LVSCA)

Area	Characteristics
Kisumu and Surrounding Area	Out of 24 urban centres in the LVSCA, there are seven urban centres in this area. It is estimated that the population is around 40% of the total population (2030). There are many available water sources, such as surface water of rivers from the Mau Forest Complex, which is one of the Five Water Towers of Kenya, and water taken from Lake Victoria.
Kisii and Surrounding Area	There are 12 urban centres in this area. It is estimated that the population is around 30% of the total population (2030). There is no available water source from lake Victoria and the Water Tower. Gucha R. with Bunyunyu Dam is the only major water source in this area. The water source for this area may have to highly depend on groundwater sources.
Other Area	Outside of the above stated areas, there are low population density areas with six urban centres. There are some available surface water sources including Lake Victoria. Basically, rural water supply systems depend on groundwater.

Source: JICA Study Team

(2) Urban Water Supply

Based on the overall concept mentioned in Section 4.2, UWSSs are planned for 25 urban centres in the LVSCA. As for six urban centres in Kisumu and its surrounding area, and seven urban centres in Kisii and its surrounding area, one water supply system is planned to cover several urban centres. The remaining 12 urban centres are planned to have independent water supply systems.

The water supply capacity required for the UWSS in the LNSCA in 2030 is 785,000 m^3/day, against the current water supply capacity (including capacity under construction) of 120,000 m^3/day, so that the additional capacity of 664,000 m^3/day is to be developed by 2030. It is to be developed through the following three types of projects:

1) Rehabilitation of existing UWSS

In order to achieve a 20% NRW ratio, water meters are to be installed for all households, and old pipes of the existing UWSS of 21 urban centres, which have 120,000 m^3/day water supply capacity, are to be replaced. In addition, the rehabilitation includes replacement and repair of mechanical and electrical equipment in water treatment plants and pumping stations.

2) Expansion of UWSS

Expansion of UWSSs is planned for the abovementioned 21 urban centres in order to meet the water demand in 2030. The total capacity of expansion is 570,000 m^3/day, and it covers two cities with no UWSS.

3) Construction of new UWSS

The construction of new UWSS is planned for four urban centres with no UWSS. The total capacity of the new construction is 94,000 m^3/day.

4) Incorporation of existing plans

According to data from WSBs, there are 27 plans of water supply development projects to cover 21 UCs and surrounding areas in LVSCA, which have 301,000 m^3/day of total water supply capacity (Refer to Section 2.4). These plans are to be incorporated in NWMP 2030. The planned capacity could cover only 45% of the development capacities required in 2030.

Feasibility studies have been provided for 11 projects. It is required to provide F/S reports of water supply development projects, which will cover the future water demand of each UC.

(3) Rural Water Supply

Based on the overall concept mentioned in Section 4.2, the rural water supply systems are planned to be developed as LSRWSS or as SSRWSS.

1) Development of LSRWSS

The LSRWSS is proposed mainly for areas with high population density or areas with difficulties of groundwater use on a personal or community basis. The LSRWSS is to be developed for 2.67 million residents in 14 counties in the LVSCA.

2) Development of SSRWSS

The SSRWSS is proposed for 3.79 million residents in one county in the LVSCA. This includes construction and improvement of boreholes, wells, and springs on personal and community basis. As this type of works is to be implemented on a personal and community basis, only the water demand projection was made for SSRWSS in this study.

(4) Water Source

1) Water Source of Urban Water Supply

Currently, the existing UWSSs depend on groundwater slightly at only 1% of the required water. However, the dependence ratio of groundwater is expected to increase because shortage of surface water is expected in the near future. The dependence ratio of groundwater is tentatively set at 5%; however, it is to be finalized by area, as based on results of the water balance calculation described in Sectoral Report (G) Water Resources Development.

2) Water Source of Rural Water Supply

The planning conditions for the LSRWSS and SSRWSS are set as shown in the table below. The conditions are to be modified based on the results of the water balance calculation.

Planning Ratio of Each Type of Rural Water Supply System (LVSCA)

Area	Large-Scale Rural Water Supply System		Small-Scale Rural Water Supply System (Groundwater)
	(Surface Water)	(Groundwater)	
Kisumu and Surrounding Area	10%	10%	80%
Kishii and Surrounding Area	10%	10%	80%
Other Area	10%	10%	80%

Source: JICA Study Team, assumed based on the current situation

For setting the planning conditions, the following were considered:

- The current proportion of the LSRWSS (piped water supply) in the rural water supply system is estimated at 1%. The proportion of the LSRWSS in 2030 was assumed to increase to 50% because of the future increase of population density and awareness of safe water.

- Surface water is not being used for private and community basis, and the SSRWSS is dependent on groundwater only.

4.4.2 Proposed Water Supply Development Plan

The proposed UWSS is presented in Table 4.4.1 and Figure 4.4.1, and the proposed LSRWSS and SSRWSS are in Tables 4.4.2 and 4.4.3, respectively. The proposed water supply development plan for the LVSCA is outlined below.

Proposed Water Supply Development Plan (LVSCA)

Type of Project		Target Area	Target Capacity (m^3/day)	Target Population (million persons)
Urban Water Supply	Rehabilitation	21 Urban Centres	120,000	6.26
	Expansion	21 Urban Centres	571,000	
	New Construction	4 Urban Centres	94,000	
	Total	25 Urban Centres	785,000	
Rural Water Supply	LSRWSS	14 Counties	277,000	6.46
	SSRWSS	14 Counties	208,000	
	Total	14 Counties	485,000	

Source: JICA Study Team

Based on the above water supply development plan, the water supply situation in the LVSCA in 2030 would be as shown in the table below.

Water Supply Situation in 2030 (LVSCA)

Items		Urban Water Supply	Large-scale Rural Water Supply	Small-scale Rural Water Supply	Total
Service Population (million)	2010	0.88		3.02	3.90
	2030	6.26	2.67	3.79	12.72
Water Supply Capacity (m^3/day)	2010	120,000	26,000	150,000	296,000
	2030	785,000	277,000	208,000	1,270,000
Operating Body		Registered WSPs	Registered WSPs	Individual, Community, etc.	--
Target Towns/ Areas		25 UCs	14 Counties		--

Source: JICA Study Team (Figures for 2010 were prepared by reference to Section 2.3. Figures for 2030 were prepared based on Tables 4.4.1 to 4.4.3.)

In order to ensure water sources required for the water supply systems mentioned above, it is proposed to construct nine new dams in LVSCA and one new dam in LVNCA, as the result of the water balance study. (Ref. Sectoral Report (G), Section 4.5)

4.5 Water Supply Development Plan for Rift Valley Catchment Area (RVCA)

4.5.1 Development Strategy

(1) Basic Strategy

The RVCA is divided into three areas, the Nakuru central populated area, the north arid area, and the south surrounding area, for UWSS planning considering the three areas' characteristics as shown in the table below.

Areal Characteristics (RVCA)

Area	Feature
Nakuru, Naivasha and Surrounding Area (Central Area)	Out of 13 urban centres in the RVCA, there are seven urban centres in this area. It was estimated that the population is around 60% of the total population (2010). Water sources in the area seem to be insufficient for the future population; therefore, it is required to get new water sources from outside the area.
Arid Area	It has a low population density area. There are three urban centres in arid areas, and groundwater is a major water source in this area.
Other Area	Outside of the above stated areas, there are four urban centres, which basically depend on surface water. For future demand, a water supply development plan with groundwater use would be considered.

Source: JICA Study Team

(2) Urban Water Supply System

Based on the overall concept mentioned in Section 4.2, UWSSs are planned for 13 urban centres in the RVCA. In case that the same water resources are used among the seven urban centres in Nakuru (Nakuru, Naivasha, Gilgil, Molo, Njo ro, Eldama Ravine, Ol Kalou), one water supply system is planned to cover several urban centres. However, the UWSS in the other seven urban centres are independently planned for each urban centre.

The water supply capacity required for the UWSS in the RVCA in 2030 is 398,000 m^3/day, against the current water supply capacity (including capacity under construction) of 129,000 m^3/day, so that the additional capacity of 269,000 m^3/day is to be developed by 2030. It is to be developed through the following three types of projects:

1) Rehabilitation of existing UWSS

In order to achieve a 20% NRW ratio, water meters are to be installed for all households, and old pipes of the existing UWSS of ten urban centres, which have 129,000 m^3/day water supply capacity, are to be replaced. In addition, the rehabilitation includes replacement and repair of mechanical and electrical equipment in water treatment plants and pumping stations.

2) Expansion of UWSS

Expansion of UWSSs is planned for the abovementioned ten urban centres in order to meet the water demand in 2030. The total capacity of expansion is 254,000 m^3/day.

3) Construction of new UWSS

The construction of new UWSS is planned for three urban centres with no UWSS. The total capacity of the new construction is 15,000 m^3/day.

4) Incorporation of existing plans

According to data from WSBs, there are four plans of water supply development projects to cover nine UCs and surrounding areas in RVCA, which have 135,000 m^3/day of total water supply capacity (Refer to Section 2.4). These plans are to be incorporated in NWMP 2030. The planned capacity could cover only 50% of the development capacities required in 2030. Feasibility studies have been carried out for only two projects. It is required to provide F/S

reports of water supply development projects, which will cover the future water demand of each UC.

UWSS prioritizes the use of surface water. On the other hand, there is a large-scale groundwater source in Nakuru and Naivasha, and the dependence ratio of groundwater is 46%. It is relatively high compared to other catchments. Out of Nakuru's surrounding area, the dependence ratio of groundwater is expected to decrease in Nakuru, Naivasha, Gilgil, and Njoro with 10% of target ratio in 2030. Also, the target ratio is 5% in other areas.

(3) Rural Water Supply System

Based on the overall concept mentioned in Section 4.2, the rural water supply systems are planned to be developed as LSRWSS or as SSRWSS.

1) Development of LSRWSS

The LSRWSS is proposed mainly for the areas with high population density or areas with difficulties of groundwater use on a personal or community basis. The LSRWSS is to be developed for 1.70 million residents in 18 counties in the RVCA.

2) Development of SSRWSS

The SSRWSS is proposed for 2.40 million residents in 18 counties in the RVCA. This includes construction and improvement of boreholes, wells, and springs on personal and community basis. As this type of works is to be implemented on a personal and community basis, only the water demand projection was made for SSRWSS in this study.

(4) Water Source of Urban Water Supply

1) Water Source of Urban Water Supply

Currently, the existing UWSSs depend on groundwater for 46% of the required water from massive groundwater resources in Nakuru and Naviash. This proportion is quite higher than other areas. The dependence ratio of groundwater is tentatively set at 10% in Nakuru, Naivasha, Gilgil, and Njoro, and at 5% in other areas; however, it is to be finalized by area, based on results of the water balance calculation described in Sectoral Report (G) Water Resources Development.

2) Water Source of Rural Water Supply

The planning conditions for the LSRWSS and SSRWSS are set as shown in the table below. The conditions are to be modified based on the results of the water balance calculation.

Planning Ratio of Each Type of Rural Water Supply System (RVCA)

Area	Large-Scale Rural Water Supply System		Small-Scale Rural Water Supply System
	(Surface Water)	(Groundwater)	(Groundwater)
Greater Nakuru Area	10%	10%	80%
Arid Area	10%	10%	90%
Other Area	10%	10%	80%

Source: JICA Study Team, assumed based on the current situation

For setting the planning conditions, the following were considered:

- The current proportion of the LSRWSS (piped water supply) in the rural water supply system is estimated at 5%. The proportion of the LSRWSS in arid areas in 2030 is assumed to increase to 10% because of the future increase of population density and awareness of safe water. On the other hand, the proportion in Nakuru and other areas was assumed to increase to 20%, which is above the national average.
- The current dependence ratio of groundwater of the LSRWSS was estimated at below 1% in the national average, and over 30% in the Nakuru area. Considering the shortage of surface water sources in the future, the target dependence ratio of groundwater is set at over 50% in the Nakuru area. The policy promotes groundwater or spring water use as much as possible for the rural water supply system
- Currently, surface water is not being used for private and community basis. Therefore, it is supposed that the SSRWS is dependent on groundwater and spring water only.

4.5.2 Proposed Water Supply Development Plan

The proposed UWSS is presented in Table 4.5.1 and Figure 4.5.1, and the proposed LSRWSS and SSRWSS are in Tables 4.5.2 and 4.5.3, respectively. The proposed water supply development plan for the RVCA is outlined below.

Proposed Water Supply Development Plan (RVCA)

Type of Project		Target Area	Target Capacity (m^3/day)	Target Population (million persons)
Urban Water Supply	Rehabilitation	10 Urban Centres	129,000	3.34
	Expansion	10 Urban Centres	254,000	
	New Construction	3 Urban Centres	15,000	
	Total	13 Urban Centres	398,000	
Rural Water Supply	LSRWSS	18 Counties	178,000	4.11
	SSRWSS	18 Counties	120,000	
	Total	18 Counties	298,000	

Source: JICA Study Team

Based on the above water supply development plan, the water supply situation in the RVCA in 2030 will be as shown in the table below.

Water Supply Situation in 2030 (RVCA)

Items		Urban Water Supply	Large-scale Rural Water Supply	Small-scale Rural Water Supply	Total
Service Population (million)	2010	1.36		1.55	2.91
	2030	3.34	1.70	2.41	7.45
Required Treatment Capacity (m^3/day)	2010	129,000	7,000	78,000	214,000
	2030	398,000	178,000	120,000	696,000
Operating Body		Registered WSPs	Registered WSPs	Individual, Community, etc.	--
Target Towns/ Areas		13 UCs	18 Counties		--

Source: JICA Study Team (Figures for 2010 were prepared by reference to Section 2.3. Figures for 2030 were prepared based on Tables 4.5.1 to 4.5.3.)

In order to ensure water sources required for the water supply systems mentioned above, it is proposed to construct nine new dams in RVCA and two new dams in LVSCA, as the result of the water balance study. (Ref. Sectoral Report (G), Chapter 4.6)

4.6 Water Supply Development Plan for Athi Catchment Area (ACA)

4.6.1 Development Strategy

(1) Basic Strategy

The ACA is divided into three areas, the Nairobi surrounding area, the Mombasa surrounding area, and other areas, for UWSS planning considering the characteristics of the three areas.

Areal Characteristics (ACA)

Area	Feature
Nairobi and Satellite Towns	This area has the highest population density area in Kenya. Out of 30 urban centres in the ACA, there are 15 urban centres with 4.46 million urban population, which is 76% of the current urban population. Thika in TCA is also covered by the water supply system of Nairobi. This area is highly dependent on water sources in the ACA.
Mombasa and Coastal Surrounding Area	There are eight urban centres with 1.28 million urban population, which is 20% of the current urban population in the ACA. Only limited surface water sources are available, and a water supply development plan consisting of spring, well field, and desalination plant should be considered.
Other Area	This is outside of above area. There are seven urban centres, which are planned to prioritize the use of surface water. As for rural water supply, it was planned to prioritize the use of groundwater.

Source: JICA Study Team

(2) Urban Water Supply System

Based on the overall concept mentioned in Section 4.2, UWSSs are planned for 32 urban centres in the ACA. In case that the same water resources are used among several urban centres in 16 urban centres in Nairobi and satellite towns, nine urban centres in Mombasa and coastal surrounding area, one water supply system is planned to cover several urban centres. However, the other seven urban centres are planned to have independent water supply systems.

The water supply capacity required for the UWSS in the ACA in 2030 is 2,260,000 m^3/day, against the current water supply capacity (including capacity under construction) of 699,000 m^3/day, so that the additional capacity of 1,561,000 m^3/day is to be developed by 2030. It is to be developed through the following three types of projects:

1) Rehabilitation of existing UWSS

In order to achieve a 20% NRW ratio, water meters are to be installed for all households, and old pipes of the existing UWSS of 30 urban centres, which have 699,000 m^3/day water supply capacity, are to be replaced. In addition, the rehabilitation includes replacement and repair of mechanical and electrical equipment in water treatment plants and pumping stations.

2) Expansion of UWSS

Expansion of UWSSs is planned for 29 of the 30 urban centres mentioned above in order to meet the water demand in 2030. The total capacity of expansion is 1,542,000 m^3/day.

3) Construction of new UWSS

The construction of new UWSS is planned for two urban centres with no UWSS. The total capacity of the new construction is 19,000 m^3/day.

4) Incorporation of existing plans

According to data from WSBs, there are 31 plans of water supply development projects to cover 21 UCs and surrounding areas in ACA, which have 1,215,000 m^3/day of total water supply capacity (Refer to Section 2.4). These plans are to be incorporated in NWMP 2030. The planned capacity could cover only 54% of the development capacities required in 2030.

(3) Rural Water Supply System

Based on the overall concept mentioned in Section 4.2, the rural water supply systems are planned to be developed as LSRWSS or as SSRWSS.

1) Development of LSRWSS

The LSRWSS is proposed mainly for areas with high population density or areas with difficulties of groundwater use on a personal or community basis. The LSRWSS is to be developed for 2.05 million residents in ten counties in the ACA.

2) Development of SSRWSS

The SSRWSS is proposed for 2.00 million residents in ten counties in the ACA. This includes construction and improvement of boreholes, wells, and springs on personal and community basis. As this type of works is to be implemented on a personal and community basis, only the water demand projection was made for SSRWSS in this study.

(4) Water Source

1) Water Source of Urban Water Supply

Currently, the existing UWSSs depend on groundwater at 2% of the required water. The dependence ratio of groundwater is expected to become flat in the near future. Also, the dependence ratio of groundwater is tentatively set at 5% in other areas. On the other hand, the installation of desalination plant is considered in Mombasa because water supply from surface

water will not be satisfied with the water demand in 2030. However, it is to be finalized by area, as based on results of the water balance calculation described in Sectoral Report (G) Water Resources Development.

2) Water Source of Rural Water Supply

The planning conditions for the LSRWSS and SSRWSS are set as shown in the table below. The conditions are to be modified based on the results of the water balance calculation.

Planning Ratio of Each Type of Rural Water Supply System (ACA)

Area	Large-Scale Rural Water Supply System		Small-Scale Rural Water Supply System (Groundwater)
	(Surface Water)	(Groundwater)	
Nairobi	0%	40%	60%
Mombasa	0%	60%	60%
Other Area	10%	10%	80%

Source: JICA Study Team, assumed based on the current situation

For setting the planning conditions, the following were considered:

- The current proportion of the LSRWSS (piped water supply) in the rural water supply system is estimated based on the existing system and future development plan.
- The current dependence ratio of groundwater of the LSRWSS was estimated. Considering the development plan of the surface water supply system in the LSRWSS, the target dependence ratio of groundwater is set at 80% in Tana, 20% in the ACA, and 50% in other areas.
- The policy promotes groundwater or spring water use as much as possible for the rural water supply system in other areas.
- Currently, surface water is not being used for private and community basis, and the LSRWSS is dependent on groundwater and spring water only.

4.6.2 Proposed Water Supply Development Plan

The proposed UWSS is presented in Table 4.6.1 and Figure 4.6.1, and the proposed LSRWSS and SSRWSS are in Tables 4.6.2 and 4.6.3, respectively. The proposed water supply development plan for the ACA is outlined below.

Proposed Water Supply Development Plan (ACA)

Type of Project		Target Area	Target Capacity (m^3/day)	Target Population (million persons)
Urban Water Supply	Rehabilitation	30 Urban Centres	699,000	17.01
	Expansion	29 Urban Centres	1,542,000	
	New Construction	2 Urban Centres	19,000	
	Total	32 Urban Centres	2,260,000	
Rural Water Supply	LSRWSS	10 Counties	209,000	4.04
	SSRWSS	10 Counties	110,000	
	Total	10 Counties	319,000	

Note: The water supply development plan (ACA) includes Thika with 0.51 million population. Thika is located in the TCA, but Thika has been connected with the water supply system in the ACA.

Source: JICA Study Team

Based on the above water supply development plan, the water supply situation in the ACA in 2030 will be as shown in the table below.

Water Supply Situation in 2030 (ACA)

Items		Urban Water Supply	Large-scale Rural Water Supply	Small-scale Rural Water Supply	Total
Service Population (million)	2010	5.29		2.15	7.44
	2030	17.01	2.04	2.00	21.05
Water Supply Capacity (m^3/day)	2010	699,000	100,000	108,000	907,000
	2030	2,260,000	209,000	110,000	2,579,000
Operating Body		Registered WSPs	Registered WSPs	Individual, Community, etc.	--
Target Towns/ Areas		32 UCs	10 Counties		--

Source: JICA Study Team (Figures for 2010 were prepared by reference to Section 2.3. Figures for 2030 were prepared based on Tables 4.6.1 to 4.6.3.)

In order to ensure water sources required for the water supply systems in Nairobi and surrounding area, it is proposed to construct eight new dams in ACA, and five new dams in TCA, and expand the inter-basin water transfer system from TCA, as the result of the water balance study.

For the water supply systems in Mombasa and coastal area, it is proposed to construct three new dams in ACA and expand two existing intra-basin water transfer systems. Also, a desalination plant is necessary for Mombasa and coastal area.

For the water supply systems in other areas in ACA, it is proposed to construct four new dams in ACA. (Ref. Sectoral Report (G), Section 4.7)

4.7 Water Supply Development Plan for Tana Catchment Area (TCA)

4.7.1 Development Strategy

(1) Basic Strategy

The TCA is divided into three areas, the upper Tana, the arid area, and other areas, for UWSS planning considering the characteristics of the three areas.

Areal Characteristics (TCA)

Area	Feature
Tana River Upstream	Out of 19 urban centres in the TCA, there are 15 urban centres in this area. It is estimated that the population is around 60% of the total population (2030). There are many available water sources, such as surface water of rivers from Mt. Kenya. The water supply development plan in this area will be considered from the existing plan of surface water use.
Arid Area	Out of three urban centres in arid areas, there are two urban centres supplied by the Tana River in this area. Groundwater is used for rural water supply system in arid areas, and surface water is also used for the water supply system in the area along the Tana River.
Other Area	This is outside of the above stated areas. There are four urban centres, which are planned to prioritize the use of surface water. As for rural water supply, it is planned to prioritize the use of groundwater.

Source: JICA Study Team

(2) Urban Water Supply

Based on the overall concept mentioned in Section 4.2, UWSSs are planned for 23 urban centres in the TCA. The water supply capacity required for UWSS in the TCA in 2030 is 543,000 m^3/day, against the current water supply capacity (including capacity under construction) of 106,000 m^3/day, so that the

additional capacity of 437,000 m^3/day is to be developed by 2030. It is to be developed through the following three types of projects:

1) Rehabilitation of existing UWSS

In order to achieve a 20% NRW ratio, water meters are to be installed for all households and old pipes of the existing UWSS of 15 urban centres, which have 106,000 m^3/day water supply capacity, are to be replaced. In addition, the rehabilitation includes replacement and repair of mechanical and electrical equipment in water treatment plants and pumping stations.

2) Expansion of UWSS

Expansion of UWSSs is planned for 14 of the 15 urban centres mentioned above in order to meet the water demand in 2030. The total capacity of expansion is 349,000 m^3/day, and it covers three cities with no UWSS.

3) Construction of new UWSS

The construction of new UWSS is planned for eight urban centres with no UWSS. The total capacity of the new construction is 88,000 m^3/day.

4) Revision of existing plans

According to data from WSBs, there are 10 plans of water supply development projects to cover 18 UCs and surrounding areas in TCA, which have 880,000 m^3/day of total water supply capacity. (Refer to Section 2.4) The planned capacity could cover around two times of the development capacities required in 2030. Existing plans of six water supply projects upstream of TCA seem to have excessive capacities, comparing with the water demand forecast in the Study. The required water supply capacities of the six projects are to be revised, based on the overall concept mentioned in Section 4.2.

(3) Rural Water Supply System

Based on the overall concept mentioned in Section 4.2, the rural water supply systems were planned to be developed as LSRWSS or as SSRWSS.

1) Development of LSRWSS

The LSRWSS is proposed mainly for areas with high population density or areas with difficulties of groundwater use on a personal or community basis. The LSRWSS is to be developed for 2.11 million residents in 16 counties in the TCA.

2) Development of SSRWSS

The SSRWSS is proposed for 2.72 million residents in 16 counties in the TCA. This includes construction and improvement of boreholes, wells, and springs on personal and community basis. As this type of works is to be implemented on a personal and community basis, only the water demand projection was made for SSRWSS in this study.

(4) Water Source

1) Water Source of Urban Water Supply

- The UWSSs are planned to be established for 23 urban centres. Basically, the UWSSs are planned for each urban centre independently. On the other hand, the same water resources are being used among several urban centres, and one water supply system is planned to cover 13 urban centres in the Tana upper stream site.
- Currently, the existing UWSSs depend on groundwater slightly at 2% of the required water. However, the dependence ratio of groundwater is expected to increase because shortage of surface water is expected in the near future. The dependence ratio of groundwater is tentatively set at 5%. However, the dependence ratio of groundwater in arid areas is tentatively set at 100% because it has no connection to surface water. Also, it is to be finalized by area, as based on the results of the water balance calculation described in Sectoral Report (G) Water Resources Development.

2) Water Source of Rural Water Supply

The planning conditions for the LSRWSS and SSRWSS are set as shown in the table below. The conditions are to be modified based on the results of the water balance calculation.

Planning Ratio of Each Type of Rural Water Supply System (TCA)

Area	Large-Scale Rural Water Supply System		Small-Scale Rural Water Supply System (Groundwater)
	(Surface Water)	(Groundwater)	
Tana	60%	0%	40%
Arid Area	5%	5%	90%
Other Area	10%	10%	80%

Source: JICA Study Team, assumed based on the current situation

For setting the planning conditions, the following were considered:

- The current proportion of the LSRWSS (piped water supply) in the rural water supply system is estimated considering the existing system and development plan.
- The current dependence ratio of surface water of the LSRWSS is estimated considering the characteristics of each catchment. Therefore, it was set at 80% in the Tana upper stream area. Considering the characteristics of each catchment, the target dependence ratio of surface water was set at 80% in the Tana upper stream area. The policy promotes groundwater or spring water use as much as possible for the rural water supply system. Basically, the dependence ratio of surface water is set at 0%; however, it was set at 20% in arid areas due to the presence of the Tana River.
- Currently, surface water is not being used for private and community basis, and the SSRWS is dependent on groundwater and spring water only.

4.7.2 Proposed Water Supply Development Plan

The proposed UWSS is presented in Table 4.7.1 and Figure 4.7.1, and the proposed LSRWSS and SSRWSS are in Tables 4.7.2 and 4.7.3, respectively. The proposed water supply development plan for the TCA is outlined below.

Proposed Water Supply Development Plan (TCA)

Type of Project		Target Area	Target Capacity (m^3/day)	Target Population (million persons)
Urban Water Supply	Rehabilitation	15 Urban Centres	106,000	4.90
	Expansion	14 Urban Centres	349,000	
	New Construction	8 Urban Centres	88,000	
	Total	23 Urban Centres	543,000	
Rural Water Supply	LSRWSS	16 Counties	211,000	4.96
	SSRWSS	16 Counties	145,000	
	Total	16 Counties	356,000	

Note: The water supply development plan (TCA) does not include Thika with 0.51 million population. Thika is located in the TCA, but it has been connected with the water supply system in the ACA.

Source: JICA Study Team

Based on the above water supply development plan, the water supply situation in the TCA in 2030 will be as shown in the table below.

Water Supply Situation in 2030 (TCA)

Items		Urban Water Supply	Large-scale Rural Water Supply	Small-scale Rural Water Supply	Total
Service Population (million)	2010	1.95		1.43	3.38
	2030	4.90	2.24	2.72	9.86
Water Supply Capacity (m^3/day)	2010	106,000	149,000	72,000	327,000
	2030	543,000	211,000	145,000	899,000
Operating Body		Registered WSPs	Registered WSPs	Individual, Community, etc.	--
Target Towns/ Areas		23 UCs	16 Counties		--

Source: JICA Study Team (Figures for 2010 were prepared by reference to Section 2.3. Figures for 2030 were prepared based on Tables 4.7.1 to 4.7.3.)

In order to ensure water sources required for the water supply systems mentioned above, it is proposed to construct four new dams and one intra-basin water transfer system and also expand two existing intra-basin water transfer systems, as the result of the water balance study. (Ref. Sectoral Report (G), Chapter 4.8).

4.8 Water Supply Development Plan for Ewaso Ng'iro North Catchment Area (ENNCA)

4.8.1 Development Strategy

(1) Basic Strategy

The ENNCA is divided into two areas, the northern arid area and the southern non-arid area, for water supply systems planning considering the characteristics of the two areas.

Areal Characteristics (ENNCA)

Area	Feature
Arid Area	There are eight urban centres in arid areas. Both urban and rural water supply systems depend on groundwater.
Other Area	This is outside the arid area. There are four urban centres, which are planned to prioritize the use of surface water. As for rural water supply, it is planned to prioritize the use of groundwater.

Source: JICA Study Team

(2) Urban Water Supply System

Based on the overall concept mentioned in Section 4.2, the UWSSs are planned for 12 urban centres in the ENNCA. The water supply capacity required for the UWSS in the ENNCA in 2030 is 124,000 m^3/day, against the current water supply capacity (including capacity under construction) of 32,000 m^3/day, so that the additional capacity of 92,000 m^3/day is to be developed by 2030. It is to be developed through the following three types of projects:

1) Rehabilitation of existing UWSS

In order to achieve a 20% NRW ratio, water meters are to be installed for all households, and old pipes of the existing UWSS of six urban centres, which have 32,000 m^3/day of water supply capacity, are to be replaced. In addition, the rehabilitation includes replacement and repair of mechanical and electrical equipment in water treatment plants and pumping stations.

2) Expansion of UWSS

Expansion of UWSSs is planned for the six urban centres mentioned above in order to meet the water demand in 2030. The total capacity of expansion is 61,000 m^3/day.

3) Construction of new UWSS

The construction of new UWSS is planned for six urban centres with no UWSS. The total capacity of the new construction is 31,000 m^3/day.

4) Incorporation of existing plans

According to data from WSBs, there are six plans of water supply development projects to cover two UCs and surrounding areas in ENNCA, which have 22,000 m^3/day of total water supply capacity (Refer to Section 2.4). These plans are to be incorporated in NWMP 2030. The planned capacity could cover only 24% of the development capacities required in 2030. Feasibility studies have not been carried out for any projects. It is required to provide F/S reports of water supply development projects, which will cover the future water demand of each UC.

(3) Rural Water Supply System

Based on the overall concept mentioned in Section 4.2, the rural water supply systems are planned to be developed as LSRWSS or as SSRWSS.

1) Development of LSRWSS

The LSRWSS is proposed mainly for areas with high population density or areas with difficulties of groundwater use on a personal or community basis. The LSRWSS is to be developed for 1.16 million residents in 14 counties in the ENNCA.

2) Development of SSRWSS

The SSRWSS is proposed for 2.20 million residents in 14 counties in the ENNCA. This includes construction and improvement of boreholes, wells, and springs on personal and

community basis. As this type of works is to be implemented on a personal and community basis, only the water demand projection was made for SSRWSS in this study.

(4) Water Source

1) Water Source of Urban Water Supply

Currently, the existing UWSSs in arid areas depend on groundwater slightly at only 2% of the required water. However, the dependence ratio of groundwater is expected to increase, because shortage of surface water is expected in the near future. The dependence ratio of groundwater was tentatively set at 5%; however, it is to be finalized by area, as based on the results of the water balance calculation described in Sectoral Report (G) Water Resources Development.

2) Water Source of Urban Water Supply

The planning conditions for the LSRWSS and SSRWSS are set as shown in the table below. The conditions are to be modified based on the results of the water balance calculation.

Planning Ratio of Each Type of Rural Water Supply System (ENNCA)

Area	Large-Scale Rural Water Supply System		Small-Scale Rural Water Supply System (Groundwater)
	(Surface Water)	(Groundwater)	
Arid Area	50%	50%	90%
Other Area	10%	10%	80%

Source: JICA Study Team, assumed based on the current situation

For setting the planning conditions, the following were considered:

- The current proportion of the LSRWSS (piped water supply) in the rural water supply system is estimated at 5% within arid areas, and 20% outside arid areas. The proportion of the LSRWSS in 2030 is assumed to be same as the current situation.
- Considering the characteristics of the catchment, the target dependence ratio of surface water was set below 50% in the ENNCA. The policy promotes groundwater or spring water use as much as possible for the rural water supply system.
- Surface water is not being used for private and community basis, and the SSRWSS is dependent on groundwater only.

4.8.2 Proposed Water Supply Development Plan

The proposed UWSS is presented in Table 4.8.1 and Figure 4.8.1, and the proposed LSRWSS and SSRWSS are in Tables 4.8.2 and 4.8.3, respectively. The proposed water supply development plan for the ENNCA is outlined below.

Proposed Water Supply Development Plan (ENNCA)

Type of Project		Target Area	Target Capacity (m^3/day)	Target Population (million persons)
Urban Water Supply	Rehabilitation	6 Urban Centres	32,000	1.04
	Expansion	6 Urban Centres	61,000	
	New Construction	6 Urban Centres	31,000	
	Total	12 Urban Centres	124,000	
Rural Water Supply	LSRWSS	14 Counties	119,000	3.36
	SSRWSS	14 Counties	101,000	
	Total	14 Counties	220,000	

Source: JICA Study Team

By the above water supply development, the water supply situation of ENNCA in 2030 will be as follows.

Water Supply Situation in 2030 (ENNCA)

Items		Urban Water Supply	Large-scale Rural Water Supply	Small-scale Rural Water Supply	Total
Service Population (million)	2010	0.99		1.53	2.52
	2030	1.04	1.16	2.20	4.40
Water Supply Capacity (m^3/day)	2010	32,000	7,000	77,000	116,000
	2030	124,000	119,000	101,000	344,000
Operating Body		Registered WSPs	Registered WSPs	Individual, Community, etc.	--
Target Towns/ Areas		12 UCs	14 Counties		--

Source: JICA Study Team (Figures for 2010 were prepared by reference to Section 2.3. Figures for 2030 were prepared based on Tables 4.8.1 to 4.8.3.)

In order to ensure water sources required for the water supply systems mentioned above, it is proposed to construct four new dams in ENNCA, as the result of the water balance study. (Ref. Sectoral Report (G), Chapter 4.9).

CHAPTER 5 COST ESTIMATE

5.1 Basic Conditions for Cost Estimate

The project costs estimated in the study are approximate or notional figures to grasp the general financial status, and is not intended to bind the project finance arrangement in the future.

The basic conditions for the project cost estimate are as follows:

a) Project costs are updated to be the price level as of November 1, 2012;

b) Exchange rate applied is US$1.0 = KSh85.24, as of November 1, 2012;

c) Physical contingency was assumed to be 15% of the direct construction cost;

d) Cost of engineering services (detailed design and construction supervision) was assumed to be 10% of the direct construction cost;

e) Land acquisition cost was assumed at KSh100,000 per ha, when no evidence is available. (Except for dam construction, land acquisition cost was not considered because it seems negligible.)

f) The construction costs of multipurpose dams are allocated on the basis of the existing F/S, the role of the leading subsector in project implementation, and water storage volume (refer to Sectoral Report (G) Water Resources Development).

5.2 Cost Estimate

5.2.1 Project Costs (Construction Costs)

The construction costs (financial initial investment costs) for the proposed water supply projects are estimated or assumed as follows.

(1) Rehabilitation of Urban Water Supply System

The objectives of the rehabilitation are to realize a 20% NRW ratio, and to restore the functions of the existing water supply system.

The scope of the rehabilitation project is expected to include the replacement of old pipes, installation/replacement of water meters, and repair/replacement works of mechanical and electric equipment. The scope of the rehabilitation projects depends on the conditions of the existing water supply systems in urban centers. There is not enough data and information for fixing the scope. Under these conditions, it is very difficult to estimate the costs of rehabilitation projects for each urban centre. Based on the estimate of existing reports prepared by the WSBs and the Aftercare Study (1998), a unit rate of US$675/$m^3$ of water supply capacity was applied in the cost estimates. Cost estimation was based on the replacement cost, which is 30% of the construction cost (US$2,250/$m^3$ x 30%).

In the Aftercare Study (1998), the rehabilitation projects were proposed for the existing urban water supply systems, having a combined capacity of 391,866 m^3/day. The total project cost was estimated at

US$44.5 million. In the Aftercare Study (1998), the unit rate of the rehabilitation project cost was estimated at US$110/m^3.

(2) Expansion and New Development of Urban Water Supply System

For estimating the project costs for the expansion and new development, the project costs were divided into three types of costs: "source works and water transmission system", "treatment works and distribution pipe networks", and "dam and water transfer system". The dam and water transfer system was considered additionally, only if enough water sources are not available in the surrounding area.

1) Source Works and Water Transmission System

The source works include water intake facilities, boreholes with pumps, and the transmission system. The water transmission system includes pipelines and pump stations up to the "treatment works and distribution pipe networks".

Based on the cost estimates of existing reports prepared by the WSBs and the Aftercare Study (1998), the costs were assumed by applying a unit rate of US$375/m^3 (the direct construction cost is US$300/m^3) of water production.

2) Treatment Works and Distribution Pipe Networks

Based on the cost estimates of existing reports prepared by the WSBs and the Aftercare Study (1998), the costs were assumed by applying a unit rate of US$1,875/m^3 (the direct construction cost is US$1,500/m^3) of water production.

3) Dam and Water Transfer System

If a water source in the surrounding areas is not available so as to meet the projected water demand, the construction of a dam and/or water inter-transfer system would be required in addition to the above intake works, treatment works and distribution pipe networks. The costs of major dams and water transfer system were estimated by each dam and transfer system, based on data provided by WSPs.

In the Aftercare Study (1998), the expansion and new development projects were proposed with a total capacity of 712,000 m^3/day, and the total project cost was estimated at US$1,270 million. In the Aftercare Study (1998), the unit rate of the project cost for the expansion and new development was estimated at US$1,780/m^3. In the study, the total project cost was estimated at US$11,001 million for the expansion and new development of 3.72 million m^3/day so that the unit rate was at US$2,957. Considering price escalation, the unit price seems reasonable as the price level in 2013. The project costs were estimated in KSh applying the exchange rate of KSh 85.24/US$.

Tables 5.2.1 to 5.2.14 show the project costs of UWSS development and LSRWSS development proposed for each catchment area. The summary of the project costs is shown below.

Summary of Project Costs for UWSS and LSRWSS Projects

(Unit: KSh million)

Category	Total Cost	Project Cost for Each Catchment Area					
		LVNCA	LVSCA	RVCA	ACA	TCA	ENNCA
1) UWSS							
Rehabilitation	70,920	7,578	6,921	7,416	40,251	6,887	1,867
Expansion/Development	1,018,098	136,580	152,947	93,977	490,879	122,601	21,114
Sub-total	1,089,018	144,158	159,868	101,393	531,130	129,488	22,981
2) LSRWSS							
Rehabilitation	9,087	528	1,500	384	0*	6,274	401
Expansion/Development	189,761	32,553	48,280	43,464	39,543	4,450	21,472
Sub-total	198,848	33,082	49,780	43,847	39,543	10,723	21,873
Total	1,287,866	177,240	209,648	145,240	570,673	140,211	44,854

Note: * It is assumed that rehabilitation of LSRWSS in ACA is to be carried out as a part of UWSS rehabilitation projects.

Source: JICA Study Team

5.2.2 Operation and Maintenance Costs

Operation and maintenance (O&M) costs highly depend on the design of water transmission and distribution. However, F/S reports as well as preliminary design have not been prepared for most of the proposed projects. Under the situation, it is impossible to estimate the O&M cost for each project. Based on estimates in the existing reports prepared by the WASREB and WSBs, the O&M cost can be roughly estimated by applying a unit rate of US$0.3/$m^3$ of water production.

5.2.3 Replacement Costs

Replacement costs of project facilities, such as mechanical and electric works, were assumed to be required every 15 years at an amount of 30% of the project cost.

CHAPTER 6 ECONOMIC EVALUATION

6.1 Evaluation Method and Basic Conditions

The economic viability of selected projects was evaluated based on the estimated economic cost and water supply benefit. The criteria by which economic decision making are made as follows:

a) Economic Internal Rate of Return (EIRR)

b) Net Present Value (NPV)

c) Benefit and Cost Ratio (B/C Ratio)

The following assumptions were made for the economic analysis:

1) Price Level

Investment costs and O&M costs were estimated at price levels on November 1, 2012. All prices are expressed by US$ currency. The foreign exchange rate was set at KSh85.24 to US$1.00, ¥79.98 to US$1.00, and KSh110.48 to €1.00.

2) Economic Value

The prices of internationally tradable goods and services will be valued based on international border prices, which is often expressed in the World Bank's "Commodity Prices and Price Forecast". The prices of non-traded goods and services will be converted from their financial value to economic value by applying a standard conversion factor of 0.90 based on the facts that the ratio of taxation against the GDP in Kenya is about 11%, as well as on the fact that the conversion factors widely applied in the water sector of Kenya are mostly around 0.90.

3) Social Discount Rate

The social discount rate reflects the opportunity cost of capital to the national economy. In this study, 10% of the prevailing opportunity cost of capital in the water sector of Kenya is applied.

4) Economic Life of Projects

The economic life of water supply projects was set at 30 years. However, a part of mechanical facilities was considered at 15 years, thus it would be replaced in 15 years within the economic life.

5) Multipurpose Dams

The construction costs and annual O&M costs of multipurpose dams were allocated based on the existing F/S, the role of the leading subsector in project implementation, and the water storage volume.

The overall economic evaluation of urban domestic water supply projects for 137 urban centres was performed for each catchment area at a master plan level. Rural water supply projects were not evaluated because of the unavailability of data for planning at this preliminary stage. In addition, industrial water supply was not included in the economic evaluation due to the unpredictability of

industrial areas in the future at this preliminary stage, although the NWMP 2030 considers industrial use of water in the water demand forecast.

6.2 Economic Benefit

The economic benefits of urban water supply projects were identified as follows:

(1) Quantifiable Benefits

- Cost-saving benefits, which replace the existing water supply and serve the people who are currently dependent on relatively expensive water vendor fees as compared to water tariffs in public water supply systems. The tariff, ranging from KSh2/L to KSh40/L, varies depending on the region and the season. In this study, the average tariff of one jerry can in the suburb of Nairobi (KSh4/20 L) in November 2012 was used as the base value in the economic analysis
- Incremental water benefits mean increased quantity of available water for consumption through a water supply project. In other words, this increased water demand results from the availability of higher quality of water at lower cost. In order to estimate the average water demand price, the study used data from the willingness to pay surveys in Nairobi, Mombasa, and Kakamega, which were undertaken by the World Bank in 2005 (US$1.1/$m^3$ in 2010 value). This demand price data was further adjusted to the current value, which was estimated at US$1.2/$m^3$ in financial price.
- The reduction of water loss through improved water system. Currently, around 40% of water loss was estimated. This rate can be reduced through an improved water supply system.

(2) Qualitative Benefits

- Improved public health, which derives from the prevention of waterborne diseases. In particular, waterborne diseases such as diarrhea and typhoid are reported as being caused by unimproved water supply.

Among the socioeconomic impact identified in the above, 1) cost-saving benefits, and 2) incremental water benefits were selected to estimate the benefits of the overall urban water supply projects.

The construction period for urban water supply was set to three years and the benefits would be starting from the fourth year, reaching full development in five years.

6.3 Economic Cost

(1) Investment Cost

For economic evaluation, the economic investment cost was converted to its equivalent economic value in order to remove transfer payments such as taxes and subsidies. The cost of a single and multipurpose dam construction was included as described in Section 6.1. The cost for engineering services was estimated at 10% of the initial construction cost. The physical contingency cost was included in the investment cost and was set at 15% of the initial direct construction cost. The total investment costs by catchment area are summarised in the following table. The ACA would require the highest investment cost in order to respond to the increased water demand in this catchment (1,597,843 m^3/day). The total economic investment cost for the proposed water supply projects was

estimated at US$11,918 million. This would provide water supply services for an additional 29.7 million people by 2030.

Summary of Estimated Investment Cost and O&M Cost by Catchment

Catchment Area	Additional Water Demand 2030 (m^3/day)	No. of Beneficiary (2030)	No. of Projects	Total Financial Cost (US$ million)	Total Economic Cost (US$ million)	Annual Financial O&M Cost (US$ million)
LVNCA	678,010	5,638,462	32	1,580	1,488	72
LVSCA	714,638	5,710,884	24	1,768	1,669	74
RVCA	306,332	2,446,316	13	1,081	1,026	32
ACA	1,597.843	10,631,645	32	5,641	5,347	266
TCA	433,151	4,344,112	23	1,418	1,342	49
ENNCA	102,818	908,719	12	242	229	10
Total	3,832,792	29,680,139	136	11,730	11,100	502

Source: JICA Study Team

(2) Annual O&M Cost

The annual O&M cost for water supply facilities was estimated at US$0.3/$m^3$ per day of treatment facility. Also, 0.5% of the initial construction cost was required for the annual O&M of water source facility (dam). The O&M cost is further converted to its economic value.

(3) Replacement Cost

The replacement cost is required for mechanical facilities such as pipes every 15 years and was set at 30% of the initial construction cost.

6.4 Results of Economic Evaluation

The results of economic evaluation by catchment area are summarised in the following table. Four out of the six catchments have an EIRR greater than 10%. The RVCA and the ACA were found not economically viable because of their high water transfer costs (both RVCA and ACA), desalination scheme (ACA), and high dam cost (RVCA). The TCA includes a water transfer component in the High Grand Falls, but its economic viability was still positive with an EIRR greater than 10%. In terms of economic benefits in NPV, the ACA has the largest – increasing the national economy by US$5,326 million at the present value.

Summary of Economic Evaluation Results for Urban Water Supply by Catchment

(Unit: US$ million)

Catchment Area	Net Present Value (10%)		B/C	EIRR
	Cost	Benefit		
LVNCA	1,745	2,278	1.31	14.0%
LVSCA	1,914	2,415	1.26	13.3%
RVCA	1,090	1,035	0.95	9.3%
ACA	6,315	5,326	0.84	7.7%
TCA	1,471	1,494	1.02	10.2%
ENNCA	263	350	1.33	14.1%
Total	12,798	12,919	10.11	10.1%

Source: JICA Study Team

CHAPTER 7 IMPLEMENTATION PROGRAMME

7.1 General

The implementation program for water supply projects toward 2030 was formulated to complete all of the projects in order to meet the water demand in 2030. The implementation schedule was considered in three terms: the short term (five years from 2013 to 2017), the medium term (five years from 2018 to 2022), and the long term (eight years from 2023 and 2030). The implementation schedule of the water supply development plan was considered in accordance with the water resources development plan, including the dam construction plan.

The total development capacity of the proposed projects by 2030 is 3.72 million m^3/day, which is more than three times the current capacity of existing water supply systems. It is quite a huge development plan, and may have to be modified due to financial constraints.

The individual projects will have EIAs which will address all issues including land acquisition and compensation.

7.2 Prioritization Criteria for Implementation

Rehabilitation of the existing urban water supply systems has the highest priority, in order to achieve effective water use. The rehabilitation projects for 98 urban centres with water supply system are proposed to be commenced in the short term.

Basically, each water supply system is proposed to be developed in two phases by 2030 in order to avoid overdevelopment. The plan of second phase projects can be modified after completion of the first phase projects.

As for urban water supply projects for new development and expansion, prioritization of implementation was made using the following criteria:

1st Priority	Projects with financing
2nd Priority	Projects with detailed design completed by the WSBs
3rd Priority	Projects with feasibility study completed by the WSBs
4th Priority	Projects proposed by the WSBs, or proposed in the First Medium Term Plan
5th Priority	Projects other than the above

Within the same ranking of project status, the following criteria will be applied for further prioritization:

- Projects with larger service population have higher priority (such as urban water supply and large-scale rural water supply projects).
- Projects which expect negative environmental impacts have lower priority.

- Small-scale rural water supply projects are to be implemented progressively by individuals or communities.

7.3 Implementation Schedule for Water Supply Development Toward 2030

Based on the criteria mentioned above, the implementation schedules of urban water supply projects by catchment area was prepared, as shown in Figures 7.3.1 to 7.3.6. They are summarised in the subsection hereunder.

The overall project implementation schedule is arranged so that the necessary budget for development would be balanced in the short term (2013/14 to 2017/18), the medium term (2018/19 to 2022/23), and the long term (2023/24 to 2030/31), respectively. Figures 7.3.1 to 7.3.6 show the required project costs per each term and per each catchment area.

7.4 Recommendations for Further Surveys and Studies for the NWMP 2030

In the course of projection of water demands and formulation of the water supply development plan, several assumptions had to be introduced due to lack or insufficiency of required data and information. For the further study, the following actions are recommended.

(1) Review of Population Projection of Urban Centres

The proposed water supply development plan was formulated to meet the future demand in 2030 as estimated based on the projected population. According to Kenya Vision 2030, the urban population would drastically increase to 46.02 million by 2030, which is around 3.5 times the population in 2010 (13.08 million). A concrete basis of population growth is unknown.

As the population affects the scale of the water supply system largely, it is recommended to review the urban population of urban centres based on concrete future urban development plans such as expansion of urban area, development of urban infrastructure, future land use, and future economic activity, before realization of the water supply projects.

(2) Accumulation of Basic Data for Water Demand Projection

The water demands projected in this study are for domestic, industrial, livestock, wildlife and fisheries. However, basic data for the projection were not sufficient and the projection has to be made by rough estimation.

It is recommended to accumulate basic data required for the projection of respective water demands for more accurate water demand projections. For this, the preparation of concrete development plans such as development plans for urban centres and counties, would be required.

The domestic water demand in the master plan was estimated by using unit water consumption amounts stipulated in the Design Manual of Kenya. In case of the increase of unit water consumption due to the level-up of the living standards in Kenya, it will be necessary to revise the relevant manuals and guidelines to re-estimate the domestic water demand.

The future industrial water demand was estimated based on a future domestic water demand in each area. If an industrial development was planned clearly in a certain area, the industrial water demand for the area should be revised based on the development plan.

(3) Measuring of Actual Water Supply Amount

The present water supply amount for domestic use was estimated through the present water demand due to the insufficiency of data required for estimation. The Water Supply Strategic Plan 2009 mentioned that the average water meter installation rate of registered WSPs is only 86%. Furthermore, many WSPs do not accurately read the meters, and the meters are not functioning well.

It is recommended to install and manage the water meters so as to cover all population under service of WSPs since the accurate measurement of the actual water supply amount is essential for the proper water supply system development.

Tables

Table 2.2.1 Basic Data of Water Service Providers

WSP	No. of Towns	Population in Service Area	Population Served	% Served	No. of Connections	Production (m3 000)	NRW %	No. of Staff
Very Large WSPs								
Nairobi	6	3,203,201	2,157,826	67	401,669	154,000	40	1,918
Mombasa	6	975,520	618,594	63	71,798	16,240	35	483
Eldoret	1	401,456	260,512	65	42,593	15,513	52	186
Nakuru	1	674,789	472,352	70	40,910	10,302	47	212
Large WSPs								
Nakuru Rural	5	441,174	202,378	46	28,921	6,405	35	118
Nzoia	4	377,036	174,215	46	28,292	5,109	57	155
Nyeri	1	122,203	83,408	68	19,863	5,219	39	111
Mathira	2	180,000	54,000	30	19,414	3,967	61	62
Othaya Mukurw	2	205,759	126,156	61	18,566	6,753	65	85
Kirinyaga	5	348,000	110,106	32	18,531	1,505	86	192
Western	6	448,400	131,617	29	16,364	2,170	41	100
Kilifi Mariakani	11	764,090	428,161	56	16,136	4,424	39	164
Murang'a South	4	299,297	91,038	30	14,932	3,368	57	62
Chemosit	14	105,535	48,523	46	14,716	2,628	67	109
Kisumu	1	525,313	153,083	29	14,084	6,200	62	135
Kahuti	1	179,983	34,212	19	13,156	3,240	72	59
Kericho	1	118,720	60,543	51	13,010	3,007	52	120
Malindi	4	259,756	207,805	80	12,486	4,301	7	75
Tetu Aberdare	3	103,202	69,769	68	11,819	2,473	63	56
Gatamathi	2	194,111	44,954	23	11,478	3,069	79	26
Nanyuki	1	83,360	50,360	60	11,364	3,832	46	83
Nyahururu	9	95,000	35,564	37	10,156	2,291	57	98
Kikuyu	3	112,830	38,136	34	10,047	1,859	46	37
Medium WSPs								
Gatundu	3	255,394	31,766	12	9,717	3,212	69	51
Garissa	2	186,522	121,239	65	9,587	3,960	64	89
Embu	1	140,000	67,549	48	9,545	3,726	57	55
Naivasha	1	70,000	19,200	27	9,240	585	47	23
Tavevo	3	259,772	126,114	49	8,914	3,072		91
Machakos	1	161,000	10,494	7	8,485	545	41	52
Imetha	7	120,872	14,160	12	8,435	3,447	81	70
Murang'a	3	47,000	24,816	53	8,200	816	50	67
Meru	1	105,985	53,146	50	7,537	1,926	28	70
South Nyanza	5	680,000	573,020	84	7,417	2,236	39	100
Ngagaka	1	64,000	26,652	42	6,698	3,500	87	39
Gatanga	1	121,000	31,644	26	6,528	1,945	42	31
Isiolo	1	70,000	28,310	40	6,496	1,234	38	55
Ruiru Juja	2	115,376	50,765	44	6,302	816	26	40
Kwale	5	174,339	67,944	39	5,979	3,189	59	71
Karimenu	1	106,865	42,746	40	5,956	2,190	93	22
Ngandori Mginda	4	73,000	28,170	39	5,936	5,110	77	30
Gusii	7	1,600,000	300,000	19	5,743	1,210	45	147
Tuuru	1	335,912	162,442	48	5,682	1,103	62	83
Ngariama Njukiini	1	50,000	15,984	32	5,407	4,680	96	22
Oloolaiser	3	420,000	32,528	8	5,203	1,623	40	52
Small WSPs								
Kyeni	2	68,200	11,352	17	4,591	107	40	15
Kiambu	8	89,921	15,162	17	4,329	1,041	38	36
Kitui	2	542,000	135,674	25	4,071	2,728	68	53
Nol Turesh	2	66,667	50,000	75	4,001	3,857	64	60
Eldama Ravine	1	61,986	30,211	49	3,969	1,601	80	37
Mavoko	1	170,000	35,595	21	3,849	688	35	47
Embe	3	60,000	8,442	14	3,257	710	80	43
Lodwar	7	85,000	25,321	30	2,860	849	29	32
Nithi	3	69,811	15,996	23	2,811	1,385	74	40
Githunguru	2	130,067	6,072	5	2,780	92		13
Kapenguria	7	92,700	7,524	8	2,595	622	42	36
Lamu	2	23,500	14,774	63	2,577	540	33	26
Olkalou	1	71,000	16,230	23	2,198	129		10
Nyandarua North	4	40,000	5,394	13	2,189	143		27
Narok	1	60,000	25,814	43	1,994	792	58	18
Tarda Kiambere	1	115,000	40,000	35	1,887	320	31	24
Kibwezi Mtito	1	186,000	29,120	16	1,801	465	24	29
Engineer Town	1	25,000	5,454	22	1,634	214		5
Makindu	1	63,178	18,996	30	1,401	726	48	21
Kapsabet Nandi	1	32,500	6,417	20	1,365	209	64	14
Uasin Gishu	6	61,773	8,392	14	1,350	545	48	53
Iten Tambach	1	45,387	7,888	17	1,322	253	47	14
Muthambi	1	22,273	9,180	41	1,299	389	40	12
Ndaragwa	1	25,000	5,802	23	1,201	700		11
Teso	2	47,550	7,008	15	1,091	198		7
Maralal	1	40,974	5,900	14	970	500	30	23
Tachasis	3	23,152	3,536	15	752	341	60	5
Rumuruti	1	12,000	3,344	28	532	7		14
Tia Wira	1	6,200	2,030	33	358	123	67	3
Upper Chania	1	25,700	7,148	28	341	45		10
Vihiga	2	8,600	784	9	206			17
Kathita Kiirua	1	32,000	7,020	22	162	523	26	16
Trans Nzoia	1	6,000	408	7	124	14	26	7
Total	**220**	**17,784,911**	**8,053,989**	**45**	**1,079,179**	**338,856**		**6,684**

Source: IMPACT Issue No.3

Table 2.2.2 Performance Records of Water Service Providers

WSP	Drinking Water Quality	Compliance with Cl_2 Standards	NRW %	Water Coverage %	Sanitation Coverage %	No. Hours Supply	Staffing	Collection Efficiency %	O&M Cost Coverage %	Metering Ratio (%)	Overall Ranking
Very Large WSPs											
Nairobi	100	98	40	67	29	13	5	80	113	94	6
Mombasa	58	91	35	83	88	6	10	90	114	55	22
Eldoret	71	94	52	65	80	24	4	81	101	90	12
Nakuru	64	100	47	70	73	16	5	92	118	89	8
Large WSPs											
Nakuru Rural	78	100	35	46	No data	7	9	90	111	18	38
Nzoia	60	99	57	46	62	20	7	88	87	62	28
Nyeri	100	99	39	68	87	24	6	90	143	96	1
Mathira	100	100	61	30	67	20	7	78	90	39	27
Othaya Mukurw	100	97	65	61	97	17	9	69	66	41	33
Kirinyaga	100	99	86	32	No data	23	18	107	105	85	23
Western	98	84	41	29	29	11	11	79	53	0	47
Kilifi Mariakani	76	90	39	56	52	24	20	83	86	62	36
Murang'a South	83	90	57	30	78	8	10	96	48	32	58
Chemosit	100	90	67	46	No data	10	19	78	25	85	54
Kisumu	91	94	62	29	6	18	10	84	97	96	21
Kahuti	84	100	72	19	70	18	13	87	85	51	49
Kericho	100	100	52	51	15	23	11	86	102	99	10
Malindi	82	96	7	80	53	24	6	85	70	98	4
Tetu Aberdare	44	100	63	68	100	20	7	80	107	78	14
Gatamathi	95	91	79	23	81	16	5	101	91	29	25
Nanyuki	100	99	46	60	98	16	7	84	81	85	7
Nyahururu	73	96	57	37	65	18	10	95	108	85	18
Kikuyu	No data	No data	46	34	70	16	5	94	70	96	29
Medium WSPs											
Gatundu	No data	No data	69	12	80	24	10	53	122	67	65
Garissa	99	100	64	65	74	17	10	74	67	77	20
Embu	100	93	57	48	92	22	6	92	135	92	3
Naivasha	No data	No data	47	27	72	12	3	88	82	3	43
Tavevo	46	100	No data	49	100	9	18	65	No data	64	66
Machakos	No data	No data	41	7	16	No data	9	82	43	25	63
Imetha	100	100	81	12	39	16	34	64	51	60	61
Murang'a	96	98	50	53	96	18	9	103	80	83	5
Meru	99	97	28	50	100	24	11	110	127	97	2
South Nyanza	97	97	39	No data	No data	18	15	95	49	80	13
Ngagaka	No data	No data	87	42	No data	8	9	90	141	96	34
Gatanga	100	100	42	26	100	6	6	70	168	54	19
Isiolo	50	100	38	40	88	18	10	110	113	86	9
Ruiru Juja	87	96	26	44	100	12	8	86	59	67	17
Kwale	72	84	59	39	36	12	21	34	46	2	76
Karimenu	No data	No data	93	40	94	8	6	84	81	78	55
Ngandori Mginda	63	100	77	39	No data	6	6	93	131	No data	45
Gusii	87	100	45	19	8	No data	26	72	34	No data	68
Tuuru	No data	No data	62	48	4	24	22	101	94	98	42
Ngariama Njukiini	No data	No data	96	32	No data	18	8	120	154	6	40
Oloolaiser	88	100	40	8	40	9	15	78	63	78	46
Small WSPs											
Kyeni	No data	No data	40	17	100	5	11	89	51	29	57
Kiambu	100	100	38	17	94	No data	9	92	104	80	11
Kitui	No data	96	68	25	No data	6	17	75	38	75	71
Nol Turesh	No data	No data	64	75	30	24	15	66	32	29	62
Eldama Ravine	100	83	80	49	74	12	19	106	No data	26	44
Mavoko	100	100	35	21	No data	5	15	95	27	93	24
Embe	69	47	80	14	36	7	53	101	80	44	74
Lodwar	39	100	29	30	51	16	14	99	77	26	26
Nithi	70	93	74	23	5	22	23	71	78	84	60
Githunguru	100	100	No data	5	No data	12	13	84	104	64	39
Kapenguria	32	100	42	8	67	12	34	99	38	15	52
Lamu	19	No data	33	No data	No data	12	16	104	84	No data	53
Olkalou	No data	No data	No data	23	50	14	6	89	45	55	59
Nyandarua North	73	98	No data	13	100	19	29	51	12	78	67
Narok	75	100	58	43	100	10	11	67	33	90	48
Tarda Kiambere	100	98	31	35	2	12	16	123	53	59	32
Kibwezi Mtito	100	100	24	16	92	24	27	88	76	0	15
Engineer Town	No data	No data	No data	22	93	8	3	78	64	13	64
Makindu	100	97	48	30	70	22	16	80	57	94	16
Kapsabet Nandi	75	100	64	20	No data	6	33	84	41	35	72
Uasin Gishu	No data	No data	48	14	34	10	115	83	6	0	69
Iten Tambach	100	97	47	17	91	12	14	84	No data	38	30
Muthambi	No data	No data	40	41	No data	24	10	72	79	98	35
Ndaragwa	100	No data	No data	23	100	7	12	No data	0	No data	70
Teso	100	99	No data	15	87	13	11	78	35	0	41
Maralal	100	100	30	14	No data	6	26	81	48	99	31
Tachasis	No data	No data	60	15	45	24	13	94	94	0	50
Rumuruti	No data	No data	No data	28	88	6	No data	83	21	0	75
Tia Wira	No data	No data	67	33	34	16	9	93	80	0	56
Upper Chania	60	67	No data	28	No data	No data	30	62	51	4	77
Vihiga	No data	No data	No data	9	91	8	No data	61	5	93	73
Kathita Kiirua	No data	No data	26	22	No data	18	99	96	159	90	37
Trans Nzoia	100	88	26	7	No data	8	113	39	3	90	51

Legend:

Good Acceptable Not Acceptable

* Indicating the degree of compliance with WSP targets from IMPACT Issue No.3.

Source: IMPACT Issue No.3

Table 2.3.1 Service Population of Each Water Connection

Catchment Area	Items	Total Population (2010)	Piped by WSPs	Spring/Well/ Borehole	Water Vendor	Stream/Lake/ Pond/Others
			UWS and LSRWSS	SSRWSS	-	-
LVNCA	Population (million persons)	6.96	0.77	4.59	0.07	1.53
	Ratio	100%	11%	66%	1%	22%
LVSCA	Population (million persons)	7.37	0.88	3.02	0.15	3.39
	Ratio	101%	12%	41%	2%	46%
RVCA	Population (million persons)	4.86	1.36	1.56	0.44	1.51
	Ratio	100%	28%	32%	9%	31%
ACA	Population (million persons)	9.79	5.29	2.15	1.27	1.08
	Ratio	100%	54%	22%	13%	11%
TCA	Population (million persons)	5.73	1.95	1.43	0.23	2.12
	Ratio	100%	34%	25%	4%	37%
ENNCA	Population (million persons)	3.82	0.99	1.53	0.31	0.99
	Ratio	100%	26%	40%	8%	26%
Total	Population (million persons)	38.53	4.24	25.43	0.39	8.48
	Ratio	100%	11%	66%	1%	22%

Note:
1) The ratios and total populations are estimated based on Census 2009.
2) The service population of each connection is caluculated by multiplying the tatol populations and the ratios
Source: JICA Study Team, based on Census 2009.

Table 2.3.2 Capacities of Existing Water Supply Systems

(Unit: m^3/day)

Catchment Area	Completed Systems			Systems Under-construction	Ground-total
	UWSS	LSRWSS	Total	UWSS	
LVN	103,890	10,326	114,216	31,000	145,216
LVS	63,349	26,089	89,438	57,000	146,438
RVCA	91,322	6,594	97,916	37,600	135,516
ACA	664,589	9,587	674,176	34,720	708,896
TCA	96,026	148,972	244,998	10,000	254,998
ENNCA	20,919	6,948	27,867	11,548	39,415
Total	1,040,095	208,516	1,248,611	181,868	1,430,479

Note:

1) Breakdown of capacities of the completed systems is shown in Table 2.3.4.

2) Breakdown of capacities of the under-construction systems of UWSS is shown in Table 2.3.5.

3) Capacities of the completed systems of UWSS are shown in Tables 4.3.1, 4.4.1, 4.5.1, 4.6.1, 4.7.1 and 4.8.1.

4) Capacities of LSRWSS are values obtained by subtracting capacities of UWSS from total capacities.

Source: JICA Study Team, based on data from WSBs

Table 2.3.3 Existing Urban Water Supply System

(Unit: m^3/day)

Catchment Area	Completed	Under-construction	Total
LVN	103,890	31,000	134,890
LVS	63,349	57,000	120,349
RVCA	91,322	37,600	128,922
ACA	664,589	34,720	699,309
TCA	96,026	10,000	106,026
ENNCA	20,919	11,548	32,467
Total	1,040,095	181,868	1,221,963

Source: JICA Study Team (Ref. Table 2.3.2)

Table 2.3.4 Existing Water Supply and Capacity (1/8)

CA	Water Service Providers	Existing Water Supply Systems and Capacities							
		Water Supply Systems	Urban Centres	Market Centres	County	River/Lake (m^3/day)	Borehole (m^3/day)	Dam (m^3/day)	Water Source Name(s)
LVNCA	Eldoret WSC	Chebara	Eldoret		Uasin Gishu	0		18,000	Chebara
		Sosiani	Eldoret		Uasin Gishu			14,950	Sosiani
		Kapsoya	Eldoret		Uasin Gishu	3,450			Kapsoya
	Nzoia WSC	Kitale, Kapolet	Kitale	Kapolet	Trans Nzoia	10,000			Kitale, Kapolet
		Kimilili, Kamtiong	Kimilili	Kamtiong	Trans Nzoia	3,200			Kamtiong
		Webuye	Webuye		Trans Nzoia	7,000			Webuye, Broderick Falls
				Malakhisi, malaba, Kocholia	Trans Nzoia				
		Bungoma, Matisi	Bungoma	Matisi	Trans Nzoia	7,000			Matisi
	Western WSC	Tindinyo	Kakamega		Kakamega/Busia	16,000			Tuiyobei, Nandi South Forest
		Mumias	Mumias		Kakamega/Busia	1,680			Mumias
		Busia Mundika	Busia, Nambale		Kakamega/Busia	7,400			Mundika
	Amatsi WSC	Maseno	Maseno		Vihiga	2,400			Maseno
		Mbale, Lunyerere		Mbale	Vihiga	2,200			Lunyerere
		Kaimosi	Kaimosi		Vihiga	1,440			Kaimosi
		Sosiani		Sosiani	Vihiga	250			Sosiani Spring
		Vihiga	Vihiga		Vihiga	60			Vihiga Spring
	Kapsabet Nandi WSC	Kapsabet , Kabutie	Kapsabet	Kabutie	Nandi	3,800			Kabutie
	Item Tambach Water Project	Iten/Tambach Water supply	Iten Town		Elgeiyo marakwet	0		1,000	Yokot dam
			Tambach Town		Elgeiyo marakwet	110			Tambach Springs
	Uasin Gishu District			Sosiani, Sigowet, Mosombor	Uasin Gishu	1,299	0	0	
	Lugari District			Lugari	Trans Nzoia	164			
	Trans Nzoia District			Kitale environs	Trans Nzoia	66			
	Sibo WSC (SIBO WASCO)	Sidindi Malanga	Yala		Siaya	2,400			Yala
		Sega		Sega	Siaya		264		Borehole No.C6154
		Ugunja	Ugunja		Siaya		385		Borehole
		Ukwala	Ukwala		Siaya		360		Borehole
		Siaya	Siaya		Siaya			2,100	Abura Dam
		Mauna Dam		Mauna	Siaya			1,200	Mauna Dam
		Bondo		Bondo	Siaya	1,125			Yala River
		Asembo Bay		Asembo Bay	Siaya	1,170			L. Victoria
		South Sakwa		South Sakwa-Bondo	Siaya	1,700			L. Victoria
	Kapenguria WSC	West Pokot county water supply	Kapenguria		West Pokot	1,680			
				Kapenguria environs	West Pokot	230			5 Rivers
									Sigor River
								133	Kacheliba dam
TOTAL						75,824	1,009	37,383	114,216

Table 2.3.4 Existing Water Supply and Capacity (2/8)

CA	Water Service Providers	Existing Water Supply Systems and Capacities							
		Water Supply Systems	Urban Centres	Market Centres	County	River/Lake (m^3/day)	Borehole (m^3/day)	Dam (m^3/day)	Water Source Name(s)
LVSCA	Kisumu WSC (KIWASCO)	Dunga	Kisumu		Kisumu	21,000			Victoria
		Kajulu			Kisumu	1,400			Kibos springs
	Kericho WSC (KEWASCO)	Timbili	Kericho		Kericho	8,640			Timbilil
		Kimugu			Kericho	4,320			Kimugu
		Ngecherok		Kapsoit	Kericho	720			3 No. protected Springs
	Nyanas WSC (NYANAS WASCO)	Nyakach		Sondu/Nyabondo/Katito	Kisumu	1,440			Sondu
		Muhoroni	Muhoroni		Kisumu	720			Muhoroni
		Koru Mnara		Koru Mnara	Kisumu	90			Manera spring/Kipchorian stream
		Kibigori		Kibigori	Kisumu	200			Stream
		Awasi	Awasi		Kisumu		100		Borehole
		Tamu		Tamu	Kisumu		80		Bore hole
		Nandi hills	Nandi hills		Nandi	268			Taitu Stream
		Kaptumo		Kaptumo	Nandi	16			Kapngoriam/kaptumo stream.
		Mosombor		Mosombor	Nandi	46			Kapngoriam/kaptumo stream.
		Lessos		Lessos	Nandi			432	Dam
		Kemeloi/Kubujoi		Kemeloi/Kubujoi	Kisumu	1,440			Kimendi
	Tililbei WSC (TILILBEI WASCO)	Litein	Litein		Bomet	12,000			Itare
		Chebangang		Chebangang	Bomet	1,250			Kiptiget
		Fort Tenan		Fort -Tenan	Bomet	360			Sombo
		Sotik	Sotik		Bomet	500			Kapsonoi
		Bomet	Bomet		Bomet	450			Nyangores
		Sigowet		Sigowet	Bomet	50			Kipsamoi (protected)springs
		Longisa		Longisa	Bomet	425			Amala
		Chepalungu		Chepalungu	Bomet	520			Nyangores
		Sosiot		Sosiot	Bomet	630			Cheboseron.
		Bargeywet		Bargeywet	Bomet	230			Stream
		Londiani	Londiani		Bomet			300	Masaita
		Kipkelion	Kipkelion		Bomet	280			Kipchorian
		Sigor		Sigor	Bomet	425			Nyangores
		Kipsitet		Kipsitet	Bomet	260			Stream
		Chesinende		Chesinende	Bomet			120	Dam
		Chepkemel		Chepkemel	Bomet	Under rehabilitation			Springs
	Gulf WSC	Maseno kombewa		Kombewa/Ojola	Kisumu	1,800			Maragoli
		Kisumu rural		Seme	Kisumu	2,000			L. Victoria
		Nyahera		Nyahera/Kiboswa	Kisumu	360			Orinde springs
		Mkendwa Kanyakwar		Mkendwa/Kiboswa	Kisumu	360			Orinde springs

Table 2.3.4 Existing Water Supply and Capacity (3/8)

CA	Water Service Providers	Existing Water Supply Systems and Capacities							
		Water Supply Systems	Urban Centres	Market Centres	County	River/Lake (m^3/day)	Borehole (m^3/day)	Dam (m^3/day)	Water Source Name(s)
LVSCA	Mikutra WSC (MIKUTRA WASCO)	Kilgoris	Kilgoris		Narok	400			Stream
		Angata Barakoi		Angata Barakoi	Narok	172			Protected Spring
		Nkararu		Nkararu	Narok	38			Springs
		Migori	Migori		Migori		1,056		3 No. Boreholes
		Rongo	Rongo		Migori	320			Misadhi
		Lolgorian	Lolgorian		Narok	60			Borehole
		Kehancha	Kehancha		Migori			320	Orarwe
		Isebania		Isebania	Migori	480			Ragana
	Gusii WSC (GUSII WASCO)	Nyamira	Nyamira		Kisii	3,200			Eaka
		Tabaka	Tabaka		Kisii	150			3 No. Springs
		Ogembo	Ogembo		Kisii	600			Gucha,Ekerongo & Mosora spring
		Keroka		Keroka	Kisii	600			Chiro chiro
		Gesusu		Gesusu	Kisii	300			Protected Stream
		Kisii	Kisii		Kisii	6,000			Gucha
		Nyakomisaro	Kisii		Kisii	1,500			Nyakomisaro Spring
		Birongo		Birongo	Kisii	2,400			Chiro chiro
		Borabu	Nyansiongo		Kisii			600	Gesebei
	South Nyanza WSC	Mbita	Mbita		Homa Bay	260			L. Victoria
		Oyugis	Oyugis		Homa Bay	1,920			Awach kibuon
		Kendu Bay	Kendu Bay/Kosele		Homa Bay	720			Awach kibuon
		West Karachuonyo		Adiedo/West karachuonyo	Homa Bay	1,280			L. Victoria
		Homa Bay	Homa Bay		Homa Bay	3,500			L. Victoria
		Ndhiwa		Ndhiwa	Homa Bay		30		2 Boreholes
	Nyasare	Nyasare	Migori		Migori	300			Springs
TOTAL						86,400	1,266	1,772	89,438

Table 2.3.4 Existing Water Supply and Capacity (4/8)

CA	Water Service Providers	Existing Water Supply Systems and Capacities							
		Water Supply Systems	Urban Centres	Market Centres	County	River/Lake (m^3/day)	Borehole (m^3/day)	Dam (m^3/day)	Water Source Name(s)
RVCA	Tachasis	Tachasis	Tachasis			1,548			Springs
	Nakuru WSC	Nakuru Water Supply	Nakuru Municipality		Nakuru	1,800			Mereroni River
			Nakuru Municipality		Nakuru	1,750			Malewa River
			Nakuru Municipality		Nakuru		33,200		24 boreholes
			Nakuru Municipality		Nakuru			5,000	Turasha
	Nakuru Rural WSC		Nakuru Suburbs, Molo, Njoro	Elburgon	Nakuru			21,193	Turasha dam
					Nakuru	3,100			Springs
					Nakuru	1,000			Rongai South Spring
					Nakuru		1,040		11 Boreholes
	Ol Kalou WSC	Olkalou town water supply	Olkalou Town		Nyandarua	2,000			Malewa
					Nyandarua		87		5 Boreholes
	Lodwar WSC	Lodwar town water supply	Lodwar Town		Turkana	0	3,068		7 Bore holes
	Narok WSC	Narok water supply	Narok Town		Narok	1,700			River Narok
					Narok		180		Borehole 1
	Eldama Ravine WSC	Eldama Ravine water supply	E/Ravine		Baringo	1,400			Narusura
					Baringo	5,300			Chemususu River
	Naivasha WSC	Naivasha water supply	Naivasha, Gilgil	Suswa	Nakuru	0	7,008		6 Bore holes
	Kabarnet WSC	Kabarnet Water Supply Scheme	Kabarnet		Baringo	0		2,496	Kirandich
	Tia Wira			Kamba	Nakuru	350			
	Engineer Town		Engineer		Nyandarua	300			Kinja
	Kikana Mku			Njeru	Nakuru	1,426			Kitiri
	Mawingo			Mawingo	Nakuru	800			Pesi
	Nyakanja			Nyakanja	Nyandarua	430			Springs
	Gitei			Gitei	Nakuru	250			Wanjohi
	Kinja			Kinja	Nyandarua	380			River Kinja
	Other					110		1,000	
TOTAL						23,644	44,583	29,689	97,916

Table 2.3.4 Existing Water Supply and Capacity (5/8)

CA	Water Service Providers	Existing Water Supply Systems and Capacities							
		Water Supply Systems	Urban Centres	Market Centres	County	River/Lake (m^3/day)	Borehole (m^3/day)	Dam (m^3/day)	Water Source Name(s)
ACA	Nairobi and Sattelite Towns[Urban]								
	Kiambu WSC	Kiambu Off takes	Kiambu	Riambai	Kiambu	0		206	
		Gichocho B Water Project		Ndumberi	Kiambu	0		25	
		Kihingo Water Project	Kiambu		Kiambu		70		
		Thuku B/H	Kiambu		Kiambu		301		
	Ruiru-Juja WSC	Ruiru Water Supply	Ruiru, Juja		Kiambu	1,600			
		Membley Water Supply		Membley	Kiambu	1,400			
	Karuri WSC	Karuri Water Supply	Karuri		Kiambu	0	975		
	Thika WSC	Thika Water Supply	Thika		Kiambu	4,400			Ruiru R.
	Nairobi WSC	Nairobi City Water Supply	Nairobi		Nairobi	0		59,000	Sasumua
			Nairobi		Nairobi			420,000	Thika-Chania
			Nairobi		Nairobi			22,000	Ruiru
			Nairobi		Nairobi	4,000			Kikuyu Springs
	Limuru WSC	Limuru Water Supply	Limuru		Kiambu	0	300		
		Thigio Water Project		Thigio	Kiambu			2,000	
		Bathi Water Supply		Kimende	Kiambu	3,000			
	Kikuyu WSC	Runana storage tank		Rural	Kiambu	0		1,600	Kikuyu D.
		Thogoto Water Project		Thogoto	Kiambu		550		
		Thamanda and Ndum boreholes		Rural	Kiambu		240		
		Muguga Water Project		Muguga	Kiambu		600		
		Kikuyu Water Supply Scheme	Kikuyu		Kiambu	2,750			
		Ruku Water Project		Rural	Kiambu		72		
		Karai Water Supply Scheme		Karai	Kiambu		4,746		
	Machakos WSC		Mavoko	Katani, Syokimau, Lukenya, Chumvi, JKIA	Machakos			500	Mavoko Portland Dam
					Machakos		220		Kinanie,
					Machakos	2,201			Bulk water from Nairobi Water Co.
	Oloolaiser WSC	Ongata Rongai, Kiserian, Matasian and Ngong Water Supplies	Ongata Rongai, Kiserian, Ngong and environs	Matasia	Kajiado	0	2,906		19 B/Hs
					Kajiado	2,935			Mbagathi river
					Kajiado	241			Springs
	Machakos WSC	Machakos, Mua Hills	Machakos	Kalumoni	Machakos	0		3,373	Maruba dam
					Machakos		91		Miwani & Iveti Plant A BHs
	Nairobi and Sattelite Towns[Rural]								
	Gatundu South WSC	Gatundu Water Scheme	Gatundu		Kiambu	1,500			
		Ndarugo Water Scheme		Ndarugo	Kiambu	2,000			
		Ruabora Water Scheme		Kiganjo	Kiambu	1,000			
		Thiririka Water Scheme		Kiganjo	Kiambu	4,500			
	Karimenu Community WSC	Karimenu 9000		Kamwangi	Kiambu	6,000			
		Karimenu 2000		Kamwangi	Kiambu	1,500			

Table 2.3.4 Existing Water Supply and Capacity (6/8)

CA	Water Service Providers	Existing Water Supply Systems and Capacities							
		Water Supply Systems	Urban Centres	Market Centres	County	River/Lake (m^3/day)	Borehole (m^3/day)	Dam (m^3/day)	Water Source Name(s)
ACA	Githunguri WSC	Githiga Water Project	Githunguri		Kiambu	3,000			
		Giathieko Borehole	Githunguri		Kiambu		120		
		Githunguri Boreholes	Githunguri		Kiambu		300		
		Komothai Water Supply		Komothai	Kiambu	3,000			
		Kiaria Boreholes		Rural	Kiambu		120		Kiaria B/H
		Mihuko Borehole		Mihugo	Kiambu		120		Mihugo B/H
		Kiratina Borehole		Rural	Kiambu		120		Kiratina B/H
		Thuita Borehole		Rural	Kiambu		120		Thuita B/H
		Gathaithi Borehole		Rural	Kiambu		120		Gathaithi B/H
		Matimbei Water Project		Rural	Kiambu	1,500			
	Kathiani WSC	Kathiani W/S	Kathiani town		Machakos	0		362	Muooni Dam
	Mbooni WSC	Mumbuni, Mulima, Tawa & Mbooni W/S		Mumbuni, Mulima,Tawa, Kikima	Machakos	0		120	Kinze & Mulima dams
					Machakos		2		Tawa B/H
	Mwala WSC	Mwala, Mbiuni, Wamunyu & Kibauni		Mwala, Mbiuni, Wamunyu, Kibauni	Kajiado	662			Athi River
					Kajiado		55		Hospital & Mwala School B/Hs
	Matunglu Kangundo WSC	Tala, Nguluni & Kyamulendu W/S	Kangundo-Tala	Matungulu	Machakos	0	240		Ndovoini A, Kyamulendu, Nguluni, Tala & Isinga B/Hs
	Mombasa and Surrounding Area								
	Mombasa WSC	Mzima water works and pipeline	Mombasa		Mombasa	28,000		0	Mzima springs
		Marere water supply pipeline	Mombasa		Mombasa	4,000		0	Marere springs
		Sabaki/Baricho well field and pipeline	Mombasa		Mombasa	28,800		0	Sabaki wellfield
		Tiwi boreholes/Likoni Pipeline	Mombasa		Mombasa		2,900		Tiwi Boreholes
	Malindi WSC	Baricho well field and pipeline	Malindi & Watamu		Kilifi	11,500			Sabaki wellfield
	Kiilifi Mariakani WSC	Baricho well field and pipeline	Kilifi		Kilifi	6,400			Sabaki
	Kwale WSC	Marere-Changamwe pipeline	Kwale		Kwale	900			Marere springs
		Tiwi boreholes	Ukunda/Diani		Kwale		3,900		
			Kinango		Kwale	220			Umba R.
				Matuga	Kwale	900			mkurumuji R.
	Remainning Area								
	Kibwezi Makindu WSC	Kibwezi, Mtito Andei, Makindu	Mtito Andei, Makindu	Kibwezi, Kalama, Kibarani	Makueni	2,951			Springs
	Wote WSC	Wote W/S	Wote Town Council area		Makueni	0	225		Mwaani B/H
	Nol Turesh Loitokitok WSC	Nolturesh W/S	Sultan Hamud	Loitokitok Central, Kimana, Ramba, Marhuru, Malili, Kilome	Kajiado	5,258			Nolturesh Springs

Table 2.3.4 Existing Water Supply and Capacity (7/8)

CA	Water Service Providers	Existing Water Supply Systems and Capacities							
		Water Supply Systems	Urban Centres	Market Centres	County	River/Lake (m^3/day)	Borehole (m^3/day)	Dam (m^3/day)	Water Source Name(s)
ACA	Olkejuado WSC	Kajiado, Isinya & Bissil Water Supplies	Kajiado, Isinya, Bissil		Kajiado		625		Isinya 4 & Bissil 2 B/Hs.
	Tavevo WSC	Voi Offtakes & Mwatate w/s	Voi, Wundanyi, Taita, Mwatate		Taita Taveta	1,400			Mzima springs
	Gatanga Community Water Project	Gatanga Community Water	Gatanga		Kiambu	5,218			
		Kigio Water supply		Rural	Kiambu	200			
	Namanga Water Users Trust	Namanga W/S	Namanga town and environs		Kajiado	151			Oldonyorok Springs
					Kajiado		365		Mashamani B/H
TOTAL						144,587	20,403	509,186	674,176
TCA	Lamu WSC	Lamu scheme	Lamu		Lamu	3,400			Shella Wells
				Mokowe T.C	Lamu	200			Hindi B/Holes
	Tana WSC	Hola scheme	Hola		Tana River	1,400			Tana R.
		Ngao scheme	Garsen		Tana River	1,700			Tana R.
	Nyeri WSC	Nyeri	Nyeri Municipality		Nyeri	27,000			Chania
	Embu WSC	Embu Urban	Embu Town	Embu environs	Embu	12,000			Rupingazi
	Kirinyaga WSC	Kerugoya	Kerugoya		Kirinyaga	4,061			Githioro
		Sagana	Sagana		Kirinyaga	2,358			Ragati
		Wang'uru		Wang'uru	Kirinyaga	1,199			Irrigation canal
		Ndia	Kerugoya/Kagumo		Kirinyaga	11,834			Kururu, Kahuhi, Muhuhi, Rundu, Kangaita and Rwamthambi Rivers
	Mathira WSC	Karatina Urban	Karatina		Nyeri	2,000			Ragati
		Mathira Rural		Mathira constituency/rural	Nyeri	15,000			Ragati, Hombe
	Meru WSC	Meru Urban	Meru Town		Meru	4,509			Kathita & Gatabora spring
	Murang'a WSC	Murang'a Urban	Murang'a Town		Murang'a	4,848			Mathioya & Kayahwe
	Othaya Mukurweini	Chinga	Othaya	Mukurweini	Nyeri	16,616			Thuti,Mumwe. Kihari, Changachicha & Kihari
	Kahuti	Rwathia		Kangema	Nyeri	9,000			South Mathioya
	Murang'a South	Kigumo		Kigumo	Murang'a	9,220			Irati
	Gichugu	Kabare		Kabare	Kirinyaga	4,333			Thimba
		Ngariama		Ngariama	Kirinyaga	11,667			Mathaga, Rumindo, Kiaragana
		Kianyaga		Kianyaga	Kirinyaga	250			Thimba
		Riamiatu		Riamiatu	Kirinyaga	1,167			Kiringa
		Rukenya		Rukenya	Kirinyaga	300			Thimba
	Nithi	Nithi	ChukaTown		Tharaka-Nithi	2,700			Tungu
			Chogoria		Tharaka-Nithi	600			Kamaara (Tributary of Mara River)
	Ngandori – Nginda	Embu Rural		Embu Rural	Embu	15,000			Rupingazi
	Gathamati	Mathioya		Njumbi	Nyeri	6,000			South Mathioya
		Gatango		Kiriaini	Nyeri	2,391			North Mathioya
	Kyeni	Kyeni		Kathageri, Karurumo &Kigumo	Embu	527			Thuci & Ciangoma

Table 2.3.4 Existing Water Supply and Capacity (8/8)

CA	Water Service Providers	Existing Water Supply Systems and Capacities							
		Water Supply Systems	Urban Centres	Market Centres	County	River/Lake (m^3/day)	Borehole (m^3/day)	Dam (m^3/day)	Water Source Name(s)
TCA	Ngagaka	Embu Rural Phase 2		Kianjokoma	Embu	24,780			Thabana
	Imetha	Nkubu	Nkubu		Meru	4,100			Thingithu & Kiadegwa
	Kathita Kiirua (CEFA)	Kathita		Kiirua	Meru	1,253			Kiirua
	Tetu Aberdaire	Tetu Thegenge		Tetu	Nyeri	115			Zaina
		Titie		Titie	Nyeri	1,300			Titie & Tosha
		Aguthi		Kinaini	Nyeri	5,622			Gura
	Rukanga	Rukanga		Rukanga	Murang'a	800			Ragati
	Ruiri Thau Water Association	Ruiri		Ruiri	Meru	1,080			
	Embe	Ishiara		Ishiara	Embu	4,000			Thuci
		Ena		Ena	Embu	2,733			Ena
	Kitui WSC	Kitui & Mutomo W/S	Kitui		Kitui	0		7,296	Masinga Dam
					Kitui		460		
	Kiambere Mwingi WSC	Mwingi W/S	Mwingi		Kitui	0		1,390	Kiambere Dam
			Mwingi		Kitui		27		Kakunike, Ukasi, Kanzui & Tya Kamuthale B/Hs
	Yatta WC			Matuu	Machakos		2	702	Yatta canal & Kyua dam
	Garissa WSC	Garissa	Garissa, Madogo		Garissa	12,640			Tana
	Gatanga Community Water Project	Gatanga Community Water Scheme		Gatanga	Kiambu	5,218			
		Kigio Water supply		Rural		200			
TOTAL						235,121	489	9,388	244,998
ENNCA	Nyahururu WSC	Nyahururu	Nyahururu		Laikipia	3,832			Ewaso Narok
		Iguamati and Gatimu supply project		Mairo Inya	Laikipia			720	Kamwana
	Nanyuki WSC		Nanyuki		Laikipia	10,610			
	Isiolo WSC	Isiolo	Isiolo		Isiolo	3,220			Isiolo
	Mandera WSC	Mandera	Mandera		Mandera	1,672			Daua
	Maralal WSC	Maralal	Maralal		Samburu	0		798	Maralal
	Rumuruti WSC	Rumuruti	Rumuruti		Laikipia	185	0	0	
	Marmanet WSC	Marmanet		Marmanet	Laikipia	2,400			Ewaso Narok
	Moyale WSC	Moyale	Moyale		Marsabit	0	0	67	Holale, Odda BHs
	Nyandarua North	Nyandarua County water supply	Nyandarua County		Nyandarua	260			Kirima river
					Nyandarua			200	Olaimutia dam
					Nyandarua			211	Kamwana dam
	Tuuru	Tuuru	Laare		Meru	3,692			Springs from Nyambene hills
TOTAL						25,871	0	1,996	27,867

Source: JICA Study Team, based on Data form WSBs

Table 2.3.5 On-going Water Supply Schemes and Capacities (1/2)

CA	Water Service Providers	On-going Water Supply Schemes and Capacities							
		Water Supply Schemes	Urban Centres	Market Centres	County	River/Lake (m^3/day)	Borehole (m^3/day)	Dam (m^3/day)	Water Source Name(s)
LVNCA	Eldoret WSC	Expansion of Chebara Water Treatment works, Chebiemit-Chebara Water Supply and	Eldoret town.	Chebiemit,Chebara	Uasin Gishu	0		10,000	Chebara dam
		Lessos water supply augmentation works		kesses,Lessos	Uasin Gishu			600	Kesses dam
		Augmentation of Kapsowar Water supply	Kapsowar town		Uasin Gishu	600			Arror River
		Augmentation of Kapcherop Water supply	Kapcherop market		Uasin Gishu	600			Chepkaitit River
	Nzoia WSC	Rehabilitation and expansion of Kimilili water supply system	Kimilili town		Trans Nzoia	1,800			Kibisi River
		Augmentation of Nakayonjo water supply		Chwele market	Trans Nzoia	1,200			Kuywa river
	Western WSC	Mumias water supply augmentation works	Mumias town.	Ekero	Kakamega/Busia	15,000			Lusumu River
		Construction of Lumakanda – Kipkarren water supply project	Lumakanda.	Kipkarren	Kakamega/Busia	1,200			Kipkarren River
	Amatsi WSC	Rehabilitation of Serem and Jeptulu water supply		Serem and Jeptulu	Vihiga	600			River Garagoli
		Rehabilitation of Kaimosi water supply		Kaimosi, Shamakhokho, Lusengeli	Vihiga	600			Kaimosi dam on Garagoli River
		Rehabilitation of Hamisi water supply		Hamisi town	Vihiga	180			2 No protected springs at Kipchekwen sub-location
	Sibo WSC (SIBO WASCO)	Siaya - Bondo Water Supply	Siaya,Yala, Bondo		Siaya	20,000	0	0	R.Yala
		Asembo Bay Water Supply		Ndori & Asembo	Siaya	4,000	0	0	L.Victoria
TOTAL						45,780	0	10,600	56,380
LVSCA	Kisumu WSC (KIWASCO)	Dunga Emergency Works	Kisumu Town		Kisumu	24,000	0	0	Lake Victoria
	Mikutra WSC (MIKUTRA WASCO)	Migori Water Supply	Migori Town	Uriri, Oyani	Migori/Narok	15,000	0	0	R.Oyani
		Rongo Water Supply-I	Rongo	Riosiri		2,000	0	0	R.Misadhi
		Awendo Water Supply	Awendo Town			2,000	0	0	R. Sare
		Dede Water Supply		Dede Centre		0	350	0	Dede BH
		Isebania Water Supply		Isebania Town& Sirare		4,000	0	0	R.Ragana
	Gusii WSC (GUSII WASCO)	Keroka Water Supply		Keroka Town	Kisii	4,000	0	0	R. Ichuni
		Kegati Expansion Works	Kisii Town			12,000	0	0	R.Gucha
	South Nyanza WSC	Kanyadhiang Water		Kanyadahiang	Homa Bay	1,800	0	0	R.Awach-Kibuon
		Homa Bay Water Supply	Homa Bay Town			2,000	0	0	Lake Victoria
TOTAL						66,800	350	0	67,150
RVCA	Ol Kalou WSC		OlKalou		Nyandarua	2,600			Malewa River
	Eldama Ravine WSC	Chemususu Water supply	Eldama Ravine , Mogotio, parts of Rongai		Baringo	0	0	35,000	Chemususu
TOTAL						2,600	0	35,000	37,600

Table 2.3.5 On-going Water Supply Schemes and Capacities (2/2)

CA	Water Service Providers	On-going Water Supply Schemes and Capacities							
		Water Supply Schemes	Urban Centres	Market Centres	County	River/Lake (m^3/day)	Borehole (m^3/day)	Dam (m^3/day)	Water Source Name(s)
ACA	Gatundu South WSC	Theta	Gatundu	Ndarugo	Kiambu	0		3,000	Theta
	Karimenu Community WSC	Karemenu		Kamwangi,karimenu	Kiambu	9,000			Karemenu
		Bathi water supply		Kimende	Kiambu	2,000			Bathi
	Ruiru-Juja WSC	Ruiru	Ruiru	Membley	Kiambu	10,000			Ruiru
		Ruiru	Ruiru		Kiambu	1,000			Ruiru
		Juja	Juja		Kiambu	3,000			Ndaragu
	Githunguri WSC	Komothai Water Expansion	Githunguri	Komothai.mihugo	Kiambu	3,000			Gatamaiyo
		Theta Water Supply	Gatundu		Kiambu			3,000	Theta
	Mombasa WSC	Rehabilitation of Marere pipelines, Mzima pipelines, Baricho intake and Tiwi boreholes	Mombasa, Changamwe, Mtwapa.	Kisauni,Nyali,Shanzu	Mombasa	19,795	6,675		Mzima/marere springs, Tiwi
	Kiilifi Mariakani WSC	Rehabilitation of Baricho intake	Kilfi, Mtwapa,Mariakani,		Kilifi	10,000			Baricho intake
	Kwale WSC	Rehabilitation of Tiwi Boreholes	Kwale, Ukunda, Diani,msambweni,Kinango	Diani	Kwale	0	1,300		Tiwi
	Oloolaiser WSC	Kiserian W/S	Kiserian, Rongai,Ngong.	Matasia	Kajiado	0		15,000	The dam awaits construction of Sewer system to be impounded
	Kibwezi Makindu WSC	Kibwezi	Kibwezi & Mtito Andei	Kalama,Kibarani	Makueni	4,700			Umani Springs Phase I
	Wote WSC	Mwaani W/S	Wote		Makueni	0	300		Mwaani 2 & Kaiti B/Hs
		Kamunyolo W/S			Makueni			400	Kamunyulu dam infiltration galleries
	Olkejuado WSC	Kajiado W/S	Kajiado,Isinya,Bissil		Kajiado	0	1,000		3 B/Hs to be drilled , equiped, rising main and reticulation lines
	Matunglu Kangundo WSC	Matungulu W/S Phase I	Tala, Nguluni,Kangundo	Matunguliu,Kisukioni,Nguluni ,Kandafu,komarock.	Machakos	0	1,420		Ngalalya B/H
	Kathiani WSC		Kathiani		Machakos	0		400	Desilting Muooni dam to increase the storage capacity
TOTAL						62,495	10,695	21,800	94990
TCA	Murang'a WSC	Murang'a Bulk Water Supply	Murang'a		Muranga	10,000			Irati
	Kitui WSC	Mutitu Water Project	Mutitu		Kitui	0		320	Suburface dam & infiltration galleries.
TOTAL						10,000	0	320	10,320
ENNCA	Isiolo WSC	Isiolo	Isiolo		Isiolo	0	1,728		12 BHs
		Rugusu system			Isiolo	5,000			
		Kithima system			Isiolo	1,800			
		Isiolo			Isiolo	2,000			
	Moyale WSC	Dam rehabilitation and supply extension	Moyale		Marsabit	0		1,000	Holale
		Odda			Marsabit		20		Odda
	Upper Chania				Nyandarua	0			
TOTAL						8,800	1,748	1,000	11,548

Source: JICA Study Team, based on Data form WSBs

Table 2.3.6 Water Service Providers (WSPs) (LVNCA)

WSPs	Service Towns/Areas	Service Population in 2010	Capacity (m^3/day)	NRW
[Urban]				
Eldoret WSC	Eldoret	220,198	36,400	25%
Nzoia WSC	Kitale, Kapolet, Kimilili, Kamtiong', Webuye, Bungoma, Matisi, Malakhisi, Malaba, Kocholia	129,798	27,200	61%
Western WSC	Kakamega, Mumias, Busia, Nambale		25,080	56%
Amatsi WSC	Maseno, Mbale, Kaimosi, Vihiga	25,767	6,350	46%
Kapsabet Nandi WSC	Kapsabet	1,584	3,800	63%
Sibo WSC	Yala, Sega, Ugunja, Ukwala, Siaya, Mauna, Bondo, Asembo bay, South Sakwa-Bondo	52,590	10,704	64%
Kapenguria WSC	Kapenguria	18,281	2,043	56%
Item Tambach Water Project	Iten, Tambach	6,492	1,110	42%
[Rural]				
Uasin Gishu District	Sosiani, Sigowet, Mosombor	17,116	1,299	38%
Lugari District	Lugari	5,512	164	N.A.
Trans Zoia District	Kitale	5,046	66	25%
Total		482,384	114,216	

Source: Performance Report of Kenya's Water Services, No. 4, 2011, and data from WSBs

Table 2.3.7 Water Service Providers (WSPs) (LVSCA)

WSPs	Service Towns/Areas	Service Population in 2010	Capacity (m^3/day)	NRW
[Urban]				
Kisumu WSC	Kisumu	181,512	22,400	50%
Kericho WSC	Kericho	98,507	13,680	46%
Gusii WSC	Kisii, Nyamira, Tabaka, Ogembo, Keroka, Gesusu, Birongo, Borabu	221,439	15,350	46%
Tililbei WSC	Litein, Chebang'ang', Fort Tenan, Bomet, Sotik, Londiani, Sigowet, Longisa, Chepalungu, Sosiot, Bargeywet, Kipkelion, Sigor, Kipsitet, Chesinende, Chepkemel	79,488	17,800	N.A
South Nyanza WSC	Mbita, Oyugis, Seme, Nyahera, Kendu Bay, West Karachuonyo, Homa Bay, Ndhiwa	417,021	7,710	39%
Nyanas WSC	Sondu, Muhoroni, Koru Mnara, Kibigori, Awasi, Tamu, Nandi Hills, Kaptumo, Mosombor, Lessos, Kubujoi	302,747	4,832	66%
Gulf WSC	Kombewa, Kiboswa	6,956	4,520	59%
Mikutra WSC	Kilgoris, Angata Barakoi, Nkararu, Migori, Isebania, Rongo, Lolgorian, Kehancha	11,814	2,846	60&
[Rural]				
NYASARE	Migori	N.A	300	N.A
Total		1,319,484	89,438	

Source: Performance Report of Kenya's Water Services, No. 4, 2011, and data from WSBs

Table 2.3.8 Water Service Providers (WSPs) (RVCA)

WSPs	Service Towns/Areas	Service Population in 2010	Capacity (m^3/day)	NRW
[Urban]				
Nakuru WSC	Nakuru	372,366	41,750	53%
Nakuru Rural WSC	Molo, Elburgon, Njoro, Rongai	213,476	26,333	62%
Ol Kalou WSC	Olkalou	10,240	2,087	30%
Lodwar WSC	Lodwar	28,920	3,068	66%
Narok WSC	Narok	12,540	1,880	45%
Eldama Ravine WSC	Eldama Ravine	26,013	6,700	80%
Naivasha WSC	Naivasha, Gilgil, Suswa	54,420	7,008	44%
Kabarnet WSC	Kabarnet	N.A	2,496	N.A
[Rural]				
Engineer Town	Engineer	5,700	300	N.A
Mawingo	Mawingu	10,000	800	95%
Kikana Mku	Njeru	28,536	1,426	51%
Kinja	Kinja	4,500	380	N.A
Tachasis	Tachasis & Environs	4,106	1,548	44%
Others			2,140	
Total		777,309	97,916	

Source: Performance Report of Kenya's Water Services, No. 4, 2011, and data from WSBs

Table 2.3.9 Water Service Providers (WSPs) in Nairobi and Satellite Towns (ACA)

WSPs	Service Towns/Areas	Service Population in 2010	Capacity (m^3/day)	NRW
[Urban]				
Kiambu WSC	Kiambu, Riambai, Ndumberi,	21,630	602	58%
Ruiru-Juja WSC	Ruiru, Juja, Membley	69,740	3,000	31%
Karuri WSC	Karuri	13,896	975	45%
Thika WSC	Thika	2,465,749	509,400	39%
Nairobi WSC	Nairobi, Thika, Kikuyu, Ngong', Machakos, Athi River			42%
Limuru WSC	Limuru, Kimende, Thigio	59,590	5,300	33%
Kikuyu WSC	Kikuyu, Thogoto, Muguga, Karai	32,868	10,558	54%
Runda WSC	Runda	13,180	-	35%
Mavoko EPZA WSC	Mlolongo, Katani, Syokimau, Athi River, Lukenya, Chumvi, JKIA	47,571	2,921	37%
Oloolaiser WSC	Ongata Rongai, Kiserian, Matasia, Ngong	116,025	6,082	44%
Machakos WSC	Machakos	13,412	3,464	48%
[Rural]				
Gatundu South WSC	Gatundu, Ndarugo	68,784	9,000	69%
Karimenu Community WSC	Karimenu	21,000	7,500	89%
Githunguri WSC	Githunguri, Komothai, Mihugo	20,844	10,020	30%
Kathiani WSC	Kathiani	N.A	362	N.A
Mbooni WSC	Mumbuni, Mulima, Tawa, Kikima	N.A	122	N.A
Mwala WSC	Mwala, Mbiuni, Wamunyu, Kibauni	N.A	717	N.A
Matunglu Kangundo WSC	Kangundo, Tala, Matungulu	N.A	240	N.A
Total		2,964,289	570,262	

Source: Performance Report of Kenya's Water Services, No. 4, 2011, and data from WSBs

Table 2.3.10 Water Service Providers (WSPs) in Mombasa Coastal Area (ACA)

WSPs	Service Towns/Areas	Service Population in 2010	Capacity (m^3/day)	NRW
[Urban]				
Mombasa WSC	Mombasa, Changamwe, Kisauni, Mtwapa, Nyali, Shanzu	708,054	63,700	35%
Malindi WSC	Malindi, Gede	186,300	11,500	25%
Kilifi Mariakani WSC	Kilifi, Mariakani, Kaloleni, Mtwapa	418,307	6,400	39%
Kwale WSC	Kwale, Ukunda, Lunga Lunga, Msambweni, Kinango	149,344	5,920	50%
Total		1,462,005	87,520	

Data Source: Performance Report of Kenya's Water Services, No. 4, 2011, and data from WSBs

Table 2.3.11 Water Service Providers (WSPs) in Remaining Area (ACA)

WSPs	Service Towns/Areas	Service Population in 2010	Capacity (m^3/day)	NRW
[Urban]				
Kibwezi Makindu WSC	Kibwezi, Mtito Andei, Makindu, Kalama, Kibarani	38,999	2,951	40%
Wote WSC	Wote	9,610	225	29%
Nol Turesh Loitokitok WSC	Loitokitok Central, Kimana, Ramba, Marhuru, Sultan Hamud, Malili, Kilome	14,630	5,258	59%
Olkejuado WSC	Kajiado, Isinya, Bissil	9,762	625	24%
Tavevo WSC	Taveta, Voi, Mwatate, Wundanyi	30,971	1,400	49%
Others			5,593	
Total		103,972	16,393	

Data Source: Performance Report of Kenya's Water Services, No. 4, 2011, and data from WSBs

Table 2.3.12 Water Service Providers (WSPs) (TCA)

WSPs	Service Towns/Areas	Service Population in 2010	Capacity (m^3/day)	NRW
[Urban]				
Nyeri WSC	Nyeri	89,582	27,000	31%
Embu WSC	Embu	83,865	12,000	55%
Kirinyaga WSC	Kerugoya, Kutus, Wang'uru, Sagana, Kagumo,	186,478	19,452	82%
Mathira WSC	Mathira	29,760	17,000	66%
Meru WSC	Meru	56,914	4,509	23%
Murang'a WSC	Murang'a	32,034	4,848	47%
Kitui WSC	Kitui	174,231	7,756	56%
Kiambere Mwingi WSC	Mwingi	57,240	1,417	35%
Yatta WC	Matuu	6,828	704	28%
Lamu WSC	Lamu, Mukowe	12,802	3,600	50%
Tana WSC	Garsen, Hola		3,100	N.A
Garissa WSC	Garissa, Madogo	124,715	12,640	58%
[Rural]				
Gatanga Community Water Project	Gatanga	36,354	5418	38%
Othaya Mukurweini	Othaya, Mukurweini	85,782	16,616	58%
Kahuti	Kangema	52,578	9,000	69%
Murang'a South	Kigumo, Kandara, Maragwa, Saba Saba	119,346	9,220	53%
Gichugu	Gichugu	29,928	17,717	74%
Nithi	Chogoria, Chuka, Kiriani	35,799	3,300	79%
Ngandori – Nginda	Manyatta, Mutunduri	49,977	15,000	26%
Gathamati	Njumbi, Kiriaini	38,930	8,391	72%
Kyeni	Kathageri, Karurumo &Kigumo	8,916	527	38%
Imetha	Nkubu, Timau, Kanyakine, Tigania, Maua, Mitunguu, Mwimbi, Ruiri	52,698	4,100	74%
Muthambi 4K	Muthambi	11,259	0	42%
Kathita Kiirua (CEFA)	Kiirua	16,788	1,253	60%
Ngagaka	Kianjokoma	27,504	24,780	70%
Tetu Aberdaire	Tetu, Kinaini, Titie	72,403	7,037	58%
Rukanga	Rukanga	N.A	800	N.A
Murugi Mukumango	Mukumango	15,612	0	67%
Ruiri Thau Water Association	Ruiri	13,892	1,080	85%
Embe	Ishiara, Ena, Siakago	7,871	6,733	86%
Total		1,530,086	244,998	

Source: Performance Report of Kenya's Water Services, No. 4, 2011, and data from WSBs

Table 2.3.13 Water Service Providers (WSPs) (ENNCA)

WSPs	Service Towns/Areas	Service Population in 2010	Capacity (m^3/day)	NRW
[Urban]				
Nyahururu WSC	Nyahururu, Mairo Inya	46,014	4,552	57%
Nanyuki WSC	Nanyuki	57,252	10,610	43%
Isiolo WSC	Isiolo	34,168	3,220	51%
Mandera WSC	Mandera	13,890	1,672	52%
Maralal WSC	Maralal	17,328	798	47%
Rumuruti WSC	Rumuruti	990	185	27%
Marmanet WSC	Marmanet		2,400	N.A
Moyale WSC	Moyale	9,110	67	30%
[Rural]				
Tuuru	Laare	158,950	3,692	75%
Upper Chania	Njabini	7,600	0	N.A
Nyandarua North	Nyandarua,	19,239	671	42%
Total		364,541	27,867	

Source: Performance Report of Kenya's Water Services, No. 4, 2011, and data from WSBs

Table 2.4.1 Reproduction of MWI's Internal Donor Matrix (Water Supply and Sanitation) (1/7)

Programme Title	Purpose	Implementing Agency	Status	Geographical Area	Scheduled Completion	Amount Allocated KES Equivalent
African Development Bank						
ONGOING PROGRAMMES AND PROJECTS						
Rift Valley Water and Sanitation Project	To improve water supply and sanitation services in urban, peri-urban and rural communities within the service area of the Rift Valley Water Services Board. The project components are : (i) Institutional Support to Rift Valley Water Services Board (RVWSB) and Nakuru Water and Sanitation Services Company (NAWASSCO); (ii) Water and Sanitation Improvements in Nakuru; (iii) Water and Sanitation Improvements in Small towns in Rift Valley; and (iv) Develop and implement a rural water supply and sanitation programme based on the demand responsive approach.	Rift Valley Water Services Board	Approved	Service area of RVWSB, Nakuru	Dec-09	1.907 billion
Water Services Boards Support Project	To improve water supply and sanitation services in urban, peri-urban and rural communities within the Athi, Lake Victoria South, Northern and Tana Water Services Boards. The project components are (i) Institutional Support; (ii) Urban Water Supply & Sanitation; (iii) Rural Water Supply and Sanitation; and (iv) Kibera Development Support	Athi, Lake Victoria South, Northern and Tana Water Services Boards.	Approved	Service Areas of AWSB, LVSWB, NWSB, and TWSB	Mar-12	4.712 billion
Small and medium towns water supply and waste water management project	To improve the access, quality, availability and sustainability of water supply and wastewater services in the towns of Kitui, Siaya, Bondo, Othaya, Matuu, Kithimani, Maua and irrigation water for existing Yatta irrigation schemes	Tanathi, Lake Victoria South Tana Water Services Boards.	Approved	Service Areas of TAWSB, LVSWB and TWSB	Dec 2014	7.0 billion
PIPELINE - PROGRAMMES AND PROJECTS						
Nairobi Rivers Rehabilitation and Restoration program: Sewerage Improvement project	To rehabilitate and expand sewerage services management of Nairobi City for sustainable environment	Athi Water services Board	Under Appraisal	Nairobi city and environs		3.5 billion
France (AFD)						
ONGOING PROGRAMMES AND PROJECTS						
Kisumu Water and Sanitation Project (KWSSP)	- Emergency rehabilitation / upgrading of water systems (phase 1) - Extension of water systems (phase 2) - Rehabilitation of the Kisat wastewater treatment plant (phase 2) - Construction of a new wastewater treatment plan (phase 2) - Capacity building to LVSWSB and KIWASCO - distribution in informal settlements	LVSWSB	- Phase 1 completed - Phase 2 in progress / all studies completed / retendering in progress	Kisumu	30.06.11	2.0 billion
Nairobi Water & Sewerage Emergency Physical Investment Project (NWSEPIP)	- Rehabilitation of Sasumua Dam - Rehabilitation of Sasumua and Ngethu treatment plants - Rehabilitation of Dandora wastewater treatment plant - Construction of sewers and 20 ablution blocks - Rehabilitation of Mwagu system - Rehabilitation of water main lines to Nairobi	Athi Water Services Board	- Emergency works on Sasumua dam completed - Rehabilitation works on Sasumua in progress - Sanitation works completed - Works on treatment plants and main lines in progress - Studies on other water infrastructures completed	Nairobi	31.12.10	3.0 billion
Mombasa water and sanitation services improvement program (MWSSIP)	Improvement of water and sanitation services in Mombasa: - rehabilitation of Baricho system - rehabilitation of Mombasa wastewater treatment plant - rehabilitation of Marere system - rehabilitation and extension of water and sewerage distribution network in Mombasa West mainland - TA to MOWASCO - extension of networks in informal settlements of Mombasa	CWSB	All TA, supervision and works contracts signed, except the consulting firm for the detailed design of the Marere system	Mombasa	31,12,14	4,0 billion
Complementary support to the Nairobi and Kisumu Water and Sanitation projects	Additional fundings for KWSSP and NWSEPIP	LVSWSB and AWSB	Loan agreement signed	Kisumu and Nairobi	31/12/14	5,1 billion
- PROGRAMMES AND PROJECTS						
Water and sanitation programme in favor of small and medium towns	Basket fund for financing small and medium towns water and sanitation infrastructures	WSBs	feasibility	global	2015	3,0 billion

Table 2.4.1 Reproduction of MWI's Internal Donor Matrix (Water Supply and Sanitation) (2/7)

Programme Title	Purpose	Implementing Agency	Status	Geographical Area	Scheduled Completion	Amount Allocated KES Equivalent
European Commission						
ONGOING PROGRAMMES AND PROJECTS						
AMREF Water and Sanitation Umbrella Programme (WASUP)	Shallow wells, giant wells, boreholes, subsurface dams, earth dams, roof attachments, VIP Latrine refuse pits, hygiene training, capacity building	AMREF	ongoing	Eastern Province: Kitui, Makueni Rift Valley Province: Kajiado Coast Province: Kilifi and Malindi District	Sep-11	268,935,405
Safe water provision and sustainable water management options in arid & semi-arid land of 3 districts in the greater Meru Region - Eastern Province - Republic of Kenya	Household rainwater harvesting, Community surface rainwater harvesting, Expansion of Mukothima and Mula piped water projects (32 km of new pipelines), Construction of VIP latrines, Training in management of the community facilities, Hygiene and sanitation promotion	LVIA	ongoing	Eastern Province: Meru region	May-10	47,500,000
GOOD WATER GOVERNANCE IN LAKE VICTORIA SOUTH REGION	Developing a stakeholder charter, Orientation education and training of board members, Preparation of manuals, Development and review various strategic plans for LVSWSB and WSPs, Development and review various plans (business-, financial management-, investment plan), Valuation of assets, Training of LVSWSB and WSP staff members, Establish a research and development unit, Reduction of un-accounted for water (UFW), Improve the image of the WSP	Lake Victoria South Water Services Board	ongoing	Nyanza Province: Bondo, Homa Bay, Gucha, Kisii, Kisumu, Kuria, Migori, Nyamira, Nyando, Rachuonyo, Siaya and Suba Districts Rift Valley Province: Bomet, Bureti, Kericho, Nandi South and Transmara Districts	Jun-11	153,175,997
Capacity-Building for Water Service Providers in Tana Water Services Board Area	Participatory capacity needs assessment for the 27WSPs, Training of the 27 WSPs Board members, Training of managers, Public awareness creation, Institutional support to 27 WSPs, Sanitation and hygiene promotion, Extension of water services, Improvement of communication, Institutional support to Tana WSB, Construction of water kiosks and VIP latrines	TANA WATER SERVICES BOARD	ongoing	Eastern Province: Meru North, Meru Central, Meru South, Tharaka, Kitui, Mwingi, Mbeere, Embu, Kirinyaga Central Province: Nyeri, Maragua and Murang'a Districts	Jun-11	192,336,566
Nairobi Informal Settlements Water and Sanitation Improvement Programme	Sustainable financing mechanisms and pro-poor tariffs, Situation surveys and interfacing CBOs with the NWSC, Transaction analysis and advice, Advocacy and communication, Consumer voice and engagement with civil society, capacity building of the poor communities, Preliminary Design and Site Identification, Detailed Design and Tender Documentation, Tendering, Evaluation and Award, Construction and Commissioning, Monitoring and Evaluation	Athi Water Services Board	ongoing	Nairobi (Informal Settlements)	Jun-13	245,454,540
Capacity-Building for Rural Water Service Providers in Northern Kenya	Board-wide consensus building, District level consensus-building, Baseline studies, Cluster formation, Development of a model constitution of the rural WSPs, Registration and Service Provision Agreement contract, Awareness creation (School-based competitions, Public posters, Local radio messages, Public meetings), Indigenous trees project, Training, Procurement, Information and communication improvement	NORTHERN WATER SERVICES BOARD	ongoing	North Eastern Province: Garissa, Ijara, Mandera, Wajir Eastern Province: Isiolo, Laikipia, Marsabit, Moyale, Samburu	Jun-11	118,854,785
Improving Access to Water Supply and Basic Sanitation for the Urban Poor	Investment in water infrastructure for the urban poor: Construction and rehabilitation of expansion measures for water supply infrastructure/ Consultancy services for tender document preparation and supervision, Consultancy services for management improvement of the WSPs, Construction of Water Kiosks and necessary improvements to the water supply system, Sensitization of the Communities, Implementation of measures to increase the financial viability of the WSPs , Capacity building and equipment for peri-urban units of the Water Service Provider; Promotion of Investment in Basic Sanitation Infrastructure for the urban poor; Institutional Strengthening of the WSTF	Water Services Trust Fund (WSTF)	ongoing	Nationwide with initial focus on Western Province: Lake Victoria North (small and medium towns) and subsequently large towns	Dec-12	973,868,085

Table 2.4.1 Reproduction of MWI's Internal Donor Matrix (Water Supply and Sanitation) (3/7)

Programme Title	Purpose	Implementing Agency	Status	Geographical Area	Scheduled Completion	Amount Allocated KES Equivalent
Improved Rural Drinking Water Supply for ASAL Mwingi District, Eastern Kenya	Protection of 2 springs, 8 km pipeline extension, construction of 29 subsurface dams with shallow wells, 6 shallow wells, 1 rock catchment, 20 school roof catchments, 80 VIP latrines, Training on public health, HIV/AIDS prevention, Sanitation and Hygiene training	German Agro Action	ongoing	Eastern Province: Mwingi District, Nuu and Tseikuru Divisions	Nov-11	151,130,370
Micro-finance for community managed water projects	Identification of target communities, facilitation of financing for water projects.	WB/The Global Partnership on Output-based Aid	ongoing	All Kenya	Dec 2011	144,454,625
FINLAND						
ONGOING PROGRAMMES AND PROJECTS						
Support to WSTF	To improve water resources management and water services provision in poor rural communities. Capacity building of WSTF and WSBs	WSTF	Implementation	Countrywide	August 2012	
Germany						
ONGOING PROGRAMMES AND PROJECTS						
German Technical Cooperation (GTZ)						
Water Sector Reform Program	Support to the water sector reform focusing on MWI (policy, SWAP, formalisation of WSS, cross cutting issues like Human Rights, Pro-poor, etc.), to the WSTF pro-poor urban and basket management, WASREB pro-poor regulation with tariff negotiations and comparative competition, WSBs and WSP for performance improvements, WRMA for IWRM.	MWI	ongoing	Country wide	December 2010	*752.70*
German Development Service (DED)						
Water Sector Development Programme	Support implementation of water sector reforms through deployment of Technical Advisors on local level (WSBs and WSPs; regional offices WRMA)	MWI	ongoing	Lake Victoria North and Tana	December 2012	*196.86*
German Financial Cooperation (KfW)						
Water Sector Development Programme (WSDP) Phase I Step 1 + 2	Reduce health risks related to water-borne diseases and the provision of adequate water supply and sanitation services to the urban population of Kitale, Webuye and Bungoma.	LVNWSB	ongoing	Lake Victoria North WSB	July 2010 (physical completion)	*2895.00*
Water Sector Development Programme (WSDP) Phase II Step 1 + 2	Reduce health risks related to water-borne diseases and the provision of adequate water supply and sanitation services to the urban population of Kakamega, Busia, Nambale	LVNWSB	ongoing	Lake Victoria North WSB	November 2010 (physical completion)	*4337.87*
Water Sector Development Programme (WSDP) Phase II Step 1 + 2	Accompanying Measures to support Water Service Provider (Western Water Services Company WWSC)	LVNWSB	ongoing	Lake Victoria North WSB & WWSC	June 2011	*115.80*
Water Supply and Sanitation for the Urban Poor (WSTF)	Providing water supply and sanitation infrastructure investments through the WSTF to the urban poor in slums and informal settlements	WSTF	ongoing	Country wide	December 2011	*636.90*
Cooperation WSDP III - WASSIP (World Bank)	Reduce health risks related to water-borne diseases and the provision of adequate water supply and sanitation services to the urban population in Mumias, Butere, Kimilili, Malakisi and several rural growth centres.	LVNWSB	ongoing	Lake Victoria North WSB	2010	*173.70*

Table 2.4.1 Reproduction of MWI's Internal Donor Matrix (Water Supply and Sanitation) (4/7)

Programme Title	Purpose	Implementing Agency	Status	Geographical Area	Scheduled Completion	Amount Allocated KES Equivalent
PIPELINE - PROGRAMMES AND PROJECTS						
German Development Service (DED)						
Water Sector Development Programme (continued)	Support implementation of water sector reforms through deployment of Technical Advisors on local level (WSBs and WSPs; regional offices WRMA), in cooperation with GTZ and KfW	MWI	continuous	(Western Kenya and Tana)	December 2014	*254.61*
German Financial Cooperation (KfW)						
Water Supply and Sanitation for the Urban Poor, Phase II (WSTF II)	Up scaling of water supply and sanitation infrastructure investments through the WSTF to the urban poor in slums and informal settlements.	WSTF	Appraisal completed	countrywide	-	*1328.4*
Water Sector Development Programme - Lake Victoria South (WSDP - LVS)	Provision of adequate water supply and sanitation services to the urban population in one cluster of secondary towns	(LVSWSB)	Appraisal in late 2010 / early 2011	Lake Victoria South / Nyanza Province	-	*3653.1*
Water Sector Development Programme - Lake Victoria South (WSDP - LVS)	Accompanying Measures to support a selected Water Service Provider (yet to be specified)	(LVSWSB)	Appraisal in late 2010 / early 2011	Lake Victoria South / Nyanza Province	-	*110.7*

IFAD						
ONGOING PROGRAMMES AND PROJECTS						
Central Kenya Dry Areas Smallholder Community Development Project	Improved and increased access to drinking water to the target group throughout the project area.	Ministry of Planning, National Dev & Vision 2030	Under implementation	Central Kenya - Semi-arid districts of Thika, Murang'a South, Nyeri, Nyandarua and Kirinyaga	Dec 31 2010	
Southern Nyanza Community Development Project	Sustainable access to safe domestic water and improved environmental sanitation and hygiene practices	Ministry of Planning, National Dev & Vision 2030	under implementation	Southern Nyanza districts of Homa bay, Kuria West, Nyatike, Nyamira North, Rachuonyo North & Suba Districts	30 Sep 2011 A request by GoK for an extension of the project completion date has been forwarded to IFAD	
Mount Kenya East Pilot Project for Natural Resources Management	To enhance equitable and efficient water use and rationalized water abstractions . This is done through river basin management and community water development.	Ministry of Water and Irrigation	under implementation	Central and Eastern Provinces (Kirinyaga District, Mara , Imenti South, Imenti North,Meru South,Meru Central,Tharaka, Mbeere,	30 Sep 2011	

Italian Cooperation						
ONGOING PROGRAMMES AND PROJECTS						
Kiambere Kirandich Water Project, 2nd Phase	Provide water supply to 120,000 users and sanitation in Mwingi and Kabarnet	Tanathi WSB, RV WSB	Tender	Mwingi and Baringo Districts	Dec 13	3,507
Kiambere Kirandich Water Project 2nd Phase - TA	Provide water supply to 120,000 users and sanitation in Mwingi and Kabarnet	Italian Cooperation	Ongoing	Mwingi and Baringo Districts	Dec 13	55
Kisawel Self Help Water Project	Increase water supply in rural areas through infrastrucutre development	MWI	Ongoing	Nyandarua District	Dec 10	33
Njabini - Ngwataniro Water Supply Project	Increase water supply in rural areas through infrastrucutre development	MWI	Ongoing	Nyandarua District	Dec 10	34
Sigor Water Supply Project	Increase water supply in rural areas through infrastrucutre development	MWI	Ongoing	West Pokot District	Mar 11	40
Mutonga Gituma Water & Sanitation Project	Increase water supply in rural areas through infrastrucutre development	MWI	Ongoing	Tharaka District	Dec 10	54
Kibung'a Kakimiki Water Project	Increase water supply in rural areas through infrastrucutre development	MWI	Ongoing	Tharaka District	Dec 10	95
Viriko/Kwa Dadu Water Project	Increase water supply in rural areas through infrastrucutre development	MWI	Ongoing	Kilifi District	Dec 10	27
Kaembeni/Mwahera Water Project	Increase water supply in rural areas through infrastrucutre development	MWI	Ongoing	Kilifi District	Dec 10	20
Modogashe Water & Sanitation Project	Increase water supply in rural areas through infrastrucutre development	MWI	Ongoing	Ladgera District	Dec 10	50
Mbale Water Project	Increase water supply in rural areas through infrastrucutre development	MWI	Ongoing	Vihiga District	Dec 10	70
Kiplombe Water Project	Increase water supply in rural areas through infrastrucutre development	MWI	Ongoing	Rongai District	Jun-11	64

Table 2.4.1 Reproduction of MWI's Internal Donor Matrix (Water Supply and Sanitation) (5/7)

Programme Title	Purpose	Implementing Agency	Status	Geographical Area	Scheduled Completion	Amount Allocated KES Equivalent
Umanyi - Mitito	Increase water supply in rural areas through infrastrucutre development	MWI	Ongoing	Kibueri District	Jun-11	120
Tigania Water suplly project	Increase water supply in rural areas through infrastrucutre development	MWI	Ongoing	Tigania East District	Jun-11	80
Nakoyocho Water project	Increase water supply in rural areas through infrastrucutre development	MWI	Ongoing	Muguoma District	Jun-11	120

Japan (JICA)						
ONGOING PROGRAMMES AND PROJECTS						
Project for Augementation of Water Supply in Kapsabet Town	Rehabilitation and expansion of water supply system	MWI, Lake Victoria North Water Services Board	Contracting stage	Kapsabet Town	October 2011	Kes. 1,778,181,818
Project for Managemen of Non-Revenue Water in Kenya	Systems and mechanisms for supervision and implementation of measures for reducing NRW in Kenya are set up and disseminated, and the capacity for reduction of NRW is developed	MWI, WASREB, KEWI	Implementation	Meru, Embu, Kapsabet and Narok Towns, Countrywide	2013	Kes. 319,090,909
Revision of National Water Masterplan	Revision of National Water Masterplan for the year 2030 including a Master Action Plan for the year 2015	MWI, WRMA	Detailed Planning Survey Study (to commence in November 2009)	Countrywide	2012	Kes. 354,545,454
Project for Improvement of Water Supply in Embu Town and Surrounding Area	Rehabilitation and expansion of water supply system	MWI, Tana Water Services Board	Basic design ongoing (from September 2009)	Embu Town and Surrounding Areas	December 2012	Kes. 2,327,272,000
PIPELINE - PROGRAMMES AND PROJECTS						
Project for Rural Water Supply In Larger Baringo District	Increase the served population with safe and stable drinking water supply.	MWI, Riftvalley Water Services Board	Basic design (from January 2010)	Larger Baringo District		
Project for Rural Water Supply (Phase II)	Increase the served population with safe and stable drinking water supply.	MWI, Tanaathi Water Services Board	Implementation Review Study (from October 2009)	Larger Makueni and Machakos Districts		

Sida (Sweden)						
ONGOING PROGRAMMES AND PROJECTS						
Kenya Water and Sanitation Program KWSP (Co-funded with GoK and Danida. Here desicribing Sida part.)	Support to Water Sector Reforms, WRM and Rural WSS	MWI, WRMA, WSBs, WSTF	Ongoing	Kenya		
	Water Sector Reforms	MWI, WRMA, WSBs, WSTF	Ongoing	Kenya		
	Water Resources Management (incl additional funding for Flood and Drought Mitigation)	MWI, WRMA,	Ongoing	Kenya.	Jun-10	*2,95BKShs*
	Rural Water Supply and Sanitation	MWI, WSTF, WSBs	Ongoing	Kenya		
PIPELINE - PROGRAMMES AND PROJECTS						
"Future water sector support"	Continued support to sector reforms and results for the poor (focus areas not yet agreed)	MWI, WRMA, WSBs, WSTF	Identification	Kenya	2014	*1,8 BKShs*

SNV						
ONGOING PROGRAMMES AND PROJECTS						
Water Services Provider Association (WASPA) Strategic Plan development and implementation	Assistance to WASPA in: a)lobby/advocacy for enabling environment (sector reforms), b)facilitating capacity development of- and c)brokering 'best practice' (in socially-responsive commercialization) between its member WSPs.	WASPA	draft Strategic Plan approved	country-wide	August 2009	

Table 2.4.1 Reproduction of MWI's Internal Donor Matrix (Water Supply and Sanitation) (6/7)

Programme Title	Purpose	Implementing Agency	Status	Geographical Area	Scheduled Completion	Amount Allocated KES Equivalent
Capacity development support to Rift Valley Water Services Board and WSPs	Socially-responsive commercialization of WSPs: 1.LOWASCO (Lodwar), 2.KAWASES (Pokot), 3.ERAWASCO (Eldama Ravine), 4.NAIVAWASS (Naivasha), 5.NASCO (Narok) e.g. WSTF-UPC roll-out, peformance mngmnt, clustering WSB-DWO/PO/SO/QCA capacity (WSTF-CPC, UNICEF WaSH Programme) and collaboration with other state/non-state actors in rural water and sanitation: Turkana, Pokot, Narok. WARIS-oriented Water Point Functionality Mapping pilot Pokot	Rift Valley WSB and WSPs	Ongoing	Rift Valley WSB area	September 2010	
Capacity development support to Northern Water Services Board and WSPs	Socially-responsive commercialization of WSPs: 6.IWASCO (Isiolo), 7.NAWASCO (Nanyuki), 8.MAWASCO (Maralal), 9.GAWASCO (Garissa) e.g. WSTF-UPC roll-out WSB-DWO/PO/SO/QCA capacity (WSTF-CPC, UNICEF WaSH Programme) and collaboration with other state/non-state actors in rural water and sanitation: Isiolo, Marsabit, Moyale	Northern WSB and WSPs	Ongoing	Northern WSB area	June 2011	
Capacity development support to WSPs and other WaSH actors in Tanathi Water Services Board area	Socially-responsive commercialization of WSPs: 10.MAVWASCO (Mavoko), 11.Oloolaiser (Ngong, O/Rongai & Kiserian), 12.Olkejuado (Kajiado), 13.Loitokitok e.g. WSTF-UPC roll-out WSB-DWO/PO/SO/QCA capacity (WSTF-CPC, UNICEF WaSH Programme) and collaboration with other state/non-state actors in rural water and sanitation: Kajiado	Tanathi WSPs	Pending	Tanathi Valley WSB area	varies per WSP	
Training and Capacity Building component of the Lake Victoria Region Water and Sanitation Initiative (LVRWSI)	Capacity Building interventions around Local Economic Development (LED) in WaSH to maximise the impact (economic benefits for the poor) of the infrastructural investments under the Programme	LVS-WSB, WSPs, Local Authorities, NGOs, local private sector	Ongoing	Kisii, Homa Bay, Bondo	April 2012	

UN-HABITAT						
ONGOING PROGRAMMES AND PROJECTS						
Kibera Water and Sanitation Project	Community-based water and sanitation improvements in Selected Areas of the Kibera Slums	Ministy of Housing	Implementation	Nairobi	May 2010	*116,779,350*
Lake Victoria South Support Programme	Developing Sanitation Stratigies and Action Plans	Ministry of Water and Irrigation	Studies in progress	Nyanza Province	Dec 2010	*75,000,000*
Mirenr-Karagita Water and Sanitation Project	Improve water and sanitation in the peri-urban areas of Navaisha Town	Rift Valley Water Services Board	Implementation	Navaisha Town	May 2011	*13,650,000*
Kibera Support Programme (Pre-Investement Study)	Pre-investment Study for the upsacaling of the Kibera Water and Sanitation Project - Design and Supervision for ADB Extension	Athi Water Services Board	Study in Progress	3 Villages in Kibera, Nairobi	Sept, 2011	*187,500,000*
Developing a Data Base on Water Supply and Sanitation in Low-Income Areas of Kenya	Provide a Data Base on water and sanitation conditions in low income areas	Water Services Trust Fund, Ministry of Water and Irrigation	Implementation	Countrywide	Dec 2010	*37,650,000*
School Water, Sanitation and Hygiene Project	Improve water, sanitation and hygiene practices in urban schools	Sustainable Aid in Africa International	Implementation	Nyanza Province Kisii, Homa Bay and Bondo)	Dec 2010	*23,175,000*
Water Supply Improvements for Huruma Village	Provide access to safe water for the residents of Huruma Village	Muthaiga Residents Association	Implementation	Nairobi North	December, 2010	*5,775,000*
Improving health conidtions in primary schools	Improve standards of hygiene in a selected number of schools in an informal settlement	Africa Population and Health research Center	Implementation	Korogcho Informal Settlement ,Nairobi	Dec 2010	*20,363,400*
Lake Victoria Region Water Supply and Sanitation Project	Improve water supply and environmental sanitaion in the secondary towns in the Lake Victoria Basin	Ministry of Water and Irrigation/Lake Victoria South Water Services Board	Implementation	Nyanza Province Kisii, Homa Bay and Bondo)	June 2011	*390,000,000*
PIPELINE - PROGRAMMES AND PROJECTS						
Lake Victoria Region Water and Sanitation Programme - Phase 2 (to be done in collaboration with the EAC and the ADB)	Improve water supply and environmental sanitaion in the secondary towns in the Lake Victoria Basin	Ministry of Water and Irrigation/Lake Victoria South Water Services Board	Project Formulation Study in Progress	Nyanza Province		*1,800,000,000*

Table 2.4.1 Reproduction of MWI's Internal Donor Matrix (Water Supply and Sanitation) (7/7)

Programme Title	Purpose	Implementing Agency	Status	Geographical Area	Scheduled Completion	Amount Allocated KES Equivalent
Lake Victoria Region Water and Sanitation Programme - Phase 3 (in Collaboration with the EIB)	Improve water supply and sanitation in the large towns in the Lake Victoria Basin	Ministry of Water and Irrigation/Lake Victoria South Water Services Board	Consultants being engaged for project formulation study	Kisumu Town		*2,250,000,000*
UNICEF / Government of Netherlands						
ONGOING PROGRAMMES AND PROJECTS						
UNICEF- Kenya WASH Programme	Acceleration of water supply and sanitation towards reaching Kenya's Millenium Developement Goals	UNICEF	Ongoing	22 districts, in 7 Water Service Boards areas North Eastern Province: Mandera, Wajir, Garissa, Ijara: Eastern Province- Kitui, Mwingi, Marsabit, Moyale: Central- Kieni: Rift Valley: West Pokot, Turkana, Kajiado: Nyanza: Kisumu, Nyando, Siaya, Bondo, Rachuonyo: Western: Busia: Coast- Kwale, Tana River	2013	*3.76 billion*
USAID						
ONGOING PROGRAMMES AND PROJECTS						
Sombeza Water and Sanitation Project (SWASIP) Inplemented by the Aga Khan Foundation	Potable Water and Sanitation Improvement	Aga Khan Foundation (AKF)	Ongoing	Kwale and Kilifi districts (larger)	Sep-10	99,055,840
Water Project	Potable Water and Sanitation Improvement	World Concern Development Organization (WCDO)	Ongoing	Narok and Lamu districts (larger)	Oct-11	199,984,480
Mwingi Water Improvement Project	Potable Water and Sanitation Improvement	Adventist Development and Relief Agency (ADRA)	Ongoing	Mwingi district (larger)	Apr-11	80,835,760
Millenium Water Program	Potable Water and Sanitation Improvement	Millenium Water Alliance	Ongoing	Marsabit, Moyale, Garissa, Kibwezi, Kisumu, Butere, Tana River	Mar-12	239,999,680
PIPELINE - PROGRAMMES AND PROJECTS						
New Water Program	Protable Water and Sanitation Improvement, Governance etc	To be decided	strategy development underway	To be decided		600,000,000
Worldbank						
ONGOING PROGRAMMES AND PROJECTS						
Water and Sanitation Service Improvement Project	Increase access and improve water supply and sanitation services	Athi Water Services Board, Coastal Water services Board, Lake Victoria North Water Services Board	Under implementation	Service areas of the three Water Service Boards	June 30, 2012	12.25 billion

Source: MWI's Donor Matrix (November 2010) arranged by JICA Study Team

Table 2.4.2 Urban Water Supply Projects Proposed by WSBs, 2012 (1/2)

Catchment Area	Water Service Providers	Planned Water Supply Projects and Capacities							
		Water Supply Schemes	Urban Centres	Market Centres	County	River/Lake (m^3/day)	Borehole (m^3/day)	Dam (m^3/day)	Water Source Name(s)
LVNCA	Nzoina Water and Sanitation Company Ltd.	Rehabilitation and Augmentation of Chesikaki- Cheptais-Sirisia water supply		Chesikaki- Cheptais- Sirisia	Trans Nzoia	2,050			Tisi Rivers
		Rehabilitation and Augmentation of Kwanza water supply		Kwanza market	Trans Nzoia			600	Ngéng'e dam
	Western Water Services Company	Rehabilitation and Augumentation of Sio Port water supply		Sio Port	Kakamega/Busia	1,250			Lake Victoria
		Rehabilitation and Augumentation of Funyula water supply		Funyula town	Kakamega/Busia		560		2 No boreholes in Funyula town
		Rehabilitation and Augumentation of Port Victoria water		Port Victoria	Kakamega/Busia	1,250			Lake Victoria
	SIBO WASCO	Sega-Ugunja-Ukwala WS	Yala, Ugunja, Ukwala, Siaya, Bondo,	Sega,Mauna,Asembo bay,	Siaya	12,000	0	0	R.Nzoia
		Mauna Dam Water Supply-ii		Mauna	Siaya	0	0	2,500	Mauna Dam
		Alego-Yimbo Water Supply		Alego,Yimbo	Siaya	6,000	0	0	L.Kanyaboli
		Usenge-Osieko W/S	Usenge	Osieko	Siaya	4,000	0	0	L.Victoria
		South Sakwa Water Supply		South Sakwa	Siaya	2,500	0	0	L.Victoria
TOTAL						**29,050**	**560**	**3,100**	**32,710**
LVSCA	KIWASCO	Kibos Dam - Water Supply	Kisumu,		Kisumu	0	0	60,000	R. Kibos, R.Yala
	KEWASCO	Kericho Water Supply	Kericho Town		Kericho	14,000	0	0	R. Kimugu
	TILILBEI WASCO	Litein Water Supply		Litein , Kapkatet and Sotik	Bomet	8,000	0	0	R.Itare
		FortTenan Water Supply	Forttenan		Bomet	1,200	0	0	R.Sombo
		Bomet Water Supply	Bomet Town		Bomet	8,000	0	0	R.Nyangoress
		Longisa Water Supply		Longisa	Bomet	4,000	0	0	R. Amala
		Sosiot Water Supply		Sosiot	Bomet	2,000	0	0	R.Cheboseron
		Londian Multi-Purpose Dam	Londiani, Kipkelion.	Lumbwa,Lessos	Bomet	0	0	28,000	Londiani Dam (Proposed)
		Sigor Water Supply		Sigor Town	Bomet	1,500	0	0	R.Nyangoress
		Chesinende Water Supply		Chesinende	Bomet	0	0	500	Dam
	Gulf Water Company	Maseno Kombewa	Maseno	Kombewa, Holo	Kisumu	22,000	0	0	R.Maragoli
		Kisumu Rural Expansion	Seme District		Kisumu	2,000	0	0	L.Victoria
	NYANAS WASCO	Magwagwa Dam Multi-Purpose	Nyamira, Oyugis.	Sondu,Upper Nyakach,Lower Nyakach	Nandi/Kisumu	0	0	36,000	Magwagwa Dam (R. Sondu)
		Koru Water Supply	Koru, Mnara, Muhoroni,Awasi, Ahero, Chemelil,Miwani		Nandi/Kisumu	0	0	42,000	Koru Dam (R.Nyando)
		Nandi Dam	Nandi Hills		Nandi/Kisumu	0	0	12,000	Proposed Nandi Dam
		Lessos Water Supply		Lessos	Nandi/Kisumu	0	0	1,200	Lessos Dam
	MIKUTRA WASCO	Kilgoris Water Supply		Kilgoris Town	Migori/Narok	4,000	0	0	River
		Nkararu-II Water Supply		Nkararu	Migori/Narok	500	0	0	Nkararu Spring
		Uriri Water Supply		Uriri Town, Stella	Migori/Narok	4,000	0	0	R.Oyani
		Rongo Water Supply -II	Rongo	Riosiri	Migori/Narok	2,000	0	0	R.Misadhi
	GUSII WASCO	Keroka Water Supply -II		Keroka	Kisii	4,000	0	0	R.Ichuni
		Bonyumyu Dam Water S.	Kisii,		Kisii	0	0	24,000	Bonynyu Dam
	South Nyanza Water Company	Mbita Water Supply	Mbita Town		Homa Bay	4,000	0	0	Lake Victoria
		West Karachuonyo -II WS		Rural parts of West	Homa Bay	2,000	0	0	L.Victoria
		Homa Bay Water Supply	Homa Bay Town,	Rodi Kopany	Homa Bay	8,000	0	0	Lake Victoria
		Ndhiwa Water Supply		Ndhiwa	Homa Bay	4,000	30	0	R.Kuja
	Nyasare	Kochia Water Supply		Olare, Ligisa	Migori	2,500	0	0	L.Victoria
TOTAL						**97,700**	**30**	**203,700**	**301,430**
RVCA	Nakuru Water and Sanitation Company Ltd.	Nakuru Long term water supply project	Nakuru town		Nakuru	0	0	100,000	Itare River in Mau Forest
	Ol Kalou Water and Sanitation Company Ltd.	Olkalou Water Supply		Olkalou town	Nyandarua	0	0	10,000	River Malewa
	Iten Tambach Water Project	Sabor - Iten Water Supply Project	Iten town		Elgeyo	0	0	5,000	Sabor River
	Naroko Water and Sanitation Company	Narok Water Supply Project	Narok town and environs		Narok	4,600	0	0	Engare Narok
	Kabarnet Water Supply	Kabarnet Water Supply Phase II	Kabarnet ,	Kabasis, Kituro, Kabartonjo	Baringo	0	0	20,000	Kirandich
TOTAL						**4,600**	**0**	**135,000**	**139,600**

Table 2.4.2 Urban Water Supply Projects Proposed by WSBs, 2012 (2/2)

Catchment Area	Water Service Providers	Planned Water Supply Projects and Capacities							
		Water Supply Schemes	Urban Centres	Market Centres	County	River/Lake (m^3/day)	Borehole (m^3/day)	Dam (m^3/day)	Water Source Name(s)
ACA	Kiambu Water and Sanitation Co. Ltd	Kiambu water supply system	Kiambu		Kiambu	0		10,000	Kamiti River Dam
		Kiambu water supply system	Kiambu					10,000	Riara river Dam
		Kiambu water supply system	Kiambu			10,000			Riara
	Gatundu South Water and Sewerage Co. Ltd	Theta treatment plant	Gatundu		Kiambu	0		3,000	Theta Dam
		Thirika Water Supply scheme	Gatundu					10,000	Thirika Dam
	Gatanga Community Water Project	Gatanga	Gatanga			6,000			Kiama
	Kikuyu Water & Sanitation Co. Ltd	Muguga water scheme	Kikuyu		Kiambu			3,000	Ngecha
	Ruiru-Juja Water and Sanitation Co. Ltd	Komothai water system	Ruiru			0		15,000	Dam on Komothai
		Gatamaiyu 2	Ruiru					10,000	Gatamaiyu 2 Dam
	Githunguri Water and sewerage Co. Ltd	4th Nairobi water supply	Nairobi, Maragua			138,000			Maragua/Irati rivers
	Thika Water and Sanitation Co. Ltd	Karemeno	Thika			0		100,000	Karemeno Dam
		Thika 3A	Thika					50,000	Thika 3A dam
	Nairobi Water and sewerage Company	Nairobi	Nairobi		Nairobi	40,000			Deep wells
		Ruiru 2 Dam	Nairobi, Ruiru Githunguri					60,000	Ruiru 2 Dam
		Ndarugu 2	Nairobi, Gatundu, Juja					10,000	Ndarugu Dam
		Nairobi 5	Nairobi					70,000	Maragua Dam
		4th Nairobi water	Nairobi					138,000	Maragua/Mathioya/Irati Rivers
		Nairobi 7	Nairobi					138,000	Ndarugu Dam
	Mombasa Water and Sanitation Company Ltd.	Mzima II project	Mombasa, Voi	Changamwe,	Mombasa	160,000			Mzima springs
		Mwache dam	Mombasa					200,000	Mwache river
		Pemba Dam						3,000	Pemba
	Mavoko Water and Sewerage Co.	Mavoko W/S			Machakos			15,000	Mavoko Water and sewerage to be done under PPP
	Machakos Water and Sewerage Ltd.	Machakos W/S reticulation upgrading			Machakos	0		5,000	Miwongoni dam detailed design on going
	Kibwezi Makindu Water and Sanitation Company	Makindu Water Supply	Kibwezi & Mtito Andei	Kalama,Kibarani	Makueni	3,000			Umani Springs Phase II
	Wote Water and Sewerage Co. Ltd.	Wote W/S	Wote		Wote	2,000			Kaiti river infiltration galleries
	Namanga Water Users Trust	Namanga W/S	Namanga		Kajiado	0	365		1 B/H to be drilled
			Namanga		Kajiado	400			Oldonyorok Springs
	Ol Kejuado Water and Sewerage Company	Kajiado W/S	Kajiado,Isinya,Bissil		Kajiado	0		1,000	Dam proposed
	Mwala Water and Sanitation Company	Kayatta W/S		Kayatta	Machakos	0		3,000	Spring
		Kabaa market & Mbiuni (Kitwamba) B/Hs		Kabaa	Machakos			600	Boreholes rehabilitations
	Mbooni Water and Sanitation Company	Mulima W/S		Mbooni	Makueni	0		1,000	Mulima dam desilting & construction of a treatment works, 1 B/H drilling
TOTAL						**359,400**	**365**	**855,600**	**1,215,365**
TCA	Lamu Water and Sewerage Company Ltd.	Naningi Lamu Pipeline			Lamu	200,000			
	Nyeri Water and Sewerage Company	Mt Kenya Bulk	Meru, Chogoria, Chuka, Maua	Meru, Taraka	Nyeri	309,530			Kathita, Mutonga, Mara, Nithi, Ruguti
	Kirinyaga Water and Sanitation Company	Kirinyaga Bulk water supply	Kerogoya	Kirinyaga	Kirinyaga	71,705			Thiba dam & Nyamindi, Kiringa, Ragati
		Embu / Mbeere Bulk	Embu	Embu		77,415			
		Nyeri District Bulk	Nyeri	Nyeri		118,351			
		Muranga / Muranga Bulk System	Muranga, Maranga			85,774			
	Kitui Water and Sanitation Company	Kitui Water Supply	Kitui	Masinga, Katheka	Kitui	0		9,000	Masinga dam Phase II expansion of intake, T-Works & upgrade the rising mains
	Kiambere Mwingi Water and Sewerage Company	Mwingi Phase II W/S	Mwingi		Kitui			2,000	Kiambere Dam T- Works & intake works
	Yatta Water Services Company Ltd.	Yatta W/s	Matuu		Machakos			3,000	Construction of Yatta dam, water supply and sewerage
	KIPIPIRI	Kipipiri Water Project		Kipipiri town		3,000	0	0	River Chitohi
TOTAL						**865,775**	**0**	**14,000**	**879,775**
ENNCA	Nyahururu Water and Sanitation Company	Nyahuru supply system	Nyahururu		Laikipia	7,822			Leshau swamp
					Laikipia		3,000		Mairo-Inya BHs
	Isiolo Water and Sewerage Company	Isiolo	Isiolo		Isiolo	0		6,552	Marania
	Marmanet Water and Sewerage Company	Marmanet water supply	Marmanet and environs		Laikipia	1,878			Leshau swamp
					Laikipia			2,000	Kamwana
					Laikipia		1,000		BH systems
TOTAL						**9,700**	**4,000**	**8,552**	**22,252**

Source: JICA Study Team based on data from WSBs

Table 3.2.1 Populatio Projection of 137 Major Urban Centres (1/3)

Urban Centres		Population in Urban and Peri-Urban Area		Population Growth Ratio	Urbann Population in 2030
City		Census 2009	Adjustment		
1	Nairobi	3,133,518	3,138,369	193.9%	6,085,297
2	Mombasa	938,131	938,131	281.9%	2,644,591
3	Kisumu	388,311	388,311	375.3%	1,457,208
-	Sub-total	4,459,960	4,464,811	-	10,187,096
Municipality					
1	Nakuru	307,990	307,990	375.3%	1,155,789
2	Eldoret	289,380	294,589	375.3%	1,105,499
3	Kehancha	30,109	30,109	503.4%	151,564
4	Ruiru	238,858	238,858	375.3%	896,358
5	Malindi	118,265	118,265	375.3%	443,811
6	Naivasha	169,142	169,142	503.4%	851,433
7	Kitui	109,568	109,568	503.4%	551,547
8	Machakos	150,041	150,041	503.4%	755,281
9	Thlka	136,917	136,917	375.3%	513,806
10	Mavoko	137,211	137,211	375.3%	514,909
11	Nyeri	119,353	119,353	503.4%	600,803
12	Vihiga	118,696	118,696	503.4%	597,496
13	Mumias	99,987	99,987	503.4%	503,318
14	Bomet	83,729	83,729	503.4%	421,478
15	Kitale	106,187	106,187	503.4%	534,528
16	Limuru	79,531	79,531	375.3%	298,455
17	Kericho	101,808	101,808	503.4%	512,485
18	Kimilili	94,927	94,927	503.4%	477,847
19	Kakamega	91,768	91,768	503.4%	461,945
20	Kapsabet	86,803	86,803	503.4%	436,952
21	Kiambu	84,155	84,155	375.3%	315,807
22	Kisii	81,801	81,801	503.4%	411,773
23	Bungoma	55,867	55,867	503.4%	281,225
24	Webuye	41,344	41,344	503.4%	208,119
25	Busia	51,981	51,981	503.4%	261,664
26	Runyenjes	19,548	19,548	503.4%	98,401
27	Migori	53,100	53,100	503.4%	267,297
28	Embu	60,673	60,662	503.4%	305,362
29	Homa Bay	58,936	43,362	503.4%	218,278
30	Lodwar	48,316	48,316	123.2%	59,544
31	Meru	53,627	53,627	503.4%	269,949
32	Nyahururu	36,450	36,450	503.4%	183,483
33	Nanyuki	38,198	38,198	503.4%	192,282
34	Maua	17,226	17,226	503.4%	86,713
35	Voi	17,152	17,152	503.4%	86,340
36	Siaya	22,586	12,208	503.4%	61,452
37	Chuka	43,470	43,470	503.4%	218,821
38	Kerugoya/Kutus	19,422	19,422	503.4%	97,767
39	Muranga	28,775	28,775	503.4%	144,849
40	Kabarnet	25,346	25,346	123.2%	31,236
41	Karatina	8,499	8,499	503.4%	42,783
-	Sub-total	3,536,742	3,515,988	-	15,628,447
Other Center		0			
1	Ngong	107,188	107,188	375.3%	402,242
2	Awasi	93,369	34,222	503.4%	172,268
3	Wajir	82,800	82,800	123.2%	102,042
4	Kakuma	36,875	36,875	123.2%	45,444
5	Ukunda	62,529	62,529	375.3%	234,651
6	Wundanyi	62,404	36,778	503.4%	185,136
7	Kitengela	58,167	58,167	375.3%	218,282
8	Mtwapa	48,625	48,625	375.3%	182,474
9	Isiolo	45,989	45,989	503.4%	231,501
10	Juja	40,446	40,446	375.3%	151,781
11	Ongata Rongai	40,178	40,178	375.3%	150,775

Table 3.2.1 Populatio Projection of 137 Major Urban Centres (2/3)

Urban Centres		Population in Urban and Peri-Urban Area		Population Growth Ratio	Urbann Population in 2030
City		Census 2009	Adjustment		
12	Moyale	37,387	37,387	123.2%	46,075
13	Gilgil	35,293	35,293	503.4%	177,659
14	Rhamu	26,367	26,367	123.2%	32,494
15	Wanguru	23,983	23,983	503.4%	120,726
16	Elwak	24,368	24,368	123.2%	30,031
17	Njoro	23,551	23,551	503.4%	118,552
18	Moi's Bridge	14,596	11,575	503.4%	58,266
19	Lokichogio	17,695	17,695	123.2%	21,807
20	Takaba	22,156	22,156	123.2%	27,305
21	Awendo	21,474	15,931	503.4%	80,193
22	Lamu	20,887	20,238	6176.5%	1,250,000
23	Chwele	14,326	14,326	503.4%	72,115
24	Kiserian	19,163	19,163	375.3%	71,913
25	Hola	14,243	14,243	123.2%	17,553
26	Usenge	11,693	11,693	503.4%	58,861
27	Madogo	15,667	15,667	123.2%	19,308
28	Marsabit	13,240	13,240	123.2%	16,317
29	Msalani	14,907	14,907	123.2%	18,371
30	Butere	14,012	12,780	503.4%	64,332
31	Masambweni	4,725	4,725	375.3%	17,731
32	Kiminini	11,985	11,985	503.4%	60,330
33	Mai Mahiu	11,659	11,659	503.4%	58,689
34	Loitoktok	11,230	11,230	503.4%	56,530
35	Lumakanda	11,064	8,876	503.4%	44,681
36	Matunda	10,031	10,031	375.3%	37,643
37	Watamu	10,030	10,030	375.3%	37,639
38	Githunguri	10,007	10,007	503.4%	50,374
-	Sub-total	1,144,309	1,046,903	-	4,742,095
Town Center					
1	Kikuyu	233,231	233,231	375.3%	875,242
2	Kangundo-Tala	218,557	218,557	375.3%	820,175
3	Karuri	107,716	107,716	375.3%	404,224
4	Kilifi	48,826	48,826	375.3%	183,228
5	Garissa	116,317	116,317	123.2%	143,348
6	Molo	40,651	40,651	503.4%	204,630
7	Litein	9,103	9,103	503.4%	45,823
8	Mariakani	24,055	24,055	375.3%	90,271
9	Mandera	87,692	87,692	123.2%	108,071
10	Nyamira	41,668	41,668	503.4%	209,750
11	Mwingi	15,970	15,970	503.4%	80,390
12	Rongo	82,066	103,183	503.4%	519,406
13	Ahero	50,730	50,730	503.4%	255,366
14	Nandi Hills	10,120	10,120	503.4%	50,942
15	Makuyu	44,007	44,007	503.4%	221,524
16	Kapenguria	34,046	34,046	503.4%	171,382
17	Narok	38,653	38,653	503.4%	194,573
18	Taveta	19,865	19,865	503.4%	99,997
19	Ol Kalou	66,015	66,015	503.4%	332,309
20	Malaba	21,477	21,477	503.4%	108,112
21	Mbita Point	11,989	11,989	503.4%	60,351
22	Malava	4,070	4,070	503.4%	20,488
23	Suneka	50,818	50,818	503.4%	255,809
24	Ogembo	3,475	2,319	503.4%	11,674
25	Ukwala	5,187	5,187	503.4%	26,110
26	Keroka	41,654	41,654	503.4%	209,679
27	Matuu	50,750	50,750	503.4%	255,467
28	Oyugis	35,451	35,451	503.4%	178,454
29	Kipkelion	46,760	46,760	503.4%	235,382
30	Luanda	49,346	49,346	503.4%	248,400

Table 3.2.1 Populatio Projection of 137 Major Urban Centres (3/3)

Urban Centres		Population in Urban and Peri-Urban Area		Population Growth Ratio	Urbann Population in 2030
City		Census 2009	Adjustment		
31	Eldama Ravine	17,872	17,872	503.4%	89,965
32	Nyansiongo	5,637	5,637	503.4%	28,376
33	Londiani	43,152	43,152	503.4%	217,220
34	Item/Tambach	42,312	42,312	503.4%	212,992
35	Malakisi	17,083	17,083	503.4%	85,993
36	Bondo	33,468	33,468	503.4%	168,472
37	Maralal	15,860	15,860	123.2%	19,546
38	Nambale	4,941	4,941	503.4%	24,872
39	Tabaka	15,351	10,423	503.4%	52,467
40	Muhoroni	34,457	34,457	503.4%	173,451
41	Ugunja	7,242	7,242	503.4%	36,455
42	Yala	6,412	6,412	503.4%	32,277
43	Rumuruti	10,064	10,064	503.4%	50,661
44	Burnt Forest	4,925	4,925	503.4%	24,792
45	Maragua	26,374	26,374	503.4%	132,762
46	Kendu Bay	14,747	14,747	503.4%	74,234
47	Chogoria	28,415	28,415	503.4%	143,036
48	Kwale	19,880	19,800	375.3%	74,303
49	Sagana	10,551	10,551	503.4%	53,112
50	Mitto Andei	4,520	4,520	503.4%	22,753
51	Sotik	8,366	8,366	503.4%	42,113
52	Port Victoria	6,561	6,561	503.4%	33,027
53	Othaya	5,137	5,137	503.4%	25,859
54	Kajiado	14,860	14,860	503.4%	74,803
55	Wote	9,875	9,875	503.4%	49,709
-	Sub-total	2,018,327	2,033,280	-	8,563,826
Ground Total		11,159,338	11,060,982		39,121,464

Source: JICA Study Team based on Census 2009 data

Table 3.2.2 Population Projection by Catchment Area

LVNCA

Items		Population in 2030
1) Urban Population		
1	Eldoret	1,105,499
2	Vihiga	597,496
3	Kitale	534,528
4	Mumias	503,318
5	Kimilili	477,847
6	Kakamega	461,945
7	Kapsabet	436,952
8	Bungoma	281,225
9	Busia	261,664
10	Luanda	248,400
11	Item/Tambach	212,992
12	Webuye	208,119
13	Kapenguria	171,382
14	Bondo	168,472
15	Siaya	61,452
16	Yala	32,277
17	Malaba	108,112
18	Malakisi	85,993
19	Chwele	72,115
20	Butere	64,332
21	Kiminini	60,330
22	Usenge	58,861
23	Moi'S Bridge	58,266
24	Nandi Hills	50,942
25	Lumakanda	44,681
26	Matunda	37,643
27	Ugunja	36,455
28	Port Victoria	33,027
29	Ukwala	26,110
30	Nambale	24,872
31	Burnt Forest	24,792
32	Malava	20,488
	Others	1,134,510
	Total	7,705,095
2) Rural Population		4,657,832
Ground Total		12,362,927

LVSCA

Items		Population in 2030
1) Urban Population		
1	Kisumu	1,457,208
2	Rongo	519,406
3	Kericho	512,485
4	Bomet	421,478
5	Kisii	411,773
6	Migori	267,297
7	Suneka	255,809
8	Ahero	255,366
9	Kipkelion	235,382
10	Homa Bay	218,278
11	Londiani	217,220
12	Nyamira	209,750
13	Keroka	209,679
14	Oyugis	178,454
15	Muhoroni	173,451
16	Awasi	172,268
17	Kehancha	151,564
18	Awendo	80,193
19	Kendu Bay	74,234
20	Mbita Point	60,351
21	Tabaka	52,467
22	Litein	45,823
23	Sotik	42,113
24	Nyansiongo	28,376
25	Ogembo	11,674
	Others	1,731,843
	Total	7,993,942
2) Rural Population		4,726,611
Ground Total		12,720,553

RVCA

Items		Population in 2030
1) Urban Population		
1	Nakuru	1,155,789
2	Naivasha	851,433
3	Ol Kalou	332,309
4	Molo	204,630
5	Narok	194,573
6	Gilgil	177,659
7	Njoro	118,552
8	Eldama Ravine	89,965
9	Lodwar	59,544
10	Mai Mahiu	58,689
11	Kakuma	45,444
12	Kabarnet	31,236
13	Lokichogio	21,807
	Others	1,144,266
	Total	4,485,896
2) Rural Population		2,961,144
Ground Total		7,447,040

ACA

Items		Population in 2030
1) Urban Population		
1	Nairobi	6,085,297
2	Mombasa	2,644,591
3	Ruiru	896,358
4	Kikuyu	875,242
5	Kangundo-Tala	820,175
6	Machakos	755,281
7	Mavoko	514,909
8	Malindi	443,811
9	Karuri	404,224
10	Ngong	402,242
11	Kiambu	315,807
12	Limuru	298,455
13	Ukunda	234,651
14	Kitengela	218,282
15	Wundanyi	185,136
16	Kilifi	183,228
17	Mtwapa	182,474
18	Juja	151,781
19	Ongata Rongai	150,775
20	Taveta	99,997
21	Mariakani	90,271
22	Voi	86,340
23	Kajiado	74,803
24	Kwale	74,303
25	Kiserian	71,913
26	Loitoktok	56,530
27	Githunguri	50,374
28	Wote	49,709
29	Watamu	37,639
30	Mitto Andei	22,753
31	Masambweni	17,731
	Others	1,235,080
	Total	17,730,165
2) Rural Population		2,813,447
Ground Total		20,543,611

TCA

Items		Population in 2030
1) Urban Population		
1	Lamu	1,250,000
2	Nyeri	600,803
3	Kitui	551,547
4	Thlka	513,806
5	Embu	305,362
6	Meru	269,949
7	Matuu	255,467
8	Makuyu	221,524
9	Chuka	218,821
10	Muranga	144,849
11	Garissa	143,348
12	Chogoria	143,036
13	Maragua	132,762
14	Wanguru	120,726
15	Runyenjes	98,401
16	Kerugoya/Kutus	97,767
17	Maua	86,713
18	Mwingi	80,390
19	Sagana	53,112
20	Karatina	42,783
21	Othaya	25,859
22	Madogo	19,308
23	Msalani	18,371
24	Hola	17,553
	Others	932,041
	Total	6,344,299
2) Rural Population		4,025,724
Ground Total		10,370,024

ENNCA

Items		Population in 2030
1) Urban Population		
1	Isiolo	231,501
2	Nanyuki	192,282
3	Nyahururu	183,483
4	Mandera	108,071
5	Wajir	102,042
6	Rumuruti	50,661
7	Moyale	46,075
8	Rhamu	32,494
9	Elwak	30,031
10	Takaba	27,305
11	Maralal	19,546
12	Marsabit	16,317
	Others	720,957
	Total	1,760,765
2) Rural Population		2,635,554
Ground Total		4,396,319

Source: JICA Study Team, based on Census 2009 and Kenya Vision 2030

Table 3.2.3 Population Distribution by County and Catchment Area

Old Administration in 1992		County	Population Forecast in 2030 (thousand)						
Province	District		LVNCA	LVSCA	RVCA	ACA	TCA	ENNCA	Total
Western	Bungoma	Bungoma	2,383	0	3	0	0	0	2,385
	Busia	Busia	791	0	0	0	0	0	791
	Kakamega	Kakamega	2,183	0	0	0	0	0	2,183
		Vihiga	1,101	92	0	0	0	0	1,193
Nyanza	South Nyanza	Homa Bay	0	1,382	0	0	0	0	1,382
		Migori	0	2,053	0	0	0	0	2,053
	Kisii	Kisii	0	2,420	0	0	0	0	2,420
		Nyamira	0	452	0	0	0	0	452
	Kisumu	Kisumu	34	2,443	0	0	0	0	2,476
	Siaya	Siaya	848	187	0	0	0	0	1,035
Rift Valley	Baringo	Baringo	0	1	622	0	0	0	623
	Kericho	Kericho	0	1,444	1	0	0	0	1,446
		Bomet	0	1,295	0	0	0	0	1,295
	Elgeyo Marakwet	Elgeyo Marakwet	310	0	220	0	0	0	530
	Kajiado	Kajiado	0	0	148	1,270	0	0	1,417
	Laikipia	Laikipia	0	0	38	0	3	707	747
	Nakuru	Nakuru	0	278	3,727	0	0	1	4,006
	Nandi	Nandi	857	200	0	0	0	0	1,057
	Narok	Narok	0	459	494	0	0	0	953
	Samburu	Samburu	0	0	62	0	0	223	285
	Trans Nzoia	Trans Nzoia	1,813	0	68	0	0	0	1,882
	Turkana	Turkana	0	0	831	0	0	0	831
	Uasin Gishu	Uasin Gishu	1,858	15	13	0	0	0	1,885
	West Pokot	West Pokot	183	0	423	0	0	0	606
Central	Kiambu	Kiambu	0	0	78	3,716	681	0	4,475
	Kirinyaga	Kirinyaga	0	0	0	0	785	1	786
	Muranga	Muranga	0	0	3	0	1,344	0	1,347
	Nyandarua	Nyandarua	0	0	695	3	48	208	954
	Nyeri	Nyeri	0	0	0	0	1,163	122	1,285
Nairobi	Nairobi	Nairobi	0	0	0	6,085	0	0	6,085
Eastern	Embu	Embu	0	0	0	0	779	0	779
	Isiolo	Isiolo	0	0	0	0	19	360	379
	Kitui	Kitui	0	0	0	22	1,408	0	1,431
	Machakos	Machakos	0	0	0	2,428	430	0	2,858
		Makueni	0	0	0	1,161	0	0	1,161
	Marsabit	Marsabit	0	0	21	0	0	297	317
	Meru	Meru	0	0	0	0	1,255	572	1,827
		Tharaka-Nithi	0	0	0	0	437	0	437
Coast	Kilifi	Kilifi	0	0	0	1,730	70	0	1,799
	Kwale	Kwale	0	0	0	920	0	0	920
	Lamu	Lamu	0	0	0	0	1,318	0	1,318
	Mombasa	Mombasa	0	0	0	2,651	0	0	2,651
	Taita Taveta	Taita Taveta	0	0	0	555	0	0	555
	Tana River	Tana River	0	0	0	2	235	0	237
North Eastern	Garissa	Garissa	0	0	0	0	394	241	635
	Mandera	Mandera	0	0	0	0	0	1,021	1,021
	Wajir	Wajir	0	0	0	0	0	642	642
Total			12,361	12,719	7,446	20,543	10,369	4,395	67,833

Source: JICA Study Team, based on Census 2009 and Kenya Vision 2030

Table 3.5.1 Districts for Each Industrial Activity Group

Industrial Activity	District
High Activity Group	Nairobi West, Nairobi East, Nairobi North, Westlands, Mombasa, Kilindini, Kisumu East, Kisumu West, Nyando, Nakuru, Nakuru North
Medium Activity Group	Nyeri North, Nyeri South, Kiambu East (Kiambaa), Kiambu West, Thika East, Thika West, Malindi, Lamu, Machakos, Eldoret West, Eldoret East, Kericho, Kakamega Central, Kakamega South, Kakamega North, Kakamega East
Low Activity Group	Nyandarua North, Nyandarua South, Kirinyaga, Muranga North, Muranga South, Kikuyu, Lari, Githunguri, Ruiru, Gatanga, Gatundu, Kwale, Kinango, Msambweni, Kilifi, Kaloleni, Taita, Taveta, Isiolo, Meru Central, Imenti North, Imenti South, Meru South, Maara, Igembe, Tigania, Tharaka, Embu, Mbeere, Kitui, Mutomo, Mwingi, Kyuso, Mwala, Yatta, Kangundo, Makueni, Mbooni, Kibwezi, Nzaui, Siaya, Bondo, Rarieda, Homabay, Suba, Rachuonyo, Migori, Rongo, Kuria East, Kuria West, Kisii Central , Kisii South, Masaba, Gucha, Gucha South, Nyamira, Manga, Borabu, West Pokot, Pokot North, Pokot Central, Trans Nzoia West, Trans Nzoia East, Kwanza, Koibatek, Wareng, Marakwet, Keiyo, Nandi North, Nandi Central, Nandi East, Nandi South, Tinderet, Laikipia North, Laikipia East, Laikipia West, Naivasha, Molo, Narok North, Narok South, Trans Mara, Kajiado Central, Loitokitok, Kipkelion, Buret, Sotik, Bomet, Kajiado North, Lugari, Vihiga, Emuhaya, Hamisi, Mumias, Butere, Bungoma South, Bungoma North, Bungoma East, Bungoma West, Mt. Elgon, Busia, Teso North, Samia, Bunyala, Teso South
Non Activity Group	Tana River, Tana Delta, Marsabit, Chalbi, Laisamis, Moyale, Garbatulla, Garissa, Lagdera, Fafi, Ijara, Wajir South, Wajirnorth, Wajir East, Wajir West, Mandera Central, Mandera East, Mandera West, Turkana Central, Turkana North, Turkana South, Samburu Central, Samburu East, Samburu North, Baringo Central, Baringo North, East Pokot

Source: JICA Study Team, based on data from MOI.

Table 4.2.1 Target 137 Urban Centres for Urban Water Supply Development

No.	LVNCA	LVSCA	RVCA	ACA	TCA	ENNCA
1	Eldoret	Kisumu	Nakuru	Nairobi	Lamu	Isiolo
2	Vihiga	Rongo	Naivasha	Mombasa	Nyeri	Nanyuki
3	Kitale	Kericho	Ol Kalou	Ruiru	Kitui	Nyahururu
4	Mumias	Bomet	Molo	Kikuyu	Thika	Mandera
5	Kimilili	Kisii	Narok	Kangundo-Tala	Embu	Wajir
6	Kakamega	Migori	Gilgil	Machakos	Meru	Rumuruti
7	Kapsabet	Suneka	Njoro	Mavoko	Matuu	Moyale
8	Bungoma	Ahero	Eldama Ravine	Malindi	Makuyu	Rhamu
9	Busia	Kipkelion	Lodwar	Karuri	Chuka	Elwak
10	Luanda	Homa Bay	Mai Mahiu	Ngong	Muranga	Takaba
11	Item/Tambach	Londiani	Kakuma	Kiambu	Garissa	Maralal
12	Webuye	Nyamira	Kabarnet	Limuru	Chogoria	Marsabit
13	Kapenguria	Keroka	Lokichogio	Ukunda	Maragua	
14	Bondo	Oyugis		Kitengela	Wanguru	
15	Siaya	Muhoroni		Wundanyi	Runyenjes	
16	Yala	Awasi		Kilifi	Kerugoya/Kutus	
17	Malaba	Kehancha		Mtwapa	Maua	
18	Malakisi	Awendo		Juja	Mwingi	
19	Chwele	Kendu Bay		Ongata Rongai	Sagana	
20	Butere	Mbita Point		Taveta	Karatina	
21	Kiminini	Tabaka		Mariakani	Othaya	
22	Usenge	Litein		Voi	Madogo	
23	Moi's Bridge	Sotik		Kajiado	Msalani	
24	Nandi Hills	Nyansiongo		Kwale	Hola	
25	Lumakanda	Ogembo		Kiserian		
26	Matunda			Loitokitok		
27	Ugunja			Githunguri		
28	Port Victoria			Wote		
29	Ukwala			Watamu		
30	Nambale			Mitto Andei		
31	Burnt Forest			Masambweni		
32	Malava					
Total	32 UCs	25 UCs	13 UCs	31 UCs	24 UCs	12 UCs

Source: JICA Study Team based on Census 2009 data

Table 4.3.1 Proposed Water Supply Development Plan for UWSS (LVNCA)

Urban Centre		Service Population in 2030	Water Demand in2030 (m^3/day)	Current Capacity in 2010 (m^3/day)	Under Construction (m^3/day)	Proposed Projects		
						Rehabilitation Works (m^3/day)	Expansion Works (m^3/day)	New Construction (m^3/day)
1	Eldoret	1,105,499	131,554	36,400	11,800	48,200	83,354	0
2	Vihiga	597,496	71,102	60	0	60	71,042	0
3	Kitale	534,528	63,609	10,000	0	10,000	53,609	0
4	Mumias	503,318	59,895	1,680	15,000	16,680	43,215	0
5	Kimilili	477,847	56,864	3,200	1,800	5,000	51,864	0
6	Kakamega	461,945	54,971	16,000	0	16,000	38,971	0
7	Kapsabet	436,952	51,997	3,800	0	3,800	48,197	0
8	Bungoma	281,225	33,466	7,000	0	7,000	26,466	0
9	Busia	261,664	31,138	7,400	0	7,400	23,738	0
10	Luanda	248,400	29,560	0	0	0	0	29,560
11	Item/Tambach	212,992	25,346	1,100	0	1,100	24,246	0
12	Webuye	208,119	24,766	7,000	0	7,000	17,766	0
13	Kapenguria	171,382	20,394	1,680	0	1,680	18,714	0
14	Bondo	168,472	20,048	1,125	0	1,125	18,923	0
15	Siaya	61,452	7,313	2,100	0	2,100	5,213	0
16	Yala	32,277	3,841	2,400	0	2,400	1,441	0
17	Ugunja	36,455	4,338	385	0	385	3,953	0
18	Ukwala	26,110	3,107	360	0	360	2,747	0
19	Malaba	108,112	12,865	2,200	0	2,200	10,665	0
20	Malakisi	85,993	10,233	0	0	0	0	10,233
21	Chwele	72,115	8,582	0	1,200	1,200	7,382	0
22	Butere	64,332	7,656	0	0	0	0	7,656
23	Kiminini	60,330	7,179	0	0	0	0	7,179
24	Usenge	58,861	7,004	0	0	0	0	7,004
25	Moi's Bridge	58,266	6,934	0	0	0	0	6,934
26	Nandi Hills	50,942	6,062	0	0	0	0	6,062
27	Lumakanda	44,681	5,317	0	1,200	1,200	4,117	0
28	Matunda	37,643	4,480	0	0	0	0	4,480
29	Port Victoria	33,027	3,930	0	0	0	0	3,930
30	Nambale	24,872	2,960	0	0	0	0	2,960
31	Burnt Forest	24,792	2,950	0	0	0	0	2,950
32	Malava	20,488	2,438	0	0	0	0	2,438
	Total	6,570,585	781,900	103,890	31,000	134,890	555,624	91,386
							647,010	

Note: The service population of piped water supply (UWSS+LSRWSS) in 2010 was estimated at 0.77 million. The service population for each urban centre in 2010 is not clear. All urban population of urban centre in 2030 was counted as service population.

Source: JICA Study Team, based on data from WSBs and Census 2009

Table 4.3.2 Proposed Water Supply Development Plan for LSRWSS (LVNCA)

Item	Service Population in 2030	Water Demand in 2030 (m^3/day)	Current Capacity in 2010 (m^3/day)	Proposed Projects	
				Rehabilitation Works (m^3/day)	New Construction (m^3/day)
Urban Pop.	1.13	135,007	15,000	15,000	169,000
Rural Pop.	0.65	49,317			
Total	1.78	184,324			

Note: The service population of piped water supply (UWSS+LSRWSS) in 2010 was estimated at 0.77 million.

Source: JICA Study Team, based on data from WSBs and Census 2009

Table 4.3.3 Proposed Water Supply Development Plan for SSRWSS (LVNCA)

Counties	Service Population in 2010	Service Population in 2030	Difference (2010-2030)	Required Water Supply Amount in 2030 (m^3/day)
11	3,888,000	4,007,252	119,252	220,399

Source: JICA Study Team, based on data from Census 2009

Table 4.4.1 Proposed Water Supply Development for UWSS (LVSCA)

Urban Centre		Service Population, in 2030	Water Demand in 2030 (m^3/day)	Current Capacity in 2010 (m^3/day)	Under Construction (m^3/day)	Proposed Projects		
						Rehabilitation Works (m^3/day)	Expansion Works (m^3/day)	New Construction (m^3/day)
Kisumu and Surrounding Area								
1	Kisumu	1,457,208	212,752	22,400	24,000	46,400	166,352	0
2	Ahero	255,366	30,389	0	0	0	0	30,389
3	Awasi	172,268	20,500	100	0	100	20,400	0
4	Muhoroni	173,451	20,641	720	0	720	19,921	0
5	Kipkelion	235,382	28,010	280	0	280	27,730	0
6	Londiani	217,220	25,849	0	0	0	0	25,849
	Sub-total	2,510,895	338,141	23,500	24,000	47,500	234,403	56,238
Kisii and Surrounding Area								
1	Rongo	519,406	61,809	320	2,000	2,320	59,489	0
2	Kisii	411,773	49,001	7,500	12,000	19,500	29,501	0
3	Suneka	255,809	30,441	0	0	0	0	30,441
4	Keroka	209,679	24,952	600	0	600	24,352	0
5	Awendo	80,193	9,543	0	2,000	2,000	7,543	0
6	Tabaka	52,467	6,244	150	0	150	6,094	0
7	Ogembo	11,674	1,389	600	0	600	789	0
	Sub-total	1,541,001	183,379	9,170	16,000	25,170	127,768	30,441
Other Area								
1	Kericho	512,485	60,986	12,960	0	12,960	48,026	0
2	Bomet	421,478	50,156	450	0	450	49,706	0
3	Migori	267,297	31,808	1,056	15,000	16,056	15,752	0
4	Homa Bay	218,278	25,975	3,500	2,000	5,500	20,475	0
5	Nyamira	209,750	24,960	3,200	0	3,200	21,760	0
6	Oyugis	178,454	21,236	1,920	0	1,920	19,316	0
7	Kehancha	151,564	18,036	320	0	320	17,716	0
8	Kendu Bay	74,234	8,834	720	0	720	8,114	0
9	Mbita Point	60,351	7,182	0	0	0	0	7,182
10	Litein	45,823	5,453	5,453	0	5,453	0	0
11	Sotik	42,113	5,011	500	0	500	4,511	0
12	Nyansiongo	28,376	3,377	600	0	600	2,777	0
	Sub-total	2,210,203	263,014	30,679	17,000	47,679	208,153	7,182
	Total	6,262,099	784,534	63,349	57,000	120,349	570,324	93,861
							664,185	

Note: The service population of piped water supply (UWSS+LSRWSS) in 2010 was estimated at 0.88 million. The service population for each urban centre in 2010 is not clear. All urban population of urban centre in 2030 was counted as service population.

Source: JICA Study Team, based on data from WSBs and Census 2009

Table 4.4.2 Proposed Water Supply Development Plan for LSRWSS (LVSCA)

Item	Service Population in 2030	Water Demand in 2030 (m^3/day)	Current Capacity in 2010 (m^3/day)	Proposed Projects	
				Rehabilitation Works (m^3/day)	New Construction (m^3/day)
Urban Pop.	1.73	206,000	26,000	26,000	251,000
Rural Pop.	0.94	71,000			
Total	2.67	277,000			

Note: The service population of piped water supply (UWSS+LSRWSS) in 2010 was estimated at 0.88 million.

Source: JICA Study Team, based on data from WSBs and Census 2009

Table 4.4.3 Proposed Water Supply Development Plan for SSRWSS (LVSCA)

Counties	Service Population in 2010	Service Population in 2030	Difference (2010-2030)	Required Water Supply Amount in 2030 (m^3/day)
14	2,369,000	3,788,577	1,419,577	208,372

Source: JICA Study Team, based on data from Census 2009

Table 4.5.1 Proposed Water Supply Development for UWSS (RVCA)

Urban Centre		Service Population in 2030	Water Demand in 2030 (m^3/day)	Current Capacity in 2010 (m^3/day)	Under Construction (m^3/day)	Proposed Projects		
						Rehabilitation Works (m^3/day)	Expansion Works (m^3/day)	New Construction (m^3/day)
Greater Naluru								
1	Nakuru	1,155,789	137,539	81,791	35,000	116,791	192,374	0
2	Naivasha	851,433	101,320					
3	Molo	204,630	24,351					
4	Gilgil	177,659	21,141					
5	Njoro	118,552	14,108					
6	Eldama Ravine	89,965	10,706					
7	Ol Kalou	332,309	39,545	2,087	2,600	4,687	34,858	0
	Sub-total	2,930,336	348,710	83,878	37,600	121,478	227,232	0
Arid Area								
1	Lodwar	59,544	7,086	3,068	0	3,068	4,018	0
2	Kakuma	45,444	5,408	0	0	0	0	5,408
3	Kabarnet	31,236	3,717	2,496	0	2,496	1,221	0
4	Lokichogio	21,807	2,595	0	0	0	0	2,595
	Sub-total	158,032	18,806	5,564	0	5,564	5,239	8,003
Others								
1	Narok	194,573	23,154	1,880	0	1,880	21,274	0
2	Mai Mahiu	58,689	6,984	0	0	0	0	6,984
	Sub-total	253,262	30,138	1,880	0	1,880	21,274	6,984
	Total	3,341,630	397,654	91,322	37,600	128,922	253,745	14,987
							268,732	

Note: The service population of piped water supply (UWSS+LSRWSS) in 2010 was estimated at 1.36 million. The service population for each urban centre in 2010 is not clear. All urban population of urban centre in 2030 was counted as service population.

Source: JICA Study Team, based on data from WSBs and Census 2009

Table 4.5.2 Proposed Water Supply Development Plan for LSRWSS (RVCA)

Item	Service Population in 2030	Water Demand in 2030 (m^3/day)	Current Capacity in 2010 (m^3/day)	Proposed Projects	
				Rehabilitation Works (m^3/day)	New Construction (m^3/day)
Urban Pop.	1.14	136,000	7,000	7,000	171,000
Rural Pop.	0.56	42,000			
Total	1.70	178,000			

Note: The service population of piped water supply (UWSS+LSRWSS) in 2010 was estimated at 1.36 million.

Source: JICA Study Team, based on data from WSBs and Census 2009

Table 4.5.3 Proposed Water Supply Development Plan for SSRWSS (RVCA)

Counties	Service Population in 2010	Service Population in 2030	Difference (2010-2030)	Required Water Supply Amount in 2030 (m^3/day)
18	1,320,000	2,403,537	1,083,537	119,700

Source: JICA Study Team, based on data from Census 2009

Table 4.6.1 Proposed Water Supply Development for UWSS (ACA)

Urban Centre		Service Population in 2030	Water Demand in 2030 (m^3/day)	Current Capacity in 2010 (m^3/day)	Under Construction (m^3/day)	Proposed Projects		
						Rehabilitation Works (m^3/day)	Expansion Works (m^3/day)	New Construction (m^3/day)
Greater Nairobi								
1	Nairobi	6,085,297	888,453					
2	Ruiru	896,358	106,667					
3	Kikuyu	875,242	104,154					
4	Kangundo-Tala	820,175	97,601					
5	Mavoko	514,909	61,274					
6	Thika	513,806	61,143					
7	Karuri	404,224	48,103					
8	Ngong	402,242	47,867	570,263	33,420	603,683	961,207	0
9	Kiambu	315,807	37,581					
10	Limuru	298,455	35,516					
11	Kitengela	218,282	25,976					
12	Juja	151,781	18,062					
13	Ongata Rongai	150,775	17,942					
14	Kiserian	71,913	8,558					
15	Githunguri	50,374	5,994					
16	Machakos	755,281	89,878	3,373	0	3,373	86,505	0
	sub-total	12,524,922	1,654,769	573,636	33,420	607,056	1,047,713	0
Mombasa Area								
1	Mombasa	2,644,591	386,110					
2	Malindi	443,811	52,814					
3	Ukunda	234,651	27,924					
4	Kilifi	183,228	21,804					
5	Mtwapa	182,474	21,714	86,620	0	86,620	449,919	0
6	Mariakani	90,271	10,742					
7	Kwale	74,303	8,842					
8	Watamu	37,639	4,479					
9	Masambweni	17,731	2,110					
	sub-total	3,908,701	536,539	86,620	0	86,620	449,919	0
Other Area								
1	Wundanyi	185,136	22,031	1,400	0	1,400	30,906	0
2	Voi	86,340	10,274					
3	Taveta	99,997	11,900	0	0	0	0	11,900
4	Kajiado	74,803	8,902	0	1,000	1,000	7,902	0
5	Loitoktok	56,530	6,727	0	0	0	0	6,727
6	Wote	49,709	5,915	225	300	525	5,690	0
7	Mitto Andei	22,753	2,708	2,708	0	2,708	0	0
	sub-total	575,268	68,457	4,333	1,300	5,633	44,498	18,627
	Grand-total	17,008,891	2,259,765	664,589	34,720	699,309	1,542,130	18,627
							1,560,756	

Note: Water demand in Thika, which is in Tana Catchment with 61,143 m^3/day, is satisfied with water supply system of Athi Catchment. The service population of piped water supply (UWSS+LSRWSS) in 2010 was estimated at 5.29 million. The service population for each urban centre in 2010 is not clear. All urban population of urban centre in 2030 was counted as service population.

Source: JICA Study Team, based on data from WSBs and Census 2009

Table 4.6.2 Proposed Water Supply Development Plan for LSRWSS (ACA)

Item	Service Population in 2030	Water Demand in 2030 (m^3/day)	Current Capacity in 2010 (m^3/day)	Proposed Projects	
				Rehabilitation Works (m^3/day)	New Construction (m^3/day)
Urban Pop.	1.23	137,000	37,000	37,000	155,000
Rural Pop.	0.81	62,000			
Total	2.04	209,000			

Note: The service population of piped water supply (UWSS+LSRWSS) in 2010 was estimated at 5.29 million.

Source: JICA Study Team, based on data from WSBs and Census 2009

Table 4.6.3 Proposed Water Supply Development Plan for SSRWSS (ACA)

Counties	Service Population in 2010	Service Population in 2030	Difference (2010-2030)	Required Water Supply Amount in 2030 (m^3/day)
10	1,126,000	2,001,856	875,856	110,102

Source: JICA Study Team, based on data from WSBs and Census 2009

Table 4.7.1 Proposed Water Supply Development for UWSS (TCA)

Urban Centre		Service Population in 2030	Water Demand in 2030 (m^3/day)	Current Capacity in 2010 (m^3/day)	Under Construction (m^3/day)	Proposed Projects		
						Rehabilitation Works (m^3/day)	Expansion Works (m^3/day)	New Construction (m^3/day)
Upstream of Tana Catchment								
1	Nyeri	600,803	71,496	27,000	0	27,000	44,496	0
2	Embu	305,362	36,338	12,000	0	12,000	24,338	0
3	Meru	269,949	32,124	4,500	0	4,500	27,624	0
4	Chuka	218,821	26,040	2,700	0	2,700	23,340	0
5	Chogoria	143,036	17,021	600	0	600	16,421	0
6	Maua	86,713	10,319	0	0	0	0	10,319
7	Makuyu	221,524	26,361	0	0	0	0	26,361
8	Muranga	144,849	17,237	4,848	10,000	14,848	2,389	0
9	Maragua	132,762	15,799	0	0	0	0	15,799
10	Wanguru	120,726	14,366	0	0	0	0	14,366
11	Runyenjes	98,401	11,710	0	0	0	0	11,710
12	Kerugoya/Kutus	97,767	11,634	11,634	0	11,634	0	0
13	Sagana	53,112	6,320	2,358	0	2,358	3,962	0
14	Karatina	42,783	5,091	0	0	0	0	5,091
15	Othaya	25,859	3,077	3,077	0	3,077	0	0
	Sub-total	2,562,468	304,934	68,717	10,000	78,717	142,570	83,646
Arid Area								
1	Garissa	143,348	17,058	12,640	0	12,640	4,418	0
2	Madogo	19,308	2,298	0	0	0	0	2,298
3	Msalani	18,371	2,186	0	0	0	0	2,186
4	Hola	17,553	2,089	1,400	0	1,400	689	0
	Sub-total	198,580	23,631	14,040	0	14,040	5,107	4,484
Other Area								
1	Lamu	1,250,000	108,750	3,400	0	3,400	105,350	0
2	Kitui	551,547	65,634	7,750	0	7,750	57,884	0
3	Matuu	255,467	30,401	702	0	702	29,699	0
4	Mwingi	80,390	9,566	1,417	0	1,417	8,149	0
	Sub-total	2,137,404	214,351	13,269	0	13,269	201,082	0
	Total	4,898,453	542,916	96,026	10,000	106,026	348,759	88,130
							436,889	

Note: It is supplied from ACA in Thika, which is in Tana catchment with 61,143 m^3/day of water demand.

The service population of piped water supply (UWSS+LSRWSS) in 2010 was estimated at 1.95 million. The service population for each urban centre in 2010 is not clear. All urban population of urban centre in 2030 was counted as service population.

Source: JICA Study Team, based on data from WSBs and Census 2009

Table 4.7.2 Proposed Water Supply Development Plan for LSRWSS (TCA)

Item	Service Population in 2030	Water Demand in 2030 (m^3/day)	Current Capacity in 2010 ^{3}/day)	Proposed Projects	
				Rehabilitation Works (m^3/day)	New Construction (m^3/day)
Urban Pop.	0.93	111,000	149,000	149,000	24,000
Rural Pop.	0.81	62,000			
Total	1.74	173,000			

Note: The service population of piped water supply (UWSS+LSRWSS) in 2010 was estimated at 1.95 million.

Source: JICA Study Team, based on data from WSBs and Census 2009

Table 4.7.3 Proposed Water Supply Development Plan for SSRWSS (TCA)

Counties	Service Population in 2010	Service Population in 2030	Difference (2010-2030)	Required Water Supply Amount in 2030 (m^3/day)
16	1,287,000	2,717,272	1,439,382	144,913

Source: JICA Study Team, based on data from Census 2009

Table 4.8.1 Proposed Water Supply Development for UWSS (ENNCA)

Urban Centre		Service Population in 2030	Water Demand in 2030 (m^3/day)	Current Capacity in 2010 (m^3/day)	Under Construction (m^3/day)	Proposed Projects		
						Rehabilitation Works (m^3/day)	Expansion Works (m^3/day)	New Construction (m^3/day)
1	Isiolo	231,501	27,549	3,220	10,528	13,748	13,801	0
2	Nanyuki	192,282	22,882	10,610	0	10,610	12,272	0
3	Nyahururu	183,483	21,835	4,552	0	4,552	17,283	0
4	Rumuruti	50,661	6,029	0	0	0	0	6,029
5	Mandera	108,071	12,860	1,672	0	1,672	11,188	0
6	Wajir	102,042	12,143	0	0	0	0	12,143
7	Moyale	46,075	5,483	67	1,020	1,087	4,396	0
8	Rhamu	32,494	3,867	0	0	0	0	3,867
9	Elwak	30,031	3,574	0	0	0	0	3,574
10	Takaba	27,305	3,249	0	0	0	0	3,249
11	Maralal	19,546	2,326	798	0	798	1,528	0
12	Marsabit	16,317	1,942	0	0	0	0	1,942
	Total	1,039,808	123,737	20,919	11,548	32,467	60,467	30,803
							91,270	

Note: The service population of piped water supply (UWSS+LSRWSS) in 2010 was estimated at 0.99 million. The service population for each urban centre in 2010 is not clear. All urban population of urban centre in 2030 was counted as service population.

Source: JICA Study Team, based on data from WSBs and Census 2009

Table 4.8.2 Proposed Water Supply Development Plan for LSRWSS (ENNCA)

Items	Service Population in 2030	Water Demand in 2030 (m^3/day)	Current Capacity in 2010 (m^3/day)	Proposed Projects	
				Rehabilitation Works (m^3/day)	New Construction (m^3/day)
Urban Pop.	0.72	86,000	7,000	7,000	112,000
Rural Pop.	0.45	33,000			
Total	1.16	119,000			

Note: The service population of piped water supply (UWSS+LSRWSS) in 2010 was estimated at 0.99 million.

Source: JICA Study Team, based on data from WSBs and Census 2009

Table 4.8.3 Proposed Water Supply Development Plan for SSRWSS (ENNCA)

Counties	Service Population in 2010	Service Population in 2030	Difference (2010-2030)	Required Water Supply Amount in 2030 (m^3/day)
14	1,386,000	2,199,200	813,200	100,943

Source: JICA Study Team, based on data from Census 2009

Table 5.2.1 Project Cost and O&M Cost for Urban Water Supply Development Projects (LVNCA)

	Urban Centre	Service Population in 2030	Water Demand in 2030 (m^3/day)	Rehabilitation Works (m^3/day)	Development Capacity (m^3/day)	Project Cost (KSh million)					O&M Cost (KSh million/year)
						Total	Rehabilitation Works	Major Dam/ Major Transmission	Intake/ Mainor Transmission	Distribution	
1	Eldoret	1,105,499	131,554	48,200	83,354	18,760	2,773		2,664	13,322	778
2	Vihiga	597,496	71,102	60	71,042	13,629	3		2,271	11,354	663
3	Kitale	534,528	63,609	10,000	53,609	10,857	575		1,714	8,568	500
4	Mumias	503,318	59,895	16,680	43,215	9,248	960		1,381	6,907	403
5	Kimilili	477,847	56,864	5,000	51,864	10,235	288		1,658	8,289	484
6	Kakamega	461,945	54,971	16,000	38,971	8,395	921		1,246	6,229	364
7	Kapsabet	436,952	51,997	3,800	48,197	9,462	219		1,541	7,703	450
8	Bungoma	281,225	33,466	7,000	26,466	5,479	403		846	4,230	247
9	Busia	261,664	31,138	7,400	23,738	4,978	426		759	3,794	222
10	Luanda	248,400	29,560	0	29,560	5,669	0		945	4,724	276
11	Item/Tambach	212,992	25,346	1,100	24,246	4,713	63		775	3,875	226
12	Webuye	208,119	24,766	7,000	17,766	3,810	403		568	2,839	166
13	Kapenguria	171,382	20,394	1,680	18,714	3,686	97		598	2,991	175
14	Bondo	168,472	20,048	1,125	24,136	6,376	186		772	3,858	225
15	Siaya	61,452	7,313	2,100							
16	Yala	32,277	3,841	2,400	8,141	0	0		260	1,301	76
17	Ugunja	36,455	4,338	385							
18	Ukwala	26,110	3,107	360							
19	Malaba	108,112	12,865	2,200	10,665	2,172	127		341	1,705	100
20	Malakisi	85,993	10,233	0	10,233	1,963	0		327	1,636	96
21	Chwele	72,115	8,582	1,200	7,382	1,485	69		236	1,180	69
22	Butere	64,332	7,656	0	7,656	1,468	0		245	1,224	71
23	Kiminini	60,330	7,179	0	7,179	1,377	0		229	1,147	67
24	Usenge	58,861	7,004	0	7,004	1,343	0		224	1,119	65
25	Moi'S Bridge	58,266	6,934	0	6,934	1,330	0		222	1,108	65
26	Nandi Hills	50,942	6,062	0	6,062	1,163	0		194	969	57
27	Lumakanda	44,681	5,317	1,200	4,117	859	69		132	658	38
28	Matunda	37,643	4,480	0	4,480	859	0		143	716	42
29	Port Victoria	33,027	3,930	0	3,930	754	0		126	628	37
30	Nambale	24,872	2,960	0	2,960	568	0		95	473	28
31	Burnt Forest	24,792	2,950	0	2,950	566	0		94	472	28
32	Malava	20,488	2,438	0	2,438	468	0		78	390	23
	Major Water Sourece Works										
	Siyoi					2,907		2,907			15
	Moi's Bridge					563		563			3
	Nzoia (34B)					0		0			0
	Kibolo					2,336		2,336			12
	Teremi					3,614		3,614			18
	Nzoia (42A)					0		0			0
	Transmission (to Eldret)					3,069		3,069			15
	Total	6,570,585	781,900	134,890	647,010	144,158	7,578	12,488	20,682	103,410	6,101

Source: JICA Study Team

Table 5.2.2 Project Cost and O&M Cost for LSRWSS Development Projects (LVNCA)

	Item	Service Population in 2030	Water	Rehabilitation Works (m^3/day)	Development Capacity (m^3/day)	Project Cost (KSh million)					O&M Cost (KSh million/year)
						Total	Rehabilitation Works	Major Dam/ Major Transmission	Intake/ Mainor Transmission	Distribution	
1	Urban Pop.	1,134,510	135,007	9,216	125,791	24,656	528		4,021	20,106	1,174
2	Rural Pop.	648,906	49,317	5,380	43,937	8,427	0		1,404	7,022	410
	Total	1,783,416	184,324	14,596	169,728	33,082	528		5,425	27,129	1,584

Source: JICA Study Team

Table 5.2.3 Project Cost and O&M Cost for Urban Water Supply Development Projects (LVSCA)

	Urban Centre	Service Population in 2030	Water Demand in 2030 (m^3/day)	Rehabilitation Works (m^3/day)	Development Capacity	Project Cost (KSh million)					O&M Cost (KSh million/year)
						Total	Rehabilitation Works	Major Dam/ Major Transmission	Intake/ Mainor Transmission	Distribution	
Kisumu and Surrounding Area											
1	Klsumu	1,457,208	212,752	46,400	166,352	34,574	2,670		5,317	26,587	1,553
2	Ahero	255,366	30,389	0	50,789	9,747	0		1,623	8,117	474
3	Awasi	172,268	20,500	100							
4	Muhoroni	173,451	20,641	720	19,921	3,862	41		637	3,184	186
5	Kipkelion	235,382	28,010	280	53,579	10,292	16		1,713	8,563	500
6	Londiani	217,220	25,849	0							
	Major Water Sourece Works										
	Nandi Forest					7,126		7,126			36
	Nyando (Koru)					8,175		8,175			41
	Kibos					9,044		9,044			45
	Sub-total	2,510,895	338,141	47,500	290,641	82,820	2,733	24,345	9,290	46,452	2,835
Kisii and Surrounding Area											
1	Rongo	519,406	61,809	2,320	59,489	11,543	133		1,902	9,508	555
2	Kisii	411,773	49,001	19,500	29,501	6,780	1,122		943	4,715	275
3	Suneka	255,809	30,441	0	30,441	5,838	0		973	4,865	284
4	Keroka	209,679	24,952	600	24,352	4,705	35		778	3,892	227
5	Awendo	80,193	9,543	2,000	7,543	1,562	115		241	1,206	70
6	Tabaka	52,467	6,244	150	6,094	1,177	9		195	974	57
7	Ogembo	11,674	1,389	600	789	186	35		25	126	7
	Major Water Sourece Works										
	Bunyunyu Dam					2,080		2,080			10
	Sub-total	1,541,001	183,379	25,170	158,209	33,871	1,448	2,080	5,057	25,286	1,487
Other Area											
1	Kericho	512,485	60,986	12,960	48,026	9,957	746		1,535	7,676	448
2	Bomet	421,478	50,156	450	49,706	9,559	26		1,589	7,944	464
3	Migori	267,297	31,808	16,056	15,752	3,945	924		504	2,518	147
4	Homabay	218,278	25,975	5,500	20,475	4,243	316		654	3,272	191
5	Nyamira	209,750	24,960	3,200	41,076	8,173	184		1,313	6,565	383
6	Oyugis	178,454	21,236	1,920			110				
7	Kehancha	151,564	18,036	320	17,716	3,416	18		566	2,831	165
8	Kendu Bay	74,234	8,834	720	8,114	1,598	41		259	1,297	76
9	Mbita Point	60,351	7,182	0	7,182	1,377	0		230	1,148	67
10	Litein	45,823	5,453	5,453	0	343	314		0	0	0
11	Sotik	42,113	5,011	500			29				
12	Nyansiongo	28,376	3,377	600	2,777	567	35		89	444	26
	Sub-total	2,210,203	263,014	47,679	210,824	43,177	2,743		6,739	33,695	1,968
	Total	6,262,099	784,534	120,349	659,674	159,868	6,921	26,424	21,086	105,437	6,289

Source: JICA Study Team

Table 5.2.4 Project Cost and O&M Cost for LSRWSS Development Projects (LVSCA)

	Item	Service Population in 2030	Water Demand in 2030 (m^3/day)	Rehabilitation Works (m^3/day)	Development Capacity (m^3/day)	Project Cost (KSh million)					O&M Cost (KSh million/year)
						Total	Rehabilitation Works	Major Dam/ Major Transmission	Intake/ Mainor Transmission	Distribution	
1	Other Urban Pop.	1,731,843	206,089	26,089	180,000	36,025	1,500	0	5,754	28,772	1,680
2	Rural Pop.	935,056	71,064	10,150	60,914	11,684	0	0	1,947	9,737	569
	Major Water Sourece Works										
	Magwagwa					68		68			0
	Katieno					0		0			0
	Ilooiterre					426		426			2
	Sand River (Naikara)					1,466		1,466			7
	Amala					111		111			1
	Total	2,666,899	277,154	36,239	240,915	49,780	1,500	2,071	7,701	38,508	2,259

Source: JICA Study Team

Table 5.2.5 Project Cost and O&M Cost for Urban Water Supply Development Projects (RVCA)

	Urban Centre	Service Population in 2030	Water Demand in 2030 (m^3/day)	Rehabilitation Works (m^3/day)	Development Capacity (m^3/day)	Project Cost (KSh million)					O&M Cost (KSh million/year)
						Total	Rehabilitation Works	Major Dam/ Major Transmission	Intake/ Mainor Transmission	Distribution	
Greater Naluru											
1	Nakuru	1,155,789	137,539								
2	Naivasha	851,433	101,320								
3	Molo	204,630	24,351	116,791	192,374	43,615	6,720		6,149	30,746	1,796
4	Gilgil	177,659	21,141								
5	Njoro	118,552	14,108								
6	Eldama Ravine	89,965	10,706								
7	Ol Kalou	332,309	39,545	4,687	34,858	6,955	270		1,114	5,571	325
	Major Water Sourece Works										
	Itare					5,131		5,131			26
	Londiani					6,223		6,223			31
	Malewa					4,305		4,305			22
	Transmission (fromm Itale and Longiani))					25,742		25,742			129
	Sub-total	2,930,336	348,710	121,478	227,232	91,971	6,989	41,401	7,263	36,317	2,328
Arid Area											
1	Lodwar	59,544	7,086	3,068	4,018	947	177		128	642	38
2	Kakuma	45,444	5,408	0	5,408	1,037	0		173	864	50
3	Kabarnet	31,236	3,717	2,496	1,221	378	144		39	195	11
4	Lokichogio	21,807	2,595	0	2,595	498	0		83	415	24
	Sub-total	158,032	18,806	5,564	13,242	2,860	320		423	2,116	124
Others							0				
1	Narok	194,573	23,154	1,880	21,274	4,188	108		680	3,400	199
	Upper Narok Dam					1,031		1,031			5
2	Mai Mahiu	58,689	6,984	0	6,984	1,340	0		223	1,116	65
	Sub-total	253,262	30,138	1,880	28,258	6,560	109	1,031	903	4,516	269
	Total	3,341,630	397,654	128,922	268,732	101,393	7,416	42,432	8,590	42,955	2,721

Source: JICA Study Team

Table 5.2.6 Project Cost and O&M Cost for LSRWSS Development Projects (RVCA)

	Item	Service Population in 2030	Water Demand in 2030 (m^3/day)	Rehabilitation Works (m^3/day)	Development Capacity (m^3/day)	Project Cost (KSh million)					O&M Cost (KSh million/year)
						Total	Rehabilitation Works	Major Dam/ Major Transmission	Intake/ Mainor Transmission	Distribution	
1	Other Urban Pop.	1,144,266	136,168	6,594	129,574	25,230	384		4,142	20,704	1,209
2	Rural Pop.	556,753	42,313	0	42,313	8,115	0		1,353	6,763	395
	Major Water Sourece Works										
	Murung-Sebit					0		0			0
	Kimwarer					1,492		1,492			7
	Arror					188		188			1
	Embobut					0		0			0
	Waseges					3,273		3,273			16
	Oletukat					1,304		1,304			7
	Leshota					1,202		1,202			6
	Oldorko					742		742			4
	Transmission (fromm Azuala)					2,301		2,301			12
	Total	1,701,019	178,481	6,594	171,887	43,847	384	10,502	5,494	27,467	1,645

Source: JICA Study Team

Table 5.2.7 Project Cost and O&M Cost for Urban Water Supply Development Projects (ACA)

	Urban Centre	Service Population in 2030	Water Demand in 2030 (m^3/day)	Rehabilitation Works (m^3/day)	Development Capacity (m^3/day)	Project Cost (KSh million)					O&M Cost (KSh million/year)
						Total	Rehabilitation Works	Major Dam/ Major Transmission	Intake/ Mainor Transmission	Distribution	
Greater Nairobi											
1	Nairobi	6,085,297	888,453								
2	Ruiru	896,358	106,667								
3	Kikuyu	875,242	104,154								
4	Kangundo-Tala	820,175	97,601								
5	Mavoko	514,909	61,274								
6	Thlka	513,806	61,143								
7	Karuri	404,224	48,103								
8	Ngong	402,242	47,867	603,683	961,207	219,084	34,734		30,725	153,625	8,972
9	Kiambu	315,807	37,581								
10	Limuru	298,455	35,516								
11	Kitengela	218,282	25,976								
12	Juja	151,781	18,062								
13	Ongata Rongai	150,775	17,942								
14	Kiserian	71,913	8,558								
15	Githunguri	50,374	5,994								
16	Machakos	755,281	89,878	3,373	86,505	16,785	194	0	2,765	13,826	807
	Major Water Sourece Works										
	Upper Athi					2,813		2,813			14
	Kikuyu					4,117		4,117			21
	Kiambaa (Ruaka)					1,961		1,961			10
	Ruiru-A					6,998		6,998			35
	Ndarugu					5,345		5,345			27
	Maragua 8					7,058		7,058			35
	Ndiara					7,058		7,058			35
	Chania-B					14,082		14,082			70
	Mbuuni					2,566		2,566			13
	Transmission of Norther Collectior and Others					74,244		74,244			371
	sub-total	1	1,654,769	607,056	1,047,713	362,109	34,928	126,240	33,490	167,451	10,410
Mombasa Area											
1	Mombasa	2,644,591	386,110								
2	Malindi	443,811	52,814								
3	Ukunda	234,651	27,924								
4	Kilifi	183,228	21,804								
5	Mtwapa	182,474	21,714	86,620	449,919	91,274	4,984		14,382	71,908	4,199
6	Mariakani	90,271	10,742								
7	Kwale	74,303	8,842								
8	Watamu	37,639	4,479								
9	Masambweni	17,731	2,110								
	Major Water Sourece Works										
	Rare Dam					3,648		3,648			18
	Mwachi Dam					4,398		4,398			22
	Pemba					5,472		5,472			27
	Disalination Plants							0			6,342
	Transmission (from Mzima)					35,289		35,289			176
	Transmission (from Sabaki)					15,002		15,002			75
	sub-total	3,908,701	536,539	92,200	444,339	155,085	4,984	63,811	14,382	71,908	10,860
Other Area											
1	Wundanyi	185,136	22,031	1,400	30,906	6,008	81		988	4,939	288
2	Voi	86,340	10,274								
3	Taveta	99,997	11,900	0	11,900	2,282	0		380	1,902	111
	Lake Chala					1,551		1,551			8
4	Kajiado	74,803	8,902	1,000	7,902	1,573	58		253	1,263	74
5	Loitoktok	56,530	6,727	0	6,727	1,290	0		215	1,075	63
6	Wote	49,709	5,915	525	5,390	1,064	30		172	862	50
7	Mitto Andei	22,753	2,708	2,951	0	170	170		0	0	0
	sub-total	575,268	68,457	5,876	62,824	13,939	338	1,551	2,008	10,041	594
	Total	4,483,970	2,259,765	705,132	1,554,876	531,130	40,251	191,602	49,880	249,397	21,865

Source: JICA Study Team

Table 5.2.8 Project Cost and O&M Cost for LSRWSS Development Projects (ACA)

	Item	Service Population in 2030	Water Demand	Rehabilitation Works (m^3/day)	Development Capacity (m^3/day)	Project Cost (KSh million)					O&M Cost (KSh million/year)
						Total	Rehabilitation Works	Major Dam/ Major Transmission	Intake/ Mainor Transmission	Distribution	
1	Other Urban Pop.	1,235,080	146,975	12,960	134,015	25,703	0		4,284	21,419	1,251
2	Rural Pop.	810,576	61,604	23,800	37,804	7,250	0		1,208	6,042	353
	Major Water Sourece Works										
	Kiteta					3,009		3,009			15
	Thwake					2,199		2,199			11
	Olkishunki					1,381		1,381			7
	Total	2,045,656	208,578	36,760	171,818	39,543	0	6,589	5,492	27,462	1,637

Source: JICA Study Team

Table 5.2.9 Project Cost and O&M Cost for Urban Water Supply Development Projects (TCA)

	Urban Centre	Service Population in 2030	Water Demand in 2030 (m^3/day)	Rehabilitation Works (m^3/day)	Development Capacity	Project Cost (KSh million)					O&M Cost (KSh million/year)
						Total	Rehabilitation Works	Major Dam/ Major Transmission	Intake/ Mainor Transmission	Distribution	
Upstream of Tana Catchment											
1	Nyeri	600,803	71,496	27,000	36,048	9,423	2,510		1,152	5,761	336
14	Karatina	42,783	5,091	0							
15	Othaya	25,859	3,077	16,616							
2	Embu	305,362	36,338	12,000	36,048	7,604	690		1,152	5,761	336
11	Runyenjes	98,401	11,710	0							
3	Meru	269,949	32,124	4,500	37,943	7,536	259		1,213	6,064	354
6	Maua	86,713	10,319	0							
4	Chuka	218,821	26,040	2,700	39,761	7,816	190		1,271	6,355	371
5	Chogoria	143,036	17,021	600							
8	Muranga	144,849	17,237	14,848	44,549	9,398	854		1,424	7,120	416
9	Maragua	132,762	15,799	0							
7	Makuyu	221,524	26,361	0							
12	Kerugoya/Kutus	97,767	11,634	11,834	18,129	4,294	817		579	2,897	169
10	Wanguru	120,726	14,366	0							
13	Sagana	53,112	6,320	2,358							
	Sub-total	2,562,468	304,934	92,456	212,478	46,071	5,320	0	6,792	33,959	1,983
Arid Area											
1	Garissa	143,348	17,058	12,640	4,418	1,575	727		141	706	41
2	Madogo	19,308	2,298	0	2,298	441	0		73	367	21
3	Msalani	18,371	2,186	0	2,186	419	0		70	349	20
4	Hola	17,553	2,089	1,400	689	213	81		22	110	6
	Sub-total	198,580	23,631	14,040	9,591	2,647	808	0	307	1,533	90
Other Area											
1	Lamu	1,250,000	108,750	3,400	105,350	22,787	196		5,754	16,838	983
	High Grand Falls Dam							0			0
	Transmission (from Tana to Lamu)					26,936		26,936			135
2	Kitui	551,547	65,634	7,750	57,884	11,548	446		1,850	9,251	540
	Mutuni Dam					3,273		3,273			16
	Kitimui Dam					4,910		4,910			25
	Transmission (to Kitis)					1,705		1,705			9
3	Matuu	255,467	30,401	702	29,699	5,736	40		949	4,747	277
	Yatta Dam					1,381		1,381			7
4	Mwingi	80,390	9,566	1,417	8,149	1,645	82		260	1,302	76
	Transmission (to Muwangi)					852		852			4
	Sub-total	2,137,404	214,351	13,269	201,082	80,772	763	39,057	8,814	32,138	2,072
	Total	4,898,453	542,916	119,765	423,151	129,488	6,887	39,057	15,912	67,632	4,145

Source: JICA Study Team

Table 5.2.10 Project Cost and O&M Cost for LSRWSS Development Projects (TCA)

	Item	Service Population in 2030	Water Demand in 2030 (m^3/day)	Rehabilitation Works (m^3/day)	Development Capacity (m^3/day)	Project Cost (KSh million)					O&M Cost (KSh million/year)
						Total	Rehabilitation Works	Major Dam/ Major Transmission	Intake/ Mainor Transmission	Distribution	
1	Other Urban Pop.	932,041	110,913	108,972	1,941	6,646	6,274		62	310	18
2	Rural Pop.	810,576	61,604	40,320	21,284	4,077	0		680	3,397	199
	Total	1,742,617	172,517	149,292	23,225	10,723	6,274		742	3,707	217

Source: JICA Study Team

Table 5.2.11 Project Cost and O&M Cost for Urban Water Supply Development Projects (ENNCA)

	Urban Centre	Service Population in 2030	Water Demand in 2030 (m^3/day)	Rehabilitation Works (m^3/day)	Development Capacity (m^3/day)	Project Cost (KSh million)					O&M Cost (KSh million/year)
						Total	Rehabilitation Works	Major Dam/ Major Transmission	Intake/ Mainor Transmission	Distribution	
1	Isiolo	231,501	27,549	13,748	13,801	3,438	791	0	441	2,206	129
	Isiolo					1,795	0	1,795	0	0	9
2	Nanyuki	192,282	22,882	10,610	12,272	2,964	610	0	392	1,961	115
3	Nyahururu	183,483	21,835	4,552	17,283	3,577	262	0	552	2,762	161
4	Rumuruti	50,661	6,029	0	6,029	1,156	0	0	193	964	56
	Nyahururu					869		869			4
	Rumuruti					946		946			5
5	Mandera	108,071	12,860	1,672	11,188	2,242	96	0	358	1,788	104
6	Wajir	102,042	12,143	0	12,143	2,329	0	0	388	1,941	113
7	Moyale	46,075	5,483	1,087	4,396	906	63	0	141	703	41
8	Rhamu	32,494	3,867	0	3,867	742	0	0	124	618	36
9	Elwak	30,031	3,574	0	3,574	685	0	0	114	571	33
10	Takaba	27,305	3,249	0	3,249	623	0	0	104	519	30
11	Maralal	19,546	2,326	798	1,528	339	46	0	49	244	14
12	Marsabit	16,317	1,942	0	1,942	372	0	0	62	310	18
	Total	1,039,808	123,737	32,467	91,270	22,981	1,867	3,611	2,917	14,586	870

Source: JICA Study Team

Table 5.2.12 Project Cost and O&M Cost for LSRWSS Development Projects (ENNCA)

	Item	Service Population in 2030	Water Demand in 2030 (m^3/day)	Rehabilitation Works (m^3/day)	Development Capacity (m^3/day)	Project Cost (KSh million)					O&M Cost (KSh million/year)
						Total	Rehabilitation Works	Major Dam/ Major Transmission	Intake/ Mainor Transmission	Distribution	
1	Other Urban Pop.	720,957	85,794	6,948	78,846	15,527	401		2,520	12,606	740
2	Rural Pop.	435,473	33,096	0	33,096	6,347	0		1,058	5,290	311
	Major Water Sourece Works										
	Kihoto							0			
	Archers' Post							0			
	Total	1,156,430	118,890	6,948	111,942	21,874	401	0	3,578	17,895	1,051

Source: JICA Study Team

ıble 5.2.13 Project Cost and O&M Cost for Urban Water Supply Development Projects for Whole of Ken

CA	Service Population in 2030	Water Demand in 2030 (m^3/day)	Rehabilitation Works (m^3/day)	Development Capacity (m^3/day)	Project Cost (KSh million)					O&M Cost (KSh million/year)
					Total	Rehabilitation Works	Major Dam/ Major Transmission	Intake/ Mainor Transmission	Distribution	
1 LVNCA	6,570,585	781,900	134,890	647,010	144,158	7,578	12,488	20,682	103,410	6,101
2 LVSCA	6,262,099	784,534	120,349	659,674	159,868	6,921	26,424	21,086	105,437	6,289
3 RVCA	3,341,630	397,654	128,922	268,732	101,393	7,416	42,432	8,590	42,955	2,721
4 ACA	4,483,970	2,259,765	705,132	1,554,876	531,130	40,251	191,602	49,880	249,397	21,865
5 TCA	4,898,453	542,916	119,765	423,151	129,488	6,887	39,057	15,912	67,632	4,145
6 ENNCA	1,039,808	123,737	32,467	91,270	22,981	1,867	3,611	2,917	14,586	870
Total	26,596,545	4,890,506	1,241,525	3,644,713	1,089,018	70,920	315,615	119,068	583,418	41,992

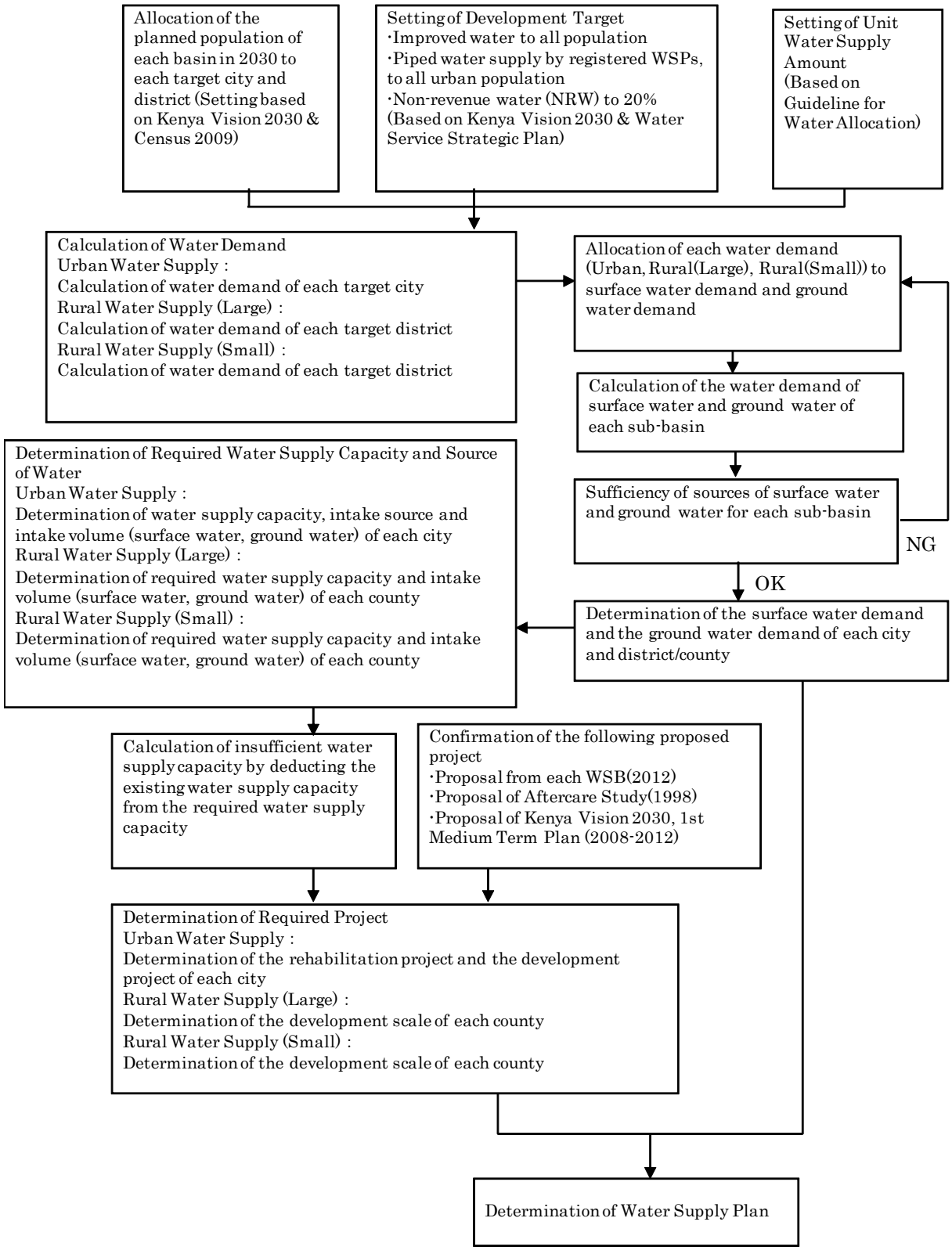
Source: JICA Study Team

Table 5.2.14 Project Cost and O&M Cost for Large Scale Rural Water Supply Development Projects for Whole of Kenya

CA	Service Population in 2030	Water Demand in 2030 (m^3/day)	Rehabilitation Works (m^3/day)	Development Capacity (m^3/day)	Project Cost (KSh million)					O&M Cost (KSh million/year)
					Total	Rehabilitation Works	Major Dam/ Major Transmission	Intake/ Mainor Transmission	Distribution	
1 LVNCA	1,783,416	184,324	14,596	169,728	33,082	528	0	5,425	27,129	1,584
2 LVSCA	2,666,899	277,154	36,239	240,915	49,780	1,500	2,071	7,701	38,508	2,259
3 RVCA	1,701,019	178,481	6,594	171,887	43,847	384	10,502	5,494	27,467	1,645
4 ACA	2,045,656	208,578	36,760	171,818	39,543	0	6,589	5,492	27,462	1,637
5 TCA	1,742,617	172,517	149,292	23,225	10,723	6,274	0	742	3,707	217
6 ENNCA	1,156,430	118,890	6,948	111,942	21,874	401	0	3,578	17,895	1,051
Total	11,096,037	1,139,943	250,429	889,514	198,848	9,087	19,162	28,433	142,168	8,393

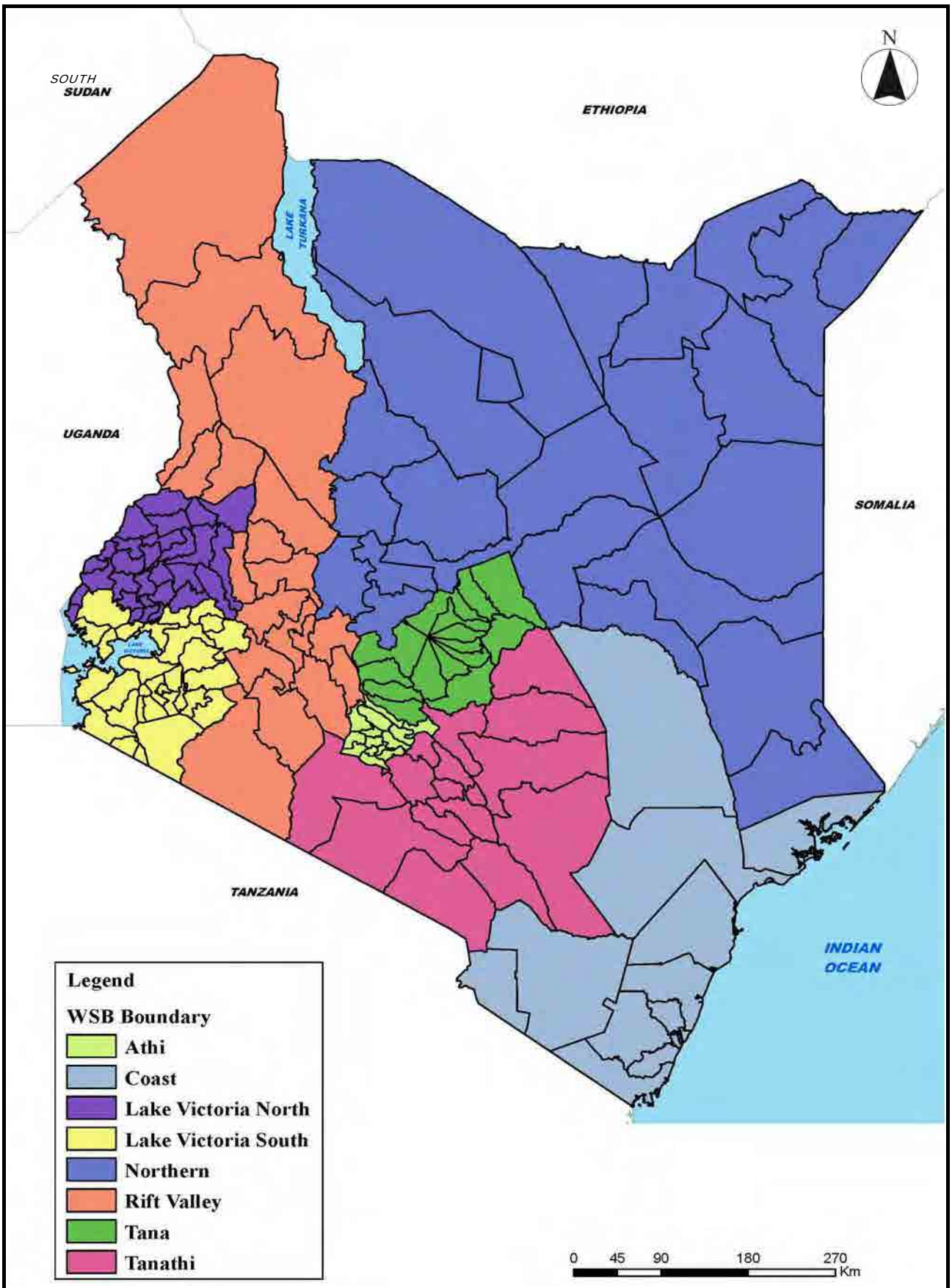
Source: JICA Study Team

Figures



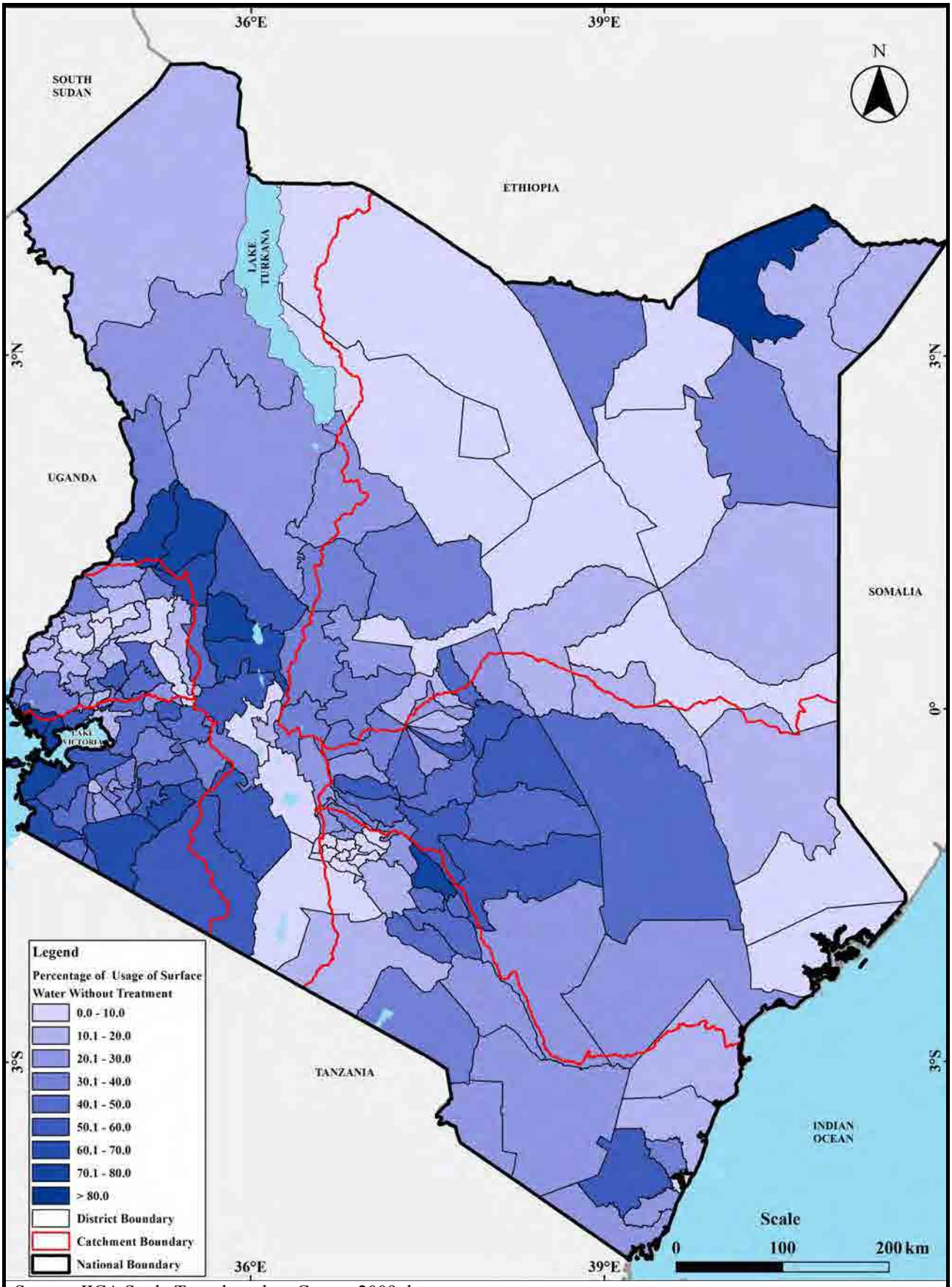
Source: JICA Study Team

THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030	**Figure 1.1.1 Study Flow of Water Supply Development Plan**
JAPAN INTERNATIONAL COOPERATION AGENCY	



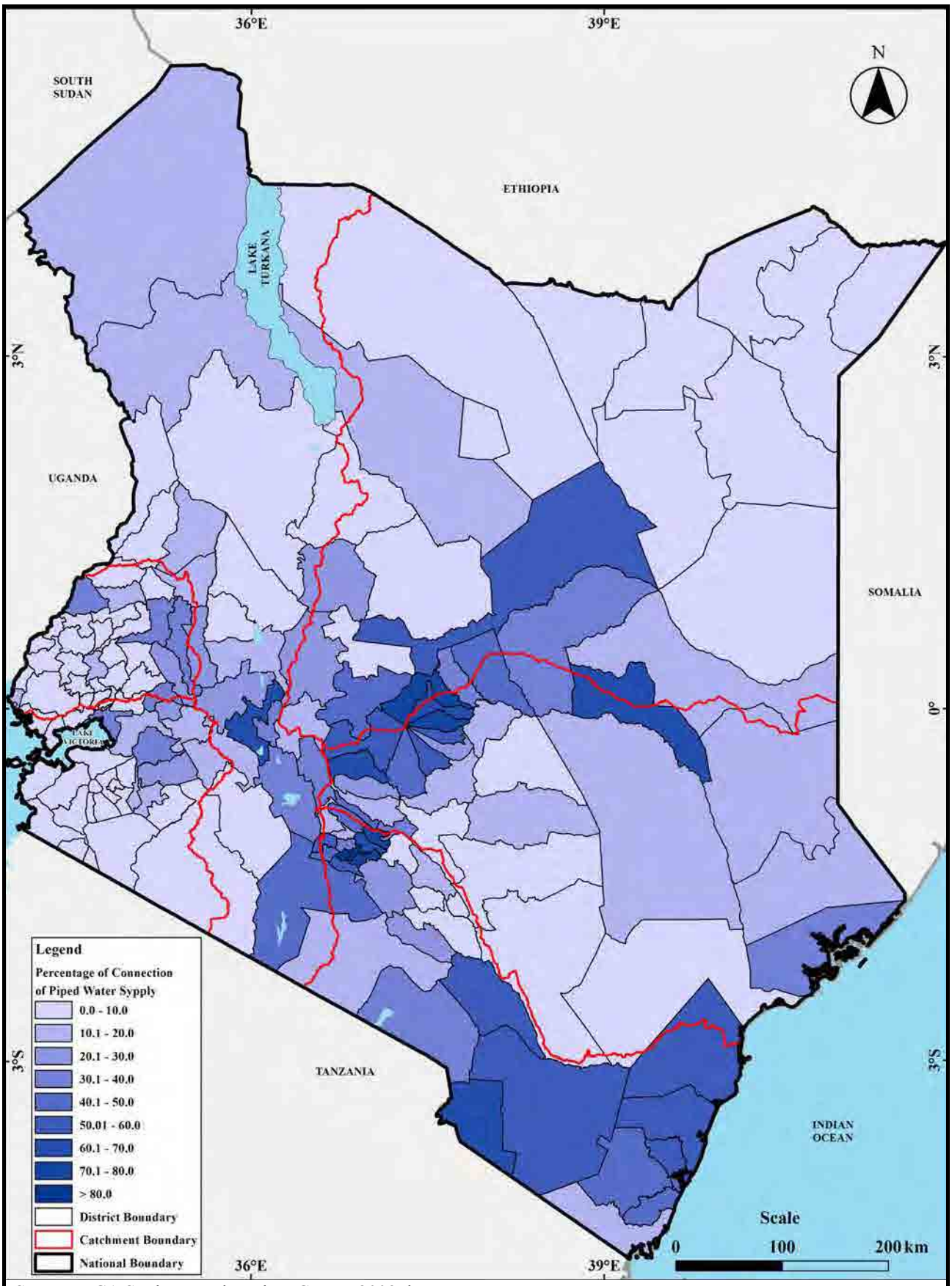
Source: JICA Study Team based on Information from WASREB

THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030	**Figure 2.2.1 Extent of the WSBs**
JAPAN INTERNATIONAL COOPERATION AGENCY	



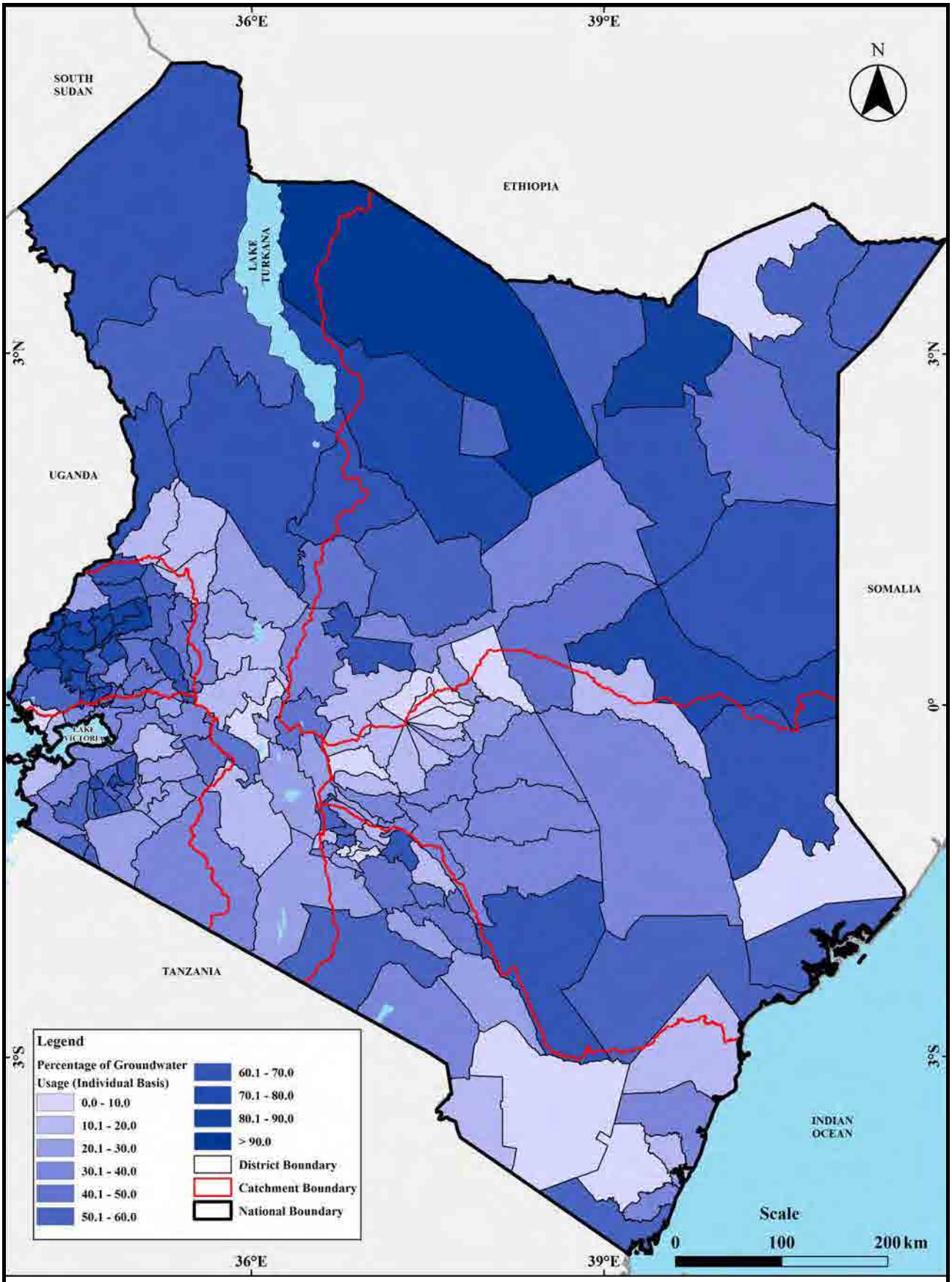
Source: JICA Study Team based on Census 2009 data

THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030	**Figure 2.3.1 Percentage of Usage of Surface Water without Treatment**
JAPAN INTERNATIONAL COOPERATION AGENCY	



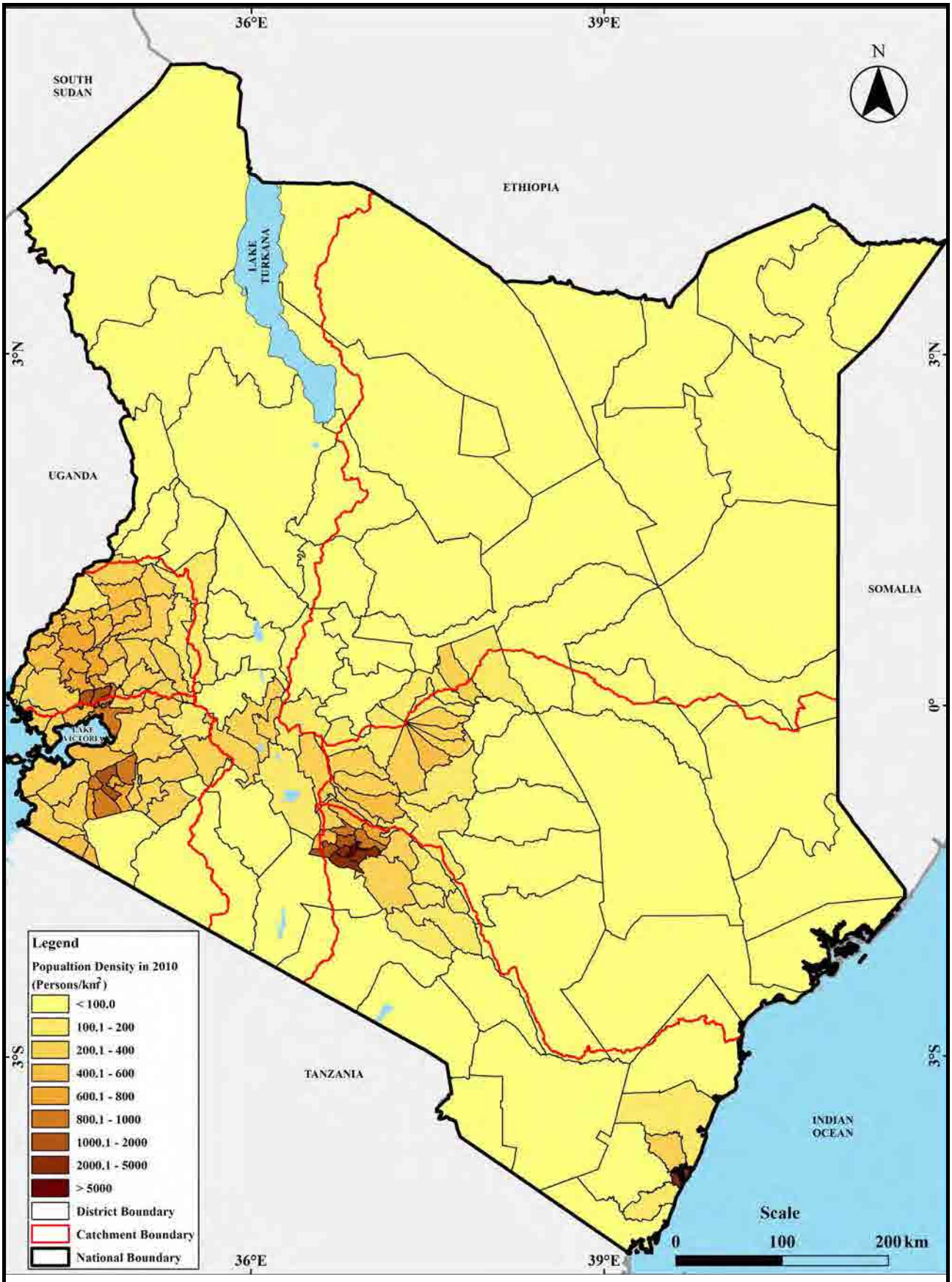
Source: JICA Study Team based on Census 2009 data

THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030	**Figure 2.3.2 Percentage of Connection of Piped Water Supply**
JAPAN INTERNATIONAL COOPERATION AGENCY	



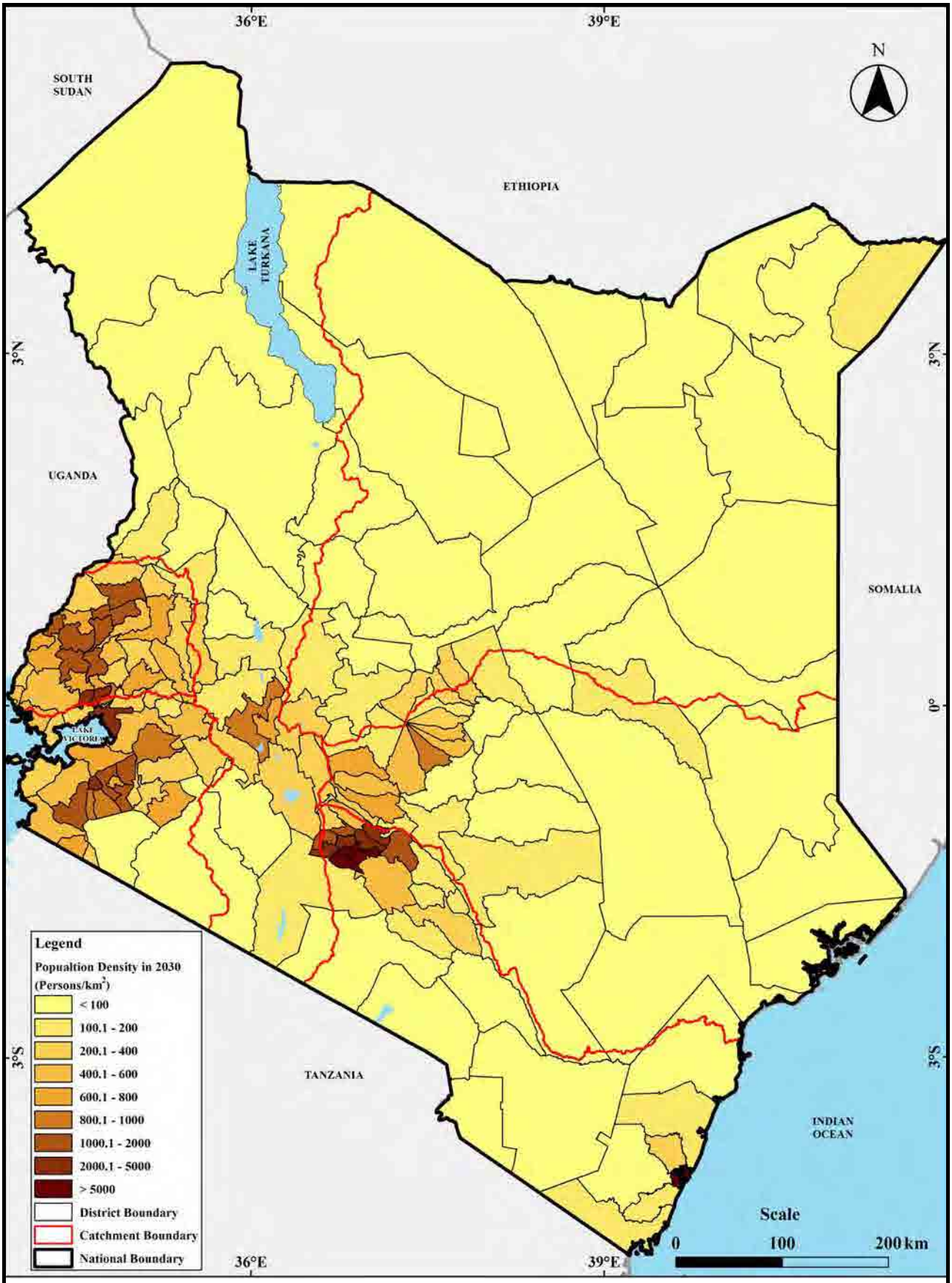
Source: JICA Study Team based on Census 2009 data

THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030	**Figure 2.3.3 Percentage of Usage of Well, Borehole and Spring (Individual basis)**
JAPAN INTERNATIONAL COOPERATION AGENCY	



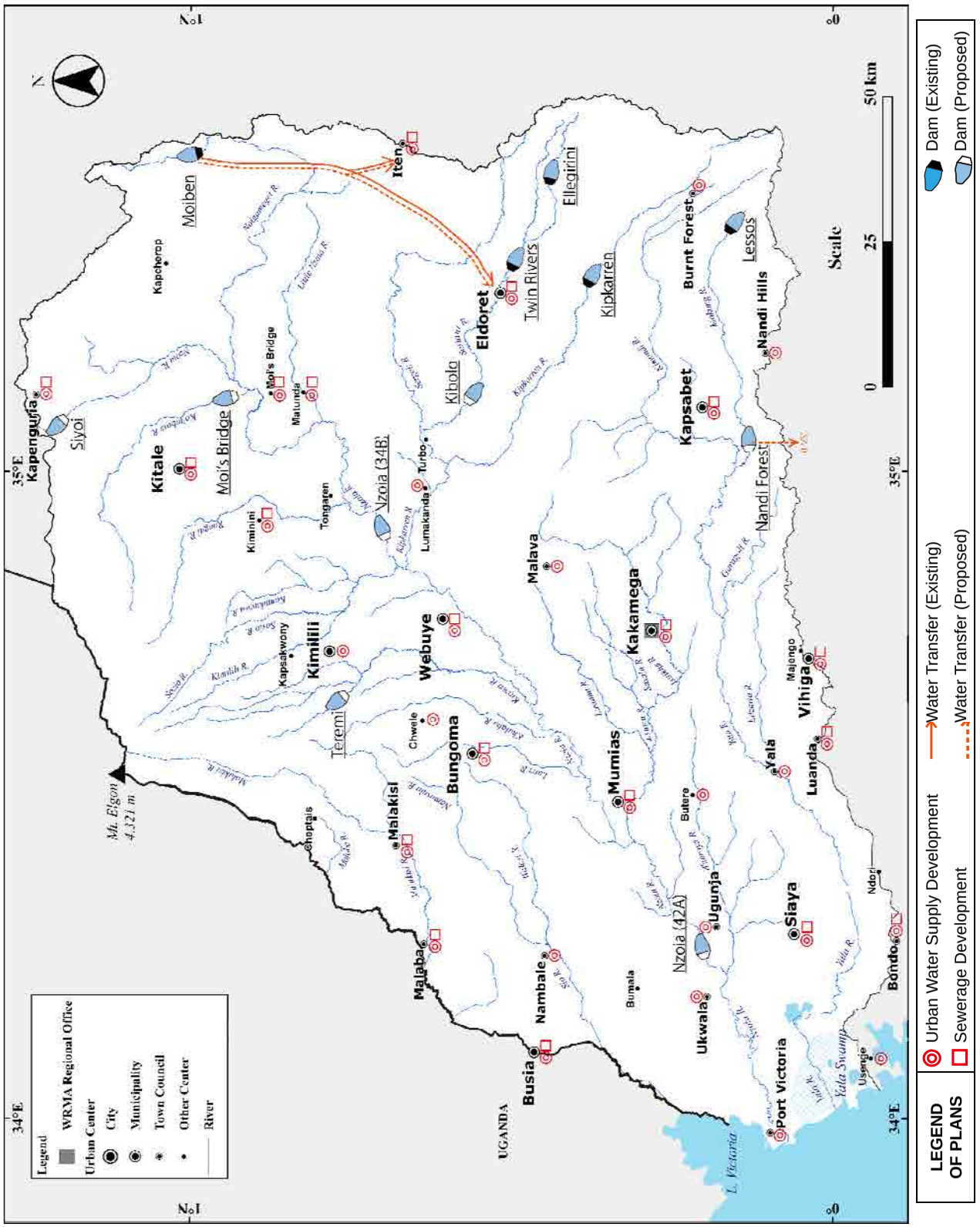
Source: JICA Study Team based on Census 2009 data

THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030	**Figure 3.2.1 Population Density in 2010**
JAPAN INTERNATIONAL COOPERATION AGENCY	



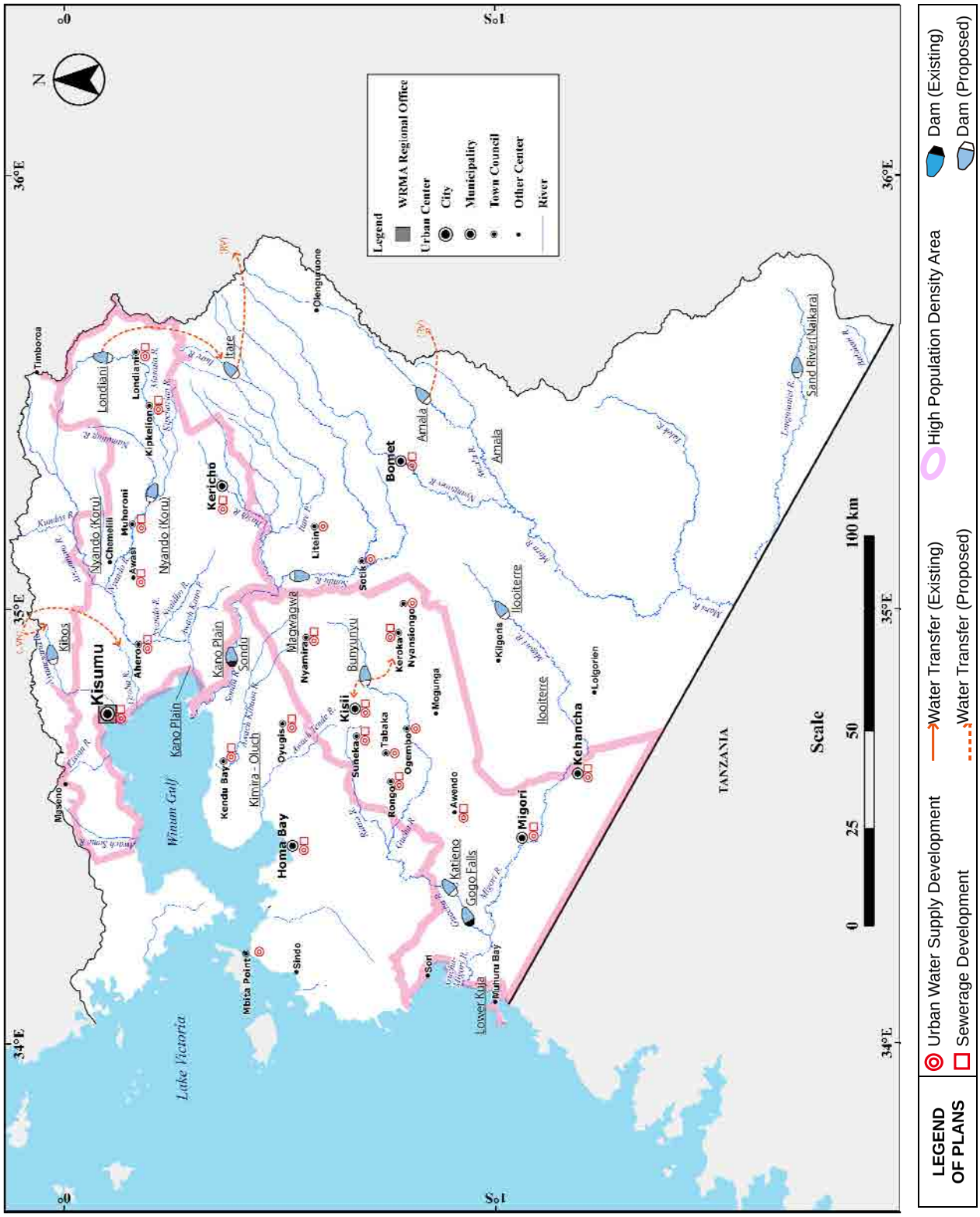
Source: JICA Study Team based on Census 2009 data and Kenya Vision 2030

THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030	**Figure 3.2.2 Population Density in 2030**
JAPAN INTERNATIONAL COOPERATION AGENCY	



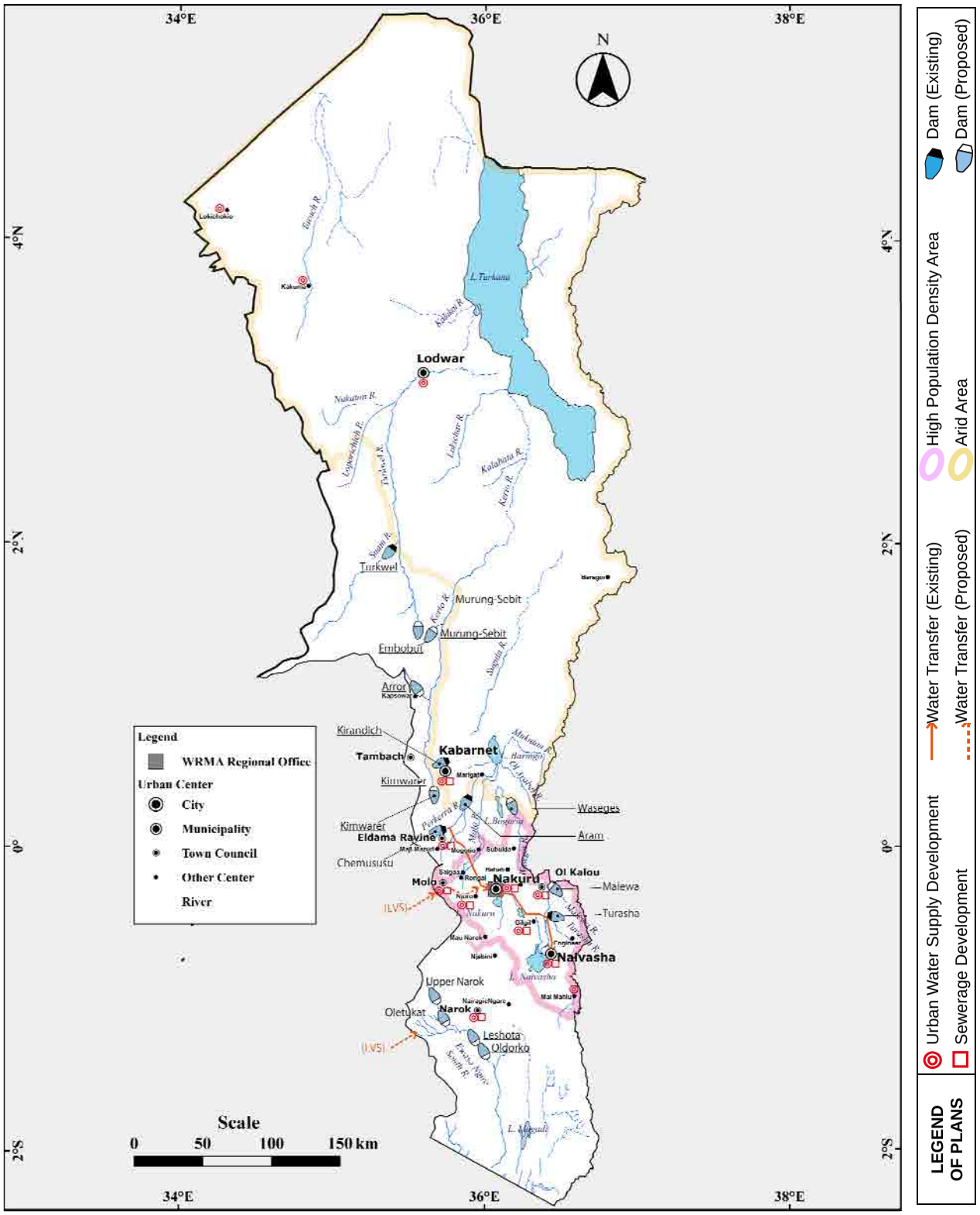
Source: JICA Study Team

THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030	**Figure 4.3.1 Proposed Urban Water Supply and Sewerage Development Plans (LVNCA)**
JAPAN INTERNATIONAL COOPERATION AGENCY	



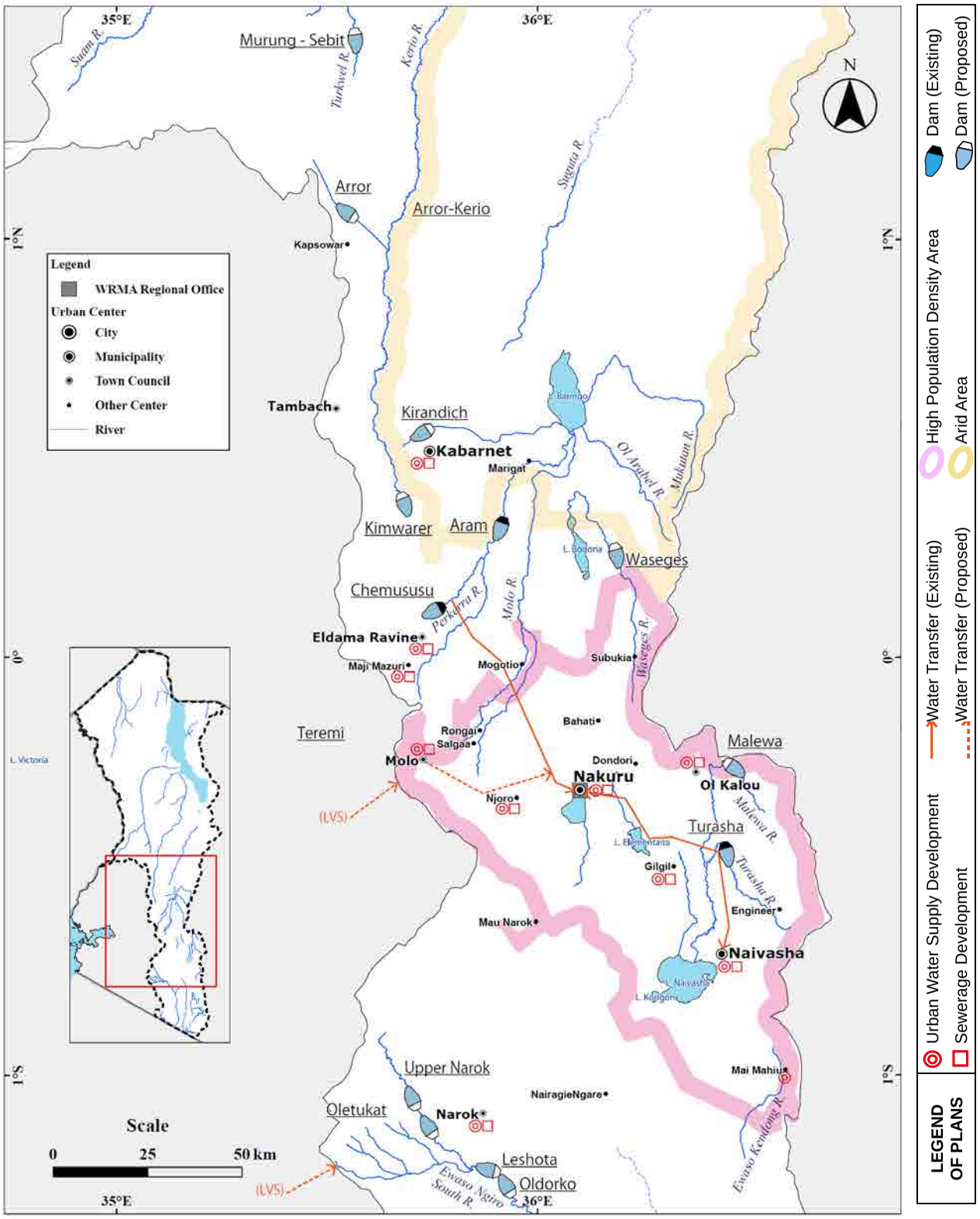
Source: JICA Study Team

THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030	**Figure 4.4.1 Proposed Urban Water Supply and Sewerage Development Plans (LVSCA)**
JAPAN INTERNATIONAL COOPERATION AGENCY	



Source: JICA Study Team

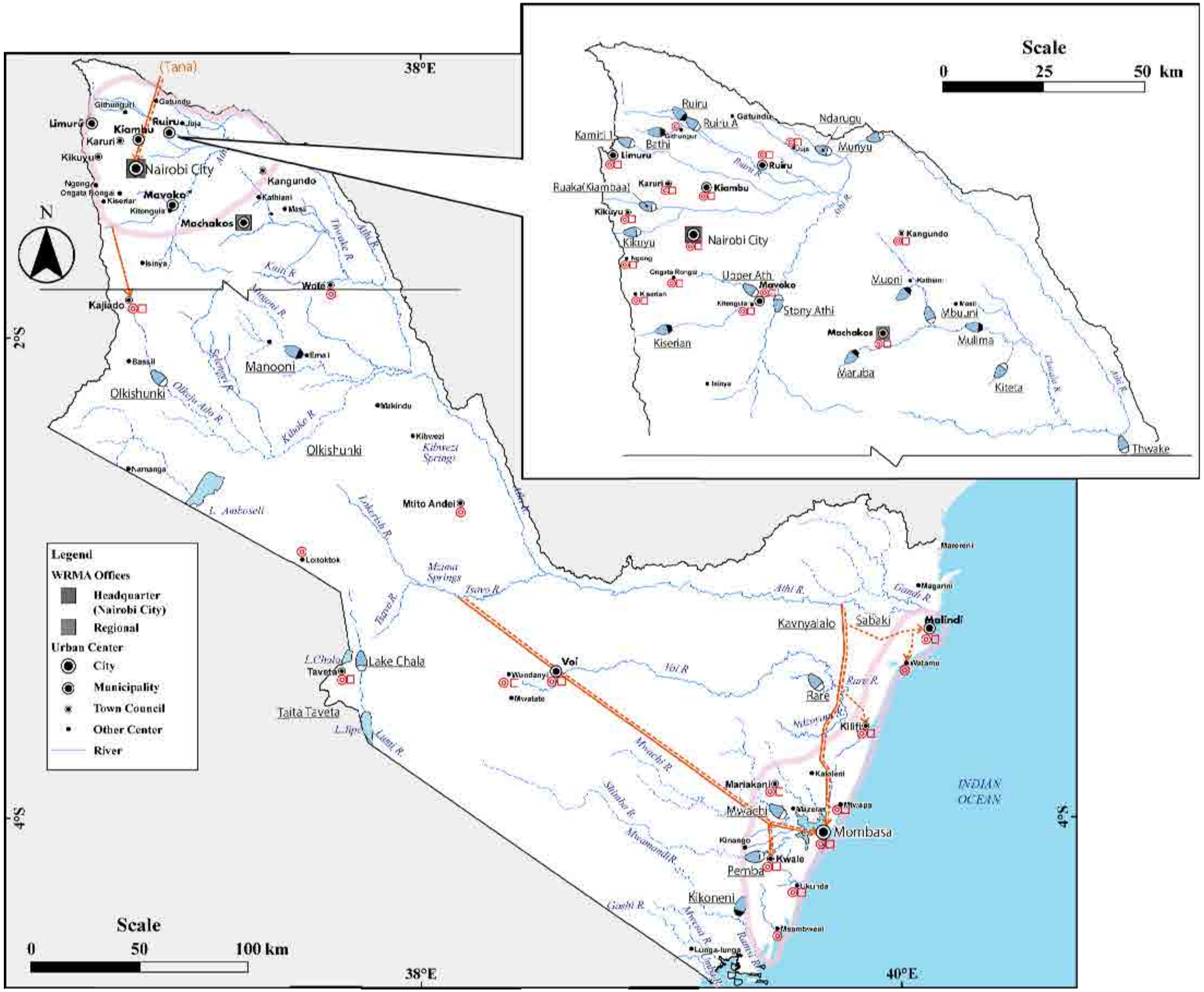
THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030	**Figure 4.5.1 Proposed Urban Water Supply and Sewerage Development Plans (RVCA) (1/2)**
JAPAN INTERNATIONAL COOPERATION AGENCY	



Source: JICA Study Team

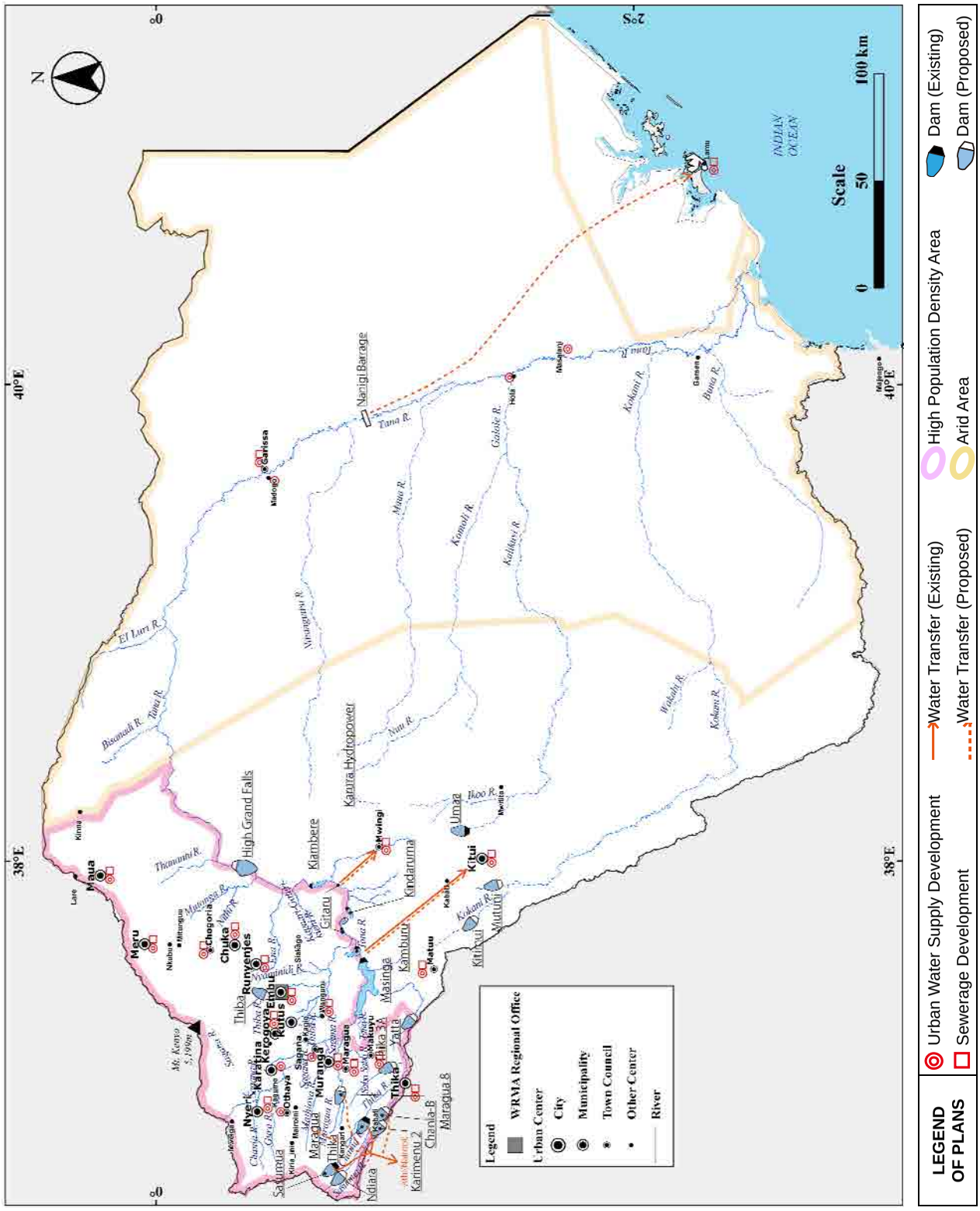
THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030	**Figure 4.5.1 Proposed Urban Water Supply and Sewerage Development Plans (RVCA) (2/2)**
JAPAN INTERNATIONAL COOPERATION AGENCY	

Source: JICA Study Team



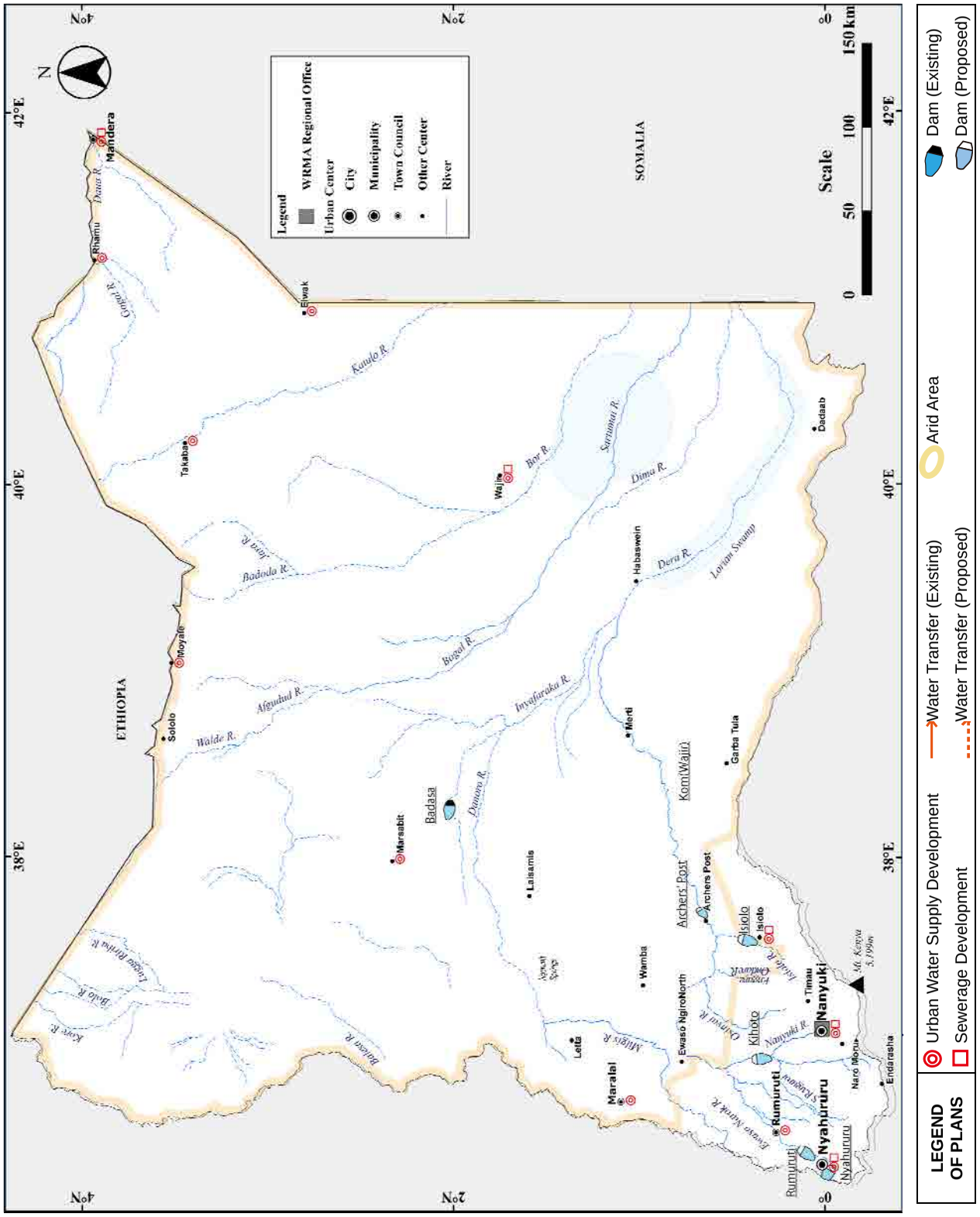
LEGEND OF PLANS				
	Urban Water Supply Development	Water Transfer (Existing)	High Population Density Area	Dam (Existing)
	Sewerage Development	Water Transfer (Proposed)		Dam (Proposed)

Figure 4.6.1 Proposed Urban Water Supply and Sewerage Development Plans (ACA)



Source: JICA Study Team

THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030	**Figure 4.7.1 Proposed Urban Water Supply and Sewerage Development Plans (TCA)**
JAPAN INTERNATIONAL COOPERATION AGENCY	



Source: JICA Study Team

THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030	**Figure 4.8.1 Proposed Urban Water Supply and Sewerage Development Plans (ENNCA)**
JAPAN INTERNATIONAL COOPERATION AGENCY	

WRMA Catchment	No.	Name of Project	Project Status	Capacity to be developed (m^3/day)			Implementation Schedule															
							Short Term					Medium Term					Long Term						
				Total	Initial Develop.	Ratio	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
							13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31
LVN		Water Resources Development for Urban Water Supply												*Siyoi Dam*										
														Moi's Bridge Multipurpose Dam										
														Kiboro Multipurpose Dam										
														Teremi										
														Transmission to Eldoret										
	1	Bondo, Siaya (2 UC)	WSB, MTP, F/S	24,136	12,000	50%																		
	2	Yala, Ugunja, Ukwala (3 UC)	WSB	8,141	2,442	30%																		
	3	Usenge	WSB, F/S	7,004	4,000	57%																		
	4	Moi'S Bridge	WSB, MTP	6,934	6,934	100%																		
	5	Item/Tambach	WSB	24,246	5,000	21%																		
	6	Port Victoria	WSB	3,930	1,250	32%																		
	7	Kapenguria	MTP	18,714	5,614	30%																		
	8	Eldoret	-	83,354	25,006	30%																		
	9	Vihiga	-	71,042	21,313	30%																		
	10	Kitale	-	53,609	16,083	30%																		
	11	Mumias	-	43,215	12,964	30%																		
	12	Webuye	-	17,766	5,330	30%																		
	13	Kakamega	-	38,971	11,691	30%																		
	14	Kapsabet	-	48,197	14,459	30%																		
	15	Kimilili	-	51,864	15,559	30%																		
	16	Bungoma	-	26,466	7,940	30%																		
	17	Chwele	-	7,382	2,215	30%																		
	18	Busia	-	23,738	7,121	30%																		
	19	Luanda	-	29,560	8,868	30%																		
	20	Malaba	-	10,665	3,200	30%																		
	21	Malakisi	-	10,233	3,070	30%																		
	22	Butere	-	7,656	2,297	30%																		
	23	Kiminini	-	7,179	2,154	30%																		
	24	Nandi Hills	-	6,062	6,062	100%																		
	25	Lumakanda	-	4,117	4,117	100%																		
	26	Matunda	-	4,480	4,480	100%																		
	27	Nambale	-	2,960	2,960	100%																		
	28	Burnt Forest	-	2,950	2,950	100%																		
	29	Malava	-	2,438	2,438	100%																		
		Rehabilitation for 18 Urban Centres																						
		Total Urban Water Supply Projects		647,010	219,516	34%																		
		Rural Water Supply Projects																						

Note: As for "Project Status", "WSB" means a project proposed by WSB, "MTP" means a flagship project proposed in the First Medium Term Plan (2008 – 2019) of Kenya Vision 2030, and "F/S" means a project proposed in completed F/S.

Source: JICA Study Team

THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030

JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 7.3.1 Implementation Schedule of Proposed Water Supply System Development Plan (LVNCA)

WRMA Catchment	No.	Name of Project	Project Status	Capacity to be developed (m^3/day)			Implementation Schedule															
							Short Term					Medium Term					Long Term							
				Total	Initial Develop.	Ratio	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
							13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31
LVS	1	Kisumu and Surrounding Area											*Nandi Forest Dam*											
										Kibos Dam														
											Koru Dam													
																		Lake Victoria						
		Kisumu	WSB, MTP, F/S*	166,352	60,000	36%																		
		Ahero, Awasi, Kipkelion, Londiani, Muhoroni (6 UC)	WSB, F/S*	124,289	37,287	30%																		
	2	Kisii and Surrounding Area														*Bunyunyu Dam*								
		Kisii	WSB, MTP, F/S	29,501	24,000	81%																		
		Rongo, Suneka, Keroka, Awendo, Tabaka, Ogembo (6 Uc)	WSB, F/S	128,708	2,000	2%																		
	3	Kericho	WSB, F/S	48,026	14,000	29%																		
	4	Bomet	WSB, F/S	49,706	8,000	16%																		
	5	Homabay	WSB, F/S*	20,475	2,000	10%																		
	6	Nyamira, Oyugis (2 UC)	WSB, D/D	41,076	36,000	88%																		
	7	Mbita Point	WSB, F/S	7,182	4,000	56%																		
	8	Litein, Sotik (2 UC)	WSB, F/S	8,000	8,000	100%																		
	9	Migori	WSB,D/D	15,752	4,726	30%																		
	10	Kehancha	-	17,716	5,315	30%																		
	11	Kendu Bay	-	8,114	2,434	30%																		
	12	Nyansiongo	-	2,777	833	30%																		
	Rehabilitation for 22 Urban Centres																							
	Total Urban Water Supply Projects			667,674	208,594	31%																		
	Water Resources Development for Rural Water Supply										*Magwagwa Dam*							*Amala Dam*						
																		Sande Dam						
																		Ilooiterre Dam						
	Rural Water Supply Projects																							

Note: As for "Project Status", "WSB" means a project proposed by WSB, "MTP" means a flagship project proposed in the First Medium Term Plan (2008 – 2019) of Kenya Vision 2030, and "F/S" means a project proposed in completed F/S.

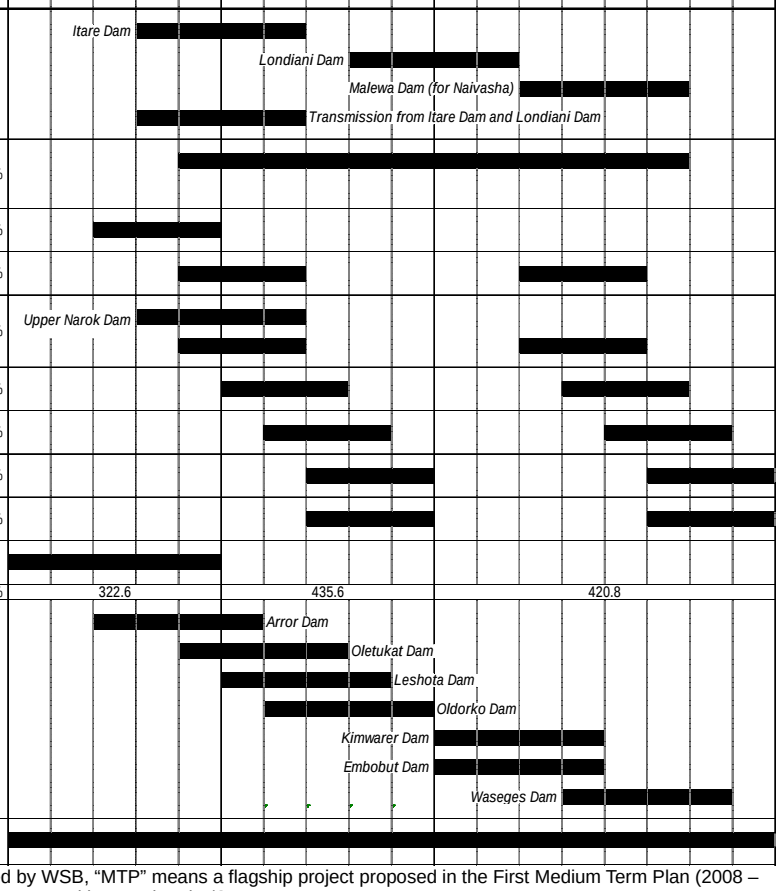
Source: JICA Study Team

THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030

JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 7.3.2
Implementation Schedule of Proposed Water Supply System Development Plan (LVSCA)

WRMA Catchment	No.	Name of Project	Project Status	Capacity to be developed (m^3/day) Total	Initial Develop.	Ratio
RV	1	Greater Nakuru Area				
		Nakuru, Naivasha, Molo, Gilgil, Njoro, Eldama Ravine (6UC)	WSB, F/S	192,374	100,000	52%
	2	Kabarnet	WSB, F/S	1,221	1,221	100%
	3	Ol Kalou	WSB, MTP	34,858	10,000	29%
	4	Narok	WSB, MTP	21,274	4,600	22%
	5	Lodwar	MTP	4,018	1,205	30%
	6	Mai Mahiu	-	6,984	2,095	30%
	7	Kakuma	-	5,408	1,622	30%
	8	Lokichogio	-	2,595	779	30%
	Rehabilitation for 11 Urban Centres					
	Total Urban Water Supply Projects			268,732	121,522	45%
	Water Resources Development for Rural Water Supply					
	Rural Water Supply Projects in RVCA					



Note: As for "Project Status", "WSB" means a project proposed by WSB, "MTP" means a flagship project proposed in the First Medium Term Plan (2008 – 2019) of Kenya Vision 2030, and "F/S" means a project proposed in completed F/S.

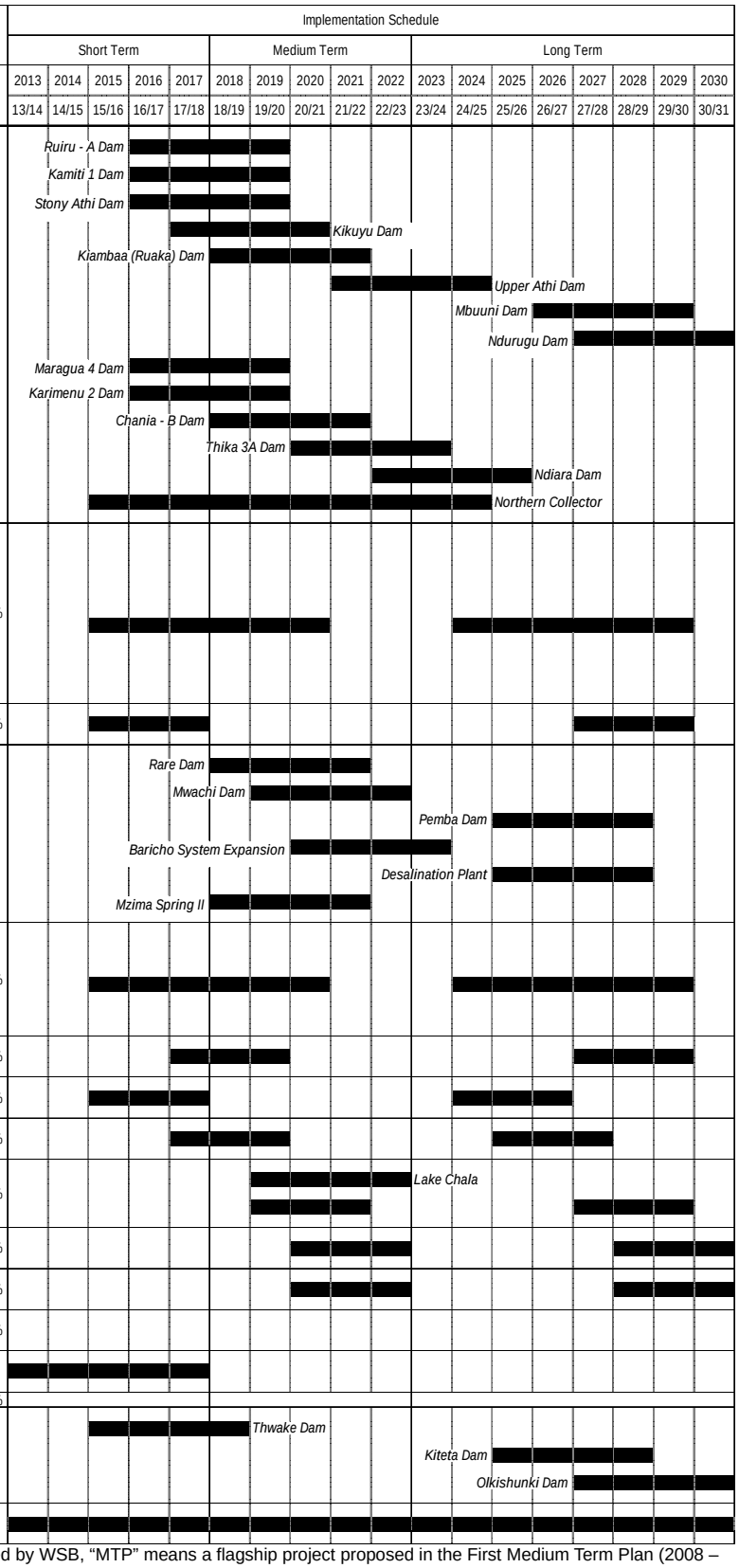
Source: JICA Study Team

THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030

JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 7.3.3
Implementation Schedule of Proposed Water Supply System Development Plan (RVCA)

WRMA Catchment	No.	Name of Project	Project Status	Capacity to be developed (m^3/day) Total	Initial Develop.	Ratio
Athi	1	Nairobi and Satellite Towns				
		Nairobi				
		Ruiru, Kikuyu, Kangundd-Tala, Mavoko, Thlka, Karuri, Ngong, Kiambu, Limuru, Kitengela, Juja, Ongata Rongai, Kiserian, Githunguri (14UC)	WSB, MTP, F/S*	961,207	635,000	66%
		Machakos	WSB, MTP, F/S	86,505	5,000	6%
	2	Mombasa and Coastal Area				
		Mombasa				
		Mtwapa, Mariakani, Kwale, Malindi, Ukunda, Kilifi, Watamu, Msambweni (8UC)	WSB, MTP, F/S*	449,919	363,000	81%
	3	Kajiado	WSB	7,902	1,000	13%
	4	Wote	WSB, MTP, F/S	5,390	2,000	37%
	5	Wundanyi	-	21,331	6,399	30%
	6	Taveta	-	11,900	3,570	30%
	7	Voi	-	9,574	2,872	30%
	8	Loitoktok	-	6,727	2,018	30%
	9	Mitto Andei	-	0	0	0%
		Rehabilitation for 27 Urban Centres				
		Total Urban Water Supply Projects		1,560,456	1,020,860	65%
		Water Resources Development for Rural Water Supply				
		Rural Water Supply Projects				



Note: As for "Project Status", "WSB" means a project proposed by WSB, "MTP" means a flagship project proposed in the First Medium Term Plan (2008 – 2019) of Kenya Vision 2030, and "F/S" means a project proposed in completed F/S.

Source: JICA Study Team

THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030

JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 7.3.4 Implementation Schedule of Proposed Water Supply System Development Plan (ACA)

WRMA Catchment	No.	Name of Project	Project Status	Capacity to be developed (m^3/day)			Implementation Schedule																
							Short Term					Medium Term					Long Term							
				Total	Initial Develop.	Ratio	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
							13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31
Tana	Upstream of Tana Catchment																						
	1	Nyeri	WSB, F/S	49,587	49,587			Nyeri County Bulk Water Supply																
	2	Karatina																						
	3	Othaya																						
	4	Embu	WSB, F/S	36,048	36,048				Embu Bulk Water Supply															
	5	Runyenjes																						
	6	Muranga	WSB, F/S*, MTP	37,943	37,943							Meru Bulk Water Supply												
	7	Maua																						
	8	Chuka	WSB, F/S*, MTP	39,761	39,761							Tharaka Nithi Bulk Water Supply												
	9	Chogoria																						
	10	Muranga	WSB, F/S	44,549	44,549			Muranga/ Maragua Bulk Water Supply																
	11	Maragua																						
	12	Makuyu																						
	13	Kerugoya/Kutus	WSB, F/S	18,129	18,129			Kirinyaga Bulk Water Supply																
	14	Wanguru																						
	15	Sagana																						
	Other Area																						
	16	Lamu	MTP	105,350	31,605	30%						High Grand Fall Dam and Traansmission												
	17	Garissa	-	4,418	4,418	100%																		
	18	Madogo	-	2,298	2,298	100%																		
	19	Msalani	-	2,186	2,186	100%																		
	20	Hola	WSB, F/S	689	207	30%																		
	21	Kitui	WSB, F/S	57,884	9,000	16%												Mutuni Dam	Kitimui Dam	Transmission to Kitui				
	22	Matuu	MTP	29,699	8,910	30%												Yatta Dam						
	23	Garissa	WSB, F/S	8,149	2,000	25%		Transmission to Muwangi																
	Rehabilitation for 16 Urban Centres																							
	Total Urban Water Supply Projects			436,690	286,640	66%																		
	Rural Water Supply Projects																							

Note: As for "Project Status", "WSB" means a project proposed by WSB, "MTP" means a flagship project proposed in the First Medium Term Plan (2008 – 2019) of Kenya Vision 2030, and "F/S" means a project proposed in completed F/S.

Source: JICA Study Team

THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030

JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 7.3.5 Implementation Schedule of Proposed Water Supply System Development Plan (TCA)

WRMA Catchment	No.	Name of Project	Project Status	Capacity to be developed (m^3/day)			Implementation Schedule
							Short Term					Medium Term					Long Term								
				Total	Initial Develop.	Ratio	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
							13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31
ENN	1	Isiolo	WSB, MTP	13,801	6,552	47%							*Isiolo Dam*											
	2	Nyahururu	WSP	17,283	10,822	63%					*Nyahururu Dam*													
	3	Rumuruti	-	6,029	1,809	30%										*Rumuruti Dam*								
	4	Wajir	MTP	12,143	3,643	30%																		
	5	Moyale	MTP	4,416	1,325	30%																		
	6	Maralal	MTP	1,528	458	30%																		
	7	Nanyuki	-	12,272	3,682	30%																		
	8	Mandera		11,188	3,356	30%																		
	9	Rhamu	-	3,867	1,160	30%																		
	10	Elwak	-	3,574	1,072	30%																		
	11	Takaba	-	3,249	975	30%																		
	12	Marsabit	-	1,942	583	30%																		
	Rehabilitation for 6 Urban Centres																							
	Total Urban Water Supply Projects			91,292	35,436	39%																		
	Water Resources Development for Rural Water Supply													*Archers' Post Dam*										
	Rural Water Supply Projects																							

Note: As for "Project Status", "WSB" means a project proposed by WSB, "MTP" means a flagship project proposed in the First Medium Term Plan (2008 – 2019) of Kenya Vision 2030, and "F/S" means a project proposed in completed F/S.

Source: JICA Study Team

THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030

JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 7.3.6
Implementation Schedule of Proposed Water Supply System Development Plan (ENNCA)

Sectoral Report (D) Sanitation

THE PROJECT
ON
THE DEVELOPMENT OF
THE NATIONAL WATER MASTER PLAN 2030
IN
THE REPUBLIC OF KENYA

FINAL REPORT
VOLUME – IV SECTORAL REPORT (1/3)

D: SANITATION

Abbreviation

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List of Abbreviations and Acronyms

ACA	:	Athi Catchment Area
B/C	:	Benefit and Cost
DHS	:	Demographic and Health Surveys
EIRR	:	Economic Internal Rate of Return
ENNCA	:	Ewaso Ng'iro North Catchment Area
F/S	:	Feasibility Study
JICA	:	Japan International Cooperation Agency
JMP	:	Joint Monitoring Programme
KIHBS	:	Kenya Integrated Household Budget Survey
LVNCA	:	Lake Victoria North Catchment Area
LVSCA	:	Lake Victoria South Catchment Area
M/P		Master Plan
MDG	:	Millennium Development Goals
MWI	:	Ministry of Water and Irrigation
NPV	:	Net Present Value
NWMP	:	National Water Master Plan
NWRMS	:	National Water Resources Management Strategy
NWSS	:	National Water Services Strategy
O&M	:	Operation and Maintenance
PPIP	:	Pro-Poor Implementation Plan
RV	:	Rift Valley
RVCA	:	Rift Valley Catchment Area
TCA	:	Tana Catchment Area
UC	:	Urban Centre
UNICEF	:	United Nations Children's Fund
VIP	:	Ventilated Improved Pit
WHO	:	World Health Organization
WSB	:	Water Service Board
WSP	:	Water Service Provider
WSSP	:	Water Sector Strategic Plan
WSTF	:	Water Services Trust Fund
WWTP	:	Waste Water Treatment Plant

Abbreviations of Measures

Length

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

Area

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

Volume

L	=	liter
m^3	=	cubic meter
m^3/s, cms	=	cubic meter per second
CM	=	cubic meter
MCM	=	million cubic meter
BCM	=	billion cubic meter
m^3/d, cmd	=	cubic meter per day
BBL	=	Barrel

Weight

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

Time

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

Money

KSh	=	Kenya shilling
US$	=	U.S. dollar

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
L/p/d	=	litter per person per day

NOTE

1. The National Water Master Plan 2030 was prepared based on the material and data provided from Kenyan Government and its relevant organisations during field surveys in Kenya carried out until November 2012. The sources etc. of the material and data utilised for the study are described in the relevant part of the reports.

2. The names of ministries and related organisations of Kenyan Government are as of November 2012.

3. Information to be updated

   The following information which is given in the report is needed to be updated properly:

   (1) Information on the proposed development projects

   The features and implementation schedules of the proposed development projects may be changed toward implementation of the project. After the subject projects were clearly featured for implementation, the project features and implementation schedules in this report should be updated.

   (2) Information on the water demand

   The water demand projected in this master plan should be revised when the large scale development plans, other than the projects proposed in this master plan, were formulated, as they will significantly affect to the water resources development and management.

4. Exchange rate for cost estimate

   The costs of the proposed development and management plans were estimated by applying the following exchange rate as of November 1, 2012.

EXCHANGE RATE
US$1.00 = KSh 85.24 = ¥79.98
as of November 1, 2012

CHAPTER 1 INTRODUCTION

The sanitation development plan is part of the National Water Master Plan 2030 (NWMP 2030). The Sectoral Report (D) presents the current situation of the sanitation sector as well as the sanitation development plan including cost estimates, economical evaluation, and implementation program. The planning conditions of the study are based on the Kenya Vision 2030, Water Service Strategic Plan, Census 2009, and other relevant official data. The study flow of the sanitation development plan is shown in Figure 1.1.1.

CHAPTER 2 CURRENT SITUATION OF SANITATION

2.1 Relevant Policies and Strategies

(1) General

Over the recent years, various kinds of government strategy and policy documents have been prepared. The most important overarching documents applicable to the water supply and sanitation sector are:

a) Kenya Vision 2030;
b) The National Water Services Strategy (NWSS), September 2007;
c) Implementation Plan for the National Water Services Strategy, July 2008 - also known as the Pro-Poor Implementation Plan (PPIP);
d) Water Sector Strategic Plan (WSSP) 2009-14, April 2010; and
e) The eight Water Service Boards (WSBs) strategic plans.

The NWMP 2030 will also need to take cognisance of the following sector-related documents:

a) Constitution of Kenya, August 2010;
b) National Water Resources Management Strategy, (NWRMS) (2007-2009), January 2007;
c) Draft Sector Investment Plan for the Water and Sanitation Sector in Kenya, January 2009;
d) Ministerial Strategic Plan 2009-2012, May 2009;
e) Water Services Strategic Plan, June 2009;
f) National Climate Change Response Strategy, April 2010; and
g) National Water Harvesting and Storage Management Policy, May 2010

The key aspects of each of the above documents are summarised below.

(2) Kenya Vision 2030

The Kenya Vision 2030 sets out the overall development vision of the country from 2008 to 2030. It aims to "transform Kenya into a newly industrialised middle-income economy providing an improved quality of life to its citizens by 2030". The Kenya Vision 2030 is based on three pillars, namely: economic, social, and political. It will be implemented through a series of successive five-year medium-term plans, the first of which covered the period from 2008 to 2012.

The popular version of Kenya Vision 2030 refers to the country's expectation "to meet its millennium development goals (MDGs) in 2015". The document states that some of the MDGs have already been achieved and that "Kenya Vision 2030 spells out the actions to achieve the rest."

Among the MDGs, the goal "to halve by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation" is applicable in this section.

The long-term aim of the Kenya Vision 2030 is to ensure that improved water and sanitation are available for all. It is projected in the Kenya Vision 2030 that more than half of the population are

likely to be living in an urban environment by 2030. This is confirmed by the NWMP 2030 estimates.

The Kenya Vision 2030 includes the following specific target projects:

a) Rehabilitation and augmentation of the Mzima pipeline;
b) Expansion of the coverage for Nairobi, Mombasa, Kisumu, Nakuru, and Kisii;
c) Rehabilitation of water supplies in 26 medium-sized towns; and
d) Rehabilitation and expansion of sewerage works in urban areas.

(3) National Water Services Strategy (NWSS), September 2007

The NWSS was prepared in accordance with Section 49 of the Water Act 2002. It provides a review of the water supply and sanitation situation in 2007. It recognizes that service coverage is poor and indeed has been deteriorating. Furthermore, it sets out the background of the Water Act 2002 and describes the main provisions of the law.

The stated vision of the NWSS is:

"Assured water supply, sewerage services, and basic sanitation for all Kenyans for improved health and wealth creation on an individual level and for the nation."

The mission is:

"To realize the goals of the MDG declaration and the Kenya Vision 2030 of the Kenyan government concerning access to safe and affordable water and basic sanitation by responsive institutions within a regime of well-defined standards and regulation."

The NWSS sets out five key goals as follows:

a) Reach at least 50% of the underserved urban population with safe and affordable water by 2015 (MDG) and thereafter, move to access for all by 2030;
b) Reach through sustainable waterborne sewage collection, treatment, and disposal systems 40% of the urban and 10% of the rural population by 2015 and total coverage in all urban centres by 2030;
c) Increase the access to safe and improved basic sanitation facilities particularly for the poor to 77.5% in the urban setting and 72.5% in the rural setting by 2015;
d) Achieve the MDGs by fast tracking affordable and sustainable access to safe water in the settlements of the urban poor; and
e) Reach at least 50% of the underserved rural population with safe and affordable water by 2015 (MDG) and thereafter, move to sustainable access for all by 2030.

In each case, the NWSS sets out the medium-term indicators for the achievements, challenges, recent developments, and strategic responses. The NWSS also provides a number of cross-cutting goals covering information systems, sector coordination, human rights and poverty alleviation, financing, gender mainstreaming, HIV/AIDS, environmental sustainability, and disaster management.

(4) Implementation Plan for the National Water Services Strategy, July 2008

Also known as the Pro-Poor Implementation Plan (PPIP), this document was prepared to supplement the NWSS and specifically address the needs of the underserved population from a social standpoint. The PPIP sets out the actions to be undertaken by each of the key institutions created under the provisions of the Water Act 2002.

It should be noted that the PPIP is significantly more user-friendly and informative than the rather cumbersome NWSS. To aid in disseminating the plan to all stakeholders, it has been released in both the full and popular formats.

(5) Water Sector Strategic Plan (WSSP) 2009-14, April 2010

At the time of the review, the WSSP was still in the draft form, although by the date of the 2011 Annual Water Sector Conference, the document had been finalised and was urged to be adopted by the MWI. It is understood that the WSSP has now been approved. The vision of the Plan is as follows:

"A Kenya where water resources are protected, harnessed, and sustainably managed to ensure availability and accessibility to all for the present and future generations, thereby increasing prosperity through effective and efficient use, and a clean and healthy environment".

The WSSP aims to meet the demand tasks and challenges through the following:

a) Increasing the knowledge among sector stakeholders of the current challenges and changes in the sector;
b) Providing policy and regulatory guidance to stakeholders, as to how the challenges should be met;
c) Providing a conducive environment for improved collaboration and coordination among stakeholders, ensuring that interventions move in the same direction, and resources are used effectively and efficiently; and
d) Providing a structure for follow-up and evaluation that covers all aspects of water development and allows its citizenry to jointly adjust their combined efforts over time, as required by circumstances.

The WSSP is based on the adoption of integrated water resources management and is guided by the Kenya Vision 2030. It provides an excellent summary of the sector as it stands today and addresses all of the key issues. The WSSP targets a sustainable and affordable access to safe water and sanitation to all, through the increased formalisation of services including low-income urban and rural areas, promotion of sustainable operation, e.g., through scheme clustering, and improved access through the works of the WSTF.

(6) WSB Strategic Plans

Copies of the eight WSB strategy plans have been collected and reviewed. Generally, the plans are vague and lacking in substance. Sanitation is poorly covered in comparison to water supply.

Through interviews conducted with the WSBs, it was clear that the plans were too ambitious and, as a result, have not been adhered to. Some WSBs indicated that their starting point, in terms of water

supply coverage, was not as advanced as they had been led to believe. It therefore seems that their progress has been limited and they consider this to be an unfair reflection on their performance.

Most WSBs have rewritten their plans to end in 2012 and are preparing new plans to cover the period from 2013 to 2017 in order to coincide with the Kenya Vision 2030.

2.2 Relevant Organisations

According to the Water Act 2002, the institutional arrangements for sewerage services are same as for the water supply sector. The institutional arrangements for the water supply sector are described in Section 2.2 of the Sectoral Report (C) Water Supply.

2.3 Current Situation

2.3.1 Overview

(1) Current Situation of Sanitation

At the time of the Aftercare Study (1998), it was estimated that 80% of the population of Kenya had access to sanitation (98% of the urban population and 76% of the rural population) although the figures presented did not differentiate between improved sanitation and unimproved sanitation and all possible facilities were in fact included in the analysis. It is generally recognised that sanitation lags well behind water supply and that insufficient attention has been paid to this subsector.

The MDG for sanitation is to reduce the proportion of the population without improved sanitation from 46% (in 1990) to 23% by 2015. The WHO/UNICEF Joint Monitoring Programme (JMP) report adopts the following definitions for improved and unimproved sanitation facilities:

JMP Definitions

Improved Sanitation	Unimproved Sanitation

• Flush or pour-flush to:
  • piped sewer system
  • septic tank
  • pit latrine
• Ventilated improved pit (VIP) latrine
• Pit latrine with slab
• Composting toilet
	• Flush or pour-flush to elsewhere
	• Pit latrine without slab/open pit
	• Cart with small tank or drum
	• Bucket
	• Hanging toilet or hanging latrine
	• Shared facilities of any type
	• No facilities, bush or field

Source: JMP Report

The JMP report states that, in overall terms, the world is set to miss the MDG for sanitation as the currently projected figure is still 36%. Like the majority of Sub-saharan Africa, Kenya is not on target to meet the MDG for sanitation. Indeed, the JMP update indicates that Kenya is not within the 10% of the required rate to meet the target. In Sub-saharan Africa, as a whole, only 31% of the population has access to improved sanitation. While this figure is low, it should be noted that there is also a significant disparity between the urban (44%) and rural (24%) environments.

The JMP report provides the following estimates regarding the type of sanitation facility used in Kenya:

JMP Estimates of Sanitation Use

Facility	Urban (%)	Rural (%)	Total (%)
Improved	27	32	31
Shared	51	18	25
Unimproved	20	32	29
Open defecation	2	18	15

Source: JMP Report

On the basis of the above total percentage figures and the JMP estimated national population of 38,765,000, it can be estimated that approximately 26,750,000 people remain without access to improved sanitation facilities in Kenya.

As with the water supply, the Census 2009 presents a good opportunity to establish the status of sanitation coverage but this has been missed as the presentation of the collected data does not allow the reader to identify the difference between the population using covered or uncovered pit latrines or the percentage of the population using shared sanitation facilities. Under MDG definitions, people using covered pit latrines and having their own facilities are counted as having improved services, while the remainder are not. The distribution of Kenya's 8,767,954 households by province and sanitation facility is summarised in the table below.

Sanitation by Province

Province	Households ('000)							
	Main sewer	Septic tank	Cesspool	VIP pit latrine	Pit latrine	Bucket	Bush	Other
Nairobi	469.8	95.4	10.5	26.5	370.5	5.2	4.0	3.2
Central	46.5	61.2	3.2	83.6	1,025.5	1.2	3.0	0.6
Coast	42.2	57.0	5.5	39.0	403.9	4.6	177.7	1.2
Eastern	20.3	21.8	3.0	91.7	1,008.1	0.9	137.4	1.7
N Eastern	1.4	1.3	0.4	4.0	100.1	7.1	197.1	1.2
Nyanza	15.8	8.4	1.0	41.6	909.9	1.0	208.4	2.2
Rift Valley	70.4	47.9	5.2	95.5	1,470.8	2.0	443.0	2.4
Western	8.1	6.0	1.0	49.0	811.5	0.8	25.9	1.6
National	674.5	299.0	29.9	430.8	6,100.2	22.8	1,196.5	14.1

Source: Census 2009 data

On the basis that the main sewer, septic tank, cesspool, and 30% of the pit latrine facilities (VIP and other) are considered as improved sanitation, then it can be determined that 31% of the total population has access. This figure can be subdivided into 47% of the urban population and 23% of the rural population. The figures are presented on a provincial basis as follows:

Access to Improved Sanitation

Province	Population with Improved Sanitation					
	Urban		Rural		Total	
	No ('000)	%	No ('000)	%	No ('000)	%
Nairobi	2,212	70.5	0	0.0	2,212	70.5
Central	679	44.5	881	30.8	1,560	35.6
Coast	665	45.5	297	15.9	962	28.9
Eastern	450	36.7	1,158	26.1	1,607	28.4
N Eastern	99	23.1	141	7.5	240	10.4
Nyanza	447	32.2	961	23.7	1,408	25.9
Rift Valley	988	40.0	1,579	21.0	2,567	25.7
Western	288	33.9	1,017	29.2	1,305	30.1
National	5,828	46.7	6,034	23.1	11,862	30.7

Source: JICA Study Team, based on Census 2009 data

As with the water supply subsector, most of the government-prepared sector policies, strategies, development plans, and management plans provide estimates of the sanitation coverage. The Kenya Vision First Medium Term Plan 2008 to 2012 states that the national sanitation coverage was increased from 45% in 1990 to 48% in 2006. This is clearly higher than the JMP report figure, and it is assumed that a different calculation philosophy was adopted, which probably includes shared facilities.

In the NWSS estimates, the 2007 overall coverage is 50% (55% in the urban setting and 45% in the rural setting). The same figures are adopted by the WSTF in its strategic plan.

Having access to sanitation is only one aspect of the subsector, and that the safe treatment of wastewater and disposal of effluent are vitally important, especially where river flows are low. It is understood that only 5% of wastewater collected is actually treated. The Kenya Vision First Medium Term Plan 2008 to 2012 mentions that the lack of wastewater treatment is leading to high pollution levels in mainstream rivers, valley depressions, and dams.

Table 2.3.1 shows the existing sewerage systems and their capacities, which were prepared based on the data from WSBs. According to the data, sewerage systems have been developed for only 27 urban centres as follows:

- Eldoret
- Kitale
- Kakamega
- Kapsabet
- Bungoma
- Busia
- Webuye
- Kisumu
- Kericho
- Homa Bay
- Nakuru
- Naivasha
- Molo
- Nairobi
- Mombasa
- Machakos
- Mavoko
- Kiambu
- Limuru
- Nyeri
- Thika
- Embu
- Meru
- Muranga
- Garissa
- Isiolo
- Nyahururu

The current situation is therefore very similar to that reported in the Aftercare Study (1998).

(2) Coverage of Sanitation

Based on the Census 2009 data, the current situation of sanitation in Kenya is estimated as shown below.

Current Situation of Sanitation in 2010

(Unit: million persons)

Sanitation/ Evaluation	Sewerage	Septic Tank, Pit Latrine, Cesspool	No Treatment (Bush, Others)	Total
	Improved Sanitation	Improved and Unimproved	Unimproved Sanitation	
Urban Population	2.4 (18%)	9.2 (70%)	1.6 (12%)	13.2 (100%)
Rural Population	0.0 (0%)	20.1 (79%)	5.3 (21%)	25.4 (100%)
Total	2.4 (6%)	29.3 (76%)	6.9 (18%)	38.6 (100%)

Source: JICA Study Team based on Census 2009 data

The definition of improved and unimproved sanitation is based on the JMP report as explained in Section 2.3.1. Sewerage system has been developed in an only limited area in Kenya. Current sewerage coverage ratio is only 7%, and around 18% of the population does not use any sanitation facilities. Around 76% of the population uses on-site treatment facilities, which include unimproved sanitation such as pit latrine without slab. Figures 2.3.1, 2.3.2, and 2.3.3 show the percentages of no wastewater treatment, sewerage connection, and usage of on-site wastewater treatment facility in each district.

(3) Progress of Projects Proposed in the Aftercare Study

Of the five urban centres given priority for sewerage works, progress has only been made in Kisumu where the treatment plant has been rehabilitated. The NWMP (1992) and the Aftercare Study (1998) may not play significant role in the current planning and development of the water supply or sanitation systems.

2.3.2 Lake Victoria North Catchment Area (LVNCA)

Based on the Census 2009 data, the current situation of access to sanitation facilities in LVNCA was estimated as shown below.

Current Situation of Access to Sanitation Facilities (LVNCA)

(Unit: households)

Type	Sewerage	Septic Tank, Pit Latrine, Cesspool	No Treatment (Bush, Others)
Urban	26,334 (7%)	329,509 (92%)	5,190 (1%)
Rural	1,428 (0%)	1,079,243 (95%)	60,582 (5%)
Total	27,762 (2%)	1,408,752 (94%)	65,773 (4%)

Source: JICA Study Team based on Census 2009 data

The table above shows number of households of each water connection. The service population of each water connection is estimated by multiplying current population to the ratio of water connection shown in the table above.

Sewerage system has been developed in limited area in LVNCA, and current sewerage coverage ratio is only 2%. There are eight small-scale wastewater treatment plants with total treatment capacity of about 21,000 m^3/day. Around 94% of the population uses on-site sanitation facilities such as septic tank, etc. The on-site sanitation facilities include unimproved ones, but the ratio of the unimproved facilities is unknown. Around 4% of the population does not have any treatment facilities and uses bush for disposal.

2.3.3 Lake Victoria South Catchment Area (LVSCA)

Based on the Census 2009 data, the current situation of access to sanitation facilities in LVSCA was estimated as shown below.

Current Situation of Access to Sanitation Facilities (LVSCA)

(Unit: households)

Type	Sewerage	Septic Tank, Pit Latrine, Cesspool	No Treatment (Bush, Others)
Urban	18,040 (4%)	367,893 (89%)	26,946 (7%)
Rural	1,751 (0%)	926,845 (80%)	234,122 (20%)
Total	19,791 (1%)	1,294,738 (82%)	261,068 (17%)

Source: JICA Study Team based on Census 2009 data

The table above shows number of households of each water connection. The service population of each water connection is estimated by multiplying current population to the ratio of water connection shown in the table above.

Sewerage system has been developed in limited area in LVSCA, and current sewerage coverage ratio is only 1%. There are four small-scale wastewater treatment plants with total treatment capacity of about 20,531 m^3/day. Around 82% of the population uses on-site sanitation facilities such as septic tank, etc. The on-site sanitation facilities include unimproved ones, but the ratio of the unimproved facilities is unknown. Around 17% of the population does not have any treatment facilities and uses bush for disposal.

2.3.4 Rift Valley Catchment Area (RVCA)

Based on the Census 2009 data, the current situation of access to sanitation facilities in RVCA was estimated as shown below.

Current Situation of Access to Sanitation Facilities (RVCA)

(Unit: households)

Type	Sewerage	Septic Tank, Pit Latrine, Cesspool	No Treatment (Bush, Others)
Urban	36,133 (10%)	330,011 (87%)	12,690 (3%)
Rural	1,412 (0%)	405,551 (59%)	279,573 (41%)
Total	37,545 (4%)	735,562 (69%)	292,263 (27%)

Source: JICA Study Team based on Census 2009 data

The table above shows number of households of each water connection. The service population of each water connection is estimated by multiplying current population to the ratio of water connection shown in the table above.

Sewerage system has been developed in limited area in RVCA and the current sewerage coverage ratio is only 4%. There are four small-scale wastewater treatment plants located in Nakuru, Naivasha, and Molo with total treatment capacity of about 18,393 m^3/day. Around 69% of the population uses on-site sanitation facilities such as septic tank, etc. The on-site sanitation facilities include unimproved ones, but the ratio of the unimproved facilities is unknown. Around 27% of the population does not have any treatment facilities and uses bush for disposal.

2.3.5 Athi Catchment Area (ACA)

Based on the Census 2009 data, the current situation of access to sanitation facilities in ACA was estimated as shown below.

Current Situation of Access to Sanitation Facilities (ACA)

(Unit: households)

Type	Sewerage	Septic Tank, Pit Latrine, Cesspool	No Treatment (Bush, Others)
Urban	550,049 (30%)	1,252,126 (69%)	25,227 (1%)
Rural	1,830 (0%)	517,232 (77%)	155,228 (23%)
Total	551,879 (22%)	1,769,358 (71%)	180,455 (7%)

Source: JICA Study Team based on Census 2009 data

The table above shows number of households of each water connection. The service population of each water connection is estimated by multiplying current population to the ratio of water connection shown in the table above.

Sewerage system has been developed in limited area in ACA, and the current sewerage coverage ratio is 22%, which is the highest coverage ratio among the six catchment areas. There are eight wastewater treatment plants in six UCs around Nairobi and Mombasa with total treatment capacity of about 222,000 m^3/day. Around 71% of the population uses on-site sanitation facilities such as septic tank, etc. The on-site sanitation facilities include unimproved ones, but the ratio of the unimproved facilities is unknown. Around 7% of the population does not have any treatment facilities and uses bush for disposal.

2.3.6 Tana Catchment Area

Based on the Census 2009 data, the current situation of access to sanitation facilities in TCA was estimated as shown below.

Current Situation of Access to Sanitation Facilities (TCA)

(Unit: households)

Type	Sewerage	Septic Tank, Pit Latrine, Cesspool	No Treatment (Bush, Others)
Urban	20,304 (7%)	246,817 (90%)	7,948 (3%)
Rural	2,727 (0%)	983,265 (87%)	143,591 (13%)
Total	23,031 (2%)	1,230,082 (87%)	151,539 (11%)

Source: JICA Study Team based on Census 2009 data

The table above shows number of households of each water connection. The service population of each water connection is estimated by multiplying current population to the ratio of water connection shown in the table above.

Sewerage system has been developed in limited area in TCA, and the current sewerage coverage ratio is only 2%. There are six small-scale wastewater treatment plants in six UCs such as Thika, Nyeri, Muranga, etc. with total treatment capacity of about 32,343 m^3/day. Around 87% of the population uses on-site sanitation facilities such as septic tank, etc. The on-site sanitation facilities include unimproved ones, but the ratio of the unimproved facilities is unknown. Around 11% of the population does not have any treatment facilities and uses bush for disposal.

2.3.7 Ewaso Ng'iro North Catchment Area (ENNCA)

Based on the Census 2009 data, the current situation of access to sanitation facilities in ENNCA was estimated as shown below.

Current Situation of Access Sanitation Facilities (ENNCA)

(Unit: households)

Type	Sewerage	Septic Tank, Pit Latrine, Cesspool	No Treatment (Bush, Other)
Urban	13,691 (9%)	120,097 (82%)	15,340 (10%)
Rural	713 (0%)	318,692 (57%)	242,176 (43%)
Total	14,404 (2%)	438,789 (62%)	257,517 (36%)

Source: JICA Study Team based on Census 2009 data

The table above shows number of households of each water connection. The service population of each water connection is estimated by multiplying current population to the ratio of water connection shown in the table above.

Sewerage system has been developed in limited area in ENNCA, and the current sewerage coverage ratio is only 2%. There is a small-scale wastewater treatment plant in Nyahururu with total treatment capacity of about 4600 m^3/day. Around 62% of the population uses on-site sanitation facilities such as septic tank, etc. The on-site sanitation facilities include unimproved ones, but the ratio of

unimproved facilities is unknown. Around 36% of the population does not have any treatment facilities and uses bush for disposal.

2.4 Ongoing Projects and Existing Plans

The MWI provided copies of their internal donor matrix dated November 2009 and its 2010 updated version. The schemes in the matrix, particularly in terms of the water supply and sanitation sectors, have been included in Table 2.4.1 of the Sectoral Report (C). While this provides useful background information, it lacks significant technical details. The JICA Study Team therefore collected information of ongoing projects and new project proposals in the existing plans from each of the WSBs. Table 2.4.1 shows the list of ongoing construction projects for sewerage system development, and Table 2.4.2 shows the projects proposed and planned by the WSBs.

2.5 Operation and Maintenance Issues

Operation and maintenance of sewerage systems are carried out by WSPs under the supervision of WSBs. Performance of the water supply sector is described in the yearly report entitled the "Impact: A Performance Report of Kenya's Water Services Sector"; however, there is no published report showing the performance of the sanitation sector.

The WSB staff recognised that there is a severe lack of data and that nobody really knows the actual condition of the sewerage systems and sanitation facilities with performance indicators, such as service population, wastewater treatment amount, and influent and effluent water quality.

The census is the only record that shows the overall condition of sanitation access in Kenya.

2.6 Challenges and Key Issues

(1) Low Coverage Ratio of the Current Sewerage System and Rapid Increase of Urban Population

The target coverage ratio of sewerage system will be 80% or 36.8 million of the urban population in 2030 although the current coverage ratio of sewerage system is only 18% which represents 2.4 million of the urban population in 2010. The service population in 2030 will be more than 15 times of the current service population. Capacity of sewerage system should be expanded rapidly up to 2030, to correspond to the increase in service population by more than 15 times.

(2) Need of Rehabilitation of the Existing Sewerage Systems

The sewerage systems with treatment capacity of 342,204 m^3/day are being operated in 29 urban centres. It is difficult to know the actual performances of the sewerage systems clearly, because performance records of the sewerage systems are quite limited. It is generally believed that most of the sewerage systems were constructed before the independence year, and had been operated without proper maintenance and rehabilitation works for long years. Large scale of rehabilitation works is therefore required for the sewerage system, to keep the design capacity and national standards.

(3) Water Pollution in the Future

Water pollution is not a serious environmental problem in Kenya. However, the increase in future urban population will generate large amount of wastewater, and thus, will cause water pollution downstream of the urban area. From the viewpoint of water resource conservation and effective water resource use, it is highly recommended to develop a sewerage system in the urban area.

(4) Improvement Needs of Rural Sanitation

Around 6.9 million of the population still do not have access to any wastewater treatment, and this same number discharge wastewater without any treatment.

It is generally not practical and economical to plan and implement the sewerage systems in rural areas with sparse distribution of the population. Therefore, expansion and improvement of sanitation will be required in rural areas for protecting people's health.

CHAPTER 3 SANITATION DEVELOPMENT PLAN

3.1 General

(1) Goal of Sanitation Service Level by 2030

The Kenya Vision 2030 states that the 2030 vision for water and sanitation is to ensure that improved water and sanitation are available to all. Based on the policy of the Kenya Vision 2030 and Water Service Strategic Plan 2009 prepared by the MWI, the targets on sanitation in Kenya by 2030 are set as follows:

a) Increase coverage of improved sanitation to 100% (Improve sanitation by sewerage system and on-site sanitation facilities);
b) Increase coverage of sewerage system to 80% for urban population; and
c) Install improved on-site sanitation facilities for remaining population who are not supposed to be covered by sewerage systems.

The sanitation development plan in the NWMP 2030 aims to meet the above target.

(2) Coverage of Sanitation

Based on the Census 2009 data, the current situation of the sanitation in Kenya is estimated as below.

Current Situation of Sanitation in 2010

(Unit: million persons)

Sanitation/ Evaluation	Sewerage	Septic Tank, Pit Latrine, Cesspool	No Treatment (Bush, Others)	Total
	Improved Sanitation	Improved and Unimproved	Unimproved Sanitation	
Urban Population	2.4 (18%)	9.2 (70%)	1.6 (12%)	13.2 (100%)
Rural Population	0.0 (0%)	20.1 (79%)	5.3 (21%)	25.4 (100%)
Total	2.4 (6%)	29.3 (76%)	6.9 (18%)	38.6 (100%)

Source: JICA Study Team based on Census 2009 data

The definition of improved and unimproved sanitation is based on the JMP report as explained in Section 2.3.1. Sewerage system has been developed in only limited area in Kenya. Current sewerage coverage ratio is only 7%, and around 18% of the population does not use any sanitation facilities. To achieve the goal, numerical targets are set for each sanitation condition as shown below.

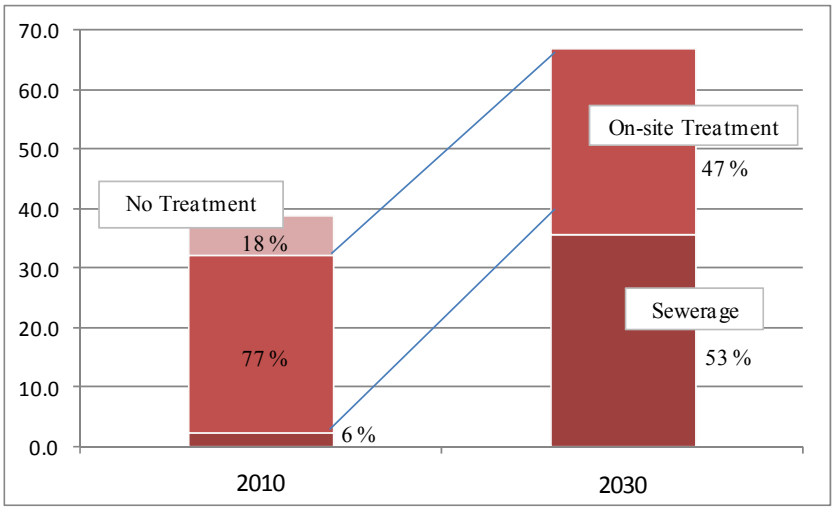
Target of Sanitation Condition in 2030

(Unit: million persons)

Sanitation/ Evaluation	Sewerage	Septic Tank, Pit Latrine, Cesspool	No Treatment (Bush, Others)	Total
	Improved Sanitation	Improved and Unimproved	Unimproved Sanitation	
Urban Population	36.8 (80%)	9.2 (20%)	0.0 (0%)	46.0 (100%)
Rural Population	0.0 (0%)	21.8 (100%)	0.0 (0%)	21.8 (100%)
Total	36.8 (54%)	31.0 (46%)	0.0 (0%)	67.8 (100%)

Source: JICA Study Team based on Census 2009 data and Water Service Strategic Plan 2009

The figure below shows the target of sanitation development by 2030. All residents will have access to sewerage systems or on-site wastewater treatment facilities. The service population of the sewerage system will be increased to 36.8 million from 2.4 million.



Source: JICA Study Team, based on Census 2009 data and Water Service Strategic Plan 2009

Development Plan of Sanitation System

3.2 Overall Concept and Framework for Planning

Based on the basic conditions and targets mentioned previously, the sanitation development plan will be formulated with the following overall concept and framework:

(1) Sewerage System Development

a) Sewerage system will be developed to cover 36.8 million residents by 2030, which is 80% of the urban population in Kenya. Basically, sewerage system will be developed in each urban centre.

b) For selection of target urban centres for sewerage system development, priorities are given to urban centres with the following conditions:

- Urban centres with large population, which are supposed to generate large amount of wastewater;
- Urban centres which already have plans to develop sewerage system; and
- Urban centres whose downstream has environmental problems caused by water pollution.

c) As shown in Table 3.2.1, 95 urban centres are proposed as the targets of sewerage system development.

d) For planning of sewerage system development, required wastewater treatment capacity is calculated based on the water supply amount with wastewater generation factor as shown below.

Unit Domestic Wastewater Generation Amount for Each Area

Area	Unit Water Supply Amount for Residential Water Use	Ration of Commercial and Institutional Water Use	Wastewater Generation Factor	Unit Domestic Wastewater Generation Amount
1) Nairobi, Mombasa, and Kisumu	92 L/p/day	27%	80%	93.4 L/p/day
2) Other Urban Area	75 L/p/day	27%	80%	76.2 L/p/day

Source: JICA Study Team based on MWI Design Manual

(2) Area Without Sewerage System

a) For areas with no sewerage system development, it is required to install suitable on-site wastewater treatment facilities (septic tanks) for 31.2 million population in 2030.

b) Around 17.0% of the population does not use wastewater treatment facility. Around 75.6% of the population uses on-site treatment facilities; however, the facilities include unsuitable ones which are categorised as unimproved sanitation (the percentage is not clear). Unsuitable on-site facilities shall be improved.

3.3 Sanitation Development Plan for Lake Victoria North Catchment Area

(1) Development Strategy

Based on the overall concept described in Section 3.2, the sewerage system development is planned for the 19 UCs in LVNCA. The sewerage system development is conducted through the following three types of projects:

a) Rehabilitation of Existing Sewerage System

The rehabilitation includes repair and replacement of mechanical and electrical equipment of wastewater treatment plants (WWTPs) and pumping stations, and replacement of corrupted sewer pipes in seven UCs. This rehabilitation will be carried out for existing sewerage systems with total capacity of 21,000 m^3/day.

b) Expansion of Sewerage System

In order to cover the demand in 2030, capacities of existing sewerage systems of seven UCs will be expanded. The expansion includes expansion and/or new construction of sewerage pipes, pumping stations, and WWTPs. The total capacity of expansion will be 230,000 m^3/day to meet the demand in 2030.

c) Construction of New Sewerage System

There is no sewerage system in 19 UCs. New sewerage system will be constructed in these 19 UCs with total capacity of 206,000 m^3/day.

d) Incorporation of existing plans

According to data from WSBs, there are five plans of sewerage development projects, which have 17,000 m^3/day of total treatment capacity in LVNCA. (Refer to Table 2.4.2) These plans are to be incorporated in NWMP 2030. The planned capacity could cover only 7% of required development capacities. Two D/D and three F/S were completed for five projects. It is required to provide F/S reports of sewerage development projects, which will cover the future demand of each UC.

Outside the sewerage service area, the improved on-site treatment facilities will be available for the remaining 6.34 million residents in 2030. Currently, 6.64 million residents (94% of the entire population) are using the existing on-site treatment facilities, but unimproved facilities will be improved with new housing. Development of on-site sanitation facilities is planned for the 11 counties in LVNCA.

(2) Proposed Sanitation Development Plan

The sanitation development plan is shown in Table 3.3.1 and Figure 3.3.1, and the required unit of on-site sanitation facility is shown in Table 3.3.2. The proposed sanitation development plan for LVNCA is outlined below.

Proposed Sanitation Development Plan (LVNCA)

Type of Project		Target Area	Target Capacity (m^3/day)	Target Population (million persons)
Sewerage System (Off-site Treatment)	Rehabilitation	7 UCs	21,000	6.03
	Expansion	7 UCs	230,000	
	New Construction	12 UCs	209,000	
	Total	19 UCs	460,000	
On-site Treatment Facilities		11 counties	--	6.33

Source: JICA Study Team

Out of the 7.71 million urban population in LVNCA, 78% is expected to be covered by the sewerage system. It is almost equal to 80% of the national target of sewerage coverage ratio. Through the above sanitation development, the sanitation situation of LVNCA in 2030 will be as follows:

Sanitation Situation in 2030 (LVNCA)

Items		Sewerage System	Septic Tank, etc. (On-site Treatment Facilities)
Service Population (million)	2010	0.14	6.54
	2030	6.03	6.33
Required Treatment Capacity (m^3/day)	2010	21,000	-----
	2030	460,000	-----
Operation Body		Registered WSP	Individual, Community, etc.
Target Towns/ Areas		19 UCs	11 Counties

Source: JICA Study Team

3.4 Sanitation Development Plan for Lake Victoria South Catchment Area

Based on the overall planning concept and framework described in Section 3.2, sewerage system development is planned for the 19 UCs in LVSCA. The sewerage system development is conducted through the following three types of projects.

a) Rehabilitation of Existing Sewerage System

The rehabilitation includes repair and replacement of mechanical and electrical equipment of WWTPs and pumping stations, and replacement of corrupted sewer pipes in three UCs. This rehabilitation will be carried out for existing sewerage systems with total capacity of 22,000 m^3/day to meet the demand in 2030.

b) Expansion of Sewerage System

In order to cover the demand in 2030, capacities of the existing sewerage systems of three UCs will be expanded. The plan includes expansion and/or new construction of sewerage pipes, pumping stations, and WWTPs. The total capacity of expanded system is 171,000 m^3/day.

c) Construction of New Sewerage System

There is no sewerage system in 16 UCs. New sewerage system will be constructed in these UCs with total capacity of 291,000 m^3/day.

d) Incorporation of existing plans

According to data from WSBs, there are seven plans of sewerage development projects to cover seven urban centres, which have 53,000 m^3/day of total treatment capacity in LVSCA. (Ref. Table 2.4.2) These plans are to be incorporated in NWMP 2030. The planned capacity could cover only 11% of required development capacities. Four F/S were completed for four projects. It is required to provide F/S reports of sewerage development projects, which will cover the future demand of each UC.

Outside the sewerage service area, the improved on-site treatment facilities will be available for the remaining 6.70 million residents in 2030. Currently, 6.09 million residents, (82% of the entire population) are using existing on-site treatment facilities but unimproved facilities will be improved with new housing. Development of on-site sanitation facilities is planned for the 14 counties in LVSCA.

(2) Proposed Sanitation Development Plan

The sanitation development plan is shown in Table 3.4.1 and Figure 3.4.1, and the required unit of on-site sanitation facility is in Table 3.4.2. The proposed sanitation development plan for LVSCA is outlined below.

Proposed Sanitation Development Plan (LVSCA)

Type of Project		Target Area	Target Capacity (m^3/day)	Target Population (million persons)
Sewerage System (Off-site Treatment)	Rehabilitation	3 UCs	22,000	6.02
	Expansion	3 UCs	171,000	
	New Construction	16 UCs	292,000	
	Total	19 UCs	484,000	
On-site Treatment Facilities		14 Counties	--	6.70

Source: JICA Study Team

Out of the 7.99 million urban population in LVSCA, 75% (6.02 million) is expected to be covered by the sewerage system. The ratio of LVSCA is little lower than the national target of 80%, because there are not many large-scale UCs which have priority for sewerage development. Through the above sanitation development, the sanitation situation of LVSCA in 2030 will be as follows:

Sanitation Situation in 2030 (LVSCA)

Items		Sewerage System	Septic Tank, etc. (On-site Treatment Facilities)
Service Population (million)	2010	0.07	6.04
	2030	6.02	6.70
Required Treatment Capacity (m^3/day)	2010	22,000	-----
	2030	484,000	-----
Operation Body		Registered WSP	Individual, Community, etc.
Target Towns/ Areas		19 UCs	14 Counties

Source: JICA Study Team

3.5 Sanitation Development Plan for Rift Valley Catchment Area

(1) Development Strategy

Based on the overall planning concept and framework described in Section 3.2, sewerage system development is planned for the nine UCs in RVCA. The sewerage system development is conducted through the following three types of projects:

a) Rehabilitation of Existing Sewerage System

The rehabilitation includes repair and replacement of mechanical and electrical equipment of WWTPs and pumping stations, and replacement of corrupted sewer pipes in three UCs. This rehabilitation will be carried out for the existing sewerage systems with total capacity of 18,000 m^3/day.

b) Expansion of Sewerage System

In order to cover the demand in 2030, capacities of the existing sewerage systems of three UCs will be expanded. The plan includes expansion and/or new construction of sewerage pipes, pumping stations, and WWTPs. The total capacity of expansion is 152,000 m^3/day to meet the demand in 2030.

c) Construction of New Sewerage System

There is no sewerage system in seven UCs. New sewerage system will be constructed in these UCs with total capacity of 70,000 m^3/day.

d) Incorporation of existing plans

According to data from WSBs, there are seven plans of sewerage development projects to cover seven urban centres, which have 106,000 m^3/day of total treatment capacity. (Ref. Table 2.4.2) These plans are to be incorporated in NWMP 2030. The planned capacity could cover only 48% of required development capacities. One D/D and two F/S were completed for three projects. It is required to provide F/S reports of sewerage development projects, which will cover the future demand of each UC.

Outside the sewerage service area, the improved on-site treatment facilities will be available for the remaining 4.29 million residents in 2030. Currently, 3.38 million residents (69% of entire population) are using existing on-site treatment facilities, but unimproved facilities will be improved with new housing. Development of on-site sanitation facilities is planned for the 18 counties in RVCA.

(2) Proposed Sanitation Development Plan

The sanitation development plan is shown in Table 3.5.1 and Figure 3.5.1, and the required unit of on-site sanitation facility is in Table 3.5.2. The proposed sanitation development plan for RVCA is outlined below.

Proposed Sanitation Development Plan (RVCA)

Type of Project		Target Area	Target Capacity (m^3/day)	Target Population (million persons)
Sewerage System (Off-site Treatment)	Rehabilitation	3 UCs	18,000	3.16
	Expansion	3 UCs	150,000	
	New Construction	6 UCs	72,000	
	Total	9 UCs	240,000	
On-site Treatment Facilities		18 Counties	--	4.29

Source: JICA Study Team

Out of the 4.49 million urban population in RVCA, 70% is expected to be covered by the sewerage system. The ratio of RVCA is little lower than the national target of 80%, because there are not many large-scale UCs which have priority for sewerage development. Through the above sanitation development, the sanitation situation of RVCA in 2030 will be as follows:

Sanitation Situation in 2030 Plan (RVCA)

Items		Sewerage System	Septic Tank, etc. (On-site Treatment Facilities)
Service Population (million)	2010	0.19	3.35
	2030	3.16	4.29
Required Treatment Capacity (m^3/day)	2010	18,000	-----
	2030	240,000	-----
Operation Body		Registered WSP	Individual, Community, etc.
Target Town/Areas		9 UCs	18 Counties

Source: JICA Study Team

3.6 Sanitation Development Plan for Athi Catchment Area

(1) Development Strategy

Based on the overall planning concept and framework described in Section 3.2, sewerage system development is planned for the 25 UCs in ACA. The sewerage system development is conducted through the following three types of projects:

a) Rehabilitation of Existing Sewerage System

The rehabilitation includes repair and replacement of mechanical and electrical equipment of WWTPs and pumping stations, and replacement of corrupted sewer pipes in six UCs. This rehabilitation will be carried out for the existing sewerage systems with a total capacity of 244,000 m^3/day.

b) Expansion of Sewerage System

In order to cover the demand in 2030, capacities of the existing sewerage systems of six UCs will be expanded. This includes expansion and/or new construction of sewerage pipes, pumping stations, and WWTPs. The total capacity of expansion is 715,000 m^3/day.

c) Construction of New Sewerage System

There is no sewerage system in 18 UCs. New sewerage system will be constructed in these UCs with a total capacity of 430,000 m^3/day to meet the demand in 2030.

d) Incorporation of existing plans

According to data from WSBs, there are 15 plans of sewerage development projects, which have 396,000 m^3/day of total treatment capacity. (Ref. Table 2.4.2) These plans are to be incorporated in NWMP 2030. The planned capacity could cover only 32% of required development capacities. Two D/D and six F/S were completed for eight projects. It is required to provide F/S reports of sewerage development projects, which will cover the future demand of each UC.

Outside the sewerage service area, the improved on-site treatment facilities will be available for the remaining 4.28 million residents in 2030. Currently, 6.72 million residents (71% of the entire population) are using existing on-site treatment facilities, but unimproved facilities will be improved with new housing. Development of on-site sanitation facilities is planned for the ten counties in ACA.

(2) Proposed Sanitation Development Plan

The sanitation development plan is shown in Table 3.6.1 and Figure 3.6.1, and the required unit of on-site sanitation facility is in Table 3.6.2. The proposed sanitation development plan for ACA is outlined below.

Proposed Sanitation Development Plan (ACA)

Type of Project		Target Area	Target Capacity (m^3/day)	Target Population (million persons)
Sewerage System (Off-site Treatment)	Rehabilitation	6 UCs	244,000	16.26
	Expansion	6 UCs	715,000	
	New Construction	19 UCs	430,000	
	Total	25 UCs	1,389,000	
On-site Treatment Facilities		10 Counties	--	4.28

Source: JICA Study Team

Out of the 17.73 million urban population in ACA, 92% is expected to be covered by the sewerage system. The ratio of ACA is higher than the national target of 80%, because there are many large-scale UCs which have priority for sewerage development. Through the above sanitation development, the sanitation situation of ACA in 2030 will be as follows:

Sanitation Situation in 2030 (ACA)

Items		Sewerage System	Septic Tank, etc. (On-site Treatment Facilities)
Service Population (million)	2010	2.15	6.95
	2030	16.26	4.28
Required Treatment Capacity (m^3/day)	2010	244,000	-----
	2030	1,389,000	-----
Operation Body		Registered WSP	Individual, Community, etc.
Target Towns/ Areas		25 UCs	10 Counties

Source: JICA Study Team

3.7 Sanitation Development Plan for Tana Catchment Area

(1) Development Strategy

Based on the overall planning concept and framework described in Section 3.2, sewerage system development is planned for the 18 UCs in TCA. The sewerage system development is conducted through the following three types of projects:

a) Rehabilitation of Existing Sewerage System

The rehabilitation includes repair and replacement of mechanical and electrical equipment of WWTPs and pumping stations, and replacement of corrupted sewer pipes in four UCs. This rehabilitation will be carried out for the existing sewerage systems with a total capacity of 32,000 m^3/day.

b) Expansion of Sewerage System

In order to cover the demand in 2030, capacities of existing sewerage systems of six UCs will be expanded. The plan includes expansion and/or new construction of sewerage pipes, pumping stations, and WWTPs. The total capacity of expansion is 118,000 m^3/day.

c) Construction of New Sewerage System

There is no sewerage system in 12 UCs. New sewerage system will be constructed in these UCs with total capacity of 248,000 m^3/day to meet the demand in 2030.

d) Incorporation of existing plans

According to data from WSBs, there are 12 plans of sewerage development projects to cover 11 urban centres, which have 98,000 m^3/day of total treatment capacity. (Ref. Table 2.4.2) These plans are to be incorporated in NWMP 2030. The planned capacity could cover only 27% of required development capacities. Two D/D and eight F/S were completed for 10 projects. It is required to provide F/S reports of sewerage development projects, which will cover the future demand of each UC.

Outside the sewerage service area, the improved on-site treatment facilities will be available for the remaining 5.88 million residents in 2030. Currently, 5.08 million residents (87% of the entire population) are using existing on-site treatment facilities, but unimproved facilities are to be improved with new housing. Development of on-site sanitation facilities is planned for the 16 counties in TCA.

(2) Proposed Sanitation Development Plan

The sanitation development plan is shown in Table 3.7.1 and Figure 3.7.1, and the required unit of on-site sanitation facility is in Table 3.7.2. The proposed sanitation development plan for TCA is outlined below.

Proposed Sanitation Development Plan (TCA)

Type of Project		Target Area	Target Capacity (m^3/day)	Target Population (million persons)
Sewerage System (Off-site Treatment)	Rehabilitation	6 UCs	32,000	5.24
	Expansion	6 UCs	118,000	
	New Construction	12 UCs	248,000	
	Total	18 UCs	398,000	
On-site Treatment Facilities		16 Counties	--	5.13

Source: JICA Study Team

Out of the 6.34 million urban population in TCA, 71% is expected to be covered by the sewerage system. The ratio of TCA is lower than the national target of 80%, because there are not many large-scale UCs which have high priority for sewerage system development. Through the above sanitation development, the sanitation situation of TCA in 2030 will be as follows:

Sanitation Situation in 2030 (TCA)

Items		Sewerage System	Septic Tank, etc. (On-site Treatment Facilities)
Service Population (million)	2010	0.11	4.99
	2030	5.24	5.13
Required Treatment Capacity (m^3/day)	2010	32,000	-----
	2030	398,000	-----
Operation Body		Registered WSP	Individual, Community, etc.
Target Towns/ Areas		18 UCs	16 Counties

Source: JICA Study Team

3.8 Sanitation Development Plan for Ewaso Ng'iro North Catchment Area

(1) Development

Based on the overall planning concept and framework described in Section 3.2, sewerage system development is planned for the five UCs in ENNCA. The sewerage system development is conducted through the following three types of projects:

a) Rehabilitation of Existing Sewerage System

The rehabilitation includes repair and replacement of mechanical and electrical equipment of WWTPs and pumping stations, and replacement of corrupted sewer pipes in two UCs. This rehabilitation will be carried out for the existing sewerage systems with a total capacity of 5,000 m^3/day.

b) Expansion of Sewerage System

In order to cover the demand in 2030, capacities of the existing sewerage systems of two UCs will be expanded. The plan includes expansion and/or new construction of sewerage pipes, pumping stations, and WWTPs. The total capacity of expansion is 27,000 m^3/day.

c) Construction of New Sewerage System

There is no sewerage system in three UCs. New sewerage system will be constructed in these UCs with a total capacity of 30,000 m^3/day to meet the demand in 2030.

d) Incorporation of existing plans

According to data from WSBs, there are two plans of sewerage development projects to cover two urban centres, which have 7,000 m^3/day of total treatment capacity in ENNCA. (Ref. Table 2.4.2) These plans are to be incorporated in NWMP 2030. The planned capacity could cover only 12% of required development capacities. One D/D and one F/S were completed for two projects. It is required to provide F/S reports of sewerage development projects, which will cover the future demand of each UC.

Outside the sewerage service area, the improved on-site treatment facilities will be available for the remaining 3.58 million residents in 2030. Currently, 2.40 million residents (62% of entire population) are using existing on-site treatment facilities, but unimproved facilities will be improved with new housing. Development of on-site sanitation facilities is planned for the 14 counties in ENNCA.

(2) Proposed Sanitation Development Plan

The sanitation development plan is shown in Table 3.8.1 and Figure 3.8.1, and the required unit of on-site sanitation facility is in Table 3.8.2. The proposed sanitation development plan for ENNCA is outlined below.

Proposed Sanitation Development Plan (ENNCA)

Type of Project		Target Area	Target Capacity (m^3/day)	Target Population (million persons)
Sewerage System (Off-site Treatment)	Rehabilitation	2 UCs	5,000	0.82
	Expansion	2 UCs	27,000	
	New Construction	3 UCs	30,000	
	Total	5 UCs	62,000	
On-site Treatment Facilities		14 Counties	--	3.58

Source: JICA Study Team

Out of the 1.76 million urban population in ENNCA, 47% is expected to be covered by the sewerage system. The ratio of ENNCA is much lower than the national target of 80%, because there are only few large-scale urban centres which have priority for sewerage development. Currently, 36% of the population has no sanitation facilities, therefore, development of on-site treatment facilities is given higher priority than sewerage development. Through the above sanitation development, the sanitation situation of ENNCA in 2030 will be as follows:

Sanitation Situation in 2030 (ENNCA)

Items		Sewerage System	Septic Tank, etc. (On-site Treatment Facilities)
Service Population (million)	2010	0.07	2.37
	2030	0.82	3.58
Required Treatment Capacity (m^3/day)	2010	5,000	-----
	2030	62,000	-----
Operation Body		Registered WSP	Individual, Community, etc.
Target Towns/ Area		5 UCs	14 Counties

Source: JICA Study Team

CHAPTER 4 COST ESTIMATE

4.1 Basic Conditions for Cost Estimate

The project costs estimated in the study are only approximate or notional figures to grasp the general financial status, but do not bind the project finance arrangement in the future.

Basic conditions for project cost estimate are as follows:

a) Project costs were updated to correspond to the November 1, 2012 price level;

b) Exchange rate applied is US$1.0 = KSh85.24 as of November 1, 2012;

c) Physical contingency was assumed to be 15% of direct construction cost;

d) Cost of engineering services (detailed design and construction supervision) was assumed to be 10% of the direct construction cost;

e) Land acquisition cost was not considered. It was assumed that the lands are provided by the central government or local governments; and

f) The construction costs of multi-purpose dams were allocated on the basis of the existing F/S, the role of leading subsector in project implementation, and water storage volume (refer to Sectoral Report G – Water Resource Development).

4.2 Cost Estimate

4.2.1 Project Costs (Construction Costs)

The construction costs (financial initial investment costs) for the proposed sewerage projects are estimated or assumed below.

(1) Rehabilitation of Sewerage System

It is expected that the scope of the rehabilitation project will include replacement of old sewers and repair/ replacement works of mechanical and electrical equipment. The scope of the rehabilitation will depend on the conditions of each existing sewerage system, however, there is insufficient data and information to determine the project range. Under these situations, it is very difficult to estimate the cost of each rehabilitation project. Based on the estimates of existing reports prepared by WSBs and the Aftercare Study report, the unit rate of US$600/$m^3$ of water supply capacity, which is 30% of unit project cost, was applied.

(2) Expansion and New Development of Sewerage System

For the expansion and new development of sewerage system, the project cost estimates are divided into wastewater collection system and wastewater treatment works.

1) Wastewater Collection System

The cost of wastewater collection system is dependent on the topographic condition of the sewerage service area. Based on the estimates of existing reports prepared by WSBs and the Aftercare Study report, the costs are assumed by applying a unit rate of US$1,250/m^3 (the direct construction cost is US$1,000/m^3) of wastewater treatment capacity.

2) Wastewater Treatment Works

The cost of wastewater treatment works is dependent on the treatment method to be adopted and topographic condition of the construction site. However, the treatment methods, locations, and construction site of wastewater treatment works for the 95 target urban centres have not been fixed yet. The construction site location will be determined through many discussions and negotiations to solve land acquisition problems. The treatment methods will be determined in the F/S to be carried out for each urban centre. For the cost estimate, it is assumed that waste stabilisation pond process is adopted for all wastewater treatment works.

Based on the estimates of existing reports prepared by WSBs and the Aftercare Study report, the costs are assumed by applying a unit rate of US$750/m^3 (the direct construction cost is US$600/m^3) of treatment capacity. The project costs were estimated in KSh applying the exchange rate of KSh 85.24/US$.

Tables 4.2.1 to 4.2.7 show the project cost estimates of sewerage system development for six catchment areas. The summary of the project costs is shown below.

Summary of Project Costs for Sewerage System Development Projects

(Unit: KSh million)

Category	Total Cost	Project Cost for Each Catchment Area					
		LVNCA	LVSCA	RVCA	ACA	TCA	ENNCA
Rehabilitation	17,502	1,074	1,114	941	12,482	1,655	236
Expansion/Development	458,981	74,781	78,781	37,869	195,222	62,497	9,831
Total	476,483	75,855	79,895	38,810	207,704	64,152	10,067

Source: JICA Study Team

4.2.2 Operation and Maintenance (O&M) Costs

The O&M cost is highly dependent on electric power cost for water transmission and distribution. However, F/S reports as well as preliminary design have not been prepared for most of the proposed projects. Under this situation, it is impossible to estimate the O&M cost for each project. Based on the estimates of existing reports prepared by WASREB and WSBs, the O&M cost is roughly estimated by applying a unit rate of US$0.2/m^{3}of treatment capacity.

4.2.3 Replacement Costs

Replacement costs of the project facilities such as mechanical and electrical works are assumed to be required every 15 years at an amount of 30% of the project cost.

CHAPTER 5 ECONOMIC EVALUATION

5.1 Evaluation Method and Basic Conditions

The economic viability of selected projects was evaluated based on the estimated economic cost and sanitation benefit. The economic decision-making criteria consist of the following:

a) Economic Internal Rate of Return (EIRR);

b) Net Present Value (NPV); and

c) Benefit and Cost Ratio (B/C Ratio).

The following assumptions were made for the economic analysis:

1) Price Level

Investment costs and O&M costs were estimated at the price level of November 1, 2012. All prices are expressed in US$ currency. Foreign exchange rate was set at KSh85.24 to US$1.00. Conversion rate was ¥79.98 to US$1.00, and KSh110.48 to €1.00.

2) Economic Value

The prices of internationally tradable goods and services will be valued on the basis of the international border prices, which is often expressed in the World Bank's Commodity Prices and Price Forecast. The prices of non-traded goods and services will be converted from their financial value to economic value by applying a standard conversion factor of 0.90 based on the facts that the ratio of taxation against the GDP in Kenya is about 11%, as well as on the fact that the conversion factors widely applied in the water sector of Kenya are mostly around 0.90.

3) Social Discount Rate

The social discount rate reflects the opportunity cost of capital to the national economy. In this study, 10% of the prevailing opportunity cost of capital in the water sector of Kenya is applied.

4) Economic Life of Projects

The economic life of sanitation projects is set at 30 years. However, parts of the mechanical facilities have economic lives of 15 years, so they would be replaced in 15 years or within their economic lives.

5) Multi-purpose Dams

The construction costs and annual O&M costs of multi-purpose dams were allocated on the basis of the existing F/S, the role of leading subsector in project implementation, and water storage volume.

The overall economic evaluation of urban sewerage projects for the 95 urban centres was performed for each catchment at the master plan level. Rural sanitation projects were not evaluated because of the unavailability of data for planning at this preliminary stage.

5.2 Economic Benefit

Economic benefits of urban sewerage projects were identified as follows:

(1) Quantifiable Benefits

- Resource cost saving benefit, which is regarded as the cost saving of not having to depend on alternative sanitation facilities such as shared pit latrines and septic tanks. According to the Joint Monitoring Programme for Water and Sanitation, around 48% of the urban population relies on shared toilet, and the other 20% is dependent on other unimproved sanitary facilities and open defecation. Rapid informal settlement assessment was undertaken in the suburb of Nairobi in October 2012, in which most people in the informal settlement were reported to pay KSh5 per session for three times per day. The proposed urban sewerage projects are expected to replace the existing sanitation system as well as serve the people who are currently dependent on unimproved shared latrines. This replacement of shared latrines is considered as cost saving benefit in this study.
- Affordability to pay, which is estimated as the maximum affordable value for urban communities for wastewater treatment. The household expenditure data from the Kenya Integrated Household Budget Survey (KIHBS) 2005/06 was used to estimate the affordable expenditure for the urban population. Expenditure data per adult in KIHBS is the only data extracted from the survey. From the conservative viewpoint, this study applied per adult expenditure to calculate the maximum affordable value for urban sewerage facility, i.e., expenditure of urban population more than 15 years old was estimated. The maximum affordability for urban sewerage facility was set at 1% of per adult expenditure, which is commonly considered in urban sewerage projects.

(2) Qualitative Benefits

- Improved public health, which derives from the prevention of catching water-borne diseases. Several water-borne diseases are caused by poor sanitation. For instance, the Water and Sanitation Program identifies diarrhea, respiratory infection, and malaria as water-borne diseases caused by poor sanitation, whose health care costs amounted to US$51 million each year in Kenya. The rapid informal settlement assessment in Nairobi also found that malaria and cholera were often referred to as illnesses caused by wastewater. From the conservative viewpoint, the study estimated the health care and health-related productivity costs caused by malaria due to poor sanitation. The base data used for this calculation are from the Water and Sanitation Programme in Kenya and the Demographic and Health Surveys (DHS) in Kenya in 2008/09. The DHS shows that the incidence of malaria due to poor sanitation was estimated at 17% of children between 0 and 4 years old. This malaria-attributed case to poor sanitation was applied to estimate the public health costs due to poor sanitation. The prevalence of malaria for children between 0 and 4 years old was 22% (DHS 2008/09), while the malaria case for all age population in Kenya was estimated at 24.9% of the total population in 2007 (World Malaria Report 2009). From these data and conservative viewpoint, this study assumed that around 20% of the population of more than 5 years old has been inflicted with malaria every year in Kenya. Accordingly, the health care costs and working days loss costs of malaria caused by poor sanitation were calculated as a benefit of the improved sanitation through urban sewerage projects.
- There are other qualitative benefits in health and environmental aspects and these benefits are often considered greater than quantifiable benefits, but due to the unavailability of data and

the difficulties of quantifying in economic terms, this study only considered the above economic benefits.

The construction period for the urban sewerage is set at three years and the benefits will start from the fourth year, reaching the full development in five years.

5.3 Economic Cost

(1) Investment Cost

For economic evaluation, the economic investment cost was converted to its equivalent economic value to remove transfer payments such as taxes and subsidies. The cost for engineering services was estimated at 10% of the initial construction cost. The physical contingency was included in the investment cost, which was set at 15% of initial direct construction cost. The total investment costs by catchment are summarised in the following table. The highest investment costs will be required in Athi catchment, in order to match the increased population in this catchment (14,427,000 beneficiaries in 2030). The total economic cost for the proposed sewerage projects was estimated at US$5,061.5 million. Note that a unit construction cost per beneficiary was estimated at US$153 at the national level.

Summary of the Estimated Investment and O&M Costs by Catchment of Urban Sewerage Projects

Catchment Area	No. of Beneficiary	No. of Projects	Unit Construction Cost (US$ per capita)	Total Financial Cost (US$ million)	Total Economic Cost (US$ million)	Annual Financial O&M Cost (US$ million)
LVN	5,928,000	18	148	877.3	824.6	48.0
LVS	5,949,000	19	155	924.2	868.7	50.6
RV	2,988,000	8	149	444.2	417.6	24.3
Athi	14,427,000	25	159	2,290.3	2,152.9	125.4
Tana	5,164,000	17	142	733.2	689.2	40.1
ENN	752,000	5	153	115.4	108.4	6.3
Total	35,208,000	92	153	5,384.6	5,061.5	294.8

Source: JICA Study Team

(2) Annual Operation and Maintenance Cost

The annual O&M cost for sewerage facility was calculated by using US$0.2/$m^3$ per day of treatment capacity and estimated as in the above table. The O&M cost was further converted to its economic value.

(3) Replacement Cost

The replacement cost is required for mechanical facilities every 15 years and set at 20% of the initial construction cost.

5.4 Results of Economic Evaluation

The results of the economic evaluation by catchment are summarised in the following table. All catchments have an EIRR greater than 10%, with the national average of EIRR of 10.9% and B/C ratio

of 1.06. The proposed urban sewerage projects are expected to boost the national economy in Kenya by US$6,593 million at the present price. In terms of contribution of each economic benefit to urban sewerage projects, resource cost saving benefit consists of 91% of the total economic benefit, while the health-related benefits comprise around 1.1% of the total. The qualitative benefits such as improved public health are normally difficult to quantify and their real socioeconomic impact is likely to be underestimated. It can be said that the quantified economic benefits, in particular health-related socioeconomic benefits and environmental benefits, may be greater than the estimated quantifiable benefits. Athi catchment has the largest economic impact on the national economy, increasing it by US$2,651 million at the present value, followed by LVSCA and LVNCA.

Summary of the Economic Evaluation Results for Urban Water Supply by Catchment

(Unit: US$ million)

Catchment Area	Net Present Value (10%)		B/C	EIRR
	Cost	Benefit		
LVNCA	1,010	1,106	1.09	11.3%
LVSCA	1,065	1,110	1.04	10.6%
RVCA	512	559	1.09	11.3%
ACA	2,641	2,713	1.03	10.4%
TCA	845	964	1.14	11.9%
ENNCA	130	141	1.08	11.1%
Total	6,205	6,593	1.06	10.9%

Source: JICA Study Team

CHAPTER 6 IMPLEMENTATION PROGRAMME

6.1 General

The implementation program for sewerage projects toward 2030 was formulated so as to complete all projects to meet the water demand in 2030. The implementation schedule was considered in three terms, namely: short term (five years from 2013 to 2017), medium term (five years from 2018 to 2022) and long term (eight years from 2023 and 2030). The implementation schedule of the water supply development plan is consistent with the water source development plan, such as dam construction plan.

The total development capacity of the proposed projects by 2030 is 2.69 million m^3/day, which is more than eight times of the current capacity of existing sewerage systems. This is quite huge development plan, and needs to be modified due to financial restriction.

The individual projects will have EIAs which will address all issues including land acquisition and compensation.

6.2 Prioritisation Criteria for Implementation

The rehabilitation of existing sewerage systems has the highest priority for effective water use. Rehabilitation projects for the 27 urban centres with water supply system are proposed in the short term.

Basically, each water supply system is proposed to be developed in two phases by 2030, in order to avoid overdevelopment. The plan of 2nd phase projects could be modified, after completion of the 1st phase projects.

As for the new development and expansion sewerage projects, prioritisation for implementation is made using the following criteria:

1st Priority	Projects with finance
2nd Priority	Projects with detailed design completed by WSBs
3rd Priority	Projects with feasibility study completed by WSBs
4th Priority	Projects proposed by WSBs, or proposed in the First Medium Term Plan
5th Priority	Projects other than the above

For projects with the same ranking as in the above, the following criteria will be applied for further prioritisation:

- Project with larger service population has higher priority.

6.3 Implementation Schedule for Water Supply Development toward 2030

Based on the criteria mentioned above, the implementation schedules of the sewerage projects were prepared as shown in Tables 6.3.1 to 6.3.6 by catchment area. These were summarised in the subsection hereunder.

The overall project implementation schedule is arranged to manage the necessary budget for development in the short term (2013/14 to 2017/18), medium term (2018/19 to 2022/23), and long term (2023/24 to 2030/31). Tables 6.3.1 to 6.3.6 show the required project costs for each term as well as by each catchment area.

6.4 Recommendations for Further Surveys and Studies for NWMP 2030

(1) Preparation of Water Pollution Map for Sewerage Development

The sewerage development target aims to increase the coverage of sewerage system to 80% of the urban population by 2030. Out of the 137 major urban centres, 95 urban centres were selected as the target. These were selected from the urban centres with large population. These urban centres with large population have huge environmental impacts in terms of generation of large volume of wastewater.

The major purpose of sewerage development is to prevent water pollution. From this viewpoint, the sewerage system should be provided so as to protect the water environment from pollution sources.

It is recommended to investigate the current situation of water environment and prepare a water pollution map for major rivers and lakes to confirm the priorities of the proposed sewerage development areas.

(2) Review of Population Projection of Urban Centres

The proposed sewerage development plans were formulated so as to treat the future wastewater to be generated by the 95 target urban centres in 2030. The wastewater generated was estimated based on the projected population of the 95 target urban centres. The Kenya Vision 2030 presents the projection of the total urban and rural populations of Kenya in 2030, however, it does not include the population projection of the urban centres. The projection for each urban centre was roughly made using the available data and information.

The priorities and required capacities of the proposed sewerage systems highly depend on the future population projection. It is recommended to review the projected urban population of the target urban centres, based on the future urban development plan, such as expansion of urban area, development of urban infrastructure, future land use, expected economic activity, etc.

(3) Confirmation on the Availability of Land for Wastewater Treatment Plant

Out of the 95 target urban centres, a feasibility study of sewerage system development has been carried out for 37 urban centres only. For the remaining 58 urban centres, the locations of wastewater treatment plants have not been determined, and it is not easy to find lands that have not

been occupied or allocated in the urban areas. Therefore, land acquisition will be a key issue in the sewerage system development. For smooth realisation of the sewerage system development, it is recommended to confirm the availability of lands as early as possible based on the future land use plans of the target urban centres.

(4) Monitoring of Performance of Sewerage System

Through this study, it was revealed that the current performance of the existing sewerage systems has not been sufficiently monitored. The following data should be recorded to ensure proper formulation of the sewerage system development plan;

- Number of households connected to sewerage system (ratio of sewerage connection),
- Influent wastewater amount to the treatment works (wastewater amount collected by sewerage system), and
- Water quality of influent and effluent wastewater to and from the treatment works.

It is recommended to monitor continuously the performance of the sewerage systems in operation as well as collect the data listed above for further study.

Tables

Table 2.3.1 Existing Sewerage Systems and Capacites

CA	Water Service Providers	Existing Sewerage Systems and Capacites						
		Sewerage Systems	Town Centre	Urban Centre	Market Centres	County	Capacity (m^3/day)	Population Served
LVNCA	Eldoret Water Sanitation Company		Eldoret			Uasin Gishu	4,800	103,760
	Nzoia Water and Sanitation Company Ltd.		Kitale			Trans Nzoia	800	30,366
			Bungoma				4,500	
			Webuye				2,700	
	Western Water Service Company	Kakamega Sewerage	Kakamega Town - Shirere	Kakamega		Kakamega/Busia	1,500	15,962
		MMUST Sewerage	Kakamega MMUST				1,200	
			Busia				3,000	
	Kapsabet Nandi Water and Sanitation Company Ltd.	Kapsabet Sewerage	Kapsabet			Nandi	2,500	1,500
LVSCA	Kisumu Water and Sewerage Compay	Kisumu Sewarage	Kisumu (Conventional)			Kisumu	6,800	47,736
			Nyalenda				11,000	
	Kericho Water and Sanitation Company	Kericho Sewarage	Kericho			Kericho	1,500	22,500
	Gusii Water and Sanitation Company	Kisii Sewarage	Kisii			Kisii	n.a.	12,600
	South Nyanza Water and Sanitation Compay	South Nyanza Sewarage	Homabay			Homa Bay	1,231	6,000
RVCA	Nakuru Water and Sanitation Company Ltd.	Nakuru Sewerage Works	Old town Domestic			Nakuru	6,600	94,293
			Njoro Industrial				n.a.	
	Nakuru Rural Water and Sanitation Company Ltd.	Molo Sewerage Works	Molo Town				1,260	
	Naivasha Water and Sanitation Company Ltd.	Naivasha Sewerage Works	Naivasha town				933	28,620
ACA	Kiambu Water and Sanitation Co. Ltd	Kiambu Sewerage	Kiambu	Kiambu		Kiambu	10,000	3,564
	Limuru Water and Sewarage Co. Ltd	Limuru Sewerage	Limuru	Limuru		Kiambu	10,000	4,800
	Thika Water and Sanitation Co. Ltd	Thika Sewerage	Thika	Thika		Kiambu	20,000	77,082
	Nairobi Water and Sewerage Company	Dandora Sewerage	Nairobi	Nairobi		Nairobi	120,000	1,241,138
		Kariobangi Sewerage	Nairobi			Nairobi	32,000	
	Mombasa Water and Sanitation Company Ltd.		Mombasa-Changamwe			Mombasa	17,100	53,872
	Mavoko Epza Water and Sewerage Co.		Athi River, Mlolongo			Machakos	n,a.	32,400
	Machakos Water and Sewerage Ltd.		Machakos-Muvuti				2, 000	12,744
			Mavoko (Athi River)				12,960	
TCA	Nyeri Water and Sewerage Company	Nyeri Sewerage	Nyeri- Kiganjo			Nyeri	2,000	26,094
			Nyeri- ADB				6,100	
	Embu Water and Sanitation Company	Embu Sewarage	Embu			Embu	682	23,400
	Mathira Water and Sewerage Company	Karatina Sewerage	Karatina			Nyeri	n.a.	16,882
	Meru Water and Sewerage Services	Meru Sewerage	Meru			Meru	1,000	6,759
	Murang'a Water and Sanitation Company	Murang'a Sewarage	Mbiri- Murang'a			Muranga	1,564	15,918
ENNCA	Nyahururu Water and Sanitation Company	Nyahururu	Nyahururu	Nyahururu		Laikipia	2,617	25,576
	Nanyuki Water and Sewerage Company	Nanyuki Sewerage	Nanyuki			Laikipia	n.a.	22,242
	Garissa Water and Sewerage Company			Garissa		Garissa	1,000	5,328
	Isiolo Water and Sewerage Company	Isiolo	Isiolo sewerage	Isiolo		Isiolo	2,000	5,430

Source: JICA Study Team based on data from WSBs

Table 2.4.1 Ongoing Sewerage System and Capacity

CA	Water Service Providers	Ongoing Sewerage System and Capacity						
		Sewerage system	Town Centre	Urban Centre	Market Centre	County	Capacity (m^3/day)	Population Served
ACA	Nairobi Water and Sewerage Company	Dandora sewerage		Nairobi		Nairobi	40,000	
				Total			40,000	

Source: JICA Study Team based on data from WSBs

Table 2.4.2 Sewerage Projects Proposed by WSBs and First Medium Term Plan (2008 - 2012) of Kenya Vision 2030

Catchment Area	No.	Urban Centre	Project Status	Projects proposed by WSBs	Flagship Project in First Medium Term Plan in Kenya Vision 2030	Proposed Capacity (m^3/day)
LVNCA	1	Bondo	D/D	Proposed	-	3,851
	2	Siaya	D/D	Proposed	-	2,000
	3	Malaba	F/S	Proposed	-	2,471
	4	Moi's Bridge	F/S	Proposed	Proposed	5,000
	5	Matunda	F/S	Proposed	Proposed	3,600
	6	Kapenguria	-	-	Proposed	-
		Total				16,923
LVSCA	1	Kisumu	F/S	Proposed	Proposed	27,972
	2	Bomet	F/S	Proposed	-	1,750
	3	Homa Bay	-	Proposed	-	4,500
	4	Migori	F/S	Proposed	-	6,000
	5	Muhoroni	F/S	Proposed	-	2,000
	6	Kisii	-	Proposed	Proposed	6,000
	7	Kericho	-	Proposed	-	4,500
		Total				52,722
RVCA	1	Kabarnet	D/D	Proposed	-	2,380
	2	Nakuru	F/S	Proposed	-	70,000
	3	Eldama Ravine	F/S	Proposed	-	6,855
	4	Naivasha	-	Proposed	-	12,000
	5	Ol Kalou	-	Proposed	Proposed	7,000
	6	Molo	-	Proposed	-	4,300
	7	Narok	-	Proposed	Proposed	3,220
		Total				105,755
ACA	1	Ruiru	D/D	Proposed	Proposed	40,000
	2	Juja				
	3	Kikuyu	D/D	Proposed	-	20,000
	4	Nairobi	F/S	Proposed	Proposed	60,000
	5	Limuru	F/S	Proposed	Proposed	20,000
	6	Mombasa	F/S	Proposed	Proposed	55,325
	7	Mavoko	F/S	Proposed	Proposed	10,000
	8	Karuri	-	Proposed	Proposed	30,802
	9	Kiambu	-	Proposed	-	24,064
	10	Ngong	F/S	Proposed	-	7,500
	11	Kiserian				
	12	Kajiado	F/S	Proposed	-	500
	13	Kangundo-Tala	-	Proposed	-	62,497
	14	Machakos	-	Proposed	Proposed	57,552
	15	Ukunda	-	Proposed	-	7,880
		Total				396,122
TCA	1	Embu	D/D	Proposed	-	6,387
	2	Maua	D/D	Proposed	Proposed	1,982
	3	Kitui	F/S	Proposed	Proposed	5,000
	4	Meru	F/S	Proposed	-	10,000
	5	Lamu	-	-	Proposed	-
	7	Thika	F/S	Proposed	-	40,000
	6	Chuka	F/S	Proposed	Proposed	3,000
	7	Garissa	F/S	Proposed	-	1,561
	8	Chogoria	F/S	Proposed	-	3,270
	9	Runyenjes	F/S	Proposed	-	2,249
	10	Kerugoya/Kutus	F/S	Proposed	-	2,235
	11	Nyeri	-	Proposed	-	5,000
	12	Matuu	-	-	Proposed	-
	13	Makuyu	-	Proposed	-	16,880
		Total				97,565
ENNCA	1	Nyahururu	F/S	WSB	-	3,347
	2	Mandera	D/D	WSB	-	4,000
	3	Isiolo	-	-	Proposed	-
	4	Wajir	-	-	Proposed	-
		Total				7,347

Source: JICA Study Team, based on the data from WSBs and the First Medium Term Plan (2008-2012) of Kenya Vision 2030

Table 3.2.1 Target 95 Urban Centres for Sewerage System Development

No.	LVNCA	LVSCA	RVCA	ACA	TCA	ENNCA
1	Eldoret	Kisumu	Nakuru	Nairobi	Lamu	Isiolo
2	Vihiga	Rongo	Naivasha	Mombasa	Nyeri	Nanyuki
3	Kitale	Kericho	Ol Kalou	Ruiru	Kitui	Nyahururu
4	Mumias	Bomet	Molo	Kikuyu	Thika	Mandera
5	Kimilili	Kisii	Narok	Kangundo-Tala	Embu	Wajir
6	Kakamega	Migori	Gilgil	Machakos	Meru	
7	Kapsabet	Suneka	Njoro	Mavoko	Matuu	
8	Bungoma	Ahero	Eldama Ravine	Malindi	Makuyu	
9	Busia	Kipkelion	Kabarnet	Karuri	Chuka	
10	Luanda	Homa Bay		Ngong	Muranga	
11	Item/Tambach	Londiani		Kiambu	Garissa	
12	Webuye	Nyamira		Limuru	Chogoria	
13	Kapenguria	Keroka		Ukunda	Maragua	
14	Bondo	Oyugis		Kitengela	Wanguru	
15	Siaya	Muhoroni		Wundanyi	Runyenjes	
16	Malaba	Awasi		Kilifi	Kerugoya/Kutus	
17	Malakisi	Kehancha		Mtwapa	Maua	
18	Moi's Bridge	Awendo		Juja	Mwingi	
19	Matunda	Kendu Bay		Ongata Rongai		
20				Taveta		
21				Mariakani		
22				Voi		
23				Kajiado		
24				Kwale		
25				Kiserian		
Total	19 UCs	19 UCs	9 UCs	25 UCs	18 UCs	5 UCs

Source: JICA Study Team, based on Census 2009 data.

Table 3.3.1 Proposed Sewerage Development Plan (LVNCA)

Major Urban Area		Service Population in 2030	Required Capacity in 2030 (m^3/day)	Current Capacity in 2010 (m^3/day)	Under Construction (m^3/day)	Proposed Projects		
						Rehabilitation Works (m^3/day)	Expansion Works (m^3/day)	New Construction (m^3/day)
1	Eldoret	1,105,499	84,239	4,800	0	4,800	79,439	0
2	Vihiga	597,496	45,529	0	0	0	0	45,529
3	Kitale	534,528	40,731	800	0	800	39,931	0
4	Mumias	503,318	38,353	0	0	0	0	38,353
5	Kimilili	477,847	36,412	0	0	0	0	36,412
6	Kakamega	461,945	35,200	2,700	0	2,700	32,500	0
7	Kapsabet	436,952	33,296	2,500	0	2,500	30,796	0
8	Bungoma	281,225	21,429	4,500	0	4,500	16,929	0
9	Busia	261,664	19,939	3,000	0	3,000	16,939	0
10	Luanda	248,400	18,928	0	0	0	0	18,928
11	Item/Tambach	212,992	16,230	0	0	0	0	16,230
12	Webuye	208,119	15,859	2,700	0	2,700	13,159	0
13	Kapenguria	171,382	13,059	0	0	0	0	13,059
14	Bondo	168,472	12,838	0	0	0	0	12,838
15	Malaba	108,112	8,238	0	0	0	0	8,238
16	Malakisi	85,993	6,553	0	0	0	0	6,553
17	Siaya	72,115	5,495	0	0	0	0	5,495
18	Moi's Bridge	58,266	4,440	0	0	0	0	4,440
19	Matunda	37,643	2,868	0	0	0	0	2,868
	Total	6,031,965	459,636	21,000	0	21,000	229,693	208,943

Note: Data of the service population for each urban centre in 2010 is not available. All urban population of urban centre in 2030 was counted as service population.

Source: JICA Study Team, based on data from WSBs and Census 2009

Table 3.3.2 Users and Required Units of On-Site Sanitation Facilities (LVNCA)

Counties	Users in 2010	Users in 2030	Difference (2010-2030)	Required Units of On-site Facilities*
11	6,540,000	6,330,000	-210,000	1,266,000

Note: * 5 users/facilities

Source: JICA Study Team, based on data from Census 2009

Table 3.4.1 Proposed Sewerage Development Plan (LVSCA)

Major Urban Area		Service Population in 2030	Required Capacity in 2030 (m^3/day)	Current Capacity in 2010 (m^3/day)	Under Construction (m^3/day)	Proposed Projects		
						Rehabilitation Works (m^3/day)	Expansion Works (m^3/day)	New Construction (m^3/day)
1	Kisumu	1,457,208	136,103	17,800	0	0	118,303	0
2	Rongo	519,406	39,579	0	0	0	0	39,579
3	Kericho	512,485	39,051	1,500	0	0	37,551	0
4	Bomet	421,478	32,117	0	0	0	0	32,117
5	Kisii	411,773	31,377	0	0	0	0	31,377
6	Migori	267,297	20,368	0	0	0	0	20,368
7	Suneka	255,809	19,493	0	0	0	0	19,493
8	Ahero	255,366	19,459	0	0	0	0	19,459
9	Kipkelion	235,382	17,936	0	0	0	0	17,936
10	Homa Bay	218,278	16,633	1,231	0	0	15,402	0
11	Londiani	217,220	16,552	0	0	0	0	16,552
12	Nyamira	209,750	15,983	0	0	0	0	15,983
13	Keroka	209,679	15,978	0	0	0	0	15,978
14	Oyugis	178,454	13,598	0	0	0	0	13,598
15	Muhoroni	173,451	13,217	0	0	0	0	13,217
16	Awasi	172,268	13,127	0	0	0	0	13,127
17	Kehancha	151,564	11,549	0	0	0	0	11,549
18	Awengo	80,193	6,111	0	0	0	0	6,111
19	Kendu Bay	74,234	5,657	0	0	0	0	5,657
	Total	6,021,294	483,887	20,531	0	0	171,256	292,101

Note: Data of the service population for each urban centre in 2010 is not available. All urban population of urban centre in 2030 was counted as service population.

Source: JICA Study Team, based on data from WSBs and Census 2009

Table 3.4.2 Users and Required Units of On-Site Sanitation Facilities (LVSCA)

Counties	Users in 2010	Users in 2030	Difference (2010-2030)	Required Units of On-site Facilities*
14	6,040,000	6,700,000	660,000	1,340,000

Note: * 5 users/facilities

Source: JICA Study Team, based on data from Census 2009

Table 3.5.1 Proposed Sewerage Development Plan (RVCA)

Major Urban Area		Service Population in 2030	Required Capacity in 2030 (m^3/day)	Current Capacity in 2010 (m^3/day)	Under Construction (m^3/day)	Proposed Projects		
						Rehabilitation Works (m^3/day)	Expansion Works (m^3/day)	New Construction (m^3/day)
1	Nakuru	1,155,789	88,071	16,200	0	16,200	71,871	0
2	Naivasha	851,433	64,879	933	0	933	63,946	0
3	Ol Kalou	332,309	25,322	0	0	0	0	25,322
4	Molo	204,630	15,593	1,260	0	1,260	14,333	0
5	Narok	194,573	14,826	0	0	0	0	14,826
6	Gilgil	177,659	13,538	0	0	0	0	13,538
7	Njoro	118,552	9,034	0	0	0	0	9,034
8	Eldama Ravine	89,965	6,855	0	0	0	0	6,855
9	Kabarnet	31,236	2,380	0	0	0	0	2,380
	Total	3,156,144	240,498	18,393	0	18,393	150,150	71,955

Note: Data of the service population for each urban centre in 2010 is not available. All urban population of urban centre in 2030 was counted as service population.

Source: JICA Study Team, based on data from WSBs and Census 2009

Table 3.5.2 Users and Required Units of On-Site Sanitation Facilities (RVCA)

Counties	Users in 2010	Users in 2030	Difference (2010-2030)	Required Units of On-site Facilities*
18	3,350,000	4,290,000	940,000	858,000

Note: * 5 users/facilities

Source: JICA Study Team, based on data from Census 2009

Table 3.6.1 Proposed Sewerage Development Plan (ACA)

Major Urban Area		Service Population in 2030	Required Capacity in 2030 (m^3/day)	Current Capacity in 2010 (m^3/day)	Under Construction (m^3/day)	Proposed Projects		
						Rehabilitation Works (m^3/day)	Expansion Works (m^3/day)	New Construction (m^3/day)
1	Nairobi	6,085,297	568,367	152,000	40,000	192,000	376,367	0
2	Mombasa	2,644,591	247,005	17,100	0	17,100	229,905	0
3	Ruiru	896,358	68,302	0	0	0	0	79,868
4	Juja	151,781	11,566	0	0			
5	Kikuyu	875,242	66,693	0	0	0	0	66,693
6	Kangundo-Tala	820,175	62,497	0	0	0	0	62,497
7	Machakos	755,281	57,552	2,000	0	2,000	55,552	0
8	Mavoko	514,909	39,236	12,960	0	12,960	26,276	0
9	Malindi	443,811	33,818	0	0	0	0	33,818
10	Karuri	404,224	30,802	0	0	0	0	30,802
11	Ngong	402,242	30,651	0	0	0	0	36,131
12	Kiserian	71,913	5,480	0	0			
13	Kiambu	315,807	24,064	10,000	0	10,000	14,064	0
14	Limuru	298,455	22,742	10,000	0	10,000	12,742	0
15	Ukunda	234,651	17,880	0	0	0	0	17,880
16	Kitengeia	218,282	16,633	0	0	0	0	16,633
17	Wundanyi	185,136	14,107	0	0	0	0	14,107
18	Kilifi	183,228	13,962	0	0	0	0	13,962
19	Mtwapa	182,474	13,905	0	0	0	0	13,905
20	Ongata Rongai	150,775	11,489	0	0	0	0	11,489
21	Taveta	99,997	7,620	0	0	0	0	7,620
22	Mariakani	90,271	6,879	0	0	0	0	6,879
23	Voi	86,340	6,579	0	0	0	0	6,579
24	Kajiado	74,803	5,700	0	0	0	0	5,700
25	Kwale	74,303	5,662	0	0	0	0	5,662
	Total	16,260,348	1,389,193	204,060	40,000	244,060	714,906	430,225

Note: Data of the service population for each urban centre in 2010 is not available. All urban population of urban centre in 2030 was counted as service population.

Source: JICA Study Team, based on data from WSBs and Census 2009

Table 3.6.2 Users and Required Units of On-Site Sanitation Facilities (ACA)

Counties	Users in 2010	Users in 2030	Difference (2010-2030)	Required Units of On-site Facilities*
10	6,950,000	4,280,000	-2,670,000	856,000

Note: * 5 users/facilities

Source: JICA Study Team, based on data from Census 2009

Table 3.7.1 Proposed Sewerage Development Plan (TCA)

Major Urban Area		Service Population in 2030	Required Capacity in 2030 (m^3/day)	Current Capacity in 2010 (m^3/day)	Under Construction (m^3/day)	Proposed Projects		
						Rehabilitation Works (m^3/day)	Expansion Works (m^3/day)	New Construction (m^3/day)
1	Lamu	1,250,000	95,250	0	0	0	0	95,250
2	Nyeri	600,803	45,781	8,100	0	8,100	37,681	0
3	Kitui	551,547	42,028	0	0	0	0	42,028
4	Thika	513,806	39,152	20,000	0	20,000	19,152	0
5	Embu	305,362	23,269	682	0	682	22,587	0
6	Meru	269,949	20,570	1,000	0	1,000	19,570	0
7	Matuu	255,467	19,467	0	0	0	0	19,467
8	Makuyu	221,524	16,880	0	0	0	0	16,880
9	Chuka	218,821	16,674	0	0	0	0	16,674
10	Muranga	144,849	11,037	1,561	0	1,561	9,476	0
11	Garissa	143,348	10,923	1,000	0	1,000	9,923	0
12	Chogoria	143,036	10,899	0	0	0	0	10,899
13	Maragua	132,762	10,116	0	0	0	0	10,116
14	Wanguru	120,726	9,199	0	0	0	0	9,199
15	Runyenjes	98,401	7,498	0	0	0	0	7,498
16	Kerugoya/Kutus	97,767	7,450	0	0	0	0	7,450
17	Maua	86,713	6,608	0	0	0	0	6,608
18	Mwingi	80,390	6,126	0	0	0	0	6,126
	Total	5,235,273	398,928	32,343	0	32,343	118,389	248,195

Note: Data of the service population for each urban centre in 2010 is not available. All urban population of urban centre in 2030 was counted as service population.

Source: JICA Study Team, based on data from WSBs and Census 2009

Table 3.7.2 Users and Required Units of On-Site Sanitation Facilities (TCA)

Counties	Users in 2010	Users in 2030	Difference (2010-2030)	Required Units of On-site Facilities*
16	4,990,000	5,130,000	140,000	1,026,000

Note: * 5 users/facilities

Source: JICA Study Team, based on data from Census 2009

Table 3.8.1 Proposed Sewerage Development Plan (ENNCA)

		Service Population in 2030	Required Capacity in 2030 (m^3/day)	Current Capacity in 2010 (m^3/day)	Under Construction (m^3/day)	Proposed Projects		
						Rehabilitation Works (m^3/day)	Expansion Works (m^3/day)	New Construction (m^3/day)
1	Isiolo	231,501	17,640	2,000	0	2,000	15,640	0
2	Nanyuki	192,282	14,652	0	0	0	0	14,652
3	Nyahururu	183,483	13,981	2,617	0	2,617	11,364	0
4	Mandera	108,071	8,235	0	0	0	0	8,235
5	Wajir	102,042	7,776	0	0	0	0	7,776
	Total	817,380	62,284	4,617	0	4,617	27,004	30,663

Note: Data of the service population for each urban centre in 2010 is not available. All urban population of urban centre in 2030 was counted as service population.

Source: JICA Study Team, based on data from WSBs and Census 2009

Table 3.8.2 Users and Required Units of On-Site Sanitation Facilities (ENNCA)

Counties	Users in 2010	Users in 2030	Difference (2010-2030)	Required Units of On-site Facilities*
14	2,370,000	3,580,000	1,210,000	716,000

Note: * 5 users/facilities

Source: JICA Study Team, based on data from Census 2009

Table 4.2.1 Project Cost and O&M Cost for Sewerage Development Projects (LVNCA)

Major Urban Area		Service Population in 2030	Required Capacity in 2030 (m^3/day)	Current Capacity in 2010 (m^3/day)	Capacity to be developed (m^3/day)	Project Cost (KSh million)			O&M Cost (KSh million/year)
						Total	Rehabilitation Works	Expansion/ New Construct.	
1	Eldoret	1,105,499	84,239	4,800	79,439	13,790	245	13,545	741
2	Vihiga	597,496	45,529	0	45,529	7,762	0	7,762	425
3	Kitale	534,528	40,731	800	39,931	6,848	41	6,807	373
4	Mumias	503,318	38,353	0	38,353	6,538	0	6,538	358
5	Kimilili	477,847	36,412	0	36,412	6,208	0	6,208	340
6	Kakamega	461,945	35,200	2,700	32,500	5,679	138	5,541	303
7	Kapsabet	436,952	33,296	2,500	30,796	5,378	128	5,250	287
8	Bungoma	281,225	21,429	4,500	16,929	3,116	230	2,886	158
9	Busia	261,664	19,939	3,000	16,939	3,041	153	2,888	158
10	Luanda	248,400	18,928	0	18,928	3,227	0	3,227	177
11	Item/Tambach	212,992	16,230	0	16,230	2,767	0	2,767	151
12	Webuye	208,119	15,859	2,700	13,159	2,381	138	2,243	123
13	Kapenguria	171,382	13,059	0	13,059	2,226	0	2,226	122
14	Bondo	168,472	12,838	0	12,838	2,189	0	2,189	120
15	Malaba	108,112	8,238	0	8,238	1,404	0	1,404	77
16	Malakisi	85,993	6,553	0	6,553	1,117	0	1,117	61
17	Siaya	72,115	5,495	0	5,495	937	0	937	51
18	Moi's Bridge	58,266	4,440	0	4,440	757	0	757	41
19	Matunda	37,643	2,868	0	2,868	489	0	489	27
Total		6,031,965	459,636	21,000	438,636	75,855	1,074	74,781	4,094

Source: JICA Study Team

Table 4.2.2 Project Cost and O&M Cost for Sewerage Development Projects (LVSCA)

Major Urban Area		Service Population in 2030	Required Capacity in 2030 (m^3/day)	Current Capacity in 2010 (m^3/day)	Capacity to be developed (m^3/day)	Project Cost (KSh million)			O&M Cost (KSh million/year)
						Total	Rehabilitation Works	Expansion/ New Construct.	
1	Kisumu	1,457,208	136,103	17,800	118,303	21,081	910	20,171	1,104
2	Rongo	519,406	39,579	0	39,579	6,747	0	6,747	369
3	Kericho	512,485	39,051	1,500	37,551	6,478	77	6,402	350
4	Bomet	421,478	32,117	0	32,117	5,475	0	5,475	300
5	Kisii	411,773	31,377	1,260	30,117	5,199	64	5,134	281
6	Migori	267,297	20,368	0	20,368	3,472	0	3,472	190
7	Suneka	255,809	19,493	0	19,493	3,323	0	3,323	182
8	Ahero	255,366	19,459	0	19,459	3,317	0	3,317	182
9	Kipkelion	235,382	17,936	0	17,936	3,058	0	3,058	167
10	Homa Bay	218,278	16,633	1,231	15,402	2,689	63	2,626	144
11	Londiani	217,220	16,552	0	16,552	2,822	0	2,822	154
12	Nyamira	209,750	15,983	0	15,983	2,725	0	2,725	149
13	Keroka	209,679	15,978	0	15,978	2,724	0	2,724	149
14	Oyugis	178,454	13,598	0	13,598	2,318	0	2,318	127
15	Muhoroni	173,451	13,217	0	13,217	2,253	0	2,253	123
16	Awasi	172,268	13,127	0	13,127	2,238	0	2,238	123
17	Kehancha	151,564	11,549	0	11,549	1,969	0	1,969	108
18	Awendo	80,193	6,111	0	6,111	1,042	0	1,042	57
19	Kendu Bay	74,234	5,657	0	5,657	964	0	964	53
Total		6,021,294	483,887	21,791	462,096	79,895	1,114	78,781	4,313

Source: JICA Study Team

Table 4.2.3 Project Cost and O&M Cost for Sewerage Development Projects (RVCA)

Major Urban Area		Service Population in 2030	Required Capacity in 2030 (m^3/day)	Current Capacity in 2010 (m^3/day)	Capacity to be developed (m^3/day)	Project Cost (KSh million)			O&M Cost (KSh million/year)
						Total	Rehabilitation Works	Expansion/ New Construct.	
1	Nakuru	1,155,789	88,071	16,200	71,871	13,083	829	12,255	671
2	Naivasha	851,433	64,879	933	63,946	10,951	48	10,904	597
3	Ol Kalou	332,309	25,322	0	25,322	4,318	0	4,318	236
4	Molo	204,630	15,593	1,260	14,333	2,508	64	2,443	134
5	Narok	194,573	14,826	0	14,826	2,528	0	2,528	138
6	Gilgil	177,659	13,538	0	13,538	2,308	0	2,308	126
7	Njoro	118,552	9,034	0	9,034	1,540	0	1,540	84
8	Eldama Ravine	89,965	6,855	0	6,855	1,169	0	1,169	64
9	Kabarnet	31,236	2,380	0	2,380	406	0	406	22
Total		3,156,144	240,498	18,393	222,105	38,810	941	37,869	2,073

Source: JICA Study Team

Table 4.2.4 Project Cost and O&M Cost for Sewerage Development Projects (ACA)

Major Urban Area		Service Population in 2030	Required Capacity in 2030 (m^3/day)	Current Capacity in 2010 (m^3/day)	Capacity to be developed (m^3/day)	Project Cost (KSh million)			O&M Cost (KSh million/year)
						Total	Rehabilitation Works	Expansion/ New Construct.	
1	Nairobi	6,085,297	568,367	192,000	376,367	73,982	9,820	64,162	3,513
2	Mombasa	2,644,591	247,005	17,100	229,905	40,069	875	39,194	2,146
3	Ruiru	896,358	68,302	0	79,868	13,616	0	13,616	745
4	Juja	151,781	11,566						
5	Kikuyu	875,242	66,693	0	66,693	11,370	0	11,370	623
6	Kangundo-Tala	820,175	62,497	0	62,497	10,655	0	10,655	583
7	Machakos	755,281	57,552	2,000	55,552	9,573	102	9,471	519
8	Mavoko	514,909	39,236	12,960	26,276	5,142	663	4,480	245
9	Malindi	443,811	33,818	0	33,818	5,765	0	5,765	316
10	Karuri	404,224	30,802	0	30,802	5,251	0	5,251	287
11	Ngong	402,242	30,651	0	36,131	6,160	0	6,160	337
12	Kiserian	71,913	5,480						
13	Kiambu	315,807	24,064	10,000	14,064	2,909	511	2,398	131
14	Limuru	298,455	22,742	10,000	12,742	2,684	511	2,172	119
15	Ukunda	234,651	17,880	0	17,880	3,048	0	3,048	167
16	Kitengela	218,282	16,633	0	16,633	2,836	0	2,836	155
17	Wundanyi	185,136	14,107	0	14,107	2,405	0	2,405	132
18	Kilifi	183,228	13,962	0	13,962	2,380	0	2,380	130
19	Mtwapa	182,474	13,905	0	13,905	2,370	0	2,370	130
20	Ongata Rongai	150,775	11,489	0	11,489	1,959	0	1,959	107
21	Taveta	99,997	7,620	0	7,620	1,299	0	1,299	71
22	Mariakani	90,271	6,879	0	6,879	1,173	0	1,173	64
23	Voi	86,340	6,579	0	6,579	1,122	0	1,122	61
24	Kajiado	74,803	5,700	0	5,700	972	0	972	53
25	Kwale	74,303	5,662	0	5,662	965	0	965	53
Total		16,260,348	1,389,193	244,060	1,145,133	207,704	12,482	195,222	10,688

Source: JICA Study Team

Table 4.2.5 Project Cost and O&M Cost for Sewerage Development Projects (TCA)

	Major Urban Area	Service Population in 2030	Required Capacity in 2030 (m^3/day)	Current Capacity in 2010 (m^3/day)	Capacity to be developed (m^3/day)	Project Cost (KSh million)			O&M Cost (KSh million/year)
						Total	Rehabilitation Works	Expansion/ New Construct.	
1	Lamu	1,250,000	95,250	0	95,250	16,240	0	16,240	889
2	Nyeri	600,803	45,781	8,100	37,681	6,838	414	6,424	352
3	Kitui	551,547	42,028	0	42,028	7,165	0	7,165	392
4	Thika	513,806	39,152	20,000	19,152	4,289	1,024	3,265	179
5	Embu	305,362	23,269	682	22,587	3,885	35	3,851	211
6	Meru	269,949	20,570	1,000	19,570	3,387	51	3,336	183
7	Matuu	255,467	19,467	0	19,467	3,319	0	3,319	182
8	Makuyu	221,524	16,880	0	16,880	2,878	0	2,878	158
9	Chuka	218,821	16,674	0	16,674	2,843	0	2,843	156
10	Muranga	144,849	11,037	1,561	9,476	1,695	80	1,616	88
11	Garissa	143,348	10,923	1,000	9,923	1,743	51	1,692	93
12	Chogoria	143,036	10,899	0	10,899	1,858	0	1,858	102
13	Maragua	132,762	10,116	0	10,116	1,725	0	1,725	94
14	Wanguru	120,726	9,199	0	9,199	1,568	0	1,568	86
15	Runyenjes	98,401	7,498	0	7,498	1,278	0	1,278	70
16	Kerugoya/Kutus	97,767	7,450	0	7,450	1,270	0	1,270	70
17	Maua	86,713	6,608	0	6,608	1,126	0	1,126	62
18	Mwingi	80,390	6,126	0	6,126	1,044	0	1,044	57
	Total	5,235,273	398,928	32,343	366,585	64,152	1,655	62,497	3,422

Source: JICA Study Team

Table 4.2.6 Project Cost and O&M Cost for Sewerage Development Projects (ENNCA)

	Major Urban Area	Service Population in 2030	Required Capacity in 2030 (m^3/day)	Current Capacity in 2010 (m^3/day)	Capacity to be developed (m^3/day)	Project Cost (KSh million)			O&M Cost (KSh million/year)
						Total	Rehabilitation Works	Expansion/ New Construct.	
1	Isiolo	231,501	17,640	2,000	15,640	2,769	102	2,666	146
2	Nanyuki	192,282	14,652	0	14,652	2,498	0	2,498	137
3	Nyahururu	183,483	13,981	2,617	11,364	2,071	134	1,937	106
4	Mandera	108,071	8,235	0	8,235	1,404	0	1,404	77
5	Wajir	102,042	7,776	0	7,776	1,326	0	1,326	73
	Total	817,380	62,284	4,617	57,667	10,067	236	9,831	538

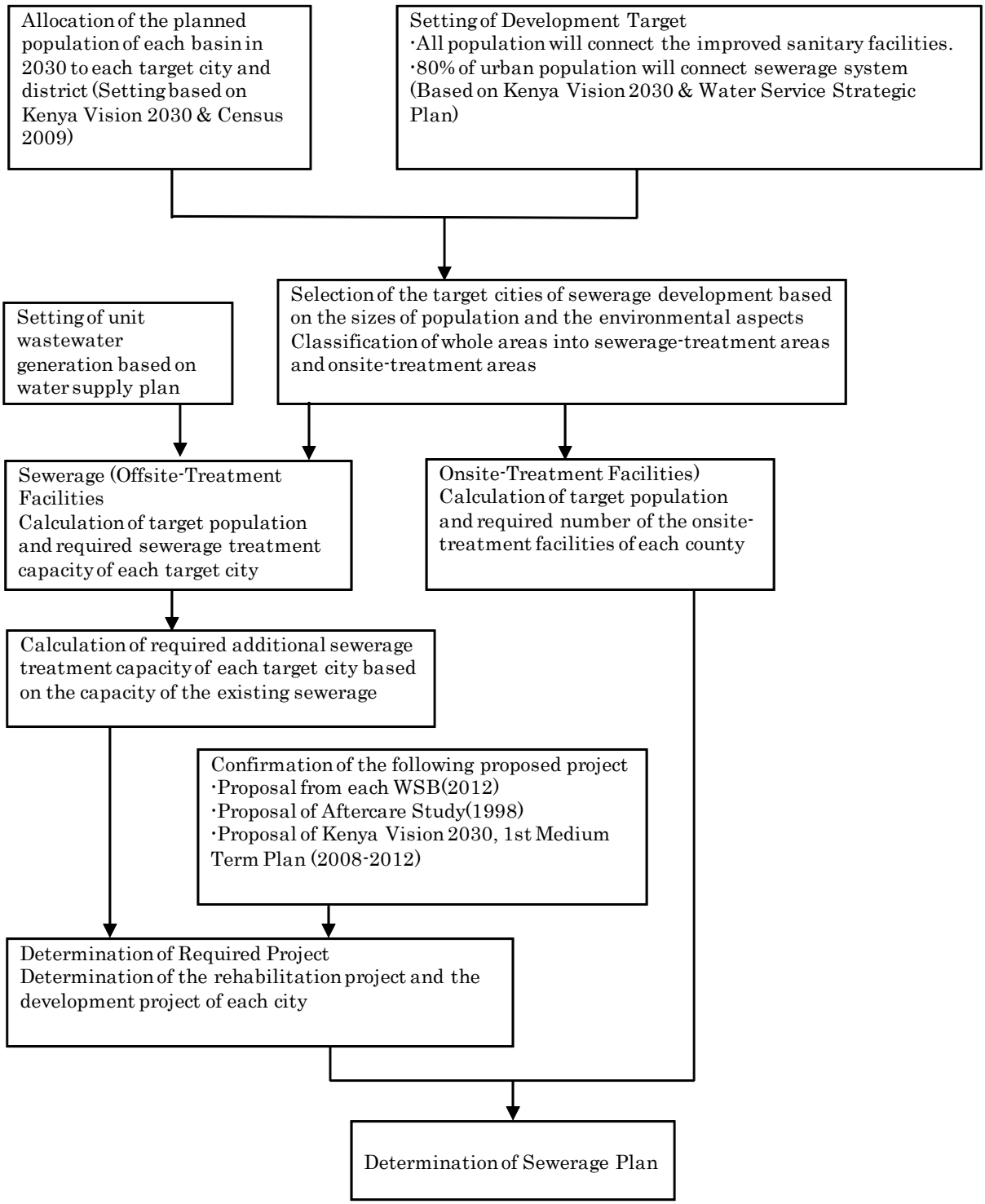
Source: JICA Study Team

Table 4.2.7 Project Cost and O&M Cost for Sewerage Development Projects for Whole of Kenya

	Catchment Area	Service Population in 2030	Required Capacity in 2030 (m^3/day)	Current Capacity in 2010 (m^3/day)	Capacity to be developed (m^3/day)	Project Cost (KSh million)			O&M Cost (KSh million/year)
						Total	Rehabilitation Works	Expansion/ New Construct.	
1	LVNCA	6,031,965	459,636	21,000	438,636	75,855	1,074	74,781	4,094
2	LVSCA	6,021,294	483,887	21,791	462,096	79,895	1,114	78,781	4,313
3	RVCA	3,156,144	240,498	18,393	222,105	38,810	941	37,869	2,073
4	ACA	16,260,348	1,389,193	244,060	1,145,133	207,704	12,482	195,222	10,688
5	TCA	5,235,273	398,928	32,343	366,585	64,152	1,655	62,497	3,422
6	ENNCA	817,380	62,284	4,617	57,667	10,067	236	9,831	538
	Total	37,522,405	3,034,425	342,204	2,692,221	476,483	17,502	458,981	25,128

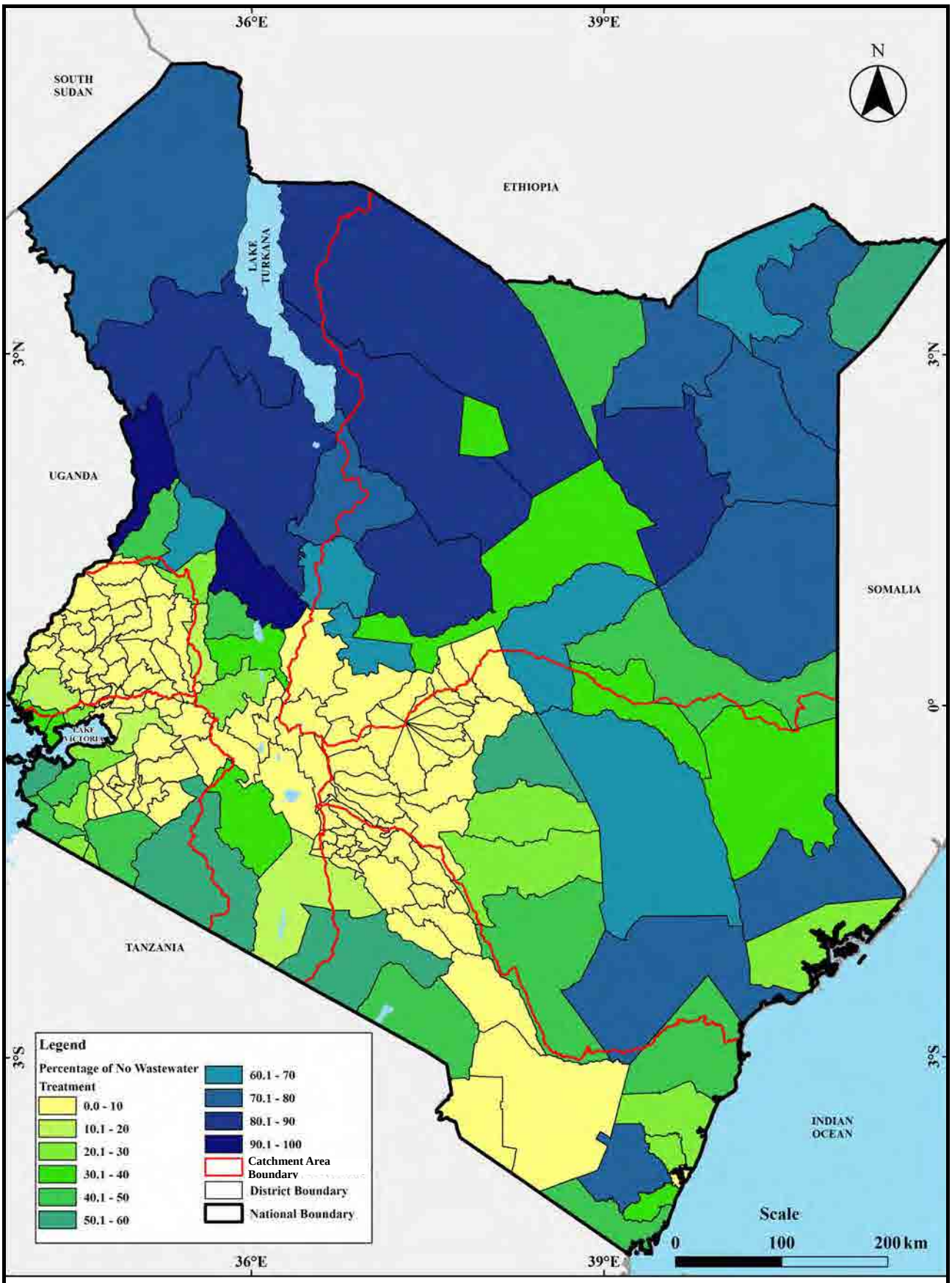
Source: JICA Study Team

Figures



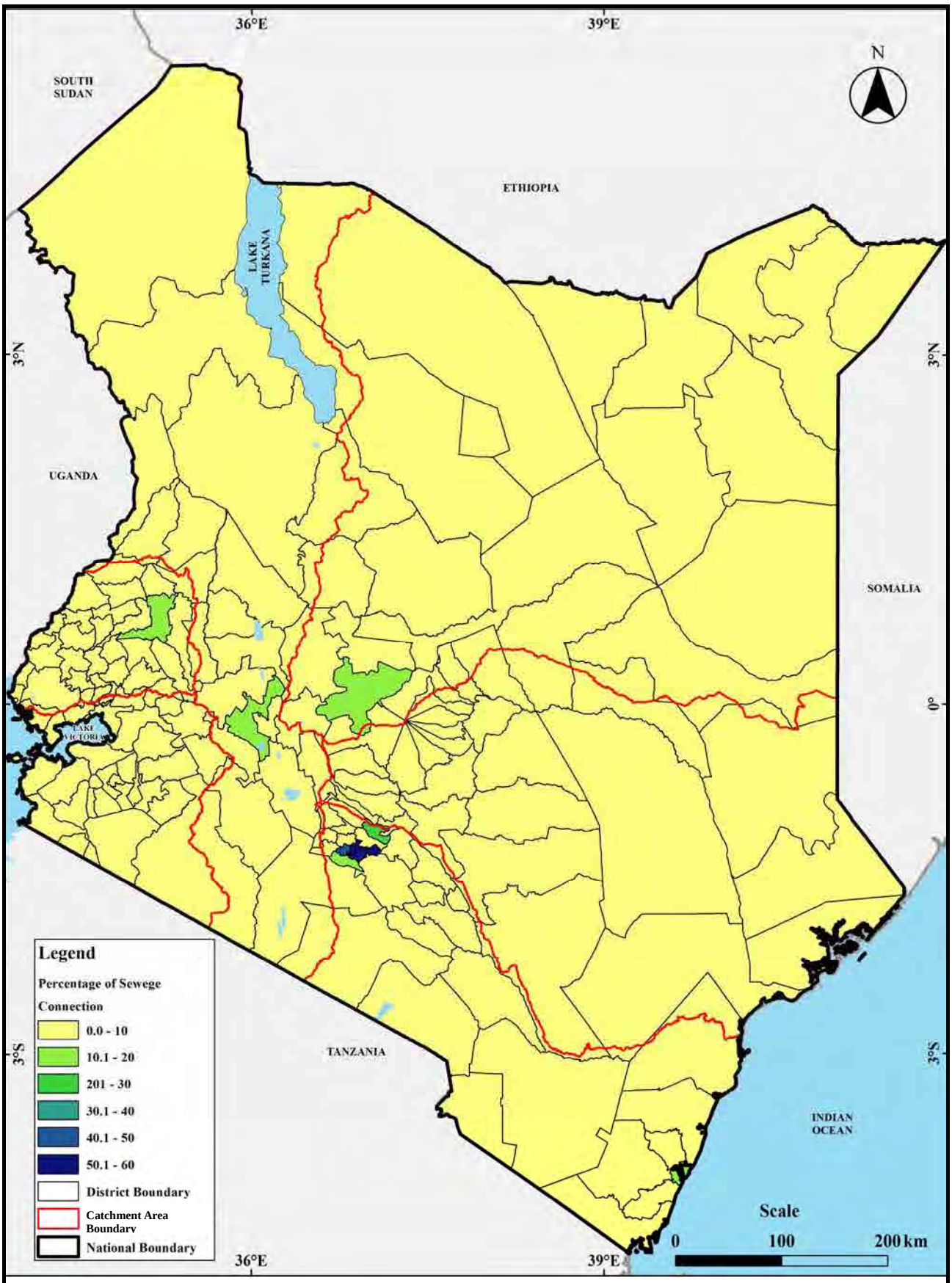
Source: JICA Study Team

THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030	**Figure 1.1.1 Study Flow for Sanitation Development Plan**
JAPAN INTERNATIONAL COOPERATION AGENCY	



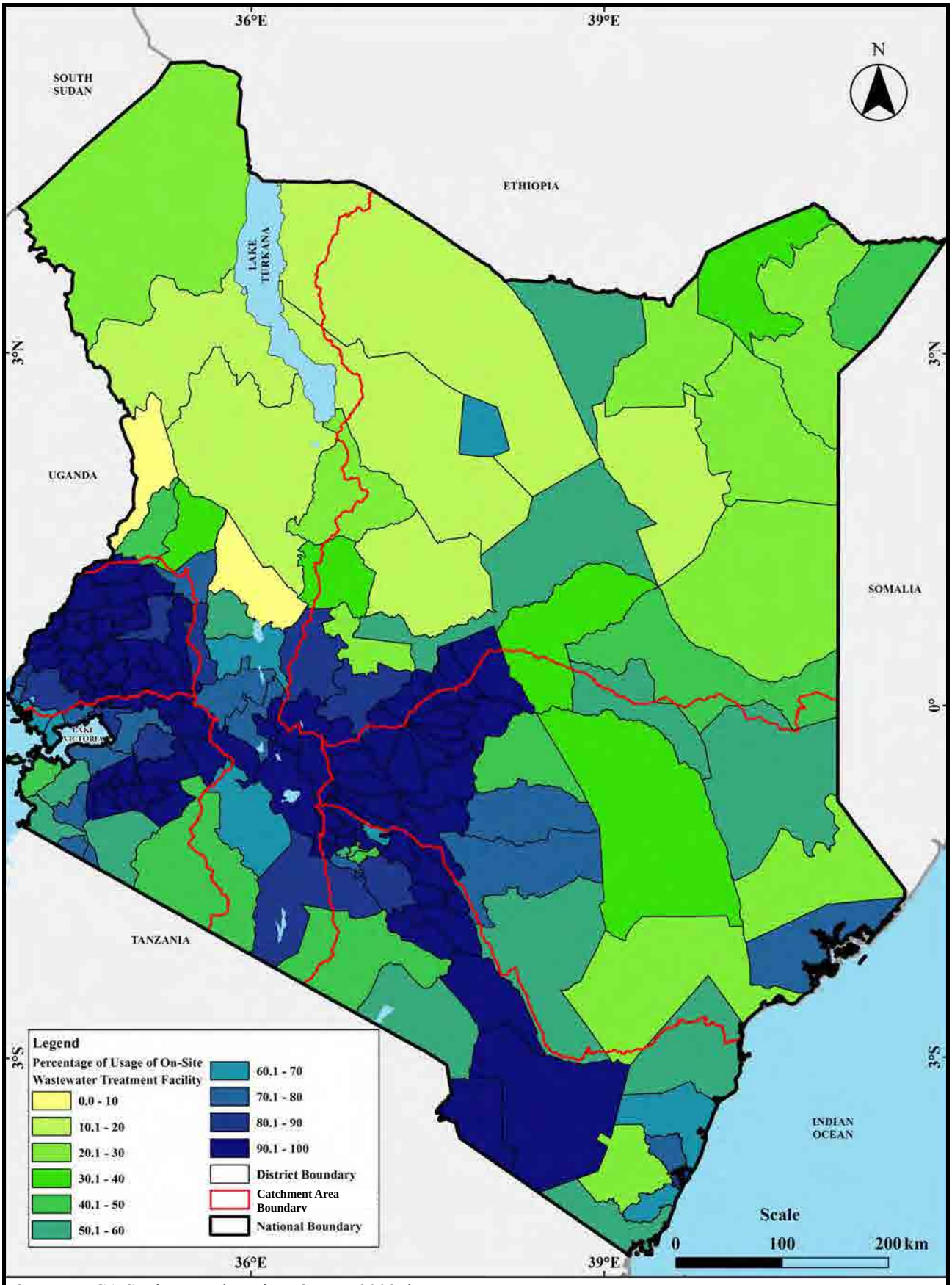
Source: JICA Study Team based on Census 2009 data

THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030	**Figure 2.3.1 Percentage of No Wastewater Treatment**
JAPAN INTERNATIONAL COOPERATION AGENCY	



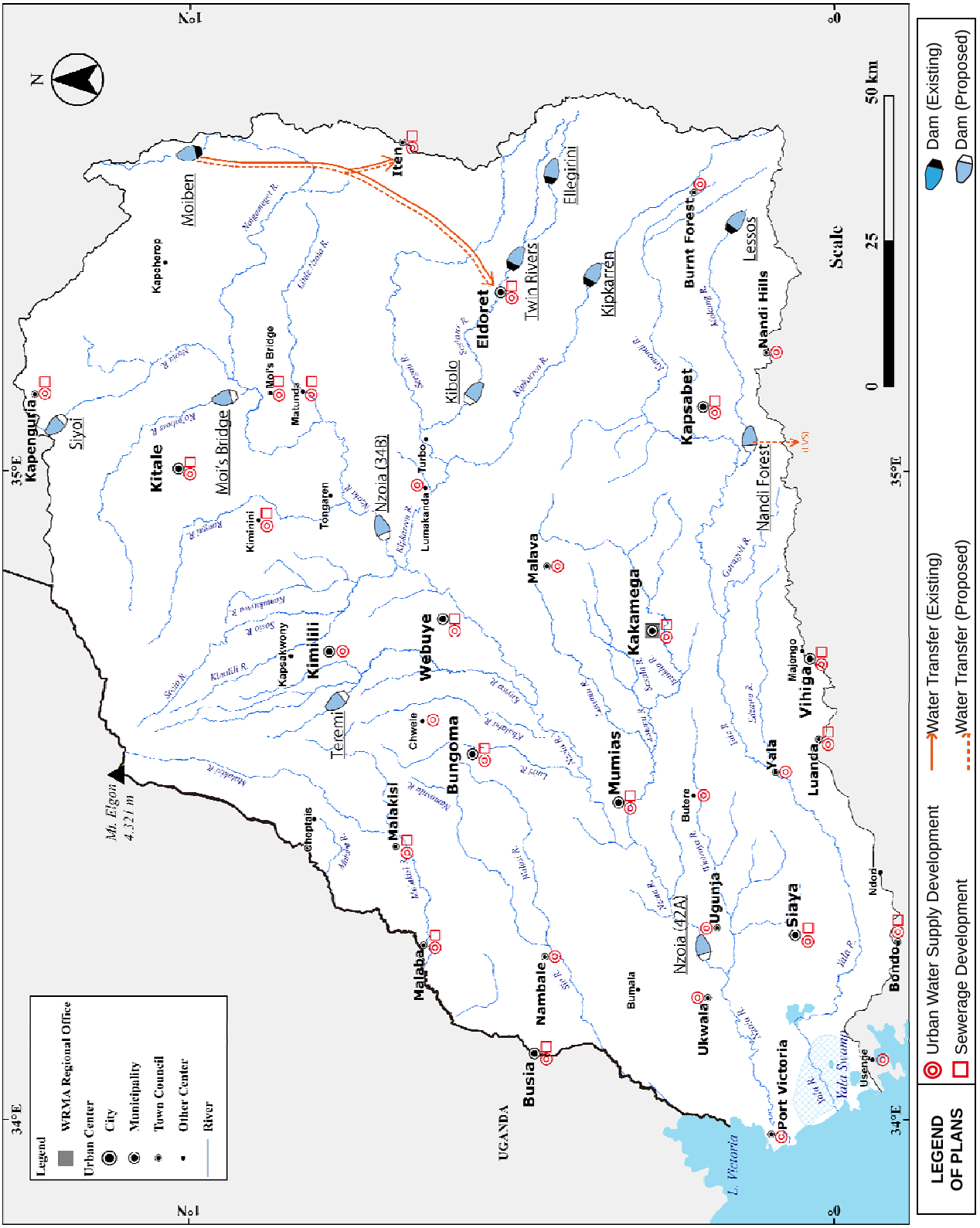
Source: JICA Study Team based on Census 2009 data

THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030	**Figure 2.3.2 Percentage of Sewerage Connection**
JAPAN INTERNATIONAL COOPERATION AGENCY	



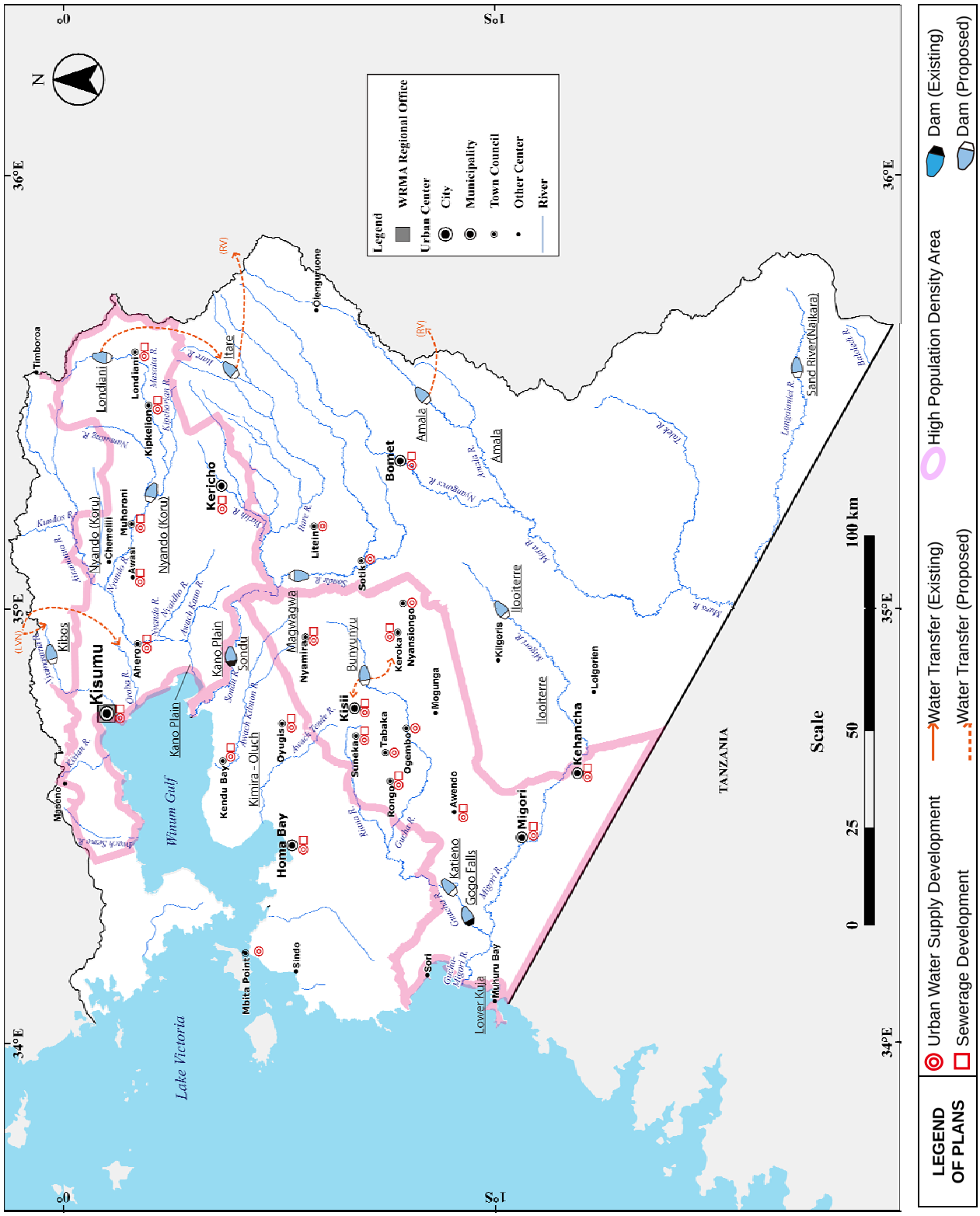
Source: JICA Study Team based on Census 2009 data

THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030	**Figure 2.3.3 Percentage of Usage of On-site Wastewater Treatment Facility**
JAPAN INTERNATIONAL COOPERATION AGENCY	



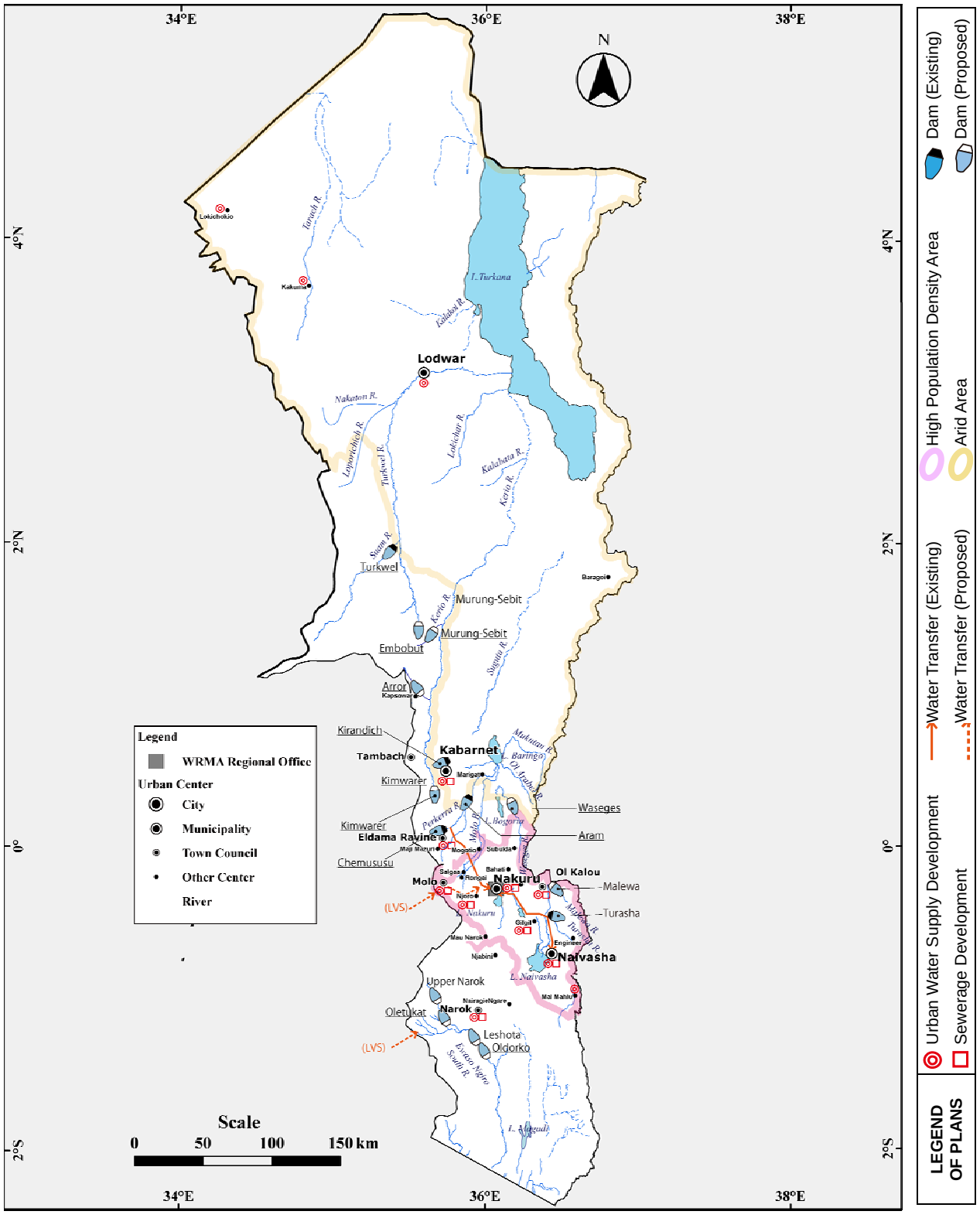
Source: JICA Study Team

THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030	**Figure 3.3.1 Proposed Urban Water Supply and Sewerage Development Plans (LVNCA)**
JAPAN INTERNATIONAL COOPERATION AGENCY	



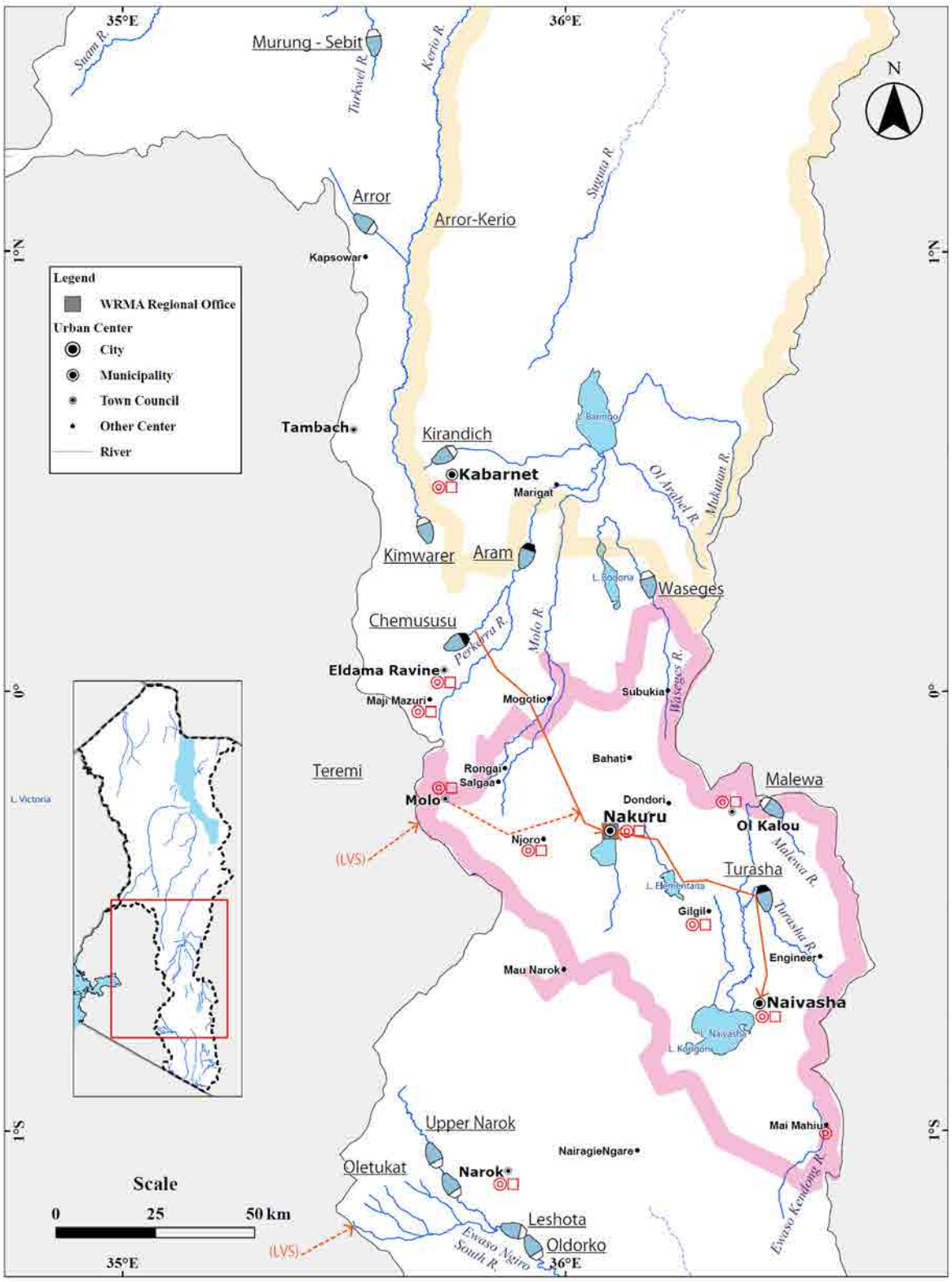
Source: JICA Study Team

THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030	**Figure 3.4.1 Proposed Urban Water Supply and Sewerage Development Plans (LVSCA)**
JAPAN INTERNATIONAL COOPERATION AGENCY	



Source: JICA Study Team

THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030	**Figure 3.5.1 Proposed Urban Water Supply and Sewerage Development Plans (RVCA) (1/2)**
JAPAN INTERNATIONAL COOPERATION AGENCY	



Source: JICA Study Team

THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030	**Figure 3.5.1 Proposed Urban Water Supply and Sewerage Development Plans (RVCA) (2/2)**
JAPAN INTERNATIONAL COOPERATION AGENCY	