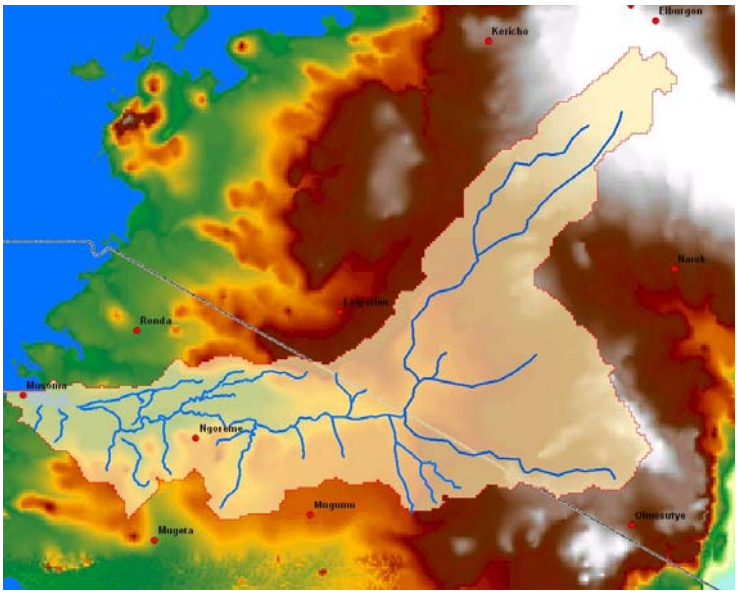
NILE BASIN INITIATIVE
NILE EQUATORIAL LAKES SUBSIDIARY ACTION PROGRAM

Mara River Basin Investment Strategy

Final Report



Water Resources and Energy Management (WREM) International Inc.

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WREM International

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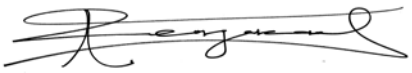
Atlanta, December 2008



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LIST OF ABBREVIATIONS AND ACRONYMS

BWB	Basin Water Board
BWO	Basin Water Office
CBO	Community-based Organisation
CIDA	Canadian International Development Agency
CBFM	Community Based Forest Management
CFMG	Community Forest Management Group
CFR	Community Forest Reserve
CMSSS	Community Management Support Services Section
COM	Council of Ministers
COWSO	Community-Owned Water Supply Organisation
CSD	Commission for Sustainable Development
CWC	Catchment Water Committee
DED	District Executive Director
DfID	Department for International Development – U.K
DFO	District Forest Officer
DWR	Division of Water Resources
DWSS	District Water Supply and Sanitation
EAC	East African Community
EIA	Environmental Impact Assessment
EWURA	Energy and Water Utilities Regulatory Authority
FAO	Food and Agricultural Organization
GEF	Global Environmental Fund
GIS	Geographical Information System
IGAD	Inter-Governmental; Authority on Development
IUCN	International Union for the Conservation of Nature
IWRM	Integrated Water Resources Management
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
IRBMP	Integrated Reviver Basin Management Plan

IWRM	Integrated Water Resource Management
JFMC	Joint Village Forest Management Committee
LA	Local Administration
LC	Local Council
LG	Local Government
LGDP	Local Government Development Program
LGA	Local Government Authority
LGRP	Local Government Reform Programme
LVDP	Lake Victoria Development Program
LVEMP	Lake Victoria Environnemental Management Programme
MDG	Millennium Development Goals
MIS	Management Information System
MTEF	Medium Term Expenditure Framework
MKUKUTA	Mkakati wa Kukuza Uchumi na Kuondoa Umaskini Tanzania
MoE	Ministry of the Environment
MoF	Ministry of Finance
MoHSW	Ministry of Health and Social Welfare
MoU	Memorandum of Understanding
MoW	Ministry of Water
NAWAPO	National Water Policy (Tanzania)
NBI	Nile Basin Initiative
NELSAP	Nile Equatorial Lakes Subsidiary Action Program
NEMA	National Environment Management Authority
NEMC	National Environment Management Council
NGO	Non-Governmental Organisation
PRSP	Poverty Reduction Strategy Paper
RWSSP	Rural Water Supply and Sanitation Programme
NSGRP	National Strategy for Growth and Reduction of Poverty
NWB	National Water Board
NWSDS	National Water Sector Development Strategy
O&M	Operation and Maintenance
PFRA	Participatory Forest Resource Assessment

PMO-RALG	Prime Minister's Office – Regional Administration and Local Government
RBMSIIP	River Basin Management and Smallholder Irrigation Improvement Project
RDP	Rural Development Policy
RDPS	Rural Development Policy and Strategy
RS	Regional Secretariat
RWSD	Rural Water Supply Division
RWSS	Rural Water Supply and Sanitation
RWSSP	Rural Water Supply and Sanitation Project
RWST	Regional Water and Sanitation Teams
SWAP	Sector Wide Approach to Planning
TAC	Technical Advisory Committee
TC	Technical Committee
TECCONILE	Technical Committee for the promotion of the Development and Environmental Protection of the Nile Basin
USD	United States dollar
UWSA	Urban Water and Sanitation Authority
UWSS	Urban Water Supply and Sewerage
UWSSP	Urban Water Supply and Sewerage Programme
VNRC	Village Natural Resource Committee
VLFR	Village Natural Forestry Reserve
WATSANs	Water and Sanitation Committees
WDC	Ward Development Committee
WEO	Ward Executive Officer
WRM	Water Resources Management
WRMP	Water Resources Management Programme
WSSA	Water Supply and Sanitation Authority
WSDP	Water Sector Development Programme
WUA	Water User Association
WUF	Water User Fee
WUG	Water User Group

EXECUTIVE SUMMARY

The overall objective of the Mara Investment Strategy is to promote environmentally sustainable socio-economic development of the Mara River Basin through identification and implementation of appropriate investment programs aimed at addressing the critical water resources issues and challenges in the basin.

This being a transboundary initiative, the investment strategy places emphasis on *transboundary* projects that will enhance collaboration between local communities across the border and strengthen inter-state cooperation in the joint management and development of the shared Mara water resources. It is envisioned that the national and local governments in the basin will continue to plan and implement their national development programs in line with their national development plans and objectives. Therefore some of the intervention measures and projects that were identified by the stakeholders as being critical will inevitably be implemented through the ongoing and planned national and local government programs in the two countries.

Proposed Investment Programs

The Mara Investment Strategy consists of six strategic investment programs:

(i) Mara River Basin Integrated Water Resources Management Program;
(ii) Mara River Basin Water Security Program;
(iii) Mara River Basin Environmental Management Program;
(iv) Mara River Basin Wildlife Management and Tourism Development Program;
(v) Mara River Basin Food Security Program;
(vi) Mara River Basin Rural Infrastructure Development Program.

The programs are designed to address the most critical water related socio-economic issues and challenges in the Mara basin to ensure sustainable water resources management and development. These programs are based on a comprehensive analysis of the Mara water resources issues and were developed through a participatory stakeholder consultative process. It is envisioned that the Investment Strategy will be periodically reviewed to take into consideration other emerging issues and developments in the basin.

The proposed programs are multi-sectoral in nature and are aimed at addressing diverse critical issues that have a bearing on the sustainable management and use of the shared Mara river basin water resources. In developing the programs, due recognition was made of the fact that there are

already other ongoing and planned local, national, and regional programs aiming to address some of the issues identified here. Therefore, the approach adopted here is to build on the ongoing programs and seek to create synergies that add value to the process and minimize resource duplication and wastage. The main purpose of the proposed programs is to add a transboundary dimension to the existing and planned local and national programs by addressing key transboundary issues that are crucial for the basin but are not accounted for under the existing programs.

A brief description of the six investment programs is given below:

(1) Mara River Basin Integrated Water Resources Management Program

One of the key challenges to sustainable integrated water resources management in the Mara basin is the lack of a comprehensive cooperative framework for the joint planning and implementation of water resources related activities by communities in the two countries. Activities in the basin are often planned with a local or national focus without considering the basin as a whole. It is therefore important for the two countries to adopt an IWRM approach to ensure sustainable management and development of the shared Mara basin water resources. This will ensure rational and objective allocation of the scarce basin water resources among competing (and often conflicting) water uses without compromising environmental quality.

To achieve this goal, this program will focus on the implementation of the proposed Mara river basin cooperative framework, capacity building plan, stakeholder participation plan, and gender mainstreaming plan. This will ensure the creation of the necessary enabling environment for implementation of the integrated water resources management approach in the basin. In addition, the program will also facilitate harmonization of policies, laws, and institutional frameworks governing the relevant water related sectors in the two countries as recommended in the same report.

The program will also support the development of appropriate management instruments and technical tools required to support decision makers in the planning, management and allocation of water resources to competing water uses in the basin.

(2) Mara River Basin Water Security Program

Water scarcity is one of the major issues facing the Mara river basin. The situation is expected to get worse as the population increases and as demand by the different sectors out-matches the existing supply. To comprehensively address the water scarcity problem, this program will comprise of two major components:

(a) ***Conduct basin-wide water resources assessments*** – The first phase of the program will be dedicated to carrying out a comprehensive assessment of the existing spatial and temporal surface water and groundwater resources availability and quality. The outcome of this assessment will give decision-makers a clear picture of what is the Mara water resources potential, how much of it is actually used, and how much remains to be developed and shared. As part of these assessments, water demand and use studies will also be carried out to establish the existing and projected water demand for the different sectors in the basin. In addition, a comprehensive climate change study will be conducted to assess the vulnerability of Mara's water resources to potential climate change impacts. The outcome of this assessment will also help formulate a Mara basin climate change adaptation and mitigation strategy as part of the water security program. A basin-wide land use change study will also be carried out to establish the nature and extent of land use changes and their impacts on the basin hydrology.

(b) ***Implement measures to improve water security in the basin*** – Outcomes from the water resources assessment studies will form the basis for design and implementation of comprehensive structural and non-structural measures aimed at improving water security in the basin through enhancement of water storage and water use efficiency. The measures will include, among others, the construction of multi-purpose water storage facilities; conjunctive use of surface and groundwater; adoption of efficient water use and demand management practices; and assessment of the potential for inter-basin and virtual water transfers.

(3) Mara River Basin Environment Management Program

The Mara river basin is experiencing extensive degradation resulting from excessive nutrient and agrochemical pollution from agricultural farms; untreated effluent discharges from industry and sewage outfalls; pollution from poorly disposed human excreta and other solid wastes; soil erosion due to unsustainable land use management and farming practices; encroachment of fragile ecosystems (e.g., wetlands, forests, etc.) in search of new farming land; and siltation of water courses and water storage facilities due to increased sediment loads; among others.

A comprehensive basin-wide environment management program is being proposed to address the above issues and reverse the current basin degradation trends. The proposed program will comprise several measures which, collectively, aim to address the basin-wide degradation issues and

contribute towards the sustainable management of the Mara river basin water resources. The program will include the following measures:

(a) ***Control of point and non-point source pollution*** – This will mainly focus on adoption of modern farming practices to reduce agrochemical pollution; increase household sanitation coverage throughout the basin through construction of toilets and sewage treatment facilities in rural and urban areas respectively; construction of solid waste collection and disposal facilities in urban areas; and training of hotel owners and gold mine operators in efficient and cost-effective effluent treatment processes.

(b) ***Promote sustainable forest management*** – The objective of this program is to ensure sustainable management and conservation of the Mara forest resources to sustain their unique biodiversity and significant benefits to the basin riparians**.**

The program will focus on reversing the current trend in basin degradation through implementation of a basin-wide tree planting, agro-forestry, soil and water conservation, and river bank protection initiative. It will also advocate for a review of the current forest policies and management practices with a view of promoting community based forestry management practices. The program will also support a basin-wide forest survey, classification, and mapping effort to establish the extent and severity of forest encroachment and degradation. In addition, the program will undertake sensitisation and training of all major stakeholder groups and local communities on sustainable management and exploitation of forest resources.

Local communities will also be encouraged to participate in the management of forests within their vicinities through development of comprehensive community based forest management plans.

(c) ***Promote Sustainable Wetlands Management –*** A comprehensive basin-wide wetlands inventory will be undertaken to establish the spatial distribution of wetlands and extent of wetland degradation in the basin. Communities will also be facilitated to develop community based wetlands management plans that will be the basis for community use and management of local wetland resources.

(4) Mara River Basin Wildlife Management and Tourism Development Program

The Mara ecosystem is a world famous wildlife sanctuary and contains the most diverse combination of grazing animals in the world. Sustainable wildlife management and tourism development are central to the economic development of the Mara river basin. This program is, therefore, intended to

address these two aspects as part of the broad Mara socio-economic development plan.

(a) ***Promote sustainable wildlife management*** - The objective of this component is to promote sustainable management and conservation of the Mara basin wildlife resources, a unique asset of the basin. This will focus on enhancing active local community participation in wildlife management to reduce encroachment on wildlife habitat for farming activities and thus minimize human-wildlife conflicts. This component will also support a basin-wide wildlife disease prevention and control initiative to foster timely information sharing on wildlife disease outbreaks between the two countries and facilitate joint research and wildlife disease surveillance and control programs. In addition, a study will be commissioned to better understand the relationship between temporal and spatial wildlife dynamics and the hydrology of the Mara ecosystem.

(b) ***Promote sustainable tourism development*** - The objective of this program is to enhance the tourism sector in the Mara basin as a major revenue source through diversification of tourism activities, improving on tourism related infrastructure, and strengthening of tourism management and revenue sharing mechanisms. The program will focus on improving the existing tourism infrastructure, development of untapped tourism resources such as ecotourism, historical sites, cultural shrines, and caves. This will be complemented with the development of a comprehensive joint marketing strategy for the tourism opportunities in the basin as a whole. The program will also address the inconsistencies in the existing tourism management policies, laws, and institutional frameworks in the Masai-Mara Game Reserve and the Serengeti National Park to ensure coordinated planning and management of tourism activities. Improvements in the tourism management mechanisms will also address the existing inequitable sharing of tourism benefits among the major stakeholders.

(5) Mara River Basin Food Security Program

Most of the households in the Mara basin depend on subsistence agriculture characterized by very low productivity and high labour intensity. This level of activity is inadequate to generate sufficient output to meet the basic food needs of the households. Poor nutrition is a very common occurrence in many households in the basin and is one of the most important health and welfare problems facing the basin.

To address the current food shortages in the basin, the following measures are proposed to be implemented under the food security program:

(a) ***Enhanced Agricultural Production –*** The objective of this component is to increase agricultural production and ensure food security in the Mara basin. The program will focus on promoting the use of improved agricultural practices such as the use of high yielding, disease resistant, and drought resistant crop varieties; adoption of simple on-farm water harvesting techniques for supplementary irrigation; and proper use of fertilizers and other farm inputs to increase crop yield. The program will also include promotion of irrigated agriculture through provision of technical and financial support for irrigation infrastructure development, acquisition of equipment, and training in efficient irrigation water use practices. It will also include strengthening of extension services to farmers, and provision of water for livestock production.

(b) ***Enhanced Livestock Production –*** The objective of this component is to increase livestock production and ensure food security in the Mara basin. The program will mainly focus on: promotion and adoption of good livestock practices such as zero grazing, disease control, and keeping of disease resistant breeds; establishment of rural based diary and beef processing industries, and skins, hides, and leather tanning industries to add value to livestock products; investment in livestock water supply infrastructure such as Valley Dams and Tanks which will also help to control nomadism and the spread of cattle diseases; establishment of a basin-wide livestock disease control program for surveillance, prevention and control of livestock diseases in the basin.

(c) ***Enhanced Fisheries Production –*** The objective of this component is to increase fish production and consumption in the Mara basin and contribute to the basin's food security and diversified revenue base. The program will promote sustainable fisheries management through sensitization and training of BMUs and local communities in sustainable fisheries management practices. The program will also support aquaculture development as an alternative fisheries source. The program portfolio will also include, among others, the establishment of ice production facilities to supply ice to fishermen to preserve their fish catches and minimize losses, and the establishment of a fish gear and mesh manufacturing plant in the basin to curb the rampant use of illegal mesh sizes and gear types.

(6) Mara River Basin Rural Infrastructure Development Program

The Mara river basin is a predominantly rural basin characterized by poor rural infrastructure which is a major constraint to socio-economic development.

To alleviate poverty and improve the living conditions of the Mara basin riparians, the following measures are proposed to be implemented under the infrastructure development program:

(a) ***Investment in Water Supply and Sanitation infrastructure –*** The objective of this component is to increase access to safe and reliable water supply and sanitation services for all Mara basin riparians through implementation of water supply and sanitation projects in different parts of the basin. This will address both rural and urban water supply and sanitation needs through construction of appropriate water supply and sanitation facilities and supporting the establishment of effective operation and maintenance mechanisms for the installed facilities.

(b) ***Investment in Rural Electrification –*** The objective of this component is to provide electricity access to more households and rural growth centers in the basin to reduce pressure on the forest resources and support small-scale industries and agro-processing activities. The component will support investments in the development of mini hydropower schemes and of alternative sources of energy. This component will also promote investments in efficient energy use technologies to promote the use of "clean" energy.

(c) ***Investment in Industrial development –*** Significant potential still exists for industrial growth in the basin. Therefore, as part of the overall economic development strategy, this component will support the development of rural based agro-processing industries to enhance value addition to the agricultural products and create jobs for the basin riparians. Although most of this industrialization will be private sector driven, there will be need for the two governments to put in place the necessary enabling environment and incentives to attract private sector investment in the basin.

(d) ***Investment in Transportation infrastructure –*** The Mara basin has a sparse road network comprising mostly of gravel roads requiring frequent maintenance. Most of these roads are impassable during the rainy seasons, causing serious disruption of movement of people and goods, and imposing huge costs on transport service providers.

To facilitate trade and the easy movement of people and goods in the basin, there is need for significant investment in road infrastructure. Specifically, there is urgent need for investment in the rural roads to help the local communities to access markets for their agricultural produce. This will increase household incomes and improve the living conditions of the local people. Easy access to markets will also help reduce post harvest losses.

(e) ***Investment in other social infrastructure***

(i) Health Infrastructure

Water-related diseases are the most common causes of illness and death among the rural poor communities in the Mara basin. Besides water borne diseases, HIV/AIDS continues to pose a very serious public health challenge contributing significantly to morbidity and mortality and straining the public health budgets of both countries.

There is need to invest in hospitals and health centers to enable easy access of the local population to health care services. In addition, there is also need to curb the spread of HIV/AIDs and eliminate the stigma of the disease by putting in place programs aimed at creating awareness on preventive measures, causes, and effects of HIV, promoting safe sex, promoting Voluntary Counselling and Testing, and providing Anti-Retroviral drugs at subsidized prices.

(ii) Education Infrastructure

Though both countries are currently implementing *universal* primary education, there are still significant challenges in providing *quality* education due to inadequate education infrastructure and well trained teachers. The same problems apply to higher education levels.

As part of the overall strategy to improve the livelihood of the people in the basin, there is need to invest in primary and secondary schools infrastructure and teacher training to increase pupil enrolment and improve the quality of education. There is also need for investment in tertiary education to ensure that pupils can receive appropriate skills and knowledge to engage in meaningful employment after their education.

Program Ranking

All above-proposed programs are crucial for the sustainable development of the basin and were arrived at following comprehensive stakeholder consultations and detailed analysis of the critical water resources related socio-economic issues and challenges.

However, for practical reasons, it is recognized that implementation of all the programs cannot commence at the same time due to financial, logistical, and technical constraints. It is, therefore, necessary that some ranking of the programs be done mostly for purposes of implementation sequencing and not as a matter of relative importance.

Program ranking will be carried out using the *Evaluation Matrix Method* using evaluation criteria developed through stakeholder consultations.

Funding and Implementation Mechanisms

Relevant Mara basin stakeholder agencies will be responsible for implementation of the proposed activities as an integral part of their existing development programs. The role of the Mara PMU/Secretariat will be to coordinate and facilitate the different stakeholder agencies in implementation of the activities.

Funds for implementation of the regional transboundary projects will be jointly mobilized by the participating countries and will include contributions from the beneficiary countries, to meet the recurrent expenditures of the Mara Secretariat, and a significant contribution from external support agencies in the form of grants or loans to finance development projects.

If the countries decide to anchor the Mara cooperative framework under the LVBC/EAC, then resources for implementation of the regional projects will be mobilized as part of the overall Lake Victoria recurrent and development funds. These funds will be managed through the two proposed Lake Victoria funds, i.e., the Lake Victoria Trust Fund for management of the recurrent funds and the Lake Victoria Development Fund for management of the development funds.

Alternatively, if the countries choose to anchor the Mara cooperative framework under the NBI, then most of the funding for the regional projects will be mobilized as part of the overall Nile Basin development funds which will be administered through the existing Nile Basin Trust Fund.

Mechanisms for implementation, coordination, monitoring, and evaluation of the proposed intervention measures are discussed in detail in Chapter 4.

Specific investment projects proposed by different stakeholder groups in the basin are outlined in Annex A.

Implementation Plan

Phase 1 of implementation of the Investment Strategy will mainly focus on establishing the necessary institutional framework and capacity building for implementation of the investment programs. It is envisioned that all the relevant organs of the permanent Mara Institutional Framework will have been established by the end of Phase 1.

Feasibility studies for the investment programs will also be undertaken during Phase 1. The results of the feasibility studies will be useful in

mobilizing the necessary financial resources for implementation of the investment programs during Phase 2.

In preparation for the feasibility studies, comprehensive pre-feasibility studies will be undertaken at the beginning of Phase 1 to determine whether the programs are technically sound and likely to be economically, socially, and environmentally sustainable. Terms of Reference (ToR) for the pre-feasibility studies are attached as Annex B.

Phases 2 and 3 of the Strategy will focus on implementation of the investment programs. It is assumed that the funds for implementation of Phase 2 activities will be secured during Phase 1.

1.0 INTRODUCTION

1.1 Background

The Mara River Basin is shared between Kenya and Tanzania and covers eight districts, namely Molo, Bomet, Narok, Transmara, Serengeti, Tarime, and Musoma Rural and Rorya. The Mara River is vitally important for both Kenya and Tanzania because it supports a wide range of socio-economic and environmental purposes in both countries. It is a source of drinking water for both the rural and urban communities, and it is the back-bone to all agricultural, livestock, fisheries, tourism, industrial, and mining activities. The river traverses the internationally acclaimed Masai Mara Game Reserve in Kenya and Serengeti National Park in Tanzania and is thus of paramount importance for tourism and biodiversity conservation.

Despite its significant development potential, the Mara River Basin is faced with serious environmental problems resulting primarily from unsustainable management and exploitation of the basin's natural resources. The basin is experiencing wide spread encroachment on its protected forests and other fragile ecosystems due to intensive settlement and cultivation. Specifically, the basin is faced with the following water resources and environmental management problems (i) Soil erosion and high sediment loads; (ii) Deforestation resulting from encroachment and human settlement in the Mau forest areas; (iii) Wildlife-human conflicts resulting from large-scale farming extended into wildlife corridors; (iv) Declining water quality and quantity due to poor agricultural practices and excessive water abstractions; (v) Pollution due to unregulated wastewater discharges, especially from mining activities, poor sanitation facilities and excessive use of agro-chemicals for pest and disease control in crops and livestock; (vi) Increased frequency and intensity of floods and droughts due to land use change and climate variability and change; (vii) Uncoordinated water resources planning and management due to lack of a comprehensive cooperative framework for the management of the basin's transboundary water resources.

Despite the above challenges, the basin is endowed with significant natural resources which present tremendous development potential and opportunity for socio-economic transformation of the basin.

It is this potential that Kenya and Tanzania wish to jointly exploit to improve the livelihoods of the Mara basin riparians and reverse the wide-spread environmental degradation in the basin.

To realize this goal, the two countries commissioned the Mara River Basin Transboundary Integrated Water Resources Management and Development Project under the auspices of NELSAP to facilitate preparation of an investment strategy for Mara River Basin. The consultancy was awarded to WREM International Inc., a US based engineering consulting firm.

The subject of this report is the Mara Investment Strategy. Other major project outputs include the Mara Cooperative Framework and the Mara River Basin Monograph and Decision Support System, which are described in separate documents.

1.2 Objective of the Investment Strategy

The overall objective of the Mara Investment Strategy is to promote environmentally sustainable socio-economic development of the Mara River Basin through identification and implementation of appropriate intervention measures (Investment Projects) aimed at addressing the critical water resources issues and challenges.

The purpose of this investment strategy is to provide guidance and the overall framework within which stakeholders and local communities will be empowered to jointly identify their development priorities and participate in the formulation and implementation of the subsequent projects. The investment strategy is not meant to replace the existing district and national development plans and strategies, but rather it serves to highlight critical issues and intervention measures directly relevant to the sustainable management and development of the Mara basin transboundary water resources.

The investment strategy emphasizes the development of *transboundary* projects that will enhance collaboration between local communities across the border and strengthen inter-state cooperation in the joint management and development of the shared Mara water resources. A number of specific local projects are proposed to motivate local communities to embrace integrated water resources management and to show tangible benefits of transboundary cooperation.

1.3 Justification for the Investment Strategy

The Mara basin is well endowed with natural resources which, if managed and developed sustainably, can become the engine of social and economic development. However, the basin is also faced with difficult challenges that undermine the realization of its full development potential. Therefore, development of a comprehensive investment strategy is a prerequisite to overcoming these challenges and effecting positive and sustainable socio-economic change.

1.4 Linkage with the Mara Monograph and DSS

The Mara River Basin Monograph is another output of the Mara TIWRD Project aiming to develop a comprehensive information and knowledge base on the existing conditions in the Mara basin that can help guide future planning and development initiatives. The Monograph contains, among others, data and information on the natural resources of the basin, land use activities, social and economic conditions, environment and ecology, and socio-economic development opportunities.

The Mara DSS is a technical decision support tool based on modern computer technology to enable Mara stakeholders to develop factual insights of various development options and trade-offs essential for the sustainable management and development of the Mara water resources. The DSS consists of four main components including a database, data analysis tools, a river basin planning tool, and a user-data-model interface. The database is the depository of all water resources and socio-economic data collected through the existing monitoring systems and all data generated by the data analysis tools and application programs. The data analysis tools provide user-friendly means to visualize and analyze data and their interrelationships. The purpose of the river basin planning tool is to analyze alternative basin development scenarios and quantify their tradeoffs, and relative benefits and impacts. The Mara DSS has been transferred to several Mara basin stakeholder agencies through extensive training.

The intervention measures and projects presented in the Mara Investment Strategy are based on detailed analysis of water resources issues and challenges contained in the Mara Monograph and the assessments conducted using the Mara DSS. Some of these assessments are included in Annex C. The projects are specifically designed to address the most critical issues and challenges identified and prioritized by the Mara stakeholders themselves.

1.5 The Approach and Methodology

The general approach adopted in the development of the Mara Investment Strategy was one based on active and sustained stakeholder engagement through out the duration of the project. This approach coupled with the significant local expertise in the Consultant's team (>50%) enabled the Consultant to leverage the existing knowledge and understanding of local issues, challenges, and opportunities by the riparians themselves. This helped ensure relevance and ownership of the Consultant's final recommendations and proposals.

Upon commencement of the assignment, the Consultant undertook a detailed review of the available relevant documents and reports to gain a thorough understanding of the key issues in the basin and ongoing and planned efforts to address them. The review mainly focused on understanding the critical water resources issues and challenges in the basin and the ongoing and planned intervention measures to address them at local, national, and regional levels. The main point of reference for this assignment was the detailed analysis that was carried out under the Mara Monograph. Other documents reviewed were acquired from the Mara PMU, national and local government agencies, NBI Secretariat, EAC Secretariat, and the public domain. A list of the documents reviewed is contained in the Bibliography to this report.

Besides literature review, the Consultant's team spent a significant amount of time physically visiting and consulting with local government officials, NGOs, CBOs, and local communities in all basin districts. Additional consultative meetings and discussions were held with officials from national and regional agencies including EAC, LVBC, NBI, NELSAP, and LVFO, among others.

Several meetings were conducted to solicit input from different stakeholders and seek guidance on some of the issues identified, proposed intervention measures, and recommended actions. Stakeholders were particularly instrumental in the identification and prioritization of potential intervention measures and specific projects. It is envisioned that the Investment Strategy will be periodically reviewed to take into consideration other emerging issues and needs.

This and the other reports generated by this Consultancy address the tasks outlined in the project ToRs, but they also include several key suggestions and inputs made by different stakeholders during the course of the project.

1.6 Outline of the Report

Chapter 1 of the report gives an introduction and background to the project, outlines the objective and justification for the Mara Investment Strategy, and outlines the linkages between the Investment Strategy and the Mara Monograph and DSS. This chapter also highlights the general approach followed during project implementation.

Chapter 2 presents an overview of the Mara River Basin and discusses its main water resources related issues and challenges. This chapter also highlights some of the key economic activities in the basin. The chapter sets the stage for subsequent discussions in the report and provides the basis and justification for the proposed intervention measures.

Chapter 3 discusses the proposed intervention measures and outlines the proposed development programs and projects.

Chapter 4 outlines the implementation strategy for the proposed investments, including the process of project planning, development, and implementation. The chapter also highlights the implementation roles of the different stakeholder groups in the implementation of the projects, and the process for mobilization of the financial resources required for implementation of the proposed projects.

Chapter 5 discusses the program ranking process and its outcomes.

Some specific projects identified during the consultative process are presented in Annex A. Draft Terms of Reference for the pre-feasibility studies are included in Annex B. Basin assessments relevant to the proposed intervention measures are presented in Annex C.

2.0 OVERVIEW OF THE MARA RIVER BASIN

2.1 Introduction

The Mara River Basin is shared between Kenya and Tanzania and covers seven districts, namely Nakuru, Bomet, Narok, Transmara, Serengeti, Tarime, and Musoma Rural. The river has a catchment area of about 13,750 km^2, with an upper basin area of about 8,941 km^2 (65%) in Kenya and a lower basin area of about 4,809 km^2 (35%) in Tanzania. The geographical location of the Mara river basin is shown in Figure 1 below.

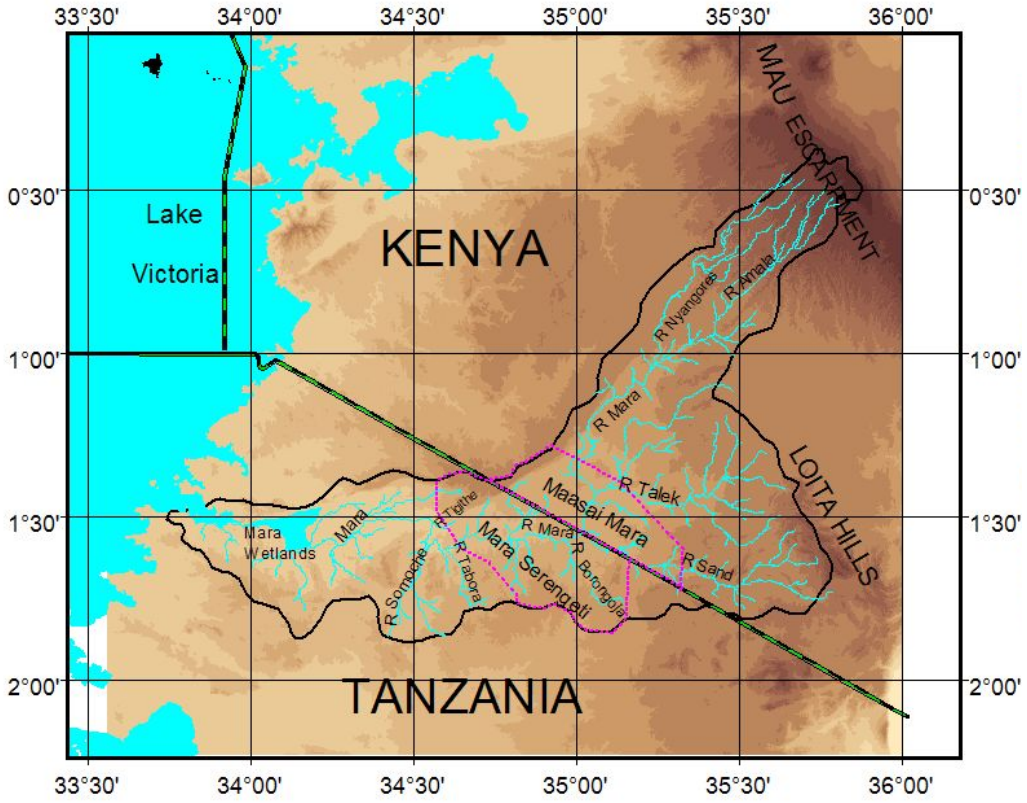


Figure 1: The Mara Basin

The river, which discharges into Lake Victoria and is thus part of the larger Nile River Basin, rises from the Napuyapui swamp in the forested Mau Escarpment as the Amala and Nyangores tributaries which flow through the Mau forest, tea plantations, settlements, and small-scale agricultural lands in Kenya before converging to form the Mara River in a region dominated by large-scale agriculture. The Mara River meanders through Masai Group Ranches, the

Masai-Mara National Reserve and the Serengeti National Park. In these protected areas two other main tributaries, the Talek River and the Sand River, join the Mara River. The main-stem Mara River continues flowing through the savannah grasslands of the Serengeti region in Tanzania before entering the Mara Swamp and finally discharging into Lake Victoria near Musoma town. Thus, the Mara River is part of the Lake Victoria drainage system as well as the greater Nile River Basin.

Although the Mara contributes about 5% of the volume of water flowing into Lake Victoria, it is regarded as one of the most important rivers flowing into the Lake. The basin is of profound environmental and biodiversity conservation interest and owes its importance and international recognition to the world-famous Masai Mara-Serengeti ecosystem.

The population of the basin is approximately 1.1 million people (2002 population census), with a population growth rate of 2.7%. About 775,000 people live in the Kenyan sub-basin, and the remaining 325,000 live in the Tanzanian sub-basin. Musoma and Bomet are the largest urban centers with about 120,000 and 95,000 residents respectively. The rest of the population lives in rural areas, and are predominantly engaged in small scale agricultural activities. The population living on less than $1 a day in Kenya and Tanzania are 23% and 20% respectively.

The basin receives rainfall with mean values varying from 1400 mm/yr on the highlands to 600 mm/yr on the plains. The high, reliable, and well-distributed rainfall in the highlands and the fertile soils are favourable for agriculture, livestock, and wildlife activities. These favourable conditions have attracted heavy migration into the basin exerting high pressure on the limited land and water resources.

The basin is characterised by a diversity of land use patterns ranging from natural forests in the upper reaches to large-scale mechanized farms, smallholder subsistence farms, communal pastoral grazing lands, open savannah in the animal parks, and wetlands and marsh vegetation just before the river discharges into Lake Victoria. Despite the diversity in land use patterns, the dominant socio-economic activity remains crop farming. About 62% of the households are smallholder farmers (Aboud et al., 2002), with livestock rearing being the second dominant activity. Tourism is a major economic activity in the basin predominant in the Masai Mara Game Reserve on the Kenyan side and the Serengeti National park on the Tanzanian side.

2.2 Water Resources Management Issues

The Mara River Basin is facing serious environmental problems primarily created from wide spread encroachment on protected forests and other fragile

ecosystems for settlement and cultivation. These specifically include: (i) Soil Erosion and high sediment loads; (ii) Deforestation resulting from encroachment and human settlement in the Mau forest areas; (iii) Wildlife-human conflicts resulting from large-scale farming that has extended into wildlife corridors; (iv) Declining water quality and quantity due to poor agricultural practices and excessive water abstractions; (v) Pollution due to unregulated wastewater discharges, especially from mining activities, poor sanitation facilities and excessive use of agro-chemicals for pest and disease control in crops and livestock; (vi) Increased frequency and intensity of floods and droughts due to climate variability and land use change; (vii) Uncoordinated water resources planning and management processes due to lack of a comprehensive cooperative framework for transboundary water resources management.

The situation is further exacerbated by the weak and poorly enforced water related laws and regulations, and water resources management institutions with inadequate technical and financial capacity to monitor and ensure compliance with established standards and regulations.

A detailed discussion of the above issues is contained in the Mara River Basin Monograph draft report.

2.3 Ongoing Water Related Initiatives in the Mara Basin

Besides the local and central government activities in the basin, there are several projects and initiatives planned or being implemented to address water related issues. Some of these initiatives are discussed below:

Mara River Basin Management Initiative

The Mara River Basin Management Initiative (MRBMI) is a transboundary project implemented by WWF Eastern African Regional Program Office (WWF-EARPO) in Kenya and Tanzania in partnership with national agencies, local governments, and other stakeholders. The project is funded by NORAD and WWF-Norway. Phase I of the project was implemented during the period 2003 - 2005. Phase II has been on-going since 2006 and is expected to end by the end of 2008.

According to the MRBMI annual reports and consultations with the project executants in Kenya and Tanzania, the Project has registered the following achievements:

(i) Gathered and documented information about demography, fisheries, socioeconomic characteristics, stakeholder relationships, wildlife,

forestry and hydrology of the Mara river basin. Additional information and knowledge gaps were identified.

(ii) Organized a number of consultative stakeholder workshops in Tanzania and Kenya intended to identify threats to the Mara ecosystem, raise awareness, facilitate dialogue, and propose strategic interventions.

(iii) Facilitated formation of WUAs, and preparation of community action plans. Facilitated the formation of MRWUA in Kenya and an interim Mara catchment committee in Tanzania. Suggested the need to have a transboundary catchment forum.

(iv) Facilitated LVBWO to establish some baseline water quality monitoring stations.

(v) Supported the Bomet Municipal council in the preparation of proposals and plans for a sewerage treatment facility.

(vi) Initiated strategic partnerships with the Global Waters for Sustainability (GLOWS) programme and USAID. Under the GLOWS program, data was collected for future Environmental Flows Assessments (EFA). Detailed proposals for the development of a Biodiversity action plan and environmental services surveys were made.

(vii) MRBMI has identified a number of schools to participate in their environmental education program. The program will be implemented in collaboration with the Ministry of Education in both Narok and Bomet.

(viii) The project has identified a venue for a resource centre and has supported three central tree nurseries which supply certified tree seeds of indigenous species and other agro-forestry species.

Transboundary Water for Biodiversity and Human Health in the Mara River Basin

A Project on the Transboundary Water for Biodiversity and Human Health for the Mara River Basin in Tanzania is to be implemented by Care International. This project aims to implement a coordinated and highly participatory project to improve water resource management in ways that reduce and mitigate threats to biodiversity in the Mara River Basin and Mara-Serengeti Eco-region and enhance the health and livelihoods of communities living in the basin. The Project will provide safe water and adequate sanitation in selected communities. It is expected that about 7,000 community members will benefit from this project through improved health and hygiene.

Lake Victoria Environmental Management Project

LVEMP-I (1997-2005) focused on knowledge development, R&D, data collection and analysis, policy review, strategy development, and strengthened support services for sound management of the Lake Victoria ecosystem.

LVEMP-II is under preparation (+15 years), and will build on the knowledge base for achieving environmentally and socially sustainable development in the lake basin with a focus on biodiversity conservation, water quality, and poverty eradication. Activities will include: support EAC capacity in transboundary environmental management; integration and sustained use of databases; research and capacity building and dissemination of best practices; investment for remedial measures (such as control of water hyacinth, and reducing pollution and eutrophication), and private-public partnerships.

LVEMP-II will be responsible for water hyacinth control including the Kagera River Basin (not retained as part of NELSAP portfolio).

Initiatives in the Forestry Sector

Intervention measures to address the problem of rampant deforestation in the Mau Forest have largely been in the form of fact finding missions by Kenya Forest Working Group (KFWG), aerial surveys by United Nations Environment Program (UNEP) and Kenya Wildlife Service (KWS), awareness raising workshops, and some limited eviction of people.

UNEP, Ewaso Ngiro South Development Authority (ENSDA), and KFWG produced a Masai Mau Forest Status Report in 2005. During stakeholder consultations held with the District officials in Transmara, Narok, Bomet, and staff of ENSDA it became known that a project proposal for a Community based Integrated Forest Resource conservation and Management project for the Masai Mau forest had been submitted, in collaboration with UNEP, to potential donors for funding. The 3-year project was expected to commence in June 2007 with a total budget of 1.6 million US Dollars. In this project, it was envisaged that UNEP would work with the Green Belt Movement, Kenya Forest Service, Narok City Council, ENSDA, and KFWG to re-afforest the Mau, train communities to implement Participatory Forest Management, and initiate capacity building activities. The status of this project has not been clarified as of now but it is clear that no confirmation of funding was communicated to the officials that were consulted.

A number of NGOs and CBOs are already working in the Mau forest to galvanise collective action around conservation work. These include Friends of the Mau Watershed (FOMAWA) and Forest Action Network. MRBMI has organized training sessions for these groups designed to promote a common understanding of the environmental services derived from forests and has also sensitized them about the provisions of the Environmental Act.

Initiatives in the Agricultural Sector

The World Agro-forestry Centre has proposed a project for Food Security and Biodiversity Conservation in the Mara Watershed. The project aims to improve food security and reduce climate and water related vulnerability of poor communities by reducing the water variability in water flow and improving the sustainability of water productivity for food and livelihoods in the transboundary Mara watershed. Other objectives of the proposed project include:

(i) To identify integrated indicators for environmental services provided by the water cycle in the tropics;
(ii) To develop hydro-ecological modelling concepts for tropical landscapes;
(iii) To develop decision support tools for upstream-downstream and transboundary dialogues on environmental issues;
(iv) To jointly develop and implement upstream-downstream related payment schemes for achieving integrated and sustainable management of land and water resources on a catchment scale.

The other partners in this project are the University of Nairobi, Jomo Kenyatta University of Agriculture and Technology, University of Dar es Salaam, International Food Policy Research (IFPR), International Livestock Research Institute (ILRI), US Geological Survey (USGS), and WWF. The proposed budget is 1,343,200 US Dollars over a period of five years. However, it appears that this initiative has not yet secured funding.

Irrigation development - Proposals also exist for development of a small holder irrigation scheme in the Mara valley in Musoma but sources of funding are yet to be secured.

Initiatives in the Tourism Sector

The Ewaso Ngiro South Development Authority (ENSDA) is proposing to formulate a Greater Mara Tourism Area plan. ENSDA being a regional institution has taken the lead to bring the stakeholders together to plan for tourism development in the two districts of Narok and Transmara. The Greater Mara Tourism Area Plan is intended to introduce special land use zones designed to preserve wildlife dispersal areas. ENSDA has prepared detailed TORs for the preparation of the Tourism Area plan but has not availed the necessary funds to implement this initiative.

TANAPA is also working with communities living near the Serengeti National Park in the Districts of Bunda, Serengeti, and Tarime to implement Wildlife Management Areas (WMA) as a possible means of distributing more direct benefits to communities. Implementation of WMA is inline with the National Wildlife Policy and Wildlife Management Area Regulations, and the new Beekeeping Act.

TANAPA in partnership with the EU and the FZS are implementing a project designed to enhance community roles and provide incentives in Ecosystem Conservation and Management of the Serengeti. This project is expected to contribute to improving the health of the ecosystems and thus to provide human livelihood benefits. The project will strengthen the policy that enables local communities to play a central role in ecosystem conservation and management, while using natural resources sustainably. The project will also focus on establishing inter-sectoral ecosystem cooperation mechanisms, improving understanding of ecosystem processes and functions, decentralising management to local institutions, improving benefits and incentives for local stakeholders, and introducing adaptive management systems.

2.4 Socio-economic Activities in the Mara Basin

The Mara River is of significant importance to the economies of both Kenya and Tanzania because it supports a wide range of socio-economic and environmental needs in both countries. The river is a source of drinking water supply for both rural and urban communities, it is a back-bone to the basin's agricultural, livestock, fisheries, wildlife, tourism, industrial, and mining activities. The river traverses the internationally acclaimed Masai Mara Game Reserve in Kenya and Serengeti National Park in Tanzania and is thus of vital importance for tourism and biodiversity conservation efforts in both countries.

A detailed discussion of the economic activities in the Mara catchment and the corresponding issues, challenges, and opportunities is contained in the Mara Monograph report. A summary of these activities is given below for ease of reference.

2.4.1 Agricultural Sector

Agriculture is a major economic activity in the Mara River basin with more than 80% of the basin riparians being dependent on agricultural activities for their livelihood. The basin is sub-divided into four distinct land use sections.

The first section, at approximately 2400-2900 meters above sea level, covers approximately 82,410 ha and mostly comprises the Mau forest complex, the source of the Mara River. The mean annual rainfall in this section is about 1400-1800 mm. The Enapuiyapui swamp located in the Kiptunga forest is in this section as well. Besides the Mau, there are a few forest plantations that provide timber for tea factories in the area.

The second section, at an altitude of between1600-2000 meters above sea level, situated just below the Mau forest and the protected South West Mau Reserve to the west, is comprised of large-scale wheat, barley, and maize farms. This section is characterized by several large-scale farms, in excess of 100 hectares

and is also popular for large-scale diary farming and sheep rearing. Several small to medium scale farms (5-20 ha) also exist to the east of the Mau forest and parts of Transmara district. The farmers in these areas practice mixed cropping of maize, beans, and potatoes. Tea is the main cash crop grown in this area and diary farming is popular.

The third section, between 1500 - 2100 meters above mean sea level, is dominated by the Masai Mara–Serengeti Wildlife ecosystem and occupies approximately 1,510 km^2. This section is characterized by marginal areas, with low and unreliable rainfall. The main activity is livestock production (ranches) and wildlife conservation.

The fourth section lies wholly in Tanzania and includes the river flood plains that dominate the downstream end of the basin. This section is characterized by high population density and has 20% of Tanzania's livestock. The latest head count (2003) recorded approximately 2.1 million heads of cattle and a large portion of sheep and goats. The section is also characterized by small scale, mixed farming activities for maize, beans, and millet. The Masurura (or Mara) swamp, an extensive wetland, occupies the lower reaches of the river and extends to the Mara Bay which is the discharge point of the river into Lake Victoria. The expansive Masurura swamp strides the lowland flood plains before the river finally discharges into the Lake. Fishing is a major economic activity in this section.

The high population growth in the basin has resulted in significant agricultural expansion which has led to encroachment on fragile ecosystems, namely, clearing of protected forests, drainage of wetlands, and conversion of wildlife rangelands into agricultural farms. For example, by 2000, the rangelands for grazing livestock and/or wildlife reserves had reduced by 24% due to agricultural encroachment, and protected forests had declined by 23%, due to forest clearing for tea and/or timber harvests (Mati, et al. 2005).

Cultivation of steep slopes and river banks coupled with poor agricultural practices has resulted in excessive soil erosion resulting in water pollution and siltation of dams, water pans, swamps, and rivers. Air pollution as a result of dust from exposed and/or bare farms is also common. Erosion has led to reduced soil fertility and higher incidences of bare hills.

The expansion and intensification of agriculture has resulted in increased use of agro-chemicals which are a major source of surface and groundwater pollution. The increasing irrigation water demands due to the thriving large-scale farms in several parts of the basin are also increasing the stress on the basin water resources.

Major land use related problems identified in the district include: low emphasis on agriculture, moderate to low soil fertility, unreliable and erratic rainfall in the low rainfall zone, poor agricultural practices, poor marketing and lack of storage facilities, unreliable supply of farm inputs, and very little use of modern farm implements such as tractors and ploughs.
Other vivid problems include lack of adequate watering facilities, inadequate veterinary facilities, cultural beliefs, poor education, lack of defined cash crops, and presence of pests and diseases.

2.4.2 Livestock Sector

Livestock keeping is a major economic activity in the basin, especially among the Masai. Besides income generated through the sale of livestock and livestock products such as meat, milk, ghee and hides, livestock also provide animal traction power for land tilling and farmyard manure.

Among several communities in the basin, livestock are also associated with some intrinsic cultural and social values. Cattle, for instance, are associated with prestige and respect on the part of the owners. Cattle are also used as dowry, and marriages are respected and valued depending on the number of animals paid as dowry.

The major livestock types in the basin include cattle, goats, sheep, pigs, poultry, and rabbits. 90% of the livestock is raised by small holders and pastoralists in a mixed farming and range system, respectively. Large-scale diary farming and sheep rearing is also practiced in a few areas in the basin, especially in the Kenyan part. Traditionally, the small East African Zebu, the Masai type, is the dominant breed kept by the local communities because they are resistant to disease and drought. The Saiwal and Boran are kept in some of the group ranches.

Livestock depend on the Mara River for drinking water and pasture production. 60% of the total livestock population is found in areas adjacent to the Masai Mara ecosystem (dispersal areas). This high concentration of livestock within the Mara ecosystem has intensified competition for forage between livestock and wildlife (grazers) within protected areas and especially at the edge of the reserve.

Land degradation due to over grazing has become a critical issue in many parts of the basin. This is largely because livestock populations per unit area have exceeded the safe stocking rate. Since a great part of the basin is within the Arid and Semi-arid Lands (ASAL), the pastoralists have tended to overstock their livestock resulting in land degradation and emergence of invasive species such as wire grass. High livestock concentrations near watering points and

feeding places have destroyed vegetation and exposed the soil to excessive erosion.

The lack of water for livestock is a common problem in many villages due to lack or poor maintenance of livestock water facilities (charcoal dams) constructed in the early 1930's to 1950's. During the dry season, livestock keepers migrate to other areas in search of water and pasture. Measures should be taken to ensure that livestock have access to adequate water supplies. Support is needed for charcos and dam construction to harvest rainwater, since these have proven to be viable technologies for water distribution in the region.

Livestock in the basin is also prone to persistent tick borne diseases like ECF, Anaplasmosis, Heart Water, and Babesiosis and non tick-borne diseases like Foot and Mouth Disease, and Contagious Bovine Pleural Pneumonia (CBPP). Though there are several livestock dipping facilities in the basin, most of them are either poorly maintained or non-functional.

2.4.3 Fisheries Sector

Fishing is a major socio-economic activity and source of food and livelihood for several communities in the basin, especially those adjacent to Lake Victoria in Musoma and Rorya districts. Most fishing occurs in Lake Victoria, the Mara Swamp and in stocked ponds and dams scattered around the basin. Most of the fish caught is either consumed locally, sold to fish processing plants, or sold in markets in neighbouring districts. In Musoma, there are two fish factories processing Nile perch fillets that are packaged, frozen, and sold in regional and overseas markets. Many fishermen from both Musoma and Rorya derive most of their income from selling Nile perch to these fish processing plants. Fish consumption is higher in the Tanzanian part of the basin than the Kenyan part. For example, the Masai, who are predominantly cattle keepers, normally consider fish consumption a taboo.

Besides Lake Victoria, significant fishing also takes place in the Mara swamp, an extensive wetland (several thousand hectares) formed by the Mara River about two kilometers before it discharges into Lake Victoria. The swamp is an ideal habitat for the lungfish and catfish, both of which are adapted to living in low oxygen environments.

In addition, aquaculture is also practiced in all districts within the Mara Basin, especially those that are distant from Lake Victoria and the Mara swamp. Aquaculture is presently more extensive in Kenya than in Tanzania. Several hatcheries for producing quality seeds/fingerlings for pond stocking exist in the Kenya part of the basin (e.g., O. niloticus seeds are raised in Kisumu and Sangoro) but none in the Tanzania part of the basin.

Despite the importance of the fisheries sector to the Mara basin, fisheries resources in the lakes and rivers in the basin have continued to decline over the years as a result of the use of destructive fishing methods, destruction of breeding grounds along the shores, wetland drainage, water pollution, and over-fishing. However, with the formation of Beach Management Units and the involvement of local communities in the management of the fishery resources, the situation has started to improve.

Fisheries Development Opportunities

Fish handling poses limitations in the marketability of Nile perch and other Lake Victoria fish because the catch is not chilled immediately. Ice facilities are needed to preserve catches. Dagaa cannot be sold fresh in distant markets because it deteriorates quickly. Ice production at fish landing sites is therefore a good venture for investment.

Usage of illegal fishing gear is rampant, and regulating imported gear has proved difficult. Thus, fishing gear manufacturing in the Lake Victoria region would increase the ability to survey and regulate the gear used and would minimize the use of illegal mesh sizes and gear types. Investing in recommended gear manufacturing locally is a promising business opportunity.

Lake Victoria is distant from most of the districts in the basin, and the infrastructure connecting them is relatively poor. In Tanzania, for example, fresh fish from the lake can hardly reach interior towns. An alternative to transporting fresh fish is to raise them in ponds. Pond culture business opportunities exist in setting up seed farms. Farmers could obtain Nile tilapia (O. Niloticus) and catfish (C. gariepinus) seeds for stocking.

Other fisheries related investment opportunities include: construction of fishing crafts; dagaa fishing and processing; Nile perch frame processing; lake transport; lungfish processing; ornamental fish; and aquaculture development.

2.4.4 Tourism Sector

Tourism is one of the major economic sectors for both Kenya and Tanzania contributing approximately 12% and 16% to their GDPs respectively.

The Mara ecosystem is a world famous wildlife sanctuary and contains the most diverse combination of grazing animals in the world. It is home to the Masai Mara game reserve in Kenya and the Serengeti National Park in Tanzania. The incredible biodiversity, concentrations of wildlife and annual wildlife migrations in the savannah grasslands of Kenya and Tanzania draw tourists from around the world. The annual animal migration is a spectacular event in this renowned game park, offering a unique wildlife viewing experience.

The Serengeti National Park is a World Heritage site and a Biosphere Reserve, and is therefore of global conservation significance. It covers an area of approximately 14,763 km^2 (about 14% of Tanzania's land area) and supports a variety of animals and birds. The Serengeti ecosystem supports the largest herds of migrating ungulates including the highest concentrations of large predators in the world. The Serengeti is among the 12 parks managed by the Tanzania National Park (TANAPA) Service.

The Serengeti National Park is the most attractive tourist destination in the Northern tourist circuit accounting for about 40% of the tourist activities in Tanzania. Tourist revenues of the Serengeti National Park have been increasing at an annual rate of 21%. Other tourist related services provide important additional revenue for local communities who sell traditional arts and crafts to the tourists.

The Masai Mara area is comprised of the Masai Mara National Reserve and the adjoining pastoral group ranches. The Reserve extends over an area of 1,523 km^2 and is a formal conservation estate where land use is restricted to wildlife and tourism. Bird numbers in the Mara, account for over 50% of the Kenya bird species. The reserve was declared an Important Bird Area, in recognition of being home to nine globally threatened bird species.

Tourism surpassed coffee as the largest single earner of foreign exchange for Kenya in 1987. The Kenyan Mara area accounted for 18% of all visits to national parks and generated 8% of gross tourist revenues. The industry is successful as seen by tourist numbers increasing at a rate of 3.8% per annum from 1980 to 2007 (NCC data 2008; Wasilwa, 1997). Economic competition in the private sector has led to excellent tourist facilities and government supported infrastructure. The Masai Mara area has attracted tourists more rapidly than any other park or reserve in the country, with visitor entries rising by 9%, and bed nights by 12% annually.

The ecosystem is characterized by resource competition between wildlife, livestock, and human communities. The major threats to the ecosystem include:

(i) Human-wildlife conflicts due to increasing encroachment on the wildlife habitat for agricultural and livestock activities and human settlements. These conflicts are more pronounced on the Kenyan side (Wasilwa, 1997). For example, there has been a significant encroachment on wildlife grazing and breeding grounds in the Loita Plains due to expansion of large scale farming in the plains. This has also resulted in blockage of the seasonal wildlife migration corridors thus restricting the free movement of wildlife and subsequently increasing human-wildlife conflicts. Other causes of the human-wildlife conflicts include the significant increase in livestock numbers

competing for grazing space with wildlife and prolonged droughts which force pastoralists to move livestock into wildlife habitat in search of greener pastures and water. The Serengeti National Park also experiences conflicts related to wildlife hunting and farmland expansions due to high human population along the park boundaries (Campbell et al., 2001).

(ii) Wildlife diseases are a major threat to the Serengeti-Masai Mara Ecosystem. Wildlife disease outbreaks in the ecosystem are well documented since the mid-1950s rinderpest outbreak which wiped out more than 85% of the ungulates. The table below shows the commonest diseases documented and the corresponding species affected.

Disease	**Species Affected**
Rinderpest	Ungulates
Pleuro-pneumonia	Ungulates
Canine Distemper Virus	Lions and hyenas
Rabies	Bat eared fox, wild dog and silver backed jackals
Anthrax	Zebra, Baboon, elephants and impala in Serengeti and buffaloes in Mara
Malignant Catarrhal Fever	Cattle
Tuberculosis	Eland and Giraffe, wildebeest and lion
Foot and mouth disease	Wildebeest
Trypanosomiasis	Human and cattle
Sycorptic Mange	Thomson's gazelle, cheetah, lion, goats and domestic dogs
Bovine tuberculosis	Lions
Brucellosis	Ruminants

Efforts have been made to establish effective wildlife disease prevention and control mechanisms for the ecosystem. Both the Masai-Mara Game Reserve and Serengeti National Park are equipped with modern veterinary facilities manned by well trained veterinary officers.

(iii) Inequitable sharing of tourism benefits among the major stakeholders (community ranches, wildlife conservation associations, tour/hotel operators, large agricultural farmers and local governments). Currently there is lack of equitable distribution of tourism benefits especially in the Masai-Mara. The Reserve, which is managed by local authorities of

Narok and Transmara Districts, contributes immensely to the national economy. Out of the annual revenue collection by the two County Councils, only 19% goes directly to local communities to finance community initiatives such as public health, education, and animal husbandry throughout the district. For example, in 1988 the NCC earned about 25 million KShs from the reserve, while the adjacent wildlife group ranches received about 2.78 million KShs (Hamilton et al., 1991). The group ranch income represents only 1% of the gross earnings of the Masai Mara, and yet these ranches provide wildlife grazing areas and scenic beauty for tourists. Equitable sharing of tourism income could significantly improve the living conditions of the local communities and decrease the human-wildlife conflicts.

(iv) Limited local community involvement in wildlife management and conservation measures has exacerbated environmental degradation and human-wildlife conflicts in the Serengeti-Masai-Mara ecosystem. Local participation through Community Based Wildlife Management (CBWM) is needed to sustain the Serengeti-Masai-Mara tourism industry. For example, the adjacent group ranches and local communities should be encouraged and supported in their efforts to develop wildlife conservancies and ecotourism sites to complement the existing tourism and wildlife conservation measures.

(v) Eco-hydrology of the Serengeti-Masai-Mara system should be studied to understand the connections between the hydrology of the basin and the wildlife dynamics. This will help to identify the hydrological features that are critical for ensuring the ecological balance of the basin and put in place management and conservation measures to ensure the long-term sustainability of these features.

(vi) Harmonize the inconsistencies in the legal and institutional framework for the management of the Masai-Mara Game Reserve and the Serengeti National Park to ensure coordinated wildlife management and conservation in the entire ecosystem.

(vii) Enact an enabling policy framework and incentives to attract private sector investment in the tourism sector in the Mara basin. This will focus on infrastructure development in the reserve and park including hotels, transport and communication facilities, and diversification of tourism activities through investment in the development of additional tourist attractions.

(viii) The border between Kenya and Tanzania is closed along the Serengeti-Masai Mara at Sand River gate. Opening the border could relieve congestion in the Masai Mara, stimulate tourism in the northern Serengeti, and help suppress poaching. The economic potential of both

Serengeti and Masai Mara would increase if security and infrastructure (roads, camps, and park facilities) improved. Conservation and marketing would increase the tourism potential in the Serengeti-Masai Mara ecosystem.

(ix) The advantages of regional co-operation in ecosystem management are obvious. Neither the Serengeti nor the Masai Mara can be considered in isolation. Benefits would accrue from a regional approach to tourism, ecological research, monitoring, environmental protection, and public education. A regional strategy should seek to harmonize the Kenyan and Tanzanian policy, legal, and institutional frameworks for management of the Serengeti-Masai-Mara ecosystem.

Tourism Development Opportunities

Significant potential exists for diversification/expansion of tourism in the Serengeti-Masai-Mara ecosystem. Opportunities include improvements in the existing tourism infrastructure and development of untapped tourism resources such as ecotourism, historical sites, cultural shrines, and caves, among others.

The Mau forest is a major resource for ecotourism development in the basin. It could become a twin conservation area with the Masai Mara National Reserve. The forest is an Important Bird Area with over 450 species. It is also popular for several unique animal species like the Bongo, yellow backed duicker, golden cat, colobus monkey, potto, bush baby and the greater galago. Other common animals found in the forest include: Lions, leopards, hyenas, giraffes, grant gazelle, buffalos, hippos, Rhinos and the African elephant.

A study conducted in 1988 by the Narok County Council established the economic viability of ecotourism in the Mau forest. The council subsequently prepared *"The Masai Mau National Reserve Development Plan"* which is yet to be implemented. The Plan highlights the tourism potential in the Mau forest and recommends specific actions and investments to realise this potential.

Other potential tourism features of intrinsic value in the basin include the Loita hills, the Loita and Suswa caves, Nguruman, and the Mau escarpment. Development of these sites would diversify tourist activities in the basin and decreases pressure on the existing tourist sites.

Other untapped tourism development opportunities in the basin include: rock climbing, scenic views, agro tourism, cultural museums, and canopy walks in the Loita indigenous forest.

2.4.5 Forest Sector

The Mara River Basin is endowed with significant forest resources which constitute a major component of the basin ecosystem. Specifically, forests are a source of livelihood for adjacent communities who depend on them for their daily subsistence needs like hunting of game meat, honey collection, crop farming, grazing, pole wood, bamboo extraction, fuel wood collection, charcoal production, collection of medicinal plants, and collection of grasses and vines for basket making and thatching. In addition to subsistence use, forests are also a major source of raw materials for the timber, pulp and paper industries. Lastly, forests are also home to the unique flora and fauna which are the backbone for the thriving tourism industry.

The Mara River Basin forests are divided into two broad categories, i.e., the Upper Catchment Forests and the Lower Catchment Forests.

The upper catchment forests are dominated by the Mau forest complex covering five districts in Kenya including Narok North and South, Bomet, Molo, and Transmara. The Mau forest complex comprises of four main protection regimes, i.e., (a) The Masai Mau Forest, which is a Trust Land Forest managed by the Narok County Council and covers approximately 45,794 ha; (b) The Ol Pusimoru Forest Reserve, which is a gazetted forest managed by the Kenya Forest Service (KFS) and covers approximately 36,832 ha; (c) The South West Mau Forest Reserve, which is a gazetted forest reserve managed by KFS and covers about 81,000 ha; and (d) The Transmara Forest Reserve, which is a gazetted forest managed by KFS and covers an area of about 35,270 ha.

The largest gazetted forest block of the Mau forest complex is in Narok North District. The forest complex is not only the source of the Mara River, but is also a crucial water catchment for several large rivers in Kenya that feed into Lakes Nakuru and Baringo. Regionally, the Mau Forest complex is the source of transboundary rivers flowing into Lakes Victoria and Natron.

The Mau forest complex is famous for its rich and unique flora and fauna and supports several bird species and five mammal species of international conservation interest. The Mau forest is a source of livelihood for over 150,000 rural families that live within its vicinity. The estimated value of products and services derived from the forest by these families is USD 10 million annually.

The Lower Catchment Forests are in the Tanzanian part of the basin and comprise of six gazetted forests covering an area of about 3,092 ha. These include: Kyanyari, Kyarano, Bwiregi, Nyabasi, Mogabiri, and Tarime forests. Plans are underway to gazette another 28,555 ha of forests in Musoma, Tarime, and Serengeti Districts. These include: Mukendo, Musoma Ranges, Bisumwa, Buruma, Rigo, Ring'wani, Machira, Kiruya, Tarime B, Bwiri, and Rorya forests.

Issues and Challenges

(a) ***Unsustainable exploitation of forest resources:*** The rapid population growth in the basin has resulted in increased pressure on the basin's forest resources which are faced with widespread deforestation. There is increased encroachment on protected forest areas in search of new agricultural farmland, firewood, charcoal, and construction materials.

A case in point is the South-western Mau and Trans-Mara forests which witnessed an explosion in population of adjacent communities from a few hundred families in 1963 to 11,400 households in 1993. The population increase is also attributed to the regular influx of landless and displaced people from other parts of the country.

Besides illegal encroachment of forests, there is also a problem of over exploitation of the forest resources, both legally and illegally. Several licensed timber logging companies are operating in the basin but their activities are not well regulated. The absence of harvesting quotas upon which appropriate regulations and controls can be based has, therefore, exacerbated the already bleak state of the basin's forests.

(b) Forest Excisions: In Kenya, the government policy of settling landless communities has also had a heavy toll on the basin's forests. Between 1964 and 1999, the government of Kenya excised about 34,000 ha of gazetted forest in the Mau Forest Complex to settle landless people. However, this policy has often been abused by some government officials who have illegally acquired large pieces of forest land for commercial use thus defeating the whole purpose for which the policy was intended.

Another case of government sanctioned forest excision is the clearing of 15,000 ha of the South-Western and Trans-Mara forests for the establishment of Nyayo tea zones under the Nyayo Tea Zone Development Corporation (NTZC). The zones were created by presidential decree in 1986 to increase government revenues from tea exports and also create alternative employment for communities adjacent to the forests.

Government sanctioned forest excisions pause one of the greatest challenges to sustainable forest management in the basin. Addressing this challenge calls for strong political will and for a review of the current forest management policy in Kenya that places gazetted forests under state ownership, and grants the state monopoly rights over their management. Failure by the government to accord the local communities the right to participate in the decision making process related to the delineation and management of state forests jeopardises the communities' contribution towards the sustainable management of the forests and compounds the problem of illegal forest encroachment and deforestation.

Ongoing initiatives

A number of initiatives are being undertaken to address the challenges facing the forest sector in the basin and in the two countries in general. Both countries are implementing policy, legal and institutional reforms in the forest sector aimed at ensuring sustainable management and utilization of forest resources through active local community participation.

In 1988, the Narok County Council proposed a "Development Plan for the Masai Mau National Reserve". The proposed plan highlights the significant tourism potential of the Mau forest and makes specific recommendations to address the rampant deforestation going on in the Mau forest, and emphasises the need to conserve the forest's ecological integrity.

Organizations such as the Kenya Forest Working Group (KFWG), Kenya Wildlife Service (KWS), Ewaso Ngiro South Development Authority, and others have been advocating the conservation of the Masai Mau forest, and are urging the government to evict all people illegally encroaching on the Masai Mau forest. The government heeded their call and has so far evicted 10,290 people from the forest since 2005. In order to strengthen law enforcement in the forest, the Narok County Council has deployed 30 rangers in the forest for its protection and management.

UNEP in collaboration with the Kenya Wildlife Service conducted an aerial survey of the Masai Mau forest in February 2005. Results of the survey indicate significant encroachment and deforestation. UNEP together with Ewaso Ngiro South Development Authority and the Kenya Forest Working Group also produced the Masai Mau Forest Status Report 2005.

In addition to national forestry policy and institutional reform in Kenya, international, sub-regional, and national efforts are being made to conserve forest resources and to reduce the pressures on forest ecosystems. The success of these efforts will depend largely on improvements in land tenure arrangements together with the realisation that available arable land is in short supply.

The WWF-Eastern Africa Program Office (EARPO) in collaboration with WWF Eastern Africa Corporate Club are implementing a project whose overall goal is to protect the Mau Forest, conserve its valuable natural resources and sustain the environmental goods and services it provides for the benefit of present and future generations. The major focus of the project is: (a) promotion of Mau forest conservation through lobbying for adoption of environmentally friendly forestry policies and funding tree planting activities; (b) Capacity building of different stakeholder groups involved in the management and exploitation of the Mau forest resources; (c) Local community empowerment through supporting alternative income generating

activities for women and youth groups and funding the establishment of tree nurseries; and (d) Sensitization of the local communities on the dangers of deforestation and the need for sustainable forest management.

UNEP, in collaboration with Ewaso Ngiro South Development Authority, the Green Belt Movement and Kenya Forest Working Group, the Narok County Council, and the Kenya Forest Service, is implementing a Mau forest conservation project whose objective is to halt further deforestation and promote reforestation primarily within and around the Masai Mau Forest, the water catchment areas of Lake Natron, and rivers Mara and Ewaso Ngiro. The main focus of the project includes: (a) facilitating the preparation of a management and development plan for the Masai Mau forest; (b) establishing a management structure for participatory management of the Masai Mau forest; (c) providing surrounding group ranch farmers with alternative income and raw material sources that simultaneously decrease the pressure on the remaining indigenous forests; (d) organizing farmers/group ranches, into cooperative business relationships (beekeeping, tree growing, fuel briquette and fodder production and marketing thereof); (e) restoring degraded forest areas through enrichment planting (Masai Mau) and promotion of on-farm forestry activities (in vicinity of Masai Mau forest); (f) initiating a carbon offset project within the Masai Mau forest area boundary; and (g) capacity building for public officials and other stakeholders in the sustainable management of the Mau forest.

Investment Opportunities

It is clear from above that most ongoing intervention measures are concentrated in the Mau forest. However, the forestry issues and challenges discussed earlier apply to the entire basin. Therefore, it is prudent that the ongoing measures in the Mau forest be up-scaled to cover other forests in the basin. Specifically, the following intervention measures are recommended for implementation:

(i) Reverse catchment degradation through implementation of a basin-wide tree planting, agro-forestry, and river bank protection program.

(ii) Promote sustainable integrated water and land management through implementation of a basin-wide soil and water conservation program.

(iii) Implementation of a basin-wide forest survey, classification, and mapping program to establish the extent and severity of forest encroachment and degradation in the basin.

(iv) Development of integrated community-based forestry management strategies and plans.

(v) Sensitisation and training of all major stakeholder groups and local communities on sustainable management and exploitation of forest resources in the basin.

3.0 PROPOSED INVESTMENT PROGRAMS

The proposed Investment Strategy consists of six strategic investment programs I.e.

(i) Mara River Basin Integrated Water Resources Management Program;
(ii) Mara River Basin Water Security Program;
(iii) Mara River Basin Environmental Management Program;
(iv) Mara River Basin Wildlife Management and Tourism Development Program;
(v) Mara River Basin Food Security Program; and
(vi) Mara River Basin Infrastructure Development Program.

The programs are designed to address the most critical water related socio-economic issues and challenges in the Mara basin to ensure sustainable water resources management and development. These programs are based on a comprehensive analysis of the Mara water resources issues and were developed through a participatory stakeholder consultative process. It is envisioned that the Investment Strategy will be periodically reviewed to take into consideration other emerging issues and developments in the basin.

The proposed programs are multi-sectoral in nature and are aimed at addressing diverse critical issues that have a bearing on the sustainable management and use of the shared Mara river basin water resources. In developing the programs, due recognition has been made of other ongoing and planned local, national and regional programs that are also aiming to address some of the issues identified. Therefore, the approach taken in formulating these programs is to build on the ongoing programs and seek to create synergies that add value to the process and minimize resource duplication and wastage. The main purpose of these programs is to add a transboundary dimension to the existing programs by addressing key transboundary issues that are crucial for the basin but are not accounted for under the existing programs.

The total cost of the proposed intervention measures is estimated at US$ 252.0 million.

A detailed description of the proposed investment programs is given below:

3.1 Mara River Basin Integrated Water Resources Management Program

Integrated Water Resources Management (IWRM) is a process that promotes the coordinated development and management of water, land and related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. The underlying principle of IWRM is that different uses of water resources in the same ecosystem are interdependent and are considered together during the planning and management process. Water allocations and management decisions should consider the effects of each use on the others. The IWRM approach also provides for participatory decision-making where all stakeholder groups can be involved in formulating strategies for water resource development and management.

One of the key challenges to sustainable integrated water resources management in the Mara basin is the lack of a comprehensive cooperative framework for the joint planning and implementation of water resources related activities by communities in the two countries. Activities in the basin are often planned with a local or national focus without considering the basin as a whole. At national level, water related development activities are planned and implemented by different government agencies with little or no coordination. This often results in water use conflicts and in duplication and wastage of resources. Furthermore, water resources decision making continues to be done with little or no participation of users and stakeholders. This often results in unsustainable projects whose outputs do not address the key concerns of the intended beneficiary communities.

It is therefore important for the two countries to adopt an IWRM approach to ensure sustainable management and development of the shared Mara basin water resources. This will ensure rational and objective allocation of the catchment's scarce water resources among competing (and often conflicting) uses without compromising environmental quality.

To achieve this goal, there is need for the two countries to put in place a comprehensive policy, legal, and institutional framework for the joint management of the shared water resources. The countries will also have to develop appropriate management instruments and invest in multi-purpose water infrastructure to ensure efficient use of the catchment's water resources.

This program will, therefore, focus on the implementation of the proposed Mara river basin cooperative framework, capacity building plan, stakeholder participation plan, and gender mainstreaming plan. This will ensure creation of the necessary enabling environment for implementation of an integrated water

resources management approach. A detailed discussion of the proposed cooperative framework and the three plans is contained in the Mara River Basin Cooperative Framework Report. In addition, the program will also facilitate harmonization of policies, laws and institutional frameworks governing the relevant water related sectors in the two countries as recommended in the same report.

The program will also support the development of appropriate management instruments and technical tools required to support decision makers in the planning, management and allocation of water resources to competing water uses in the basin. The management instruments include comprehensive water resources data bases, information systems, water resources models, and decision support tools.

(1) Implementation of the Mara River Basin Cooperative Framework

The main objective of this component is to create the necessary enabling environment for implementation of the integrated water resources management approach in the Mara river basin. Following a detailed review of the existing water related policies, laws, and institutional frameworks in Kenya and Tanzania, it was observed that the frameworks in the two countries are largely comparable in several respects. There are however two major shortcomings in the effort to achieve harmony in the legal frameworks of the two countries: (a) in both countries the existing laws do not have provisions for the management of trans-boundary water resources and (b) the implementation and enforcement of the laws is poor and largely detracts from the existence of the provisions themselves. Furthermore, there are no formal mechanisms for resolution of transboundary water resources issues and conflicts.

It is against this background that Kenya and Tanzania initiated the project on the development of a comprehensive Cooperative Framework for the sustainable management and development of the Mara basin water resources. Fast tracking the process of negotiation and implementation of the proposed Cooperative Framework is therefore a key pre-requisite for the successful implementation of the IWRM approach in the basin. Implementation of the Mara basin cooperative framework will involve the following steps:

(i) Formal negotiation and adoption of the Mara Policy, Legal, and Institutional Framework by the two countries; This framework is discussed in a separate project report (The Mara Basin Cooperative Framework Report);

(ii) Signing and ratification of the relevant legal instruments to give effect to the Mara Cooperation Framework;

(iii) Establishment of the necessary Mara policy organs;

(iv) Establishment of a fully functional Mara Secretariat (including recruitment of technical and support staff and procurement of necessary equipment).

Specific Follow-up Actions: It is recommended that the existing Mara PMU serves as the transitional entity to coordinate and facilitate the above process. This also implies that the current Mara policy organs will continue to give guidance to the process until the new Mara institutional arrangement comes into effect. Specifically, the above process could evolve as follows:

(i) The two governments, through the relevant Mara and NELSAP organs, shall discuss the Mara Framework options proposed by the Consultant and agree on the most appropriate option to be adopted. These discussions will also be attended by representatives from LVBC and/or NBI.

(ii) Following agreement on a specific Mara Framework option, the two governments shall submit a formal joint proposal outlining the main elements of the proposed Cooperative Framework to the appropriate regional entity (NBI or EAC) for consideration and approval.

(iii) The regional entity shall, upon approval of the proposal, authorize and guide the process for operationalization of the Mara Cooperative Framework, including the drafting, signing, and ratification of the relevant legal instruments. The exact form that this process will take and the pace at which it will proceed will depend on the internal bureaucratic processes of the regional entity (EAC or NBI) under which the Mara Framework will be anchored.

(iv) Upon signing and ratification of the necessary legal instruments, the two governments shall proceed to establish the necessary permanent Mara basin institutional organs.

It is also possible that the proposed cooperative frameworks for the SMM, Kagera, and Mara could be jointly discussed with guidance from the EAC and/or NBI and a uniform framework developed for the three river basins. However, this decision can only be made by NELSAP/NBI, under which the three river basin projects have been implemented, in consultation with the riparian governments.

(2) Harmonization of water related Policies, Laws, and Institutions

In order to achieve sustainable water resources management and development in the Mara basin, there is need for a harmonized effort between both Kenya and Tanzania to tackle the key water resources related issues and causes of environmental and natural resources degradation.

The key water resources management issues facing the basin include among others: Deforestation; Wetland degradation; point and non-point pollution, cultivation of ecologically fragile areas like hill slopes, swamps and river banks; Land fragmentation; increased reliance on agro-chemicals which leaches into the rivers, causing water pollution; and loss of bio-diversity.

In order to address the above issues and realise sustainable development of the basin, cross-sectoral harmonization of policies, laws and institutional frameworks governing the relevant sectors in the two countries should be a key priority.

Effective harmonization depends on the existence of a cooperative framework governing the relationship between the two countries seeking to harmonize their laws, policies and institutions. It is therefore important that the cooperative framework discussed in (1) above is implemented before effective harmonization can be undertaken. The co-operative framework would, among other things, stipulate the requirement for harmonization and set out the principles on the basis of which the respective frameworks are to be harmonized.

A comprehensive analysis of the existing policy, legal, and institutional frameworks for water resources management in the two countries is contained in the Mara Basin Cooperative Framework Report. The report also includes a detailed discussion of potential areas of harmonization in the two frameworks and specific recommendations on the scope and level of harmonization to be done.

The proposed harmonization strategy recognizes the differences in legal culture and traditions between the two countries, and the specific and unique circumstances in the countries. The main goal of the proposed harmonization is, therefore, not to make the two national frameworks similar but rather to try to eliminate the gaps and differences in the principles, objectives, coverage, and capacities of institutions which, over time, can lead to differences in the management of the same river basin on different sides of the border.

(3) Implementation of the Mara River Basin Capacity Building Plan

The objective of this component is to strengthen the capacity for integrated water resources management and development in the Mara river basin through implementation of the proposed Mara Capacity Building Plan.

One of the major challenges to sustainable water resources management and development in the Mara basin is the inadequate technical and financial capacity to plan, implement, and monitor water resources management and

development activities. Following a comprehensive situation analysis conducted as part of the study, it was discovered that most stakeholder groups at the national and local levels did not have adequate technical and financial capacity to effectively implement their mandates. The lack of adequate qualified and skilled personnel has significantly undermined the performance of both national and local level institutions in both countries. This, coupled with inadequate facilities and equipment such as computers, vehicles, monitoring equipment, etc., and persistent financial constraints, has undermined the ability of most institutions to implement their mandates and has led to poor service delivery.

A comprehensive Mara river basin Capacity Building Plan has been developed and is discussed in detail in the Mara Basin Cooperative Framework Report. The Plan highlights priority water resources related capacity building needs of the relevant institutions and stakeholders involved in the Mara basin and recommends appropriate intervention measures required to address these needs to ensure sustainable management and development of the Mara basin transboundary water resources.

It is envisioned that once implemented, this plan will not only strengthen the capacity of the water resources management institutions but will also enhance effective stakeholder participation in the management and development of the basin water resources.

(4) Implementation of the Mara River Basin Stakeholder Participation Plan

Effective stakeholder participation is crucial for sustainable and integrated water resources management in the Mara basin. Acceptability and sustainability of the planned development activities in the basin will highly depend on the level and extent of stakeholder participation in the planning and implementation of these activities.

A comprehensive Stakeholder Participation Plan has been developed for the basin and is discussed in detail in the Mara Basin Cooperative Framework Report.

The plan addresses stakeholder participation issues and makes specific recommendations on how to ensure effective participation of all key Mara basin stakeholders in the management and development of the basin water resources. The Plan comprises ten strategic intervention measures aimed at enhancing effective stakeholder participation in the sustainable management and development of the Mara transboundary water resources.

(5) Implementation of the Mara River Basin Gender mainstreaming Plan

Decision-making based on gender equity is a pre-requisite for good water governance and a key factor in achieving sustainable water resources management and development. Though the complementary role of men and women in effective water governance and in decision-making has been recognised for a long time, its realisation still faces several challenges not only because women's experience, interests, and concerns are different from those of men but also because the structural conditions under which decisions are made tend to favour men more than women.

The allocation of resources, of decision-making power, status, opportunities, and rewards to men and women are defined by gender, which is itself largely defined by cultural norms, expectations, attitudes, and beliefs. Culture has a pervasive impact on social and economic life that influences the roles and status of men and women in different sectors.

A comprehensive gender mainstreaming plan has been developed for the basin and is discussed in detail in the Mara Basin Cooperative Framework Report. The Plan analyses issues related to gender imbalance and inequity in the planning and implementation of water resources management and development activities in the basin and proposes specific intervention measures aimed at mainstreaming gender in water related decision making processes in the basin. The Plan comprises five strategic intervention measures aimed at enhancing gender sensitive planning, management, and development of the Mara basin water resources.

(6) Development of appropriate management instruments

To ensure integrated water resources management and development in the Mara basin, there is need to develop appropriate management tools to support decision makers in the planning and allocation of water resources to competing water uses in the basin. The management instruments include comprehensive water resources data bases, information systems, water resources models, and decision support tools. These instruments are discussed in detail below.

(a) Water Resources Databases and Modelling Tools

In both Kenya and Tanzania, various institutions and programs pertaining to water resources related data and information have developed their individual databases and modelling tools. There are databases and modelling tools developed by Ministries responsible for Water, Meteorological Departments, Lake Victoria Environmental Management Project, and the FAO-Nile Basin Water Resources Project, among others. However, most of these databases and tools are incompatible and are not coherent enough to address the water resources planning and management challenges in the Mara basin.

Recognizing the shortfalls in the existing water resources databases and modelling tools, a comprehensive decision support system (Mara DSS) has been developed for the Mara river basin as part of the Mara basin Monograph project. The Mara DSS is a technical decision support tool based on modern computer technology to enable the basin stakeholders to develop factual insights of various development options and trade-offs essential for the sustainable management and development of the Mara water resources. The Mara DSS consists of several components including a database, GIS, data analysis tools, a river basin planning tool, and a user-data-model interface. The database is the depository of all water resources and socio-economic data collected through the existing monitoring systems and all data generated by the data analysis tools and application programs. The data analysis tools provide user-friendly means to visualize and analyze data and their interrelationships. The purpose of the river basin planning tool is to analyze alternative basin development scenarios and quantify their tradeoffs, and relative benefits and impacts. The Mara DSS has been transferred to the relevant stakeholder agencies in the basin through extensive training. A detailed description of the Mara DSS is contained in the Mara DSS report.

Additional work is required to provide additional training to the Mara DSS core group and also to provide training to new users of the tool. There will also be need to regularly update the DSS database with new water resources data as it becomes available, and to expand the Mara DSS to include additional data-supported models.

Specific interventions that have to be undertaken as part of the broad Mara basin IWRM program include the following:

- ***Establish DST/IT Support Unit (Hydroinformatics Center) –*** Establish a technical unit at the Mara basin Secretariat, to operate and continue updating the Mara DSS, offer technical training and backstopping to district and central government technical officers in database management, DSS operations, data analysis and quality control, and information technology (IT) updates. The unit will be responsible for coordinating DSS/IT related professional training for technical officers from relevant stakeholder agencies. In addition, the unit will also coordinate joint technical water resources assessment working sessions and other technical discussions between officials from different stakeholder agencies.

- ***Adoption of uniform data procedures and standards –*** Support the development and adoption of compatible/uniform data collection, quality control, storage, and dissemination procedures, guidelines, standards, and formats for the Mara basin. The Mara Secretariat/PMU will facilitate

this process and also coordinate training in the use and adoption of the procedures and standards.

- ***Data sharing and Information Exchange Protocol –*** Support the development, negotiation and adoption of a data sharing and information exchange protocol for the Mara basin to ensure regular exchange of water related data and information between different stakeholder agencies in support of their planning and decision making processes. A draft protocol has been developed and is contained in the Mara Basin Cooperative Framework Report.

3.2 Mara River Basin Water Security Program

Water scarcity is one of the major issues facing the Mara basin. The situation is expected to get worse as the population increases and as demand by the different sectors out-matches the existing supply. Water related conflicts are on the rise and present a serious security risk in the basin if the underlying issues are not adequately addressed.

To comprehensively address the basin's water scarcity problem, the following measures will have to be implemented under the water security program:

(1) Water Resources Assessments

There is need to carry out a comprehensive assessment of the basin's existing spatial and temporal surface water and groundwater resources availability and quality. The outcomes of this assessment will give decision-makers a clear picture of what is the basin water resources potential, how much of it is used, and how much remains to be developed and shared. This kind of detailed assessment could not be conducted under the current project because of lack of adequate and reliable water resources data.

The existing water resources data is scanty, unreliable, and characterized by significant gaps. There is an urgent need to rehabilitate (and expand where necessary) the existing water resources monitoring network to ensure immediate commencement of collection of adequate and reliable data for water resources planning and management. This effort should address both surface and groundwater monitoring and should cover both quantity and quality aspects. A separate study was commissioned by the Mara PMU to assess the water resources monitoring requirements of the basin. The study was completed and its recommendations are awaiting implementation.

Once adequate and reliable water resources data becomes available, the Mara DSS can be used to conduct most of the water resources assessment studies in the basin. One of the outputs of these studies will be surface and groundwater maps depicting the spatial variability of surface and groundwater resources with respect to quantity and quality.

In addition, if adequate detailed groundwater data is collected as part of the monitoring program, a groundwater module could be developed and incorporated as one of the modules of the Mara DSS for groundwater assessments.

The following specific assessments will also be conducted as part of the broader water resources assessments studies:

(a) ***Water Demand and Use Assessment Studies*** – Basin-wide water demand and use studies will be carried out to establish the existing and projected water demand for the different sectors in the basin. These will include agricultural water demand, domestic water demand, industrial water demand, environmental water requirements, and water needs for hydropower production. The projections for the future water demands will take into consideration potential future water related developments and investments in the basin.

(b) ***Climate Change Assessment Study*** – In addition to the water resources assessments discussed above, a basin-wide climate change assessment study will be conducted to assess the vulnerability of the basin water resources to potential climate change impacts. The outcome of this study will also help in developing a Mara basin climate change adaptation and mitigation strategy. Given the scale of climate change impacts, it would be more appropriate to carry out the climate change assessment study on a bigger scale such as the Lake Victoria or the entire Nile basin. Discussions are currently ongoing under the NBI to conduct climate change assessment studies for the entire Nile basin. At their meeting held on 21 – 22 July 2008 in Kinshasa, DR Congo, the Nile Basin Council of Ministers (Nile-COM) endorsed a concept note for the development of a project to address climate change impacts and adaptation in the Nile basin and also instructed the Nile Basin Initiative Secretariat (Nile-SEC) to go ahead and prepare a comprehensive project proposal and mobilize the necessary funds for implementation of the project. The Mara climate change assessment study could be undertaken as part of this broader project if this project comes to fruition.

(c) ***Land use Change Assessment Study*** – The Mara basin has experienced significant land use changes over the past years, due to population

pressure, as people continue to clear forests and drain wetlands to create new agricultural land and establish new settlements. These land use changes are having a negative impact on the hydrology of the basin as manifested through reduced base flows in rivers and drying up of streams, increased flash floods and land slides in hilly areas, and increased sediment loads in rivers and lakes. Therefore, as part of the proposed broader water resources assessment, comprehensive land use change assessments will be carried out in the basin to establish the extent of land use change that has taken place and quantify the impacts of these changes on the hydrology of the basin. This information will be useful in identifying appropriate intervention measures to reverse the current land degradation trends.

The Mara basin water resources assessments will be carried out jointly between Kenya and Tanzania as a regional transboundary project since such assessments are more meaningful and intuitive if based on a basin as a hydrological unit. Information from these assessments will be very valuable in developing a comprehensive water security program for the Mara basin.

(2) Implementation of Measures to Improve Water Security

Outcomes from the water resources assessment studies will form the basis for design and implementation of comprehensive structural and non-structural measures aimed at improving water security in the basin through enhancement of water storage and water use efficiency. The measures will include the following:

(a) Construction of water storage facilities (e.g., reservoirs and dams) to increase water storage in the basin and augment low flow during dry periods. Preliminary assessment shows that the topography in the Mara basin may not support the construction of large storage reservoirs/dams. Therefore, the strategy that will be adopted will be construction of several medium to small sized reservoirs/dams in different parts of the basin where the potential exists. Preference will be given to multi-purpose storage facilities that will address issues of flood control, mini-hydropower generation, irrigation, and sediment control. A comprehensive basin-wide topographical study will be carried out to identify potential storage sites and their corresponding capacities and appropriate use. This activity is transboundary in nature since it will be addressing the overall storage requirements for the basin and will, therefore, be carried out jointly between Kenya and Tanzania. There will be need to jointly share and manage these storage facilities between communities in both countries to take advantage of economies of scale.

(b) Conjunctive use of surface and groundwater – Based on the outcomes of the groundwater assessments, areas with high groundwater potential will be identified and developed to augment surface water use. Currently groundwater is being exploited on a small scale in several parts of the basin mostly for domestic water consumption. However, it is not clear what the true groundwater potential of the basin is, thus making it difficult to promote large scale groundwater use for irrigation and other uses. The outcomes of the basin-wide groundwater assessments will therefore be very valuable in developing a comprehensive plan for the conjunctive use of surface and groundwater as part of the broader Mara basin water security program.

(c) Efficient water use and demand management measures – Despite the general scarcity of water in the basin, there is also evidence of inefficient water use in almost all water uses in the basin. This ranges from poor irrigation practices to high levels of water losses in conventional urban water distribution networks. There is also inappropriate use of water (such as bathing in rivers, discharge of waste into rivers, etc.) that results in water pollution rendering the resource unsafe for domestic consumption and other uses. Therefore, as part of the broad basin water security program, measures will be put in place to promote efficient water use in the basin. Among others, these will include training of farmers in efficient irrigation water use technologies and practices; promotion of improved household sanitation and hygiene; promotion of wastewater recycling and re-use; and sensitization of the public on the dangers of engaging in pollution generating activities.

(d) Inter basin water transfers – Since water scarcity is a general problem in the Lake Victoria basin and in the two countries in general, a broader study, say covering the entire Lake Victoria basin could be undertaken to assess the feasibility of inter basin water transfers across sub-basins in the lake basin as part of a broader strategy to address water security in the region. This kind of initiative will best be undertaken under the auspices of the Lake Victoria Basin Commission. This broader outlook will significantly benefit the water security programs for the individual sub-basins like the Mara.

(e) Virtual water transfers – This is yet another measure that could be explored as part of the Mara water security program or indeed as part of a broader water security program for the Lake Victoria basin. The importance of this measure is that other than focusing on sharing cubic meters of water in the river, an arrangement can be agreed upon by the riparians to let water be used more efficiently in basin areas with the highest comparative advantage and the resulting net benefits be shared by

all riparians in terms of virtual water transfer. This measure implies true transboundary cooperation.

3.3 Mara River Basin Environment Management Program

The Mara basin is experiencing extensive degradation resulting from excessive nutrient and agrochemical pollution from agricultural farms; untreated effluent discharges from industry and sewage outfalls; pollution from poorly disposed human excreta and other solid wastes; soil erosion due to unsustainable land use management and farming practices; encroachment of fragile ecosystems (e.g., wetlands and forests) in search of new farming land; and siltation of water courses and water storage facilities due to increased sediment loads. Specific examples of degradation in the basin include the extensive deforestation of the Mau forest complex due to illegal logging and human settlements; non-point source pollution from agrochemicals used in medium to large scale farms mostly found in the middle reaches of the basin; point source pollution in the downstream reaches of the basin from untreated effluent from the gold mines and sewage from the numerous hotels in the park.

A comprehensive basin-wide environment management program is being proposed to address the above issues and reverse the current trend in basin degradation. The proposed program comprise several measures which collectively address the degradation issues basin-wide and contribute towards the sustainable management of the Mara river basin water resources. The program will include the following measures:

(a) Control of point and non-point source pollution

Point and non-point source pollution is the major cause of environmental degradation in the Mara basin. To address this problem, the following interventions are proposed:

(i) ***Improve household sanitation and hygiene*** - The latrine coverage in most parts of the basin is very low resulting in poor disposal of human waste which ends up polluting surface water and groundwater. The situation is worse in the slums in urban areas where several families use polythene bags ("flying toilets") to dispose off human waste. In most urban areas, there are no conventional sewerage treatment facilities leading to indiscriminate construction of poorly sited septic tanks which are a major source of groundwater pollution.

To address the above problem, the following measures are proposed:

- Increase rural household sanitation coverage through development and promotion of appropriate and affordable household sanitation

technologies. It should be noted that the ultimate responsibility for household sanitation lies with the households themselves. Therefore all that can be done under the program is to make available appropriate and affordable sanitation technologies that the households can easily acquire and implement.

- Increase access to improved sanitation services through construction of appropriate sanitation facilities in public areas such as schools, markets, hospitals, and barracks. This particular intervention addresses public sanitation which can either be provided as a commercial venture (e.g., in markets and entertainment areas) or subsidized by the government (e.g., in schools and barracks).

- Increase access to improved sanitation in major towns through rehabilitation and expansion of existing sewerage systems and construction of new systems where they are lacking. Though this intervention is capital intensive, it is financially viable since the beneficiaries will have to pay for the service as the current practice is.

(ii) ***Improve solid waste management and disposal*** – Poor solid waste management is a big problem in most urban centers in the basin. In most of these areas it is common to find large amounts of solid waste indiscriminately scattered along roads and on streets. Solid waste is not only aesthetically offensive but also attracts disease carrying vectors such as flies and other pests. Stormwater carries this waste into urban drainage channels and rivers making it a major source of pollution. The waste also clogs drainage channels causing street and road flooding and paralyzing transportation and business activities in urban areas.

To address this problem, there will be need to improve solid waste management in urban centers through provision of adequate solid waste collection, management, and disposal facilities. This will be undertaken by the urban authorities with financing from regular tax revenues. Neighbouring border towns will be encouraged to acquire joint solid waste collection and dumping facilities to benefit from economies of scale. The private sector will also be encouraged to provide solid waste collection and disposal services, on commercial basis, in the major urban centers to supplement the efforts of the urban authorities.

(iii) ***Improve Agriculture Practices*** – Poor agricultural practices in many parts of the basin are a major source of non-point pollution. These include indiscriminate use and poor handling of fertilizers and herbicides which are washed into the rivers by the rains; up-down cultivation of hill slopes resulting in excessive soil erosion; cultivation up to river banks and lake shores eliminating buffer zones and exacerbating river bank and lake

shore erosion and siltation of rivers and lakes; and drainage of wetlands for new agricultural land thus resulting in excessive wetland degradation.

To address this problem, the following measures will be implemented as part of the pollution control program:

- Strengthen agricultural extension services to provide regular good agricultural advisory services to farmers on good agricultural practices and proper handling and use of fertilizers and herbicides. This will involve increasing the number of well trained agricultural extension officers to be stationed at the lowest appropriate level (e.g., village level) and facilitating them to be responsive to local community needs in a timely manner. The extension officers will also train farmers in good agricultural practices and work with the farmers to set up pilot demonstration schemes in their areas of jurisdiction.

- Promote soil and water conservation practices in the basin through training and sensitization of farmers in proper land and water management practices such as establishment of contour bands and cultivation across hills to control soil erosion; establishment of buffer zones to control erosion of river banks and lake shores and siltation of rivers and lakes; and wise use of wetlands to prevent excessive wetland degradation.

(b) Promote sustainable forest management

The objective of this program is to ensure sustainable management and conservation of the Mara forest resources to sustain their unique biodiversity and the significant benefits to the basin riparians**.**

The program will focus on reversing the current basin degradation trend through implementation of the following measures:

(i) Catchment afforestation – To reverse the extensive deforestation in the basin, a significant effort will be needed to plant trees in most parts of the basin to restore the degraded forest cover in both protected and open forest areas. This will be a community based initiative with limited financial and technical support from the central and local governments. The initiative will be incentive driven where the participating local communities will be provided with free or subsidized tree seedlings and possibly tax breaks. Due to the shortage of agricultural land in the basin, emphasis will be put on promoting agro-forestry to allow local communities to continue utilizing the forested land for food and cash crop production.

The afforestation initiative will be preceded by a basin-wide forest survey, classification, and mapping program to establish the extent and severity of forest encroachment and degradation in the basin. This will help to identify the most affected areas to be focused on first and the required level of effort and resources.

(ii) Development of integrated community-based forest management plans – To ensure sustainable forest management, local communities have to actively participate in the management of forest resources in their neighbourhood. The community based forest management plans will clearly define the basis for local communities to own and manage forest resources on their land in ways that are both sustainable and profitable. For example, as managers of their forest resources, local communities will be able to retain income from sale of forest produce and confiscate forest produce and equipment from illegal harvesting. The plans will enable local communities to declare – and ultimately gazette – village, group, or private forest reserves in their communities.

Development of the community based forest management plans will be preceded by sensitization and training of all major stakeholder groups and local communities on sustainable management and exploitation of forest resources in the basin.

(c) Promote Sustainable Wetlands Management

Despite the significant benefits derived from the basin's wetland resources, they are faced with excessive degradation and mismanagement. A preliminary assessment shows that about 7% of the catchment's wetlands have been drained and converted into agricultural farming land. This indiscriminate conversion of wetlands into agricultural land is increasing at an alarming rate due to population pressure and increasing food demand. It is important that urgent measures be taken as part of the environmental management program to reverse the current trend of wetlands degradation in the basin.

To address this problem, the following measures are proposed:

(i) Wetlands Inventory – The first step in addressing the wetland degradation problem will be to conduct a comprehensive basin-wide wetlands inventory that will also include wetlands mapping and classification. This information will be useful in establishing the spatial distribution of wetlands and the extent of wetland degradation. This will also help in identifying the critical wetlands that require urgent attention in restoration and conservation. The Nile Basin Transboundary Environment Action Program is in the process of implementing a

wetlands resources inventory for the entire Nile basin, and the Mara basin could benefit from this initiative.

(ii) Development of community-based wetlands management plans – Following a comprehensive inventory and classification of the catchment's wetlands, local communities will be mobilized and sensitized on sustainable wetland management practices. The communities will be facilitated to develop community based wetland management plans that will be the basis for community use and management of local wetland resources. The plan will also provide for local wetland management committees and guidelines for sustainable exploitation of different wetland resources.

3.4 Mara River Basin Wildlife Management and Tourism Development Program

The Mara ecosystem is a world famous wildlife sanctuary and contains the most diverse combination of grazing animals in the world. It is home to the Masai Mara game reserve in Kenya and the Serengeti National Park in Tanzania. The incredible biodiversity, concentrations of wildlife, and annual wildlife migrations in the savannah grasslands of Kenya and Tanzania draw tourists from around the world. The tourism industry in the Mara basin thrives on the existence of unique and diverse wildlife resources. The Masai-Mara area accounts for over 50% of the Kenya bird species. The reserve was declared an Important Bird Area, in recognition of being home to nine globally threatened bird species. The Serengeti National Park is a World Heritage site and a Biosphere Reserve, and is therefore of global conservation significance.

It is clear that sustainable wildlife management and tourism development are central to the economic development of the Mara river basin. This program is, therefore, intended to address these two aspects as part of the broad socio-economic development plan for the basin.

(1) Promote sustainable wildlife management

The objective of this component is to promote sustainable management and conservation of the Mara basin wildlife resources, a unique asset of the basin.

This component would address the following areas:

(a) *Minimize Human-Wildlife Conflicts*

One of the main challenges to sustainable wildlife management in the Mara basin are the increasing human-wildlife conflicts due to increasing encroachment on the wildlife habitat for agricultural and livestock activities and human settlements. These conflicts are more pronounced on the Kenyan side (Wasilwa, 1997). For example, there has been a significant encroachment on wildlife grazing and breeding grounds in the Loita Plains due to expansion of large scale farming in the plains. This has also resulted in blockage of the seasonal wildlife migration corridors thus restricting the free movement of wildlife and subsequently increasing human-wildlife conflicts. Other causes of the human-wildlife conflicts include the significant increase in livestock numbers competing for grazing space with wildlife, and prolonged droughts which force pastoralists to move livestock into wildlife habitat in search of greener pastures and water. The Serengeti National Park also experiences conflicts related to wildlife hunting and farmland expansions due to high human population along the park boundaries (Campbell et al., 2001).

There is therefore need to address this issue through local community sensitization and training in wildlife conservation measures; encourage active local community involvement in wildlife management; increase local community benefits from tourism revenues as an incentive for their participation in the wildlife management and conservation measures; and support other local community income generating activities to reduce encroachment on wildlife habitat for farming activities.

(b) *Prevention and Control of Wildlife Diseases*

Wildlife diseases are a major threat to the Serengeti-Masai Mara Ecosystem. Wildlife disease outbreaks in the ecosystem are well documented since the mid-1950s rinderpest outbreak which wiped out more than 85% of the ungulates.

There are ongoing efforts to establish effective wildlife disease prevention and control mechanisms for the Masai-Mara and Serengeti areas. However, these efforts are limited and need to be up-scaled and coordinated better between the two governments. There is need to equip both the Masai-Mara Game Reserve and Serengeti National Park with modern veterinary facilities manned by adequate well trained veterinary officers. There is also need for timely information sharing on wildlife disease outbreaks between the two entities and for joint research and wildlife disease surveillance and control programs.

(c) *Enhanced local community participation in wildlife management*

Limited local community involvement in wildlife management and conservation measures has exacerbated environmental degradation and human-wildlife conflicts in the Serengeti-Masai-Mara ecosystem. Local participation through Community Based Wildlife Management (CBWM) is needed to sustain the Serengeti-Masai-Mara tourism industry. For example, the adjacent group ranches and local communities should be encouraged and supported in their efforts to develop wildlife conservancies and ecotourism sites to complement the existing tourism and wildlife conservation measures.

Increased local community participation should also be rewarded with increased local community benefits from tourism resources. Such rewards could be an increase in the share of the tourism revenues retained by the local communities and increased investment in local social services (health, education, water and sanitation, and access to electricity) and local infrastructure (health centers, roads, and schools, among others).

(d) ***Studying and understanding better the relationship between temporal and spatial wildlife dynamics and the hydrology of the Mara ecosystem***

Wildlife migration patterns in the Mara ecosystem are attributed to a number of factors, e.g., seasonal changes in water and green pasture availability, wildlife disease outbreaks, wildfire outbreaks, and encroachment on wildlife habitats, among others. However, most stunning is the spectacular annual wildebeest migrations in the savannah grasslands of Kenya and Tanzania that draw tourists from around the world. The annual animal migration is a spectacular event in this renown game park, offering a unique wildlife viewing experience.

It is therefore important to study and understand the eco-hydrological factors, risks, and vulnerabilities underlying this spectacular wildebeest migration and institute appropriate conservation measures to maintain the existing wildlife-hydrological environment as part of the broader tourism enhancement and sustainability strategy. Detailed eco-hydrology studies of the Mara system should be undertaken to understand the connections between the hydrology of the basin and wildlife dynamics. This will help to identify the hydrological features that are critical for ensuring the ecological balance of the basin and put in place management and conservation measures to ensure the long-term sustainability of these features.

(2) Promote sustainable tourism development

The objective of this program is to enhance the tourism sector in the Mara basin as a major revenue source through diversification of tourism activities,

improving on tourism related infrastructure, and strengthening of tourism management and revenue sharing mechanisms.

This component would address the following areas:

(a) *Diversification of tourism activities*

Significant potential exists for diversification of tourism activities in the Serengeti-Masai-Mara ecosystem. Opportunities include improvements in the existing tourism infrastructure and development of untapped tourism resources such as ecotourism, historical sites, cultural shrines, and caves. The Mau forest is a major resource for ecotourism development and can become a twin conservation area with the Masai-Mara National Reserve. The forest is an Important Bird Area with over 450 species. It is also popular for several unique animal species including the Bongo, yellow backed duicker, golden cat, colobus monkey, potto, bush baby and the greater galago. Other common animals found in the forest include: Lions, leopards, hyenas, giraffes, grant gazelle, buffalos, hippos, Rhinos and the African elephant.

A study conducted in 1988 by the Narok County Council established the economic viability of ecotourism in the Mau forest. The council subsequently prepared "The Masai Mau National Reserve Development Plan" which is yet to be implemented. The Plan highlights the tourism potential in the Mau forest and recommends specific actions and investments to realise this potential.

Other potential tourism features of intrinsic value in the basin include the Loita hills, the Loita and Suswa caves, Nguruman, and the Mau escarpment. Development of these sites would diversify tourist activities in the basin and decrease pressure on the existing tourist sites.

Other untapped tourism development opportunities in the basin include: rock climbing, scenic views, agro tourism, cultural museums, and canopy walks in the Loita indigenous forest.

(b) *Strengthening of Tourism Management Mechanisms*

Clear differences exist in the management frameworks for the Masai-Mara Game Reserve and the Serengeti National Park. These differences have created inconsistencies in the planning and management of tourism activities in the two entities thus affecting the realization of the full tourism potential. There is, therefore, need for harmonization of the legal and institutional frameworks for the management of the Masai-Mara Game Reserve and the Serengeti National Park to ensure coordinated planning and management of tourism activities and enhance wildlife management and conservation in the entire ecosystem.

As an example, the inconsistency in the management of the two entities is reflected in the closing of the border between Kenya and Tanzania along the Serengeti-Masai Mara at Sand River gate. Opening the border could relieve congestion in the Masai Mara and stimulate tourism in the northern Serengeti.

Neither the Serengeti nor the Masai Mara can be considered in isolation. The advantages of regional co-operation in ecosystem management are obvious. Benefits would accrue from a regional approach to tourism, ecological research, monitoring, environmental protection, and public education.

Improvements in the tourism management mechanisms in the basin should also address the existing inequitable sharing of tourism benefits among the major stakeholders, especially in the Masai-Mara Game Reserve. Equitable sharing of tourism income could significantly improve the living conditions of the local communities and decrease the human-wildlife conflicts.

(c) ***Strengthening of Tourism Infrastructure***

Tourism activities in both Serengeti and Masai Mara would increase significantly if investments are made in improving infrastructure (roads, hotels, camps, security, and park facilities). These improvements in infrastructure should be complemented with an aggressive joint marketing strategy for the tourism opportunities in the basin as a whole. This would attract more tourists (both local and international) and lead to increased tourism revenue for the entire basin.

There is also a need to put in place an enabling policy framework and incentives to attract private sector investment in tourism infrastructure development to complement efforts of the two governments. The private sector will mainly focus on infrastructure development in the reserve and park including hotels, transport and communication facilities, and diversification of tourism activities through development of additional tourist attractions.

3.5 Mara River Basin Food Security Program

Most of the households in the Mara basin depend on subsistence agriculture characterized by very low productivity and high labour intensity. This level of activity is inadequate to generate sufficient output to meet the basic food needs of the households. Poor nutrition is a very common occurrence in many households in the basin and is one of the most important health and welfare problems facing the basin.

To address the current food shortages in the basin, the following measures will have to be implemented under the food security program:

(1) Enhanced Agricultural Production

The objective of this component is to increase agricultural production and ensure food security in the Mara basin. The program will focus on the following activities:

- Sensitisation and training of farmers in the adoption of good agricultural practices and use of improved high-yielding crop varieties.
- Promotion of small-scale supplementary irrigation through sensitisation, field training, and practical on-site demonstrations.
- Increased access to agricultural extension and advisory services through strengthening of existing extension services.
- Reduction of post-harvest losses through provision of technical and financial support for construction of appropriate community based storage facilities.
- Promotion of small-scale irrigation infrastructure through technical and financial support.
- Promotion and training in the use of efficient water use irrigation technologies and methods.

(2) Enhanced Livestock Production

Livestock keeping is a major economic activity in the basin which contributes to increased food security and nutritional balance. The objective of this program is to increase livestock production and ensure food security in the Mara basin. The program will mainly focus on: promotion and adoption of good livestock practices such as zero grazing, disease control, and keeping of disease resistant breeds; establishment of rural based diary and beef processing industries, and skins, hides, and leather tanning industries to add value to livestock products; investment in livestock water supply infrastructure such as Valley Dams and Tanks which will also help to control nomadism and the spread of cattle diseases; establishment of a basin-wide livestock disease control program for surveillance, prevention and control of livestock diseases in the basin.

(3) Enhanced Fisheries Production

Fishing is a major socio-economic activity and source of food and livelihood for communities living close to rivers and lakes. The objective of this

program is to increase fish production and consumption in the Mara basin and contribute to the basin's food security and diversified revenue base. The program will engage in the following and other activities:

- Promote sustainable fisheries management through sensitization and training of BMUs and local communities in sustainable fisheries management practices.

- Promote aquaculture as an alternative source of income and protein through sensitisation, training, and provision of incentives to organized groups interested in engaging in aquaculture activities. This will also include provision of support for the development of a basin-wide hatcheries initiative to produce adequate fish fries to support the aquaculture industry.

- Support the establishment of ice production facilities to supply ice to fishermen to preserve their fish catches and minimize losses.

- Support the establishment of a fish gear and mesh manufacturing plant in the basin to curb the rampant use of illegal mesh sizes and gear types.

3.6 Mara River Basin Rural Infrastructure Development Program

The Mara river basin is a predominantly rural basin characterized by poor rural infrastructure. Though most of the basin riparians are involved in agricultural production, the poor road infrastructure in the basin makes it difficult for them to access markets to sell their products. Failure to access markets is a major disincentive for many farmers to engage in commercial farming. Secondly, the lack of adequate agro-processing industries in the basin makes it difficult for the farmers to add value to their products to attract high prices. Farmers are left with no option but to either grow what they can consume in their homes or to sell the surplus to middlemen at very low prices. The low industrialization levels in the basin can also be partially attributed to the low levels of electricity coverage (less than 10%). The situation is further exacerbated by the inadequate coverage of other social infrastructure such as schools and hospitals which is reflected in the low productivity of the population due to high illiteracy levels and poor health. All these factors contribute to the poor socio-economic conditions in the basin as can be seen from the high percentage (about 64%) of the basin population living below the poverty line.

To reduce poverty and improve the living conditions of the riparians of the Mara basin, the following measures are proposed to be implemented under the infrastructure development program:

(1) Investment in Water Supply and Sanitation Infrastructure

Provision of safe drinking water and basic sanitation is crucial to the preservation of human health, especially among children. Households with improved access to safe water and sanitation services suffer less morbidity and mortality from water-related diseases, spend less money on health related issues, and are more productive. The objective of this program is to ensure access to safe and reliable water supply and sanitation services for all Mara basin riparians through implementation of water supply and sanitation projects in different parts of the basin. The program will address both rural and urban water supply and sanitation needs through the following specific interventions:

- Increase access to potable water through development of adequate water sources based on a demand driven approach and the use of appropriate technologies such as borehole drilling, protection of springs and wells, development of Gravity Flow Schemes, and construction of valley Dams and Tanks.
- Increase access to improved sanitation in major towns through rehabilitation and expansion of existing sewerage systems and construction of new systems where they are lacking.
- Promote private sector participation in the operation and maintenance of urban water supply and sewerage systems.
- Promote local community participation in the operation and maintenance of rural water supply and sanitation facilities through provision of training and technical support to Water Users Associations and Sanitation Committees.
- Increase rural household sanitation coverage through development and promotion of appropriate and affordable household sanitation technologies.
- Sensitize rural communities on household sanitation, hygiene, and public health.
- Construction of surface water storage facilities (reservoirs and dams) to increase water storage in the basin to augment low flow during dry periods. This measure is discussed in details under the Mara Water Security Program.
- Construction of livestock water supply infrastructure such as Valley Dams and Tanks. This measure is discussed in details under the Mara Food Security Program.

(2) Investment in Rural Electrification

Electric power coverage in the basin is very low (less than 10%), although the demand for it is growing. Use of electricity is limited to urban areas. There is need to provide electricity access to more households and rural growth centers to reduce pressure on the forest resources and support small-scale industries and agro-processing activities.

Some of the Mara tributaries in Kenya have potential for mini and micro-electric hydropower generation at various waterfall sites. For example, the Tenwek Mission in Bomet district is exploiting the potential of the Nyangores River by generating its own hydropower for use in the Mission Hospital. The Tenwek power generation has a firm capacity of 5 MW.

Potential also exists (and has been studied) for a water transfer scheme of 2.6 m^3/s mean flow water transfer from the Amala River to the Nosagami River which is a tributary of the Ewaso Ngiro South to generate a maximum of 220 MW. Maximum water transfer is not to exceed $6m^3/s$.

As part of this program a comprehensive assessment of the catchment's potential for small scale hydropower generation will be carried out. If any potential sites are identified, pre-feasibility studies will be carried out to ascertain their capacity and economic viability before the private sector is encouraged to invest in the actual development.

There is also potential for extending the existing electricity transmission grid lines to other areas in the basin. This is already being undertaken as part of the rural electrification programs in both countries and should be up-scaled to cover other parts of the basin.

(3) Investment in alternative sources of energy

Despite the hydropower interventions discussed above, the capacity is still low and cannot meet the existing and future energy demands. Secondly, the high electricity tariffs are a disincentive for poor rural people to access electricity even if it were available. It is therefore important to consider investing in alternative sources of energy. Toward this end, there is good potential in the basin for harnessing solar energy, wind energy, and biogas. Studies should be undertaken to establish the viability of these alternative sources of energy before actual investment can be done.

(4) Investment in efficient energy use technologies

To ensure efficient use of the limited energy resources in the basin, investments should be made in efficient energy use technologies such as energy saving stoves and bulbs to reduce on energy consumption and associated costs in households.

(5) Investment in Industrial development

A few small-scale industries exist in the basin mostly related to agriculture, livestock, timber/wood, and tourism, but the full potential is not yet utilized.

The basin is well endowed with natural resources that could provide raw materials for industries. For example, hides and skins are produced which can be used in the tannery industry, but this potential remains largely untapped. Milk is frequently wasted due to poor handling and lack of dairy processing facilities.

Significant potential still exists for industrial growth in the basin. Thus, as part of the overall strategy for the economic development of the basin, there are opportunities for industrial development to create jobs and add value to the raw materials produced in the basin. Specifically, good potential exists for the establishment of rural based agro-processing industries; dairy and beef processing industries, and skins, hides, and leather tanning industries; and fish processing industries. Although most of this industrial development will be private sector driven, there is need for the two governments to put in place the necessary enabling environment and incentives to attract private sector investment in the basin.

(6) Investment in Transportation infrastructure

The Mara basin has a sparse road network comprising mostly of gravel roads, which require frequent maintenance. Most of these roads are impassable during the rainy seasons, causing serious disruption of movement of people and goods and imposing huge costs on transport service providers.

To facilitate trade and the easy movement of people and goods in the basin, there is need to upgrade the road infrastructure. Specifically, there is urgent need for investment in the rural roads to help the local communities to access markets for their agricultural produce. This will increase household incomes and improve the living conditions of the people. Easy access to markets will also help reduce post harvest losses.

(7) Investment in other social infrastructure

Health Infrastructure

Water-related diseases are the most common causes of illness and death among the rural poor communities in the Mara basin. Diarrhoeal diseases (cholera & dysentery) are among the major killer diseases of young children, accounting for about 20% of all infant deaths in the basin.

Besides water borne diseases, HIV/AIDS continues to pose a very serious public health challenge in the basin contributing significantly to morbidity and mortality and straining the public health budgets of both countries. About 75% of all AIDS cases occur among people in the most economically productive age group, 20 to 45 years. This has an adverse impact on productivity and further aggravates the poverty situation. Women are particularly more vulnerable to HIV infection compared to men. For example, HIV prevalence in women aged 15-49 years is nearly 9% compared to fewer than 5% for men in the same age bracket.

There is need to invest in hospitals and health centers to enable easy access of the local population to health care services. In addition, there also need to curb the spread of HIV/AIDs and eliminate the stigma of the disease by putting in place programs aimed at creating awareness on preventive measures, causes, and effects of HIV, promoting safe sex, promoting Voluntary Counselling and Testing, and providing Anti-Retroviral drugs at subsidized prices.

Education Infrastructure

Though both countries are currently implementing universal primary education, there are still significant challenges in providing quality education due to inadequate education infrastructure and well trained teachers. The same problems apply to higher education levels.

As part of the overall strategy to improve the livelihood of the people in the basin, there is need to invest in primary and secondary schools infrastructure and teacher training to increase pupil enrolment and improve the quality of education. There is also need for investment in tertiary education to ensure that pupils can receive appropriate skills and knowledge to engage in meaningful employment after their education.

A summary of the proposed investment programs and their core components is given in the Table below.

Investment Program	**Component**	**Objective**	**Benefit/Impact**	**Estimated Cost (US$ mil.)**
Mara River Basin Integrated Water Resources Management Program	Support to Mara transitional Secretariat/PMU	To facilitate coordination of transitional activities of the Mara PMU.	Ensure continuity of Mara initiative pending formation of permanent Mara framework	2.0
	Implementation of the Mara Cooperative Framework	To support and facilitate the process of negotiation, consensus building, adoption and implementation of the proposed Mara Policy, Legal and Institutional Framework.	Permanent Mara Framework established as a basis for future cooperation on Mara basin issues.	1.0
	Harmonization of water related policies, laws and institutions	To ensure cross-sectoral harmonization of policies, laws and institutional frameworks governing the relevant sectors in the basin.	Consistency in the application of water related policies and laws in the basin.	0.5
	Implementation of the Mara Basin Capacity Building Plan	To strengthen the human and institutional capacity of all Mara River Basin stakeholder institutions and groups to effectively participate in the management and development of the basin's water resources.	Increased efficiency of implementation of Mara basin water related activities with effective participation of all stakeholders.	15.2
	Implementation of the Mara Basin Stakeholder Participation Plan	To ensure effective and active participation of all stakeholders in water related decision making processes and activities in the basin.	Enhanced participation of all stakeholders in the management and development of the water resources of the basin.	2.7

	Implementation of the Mara Basin Gender mainstreaming Plan	To ensure gender mainstreaming in water related decision making processes and activities in the basin.	Gender sensitive planning and management processes in the basin.	0.6
	Development of water resources management tools	To ensure easy access to adequate and reliable water resources data and information to support water resources planning and management processes in the basin.	Sustainable management and development of the basin's water resources.	0.4
Mara River Basin Water Security Program	Rehabilitation and expansion of the Mara basin water resources monitoring network	To facilitate the timely collection of adequate and reliable water resources data and information to support the planning and management processes in the basin.	Improved and efficient water resources planning, management and development.	2.0
	Implementation of water resources assessment studies	To conduct basin-wide surface and groundwater assessments, water use and demand studies, climate change assessment studies, and land use change assessment studies.	Improved understanding of the spatial and temporal distribution of the basin's water resources.	2.0
	Implementation of measures to improve water security in the basin.	To increase water storage and availability in the basin, ensure equitable access and utilization of the shared water resources, and increase water use efficiency.	Increased water security in the basin and improved mitigation against droughts.	30.0

Mara River Basin Environment Management Program	Control point and non-point source pollution	To reduce point and non-point pollution in the basin.	Reduced environmental degradation and improved water quality.	3.0
	Promote sustainable forest management	To ensure sustainable management and utilization of the basin's forest resources.	Sustainability of the basin's unique biodiversity; Improved water quality due to reduction in pollution from soil erosion; Reduction in flash floods due to increased vegetation cover.	1.5
	Promote sustainable wetlands management	To ensure sustainable management, conservation, and exploitation of the basin's wetlands resources.	Improved water quality and reduction in floods due to enhanced buffering capacity of wetlands; Increased household income from sustainable exploitation of wetland products.	0.5
Mara River Basin Wildlife Management and Tourism Development Program	Promote sustainable tourism development in the basin.	To enhance the tourism sector as a major revenue source for the basin through diversification of tourism activities, improvement of tourism related infrastructure, and strengthening of tourism management and revenue sharing mechanisms in the basin.	Improved livelihoods of the basin riparians due to increased revenue from tourism activities in the basin.	10.0

	Promote sustainable wildlife management in the basin.	To ensure sustainable management and conservation of the basin's wildlife resources through prevention of human-wildlife conflicts, control of wildlife disease, and enhancement of local community participation in wildlife management.	Thriving tourism industry due to sustainability of the basin's unique biodiversity.	8.0
Mara River Basin Food Security Program	Increased agricultural production in the basin	Support and facilitate increased agricultural production to ensure food security and improved livelihoods in the basin.	Increased farm productivity and household nutrition and income.	10.0
	Increased livestock production in the basin	To increase livestock production to ensure food security, nutritional balance, and enhanced household incomes.	Increased household income and protein uptake; Increased employment opportunities due to thriving livestock industry.	5.0
	Increased fisheries production in the basin	To increase fish production and consumption in the basin thus contributing to the basin's food security and diversified revenue base.	Increased household income and protein uptake; Increased employment opportunities due to thriving fisheries industry.	5.0
Mara River Basin Infrastructure Development Program	Expansion of water supply and sanitation infrastructure	To increase access to safe and reliable water supply and sanitation services for all rural and urban areas in the Basin.	Increased safe water and sanitation coverage; Reduction in water related diseases and deaths;	30.0
	Development of rural electrification infrastructure	Increase access to electricity in the basin to reduce dependence on wood fuel and stimulate industrial development.	Reduced deforestation and growth in electricity-dependent rural agro-processing industries.	20.0

	Industrial development	Promote investments in rural based agro-processing industries to add value to agricultural produce and reduce post harvest losses.	Creation of jobs and increased household incomes.	30.0
	Development of transportation infrastructure	Improve rural transportation in the basin to facilitate easy movement of people and goods.	Increased commercial activity in the basin due to improved accessibility to markets.	50.0
	Development of health and educational infrastructure	Increase access to health and educational services in the basin.	Improved productivity and living conditions of the basin riparians.	22.6
TOTAL				**252.0**

Note:

- Estimated costs for the Mara River Basin Integrated Water Resources Management Program are based on the detailed budget estimates for the respective components contained in Mara River Basin Policy, Legal, and Institutional Framework Final Report.

- Estimated costs for the other proposed investment programs are based on existing cost estimates for similar project activities in the basin and in the region. Specifically, cost estimates for similar activities contained in the district development plans and in specific project documents for ongoing and planned local, national and regional project activities were particularly useful in establishing the above cost estimates.

- It should be noted that these are tentative cost estimates based on a broad generalization of project activities under the proposed investment programs. More accurate cost estimates will be established during the pre-feasibility and feasibility study phase during which specific project activities will be identified, quantified and costed appropriately.

- Most of the above cost estimates are for activities during the initial phases of the proposed investment programs. Costs for later phases of the different programs will be established as implementation of the initial phases nears completion, at which point in time, specific follow-up activities will be identified, quantified, and accurately costed.

4.0 PROGRAM IMPLEMENTATION MODALITIES

4.1 Introduction

The programs will be divided into two broad categories, i.e., nationally implemented projects and regionally implemented projects.

(1) Nationally Implemented Programs

To avoid duplication, projects that have already been identified as part of the national and local government development programs shall be implemented at that level and shall not be part of the regional program portfolio. The programs will be planned, funded, and implemented through existing national and bilateral funding mechanisms in the two countries. Programs that are part of the investment strategy but will be implemented under the existing national and local government development programs include:

(i) Mara River Basin Food Security Program; and
(ii) Mara River Basin Infrastructure Development Program.

The main reason why the above programs have been included in the Mara Investment Strategy is to highlight their importance for the sustainable and integrated management of the basin, and to build a case for their urgent prioritization by the two countries and potential development partners under the existing bilateral funding mechanisms.

(2) Regionally Implemented Programs

Regionally implemented programs will comprise of the following types:

(i) Programs that are transboundary in nature and whose implementation requires to be done concurrently in both countries in order to address a critical transboundary issue, e.g., pollution, soil erosion, etc.; and/or

(ii) Programs that may not be transboundary in nature but which are (or whose impacts are) considered to be critical for the entire or significant part of the basin and whose implementation at regional level would be considered efficient and effective due to economies of scale, and clearly provide tangible benefits at regional level.

(iii) Responsive to the overall objective of the project of improving the living conditions of the people, while protecting the environment

The regionally implemented programs will include the following:

(i) Mara River Basin Integrated Water Resources Management Program;
(ii) Mara River Basin Water Security Program;
(iii) Mara River Basin Environmental Management Program;
(iv) Mara River Basin Wildlife Management and Tourism Development Program;

Planning and implementation of the regional programs will be undertaken jointly by stakeholders from the two countries. Activities under these projects will be implemented concurrently in the two countries under the coordination of a regional project management unit (Mara Secretariat).

4.2 Implementation Roles and Responsibilities

(a) Regional Level

LVBC/NBI will play a very important role in providing the overall regional framework under which the proposed investment programs will be implemented.

Mara Policy Organs will be responsible for provision of overall policy guidance for implementation of the planned projects; review and approval of the planned projects; mobilization of the required financial resources; and overall monitoring and evaluation of the performance of the projects.

Mara Secretariat will be responsible for ensuring the effective and timely implementation of the directives of the Mara policy organs; coordination of mobilization, disbursement, and accountability for financial resources; coordination of project monitoring and evaluation; coordination of timely preparation and submission of project work plans, budgets and reports; collection and dissemination of relevant data and information to different stakeholder groups; coordination of regional training and capacity building activities; and facilitation of regional meetings and workshops.

(b) National Level

At national level, several ministries, line departments, and non-governmental organizations will be involved in the planning and implementation of different thematic Mara projects as follows:

(i) **Ministries of Finance** will play a lead role in the mobilization, budgeting and allocation of funds to different sectors and will also coordinate donor inputs (through budget support). The Ministries will also ensure that Mara project expenditures conform to the overall national medium-term expenditure frameworks of the respective governments.

(ii) **Ministries Responsible for Water** will have the overall responsibility for setting national policies and standards, and priorities for water resources management and development. They will ensure that all the planned Mara water resources management and development projects are consistent with the national priorities and development objectives. They will also coordinate and liaise with other sector agencies (Ministries responsible for Agriculture, Livestock, Health, Tourism, among others) in the implementation of cross-sectoral activities in the basin.

(iii) **National Water Supply and Sanitation Agencies –** In Kenya, the Lake Victoria South Water Service Board is the lead agency responsible for water supply in the Mara River Basin districts in Kenyan. The Board will contract independent water service providers to provide water and sanitation services to specific areas in the Mara basin. The water service providers shall be autonomous bodies such as water and sanitation companies formed by the Local Authorities as Public or Private companies. In cases where competent Water Service Providers are not available or the production of bulk water supply through state schemes is limited, the National Water Conservation and Pipeline Corporation will act as a fall back organization.

In Tanzania, the Ministry of Water is responsible for coordinating and regulating all water supply and sanitation, and water resources development and management activities and providing support services to local Governments and other service providers. The Ministry will work with the Lake Victoria Basin Board to offer technical support and guidance to the Mara Basin districts in the implementation of water supply and sanitation projects in rural areas, small towns, and rural growth centers.

(iv) **Water Resources Management Agencies –** In Kenya, the Water Resources Management Authority (WRMA) is responsible for the sustainable management of the country's water resources. Therefore, WRMA will be the lead agency in the implementation of all water resources management project activities in the Kenyan part of the basin. The Catchment Area Advisory Committee for the Lake Victoria South Catchment Area will play a key advisory role in all project activities related to conservation, use, and allocation of water resources in the basin. At the local level, Water Resources Users Associations (WRUAs) will play a major role in all project activities related to the management and utilization of the water resources within their localities. The WRUAs will also serve as fora for resolution of conflicts arising from competing water uses in their localities.

In Tanzania, the Lake Victoria Basin Water Office under the Ministry of Water will play the lead role in the implementation of all water resources management project activities in the Tanzanian part of the basin.

(c) Local Level

At the local level, local governments, NGOs, CBOs, several special interest groups, and local communities will be involved in the planning and implementation of different projects as follows:

(i) **Local Governments** – District authorities in Kenya and Tanzania will oversee and provide effective coordination of water sector activities in their respective Local Governments.

(ii) **Private Sector** – Private Sector firms will undertake design and construction of water supply infrastructure under contract to relevant local and central government agencies. Private hand pump mechanics and scheme attendants will provide maintenance services to water users in rural and peri-urban areas. Private operators will manage piped water services in the majority of small towns with piped water.

(iii) **NGOs and CBOs** - Non-Government Organizations (NGOs) and Community Based Organizations (CBOs) will be actively involved in the provision of water and sanitation services through construction of facilities, community mobilization, training of communities and local Governments, hygiene promotion, as well as advocacy and lobbying.

(iv) **Local Communities** – The beneficiary communities will be responsible for demanding improved water supply and sanitation services from their leaders. They will also be actively involved in the planning, implementation, and management of community water supply and sanitation facilities. Local communities will also be required to make cash and in-kind contributions (land, labor, and materials, among others) towards implementation of water and sanitation projects in their areas to ensure ownership and collective responsibility. Upon construction of a water source, a Water Users Committee (WUC) will be established to take responsibility for its operation and maintenance.

4.3 Mobilization of Financial Resources

Mobilization of the required financial resources to implement the Investment Strategy will be a major undertaking. Sources of funding will include development partners as well as contributions from the beneficiary countries.

Mobilization of financial resources for implementation of Phase 1 transboundary activities should commence as soon as possible to ensure

timely activity implementation. The Mara PMU/NELCU will coordinate with the governments of Kenya and Tanzania in mobilizing financial resources necessary for Phase 1 pending establishment of the permanent Mara Institutional Framework.

Existing funding mechanisms

Most of the central and local government institutions in both countries depend on government appropriations to fund their activities. Government appropriations are usually inadequate due to limited revenues and several competing needs in other sectors.

The local governments have very low local revenues the collection of which is inefficient. In addition, central government transfers are inadequate, pegged to specific activities, and are not released on time thus impacting negatively on planning and implementation of activities in the local governments.

Community contributions to support the water sector cannot be over emphasized since a major source of finance is envisaged to be the fees for services rendered. Further, contributions can be in the form of provision of labor, land for construction of water tanks, time, and other resources which can help to improve the linkage between the ministry, water sector regulators, and water service providers. As such, increasing the involvement of the community in this process is critical to the success of water sector reforms, especially in urban slums and rural areas.

The private sector also has an important role to play, especially in improving efficiency, strengthening commercial discipline through competition and autonomy of management, and gradually raising equity financing to help deliver services to underserved areas.

Funding for regional projects:

Funds for implementation of regional projects will be jointly mobilized by the participating countries and shall include contributions from the beneficiary countries, to meet the recurrent expenditures, and a significant contribution from external support agencies in the form of grants or loans to finance development projects. Infrastructure development projects will be funded using loans whereas environmental/natural resources management projects will be funded through grants. Resources mobilization will be coordinated by the regional entity under whose auspices the projects are conceived, e.g., EAC, LVFO, LVBC, NBI, UN-HABITAT, FAO, and other organizations.

Some of these regional entities have established specific Trust Funds to administer funds for implementation of regional initiatives. Examples of such Trust Funds include the Nile Basin Trust Fund, for implementation of projects

under the NBI, and the Lake Victoria Trust Fund and Development Fund. Under this funding mechanism, projects are jointly prepared and implemented by the beneficiary countries using the regionally sourced funds.

If the countries decide to anchor the Mara cooperative framework under the LVBC/EAC then resources for implementation of the Mara regional projects will be mobilized as part of the overall Lake Victoria recurrent and development funds. These funds will be managed through the two proposed Lake Victoria funds, i.e., the Lake Victoria Trust Fund for management of the recurrent funds and the Lake Victoria Development Fund for management of the development funds. Furthermore, since the Mara basin is part of the Nile Basin, part of the funds for implementation of the Mara activities will also come from the Nile Basin Trust Fund based on a memorandum of understanding with the LVBC.

Alternatively, if the countries choose to anchor the Mara cooperative framework under the NBI, then most of the funding for the Mara regional projects will be mobilized as part of the overall Nile Basin development funds which will be administered through the existing Nile Basin Trust Fund.

4.4 Coordination Mechanism

Mara stakeholder agencies will be responsible for implementation of the proposed activities as an integral part of their existing development programs. The role of the Mara PMU/Secretariat will be to coordinate and facilitate the different stakeholder agencies in implementation of the activities.

Overall oversight for implementation of Phase 1 activities will be provided by the existing Mara/NELSAP policy organs (RPSCs, NELTAC, and NELCOM) pending establishment of the permanent Mara Institutional Framework. Oversight for Phase 2 and 3 activities will be provided by the relevant policy organs established under the permanent Mara Institutional Framework.

4.5 Monitoring and Evaluation

Monitoring and evaluation of Phase I activity progress will be undertaken as per the existing Mara/NELSAP project monitoring and evaluation guidelines. Monitoring and evaluation of Phase 2 and 3 activities will be undertaken in accordance to the guidelines that will be established by the permanent Mara Institutional Framework.

4.6 Implementation Plan

Phase 1 of implementation of the Investment Strategy is aimed at establishing the necessary enabling environment (Policy, Legal, and Institutional Framework) and capacity for implementation of the investment projects. It is

envisioned that the proposed Mara Policy, Legal, and Institutional Framework will be discussed, approved and implemented during Phase 1. Implementation of the proposed Mara Capacity Building Plan will also commence during the phase 1. During phase 1, preliminary basin studies will be carried out to identify concrete investment projects under the six broad investment programs. Depending on availability of financial resources, pre-feasibility and feasibility studies for the investment projects will also be undertaken. Results of the feasibility studies will be helpful in mobilizing the necessary financial resources for implementation of the investment projects during phase 2.

In preparation for the feasibility studies, comprehensive pre-feasibility studies of the proposed programs will be carried out to determine whether the programs are technically sound and likely to be economically, socially, and environmentally sustainable. Terms of Reference (ToR) for the pre-feasibility studies are attached as Annex B.

Phases 2 and 3 of the Strategy will be focused on implementation of the investment projects. It is assumed that the funds for implementation of Phase 2 activities will be secured during Phase 1 and those for implementation of Phase 3 activities will be secured during Phase 2. It is also envisioned that all relevant organs of the permanent Mara Institutional Framework, including the Mara Trust Fund, will have been established by the end of Phase 1.

The plan for implementation of the investment strategy is shown in the Table below.

Table 4.2: Phased implementation of Investment Programs

Investment Program	Component	Phase 1 (2009-10)	Phase 2 (2011-15)	Phase 3 (2016-20)
Integrated Water Resources Management Program	Support to Mara transitional Secretariat/PMU			
	Implementation of the Mara Cooperative Framework			
	Harmonization of water related policies, laws and institutions			
	Implementation of the Mara Basin Capacity Building Plan			
	Implementation of the Mara Basin Stakeholder Participation Plan			
	Implementation of the Mara Basin Gender mainstreaming Plan			
	Development of water resources management tools			
Water Security Program	Rehabilitation and expansion of the Mara basin water resources monitoring network			
	Implementation of water resources assessment studies			
	Implementation of measures to improve water security in the basin.			
Environment Management Program	Control point and non-point source pollution			
	Promote sustainable forest management			
	Promote sustainable wetlands management			
Wildlife Management and Tourism Development Program	Promote sustainable tourism development in the basin.			
	Promote sustainable wildlife management in the basin.			
Food Security Program	Increased agricultural production in the basin			
	Increased livestock production in the basin			
	Increased fisheries production in the basin			
Infrastructure Development Program	Expansion of water supply and sanitation infrastructure			
	Development of rural electrification infrastructure			
	Industrial development			

FEASIBILITY STUDIES

	Development of transportation infrastructure		
	Development of health and educational infrastructure		

5.0 RANKING OF INVESTMENT PROGRAMS

The proposed Mara river basin investment programs include the following:

(i) *Program 1* - Mara River Basin Integrated Water Resources Management Program;
(ii) *Program 2* - Mara River Basin Water Security Program;
(iii) *Program 3* - Mara River Basin Environmental Management Program;
(iv) *Program 4* - Mara River Basin Wildlife Management and Tourism Development Program;
(v) *Program 5* - Mara River Basin Food Security Program; and
(vi) *Program 6* - Mara River Basin Infrastructure Development Program.

The proposed programs above are all very crucial to the sustainable development of the Mara basin and were arrived at following comprehensive stakeholder consultations and detailed analysis of the critical water resources related socio-economic issues and challenges in the basin.

However, for practical reasons, it is recognized that implementation of all the programs cannot commence at the same time due to financial, logistical and technical constraints. It is, therefore, necessary that some form of ranking of the programs is done mostly for purposes of sequencing implementation of the programs and not necessarily inferring the relative importance of the programs.

5.1 Ranking Methodology

The methodology used was based on the *Evaluation Matrix* procedure which is a standard method commonly used to rank options by identifying their relative strengths and weaknesses based on a given set of criteria. Choices can then be made based on that information and the options can be modified to make them more acceptable. The evaluation matrix presents the decision maker with a compact set of useful information on which to base objective decision making.

It should be emphasized that neither the ranking process itself nor its outcomes will give you the one “magic” answer! This information is supposed to be used by the decision maker who has to make the ultimate decision as to what the final sequencing of the different potential development options should be given the prevailing circumstances and constraints. The ranking process allows one to narrow the possible options and evaluate them in an orderly and efficient manner. The ranking process is not intended to be an end in itself but rather to guide the decision maker in making objective decisions.

5.2 Ranking Process

The ranking process involved the following steps:

(a) ***Selection of Criteria*** – One of the most important steps in the ranking process was the selection of an appropriate set of ranking criteria representative of the overall strategic development objectives of the Mara basin initiative. The criteria that was used in the ranking process was developed with input from different stakeholders and is summarized below:

(i) ***Transboundary dimension*** - Preference to be given to programs that are transboundary in nature involving communities in both countries.

(ii) ***Regional benefits*** - Preference to be given to programs with potential basin-wide socio-economic and environmental benefits.

(iii) ***Positive Program impacts*** - Preference to be given to programs whose potential positive socio-economic and environmental impacts outweigh the negative impacts.

(iv) ***Sustainability of program*** - Preference to be given to programs whose outcomes can easily be sustained by the beneficiary communities in the short and long term.

(v) ***Potential for private sector investment*** –Preference to be given to programs with the highest potential for private sector investment.

(vi) ***Local community participation*** - Preference to be given to programs with strong and effective participation of local communities in the basin.

(vii) ***Per capita investment costs*** - Preference to be given to program options with the lowest per capita investment costs.

(b) ***Ranking of options*** - To use the evaluation matrix, a ranking scale of 1, 3, and 5 was chosen for each criteria with 1 having the lowest desirability, 3 middle level, and 5 the highest desirability. The program options were then evaluated against each criterion and assigned a score of 1, 3, or 5 depending on the extent to which the option matched the requirements of a specific criterion. The program options were all ranked against the same criterion before moving to the next criterion to minimize bias and avoid the possibility of favoring one option over the others.

The ranking was independently carried out by a team of 7 experts from the consultant's team and the results compared, discussed and amalgamated into one final ranking. Some choices were all team members had similar scores but where they are not, the team discussed and came to a common agreement on a single score. No attempt was made to simply take the average score because

the team had to make sure that the scores were based on an objective reasoning and not mere guess work. Individuals whose scores were clear outliers were asked to explain their positions and adjustments were made were it was realized that a specific score was not backed up by a firm reason. This discussion helped the team to reach a common understanding and consensus.

A summary of the scores and final rankings is presented in the matrix below.

	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5	Criteria 6	Criteria 7	Total	Rank
Program 1	5	5	5	3	1	5	5	29	2
Program 2	5	5	5	3	3	5	3	29	2
Program 3	5	5	3	5	1	5	5	29	2
Program 4	5	5	5	5	5	5	3	33	1
Program 5	1	3	5	5	5	5	3	27	3
Program 6	1	3	5	3	3	5	1	21	4

Note:
Program 1 - Integrated Water Resources Management Program;
Program 2 - Water Security Program;
Program 3 - Environmental Management Program;
Program 4 - Wildlife Management and Tourism Development Program;
Program 5 - Food Security Program; and
Program 6 - Infrastructure Development Program.

Discussion:

Based on the selected criteria a number of program options were ranked similarly as shown in the matrix above. Program 4 was ranked highest followed by programs 1, 2, and 3. In a situation were we are interested in private sector investment, if we go by these rankings, program 2 would be considered before programs 1 & 3.

It should be emphasized that equally ranked program options don't necessarily have to be implemented at the same time. The decision maker can still make a choice between equally ranked program options and sequence them appropriately. Since equally ranked program options do not necessarily have identical scores against all criteria, the decision maker has to decide which

criterion is more important under the prevailing circumstances and use that as the basis for his choice among tied program options. For example if we consider programs 1, 2, and 3, though they are equally ranked, program 2 has a higher potential for private sector investment, at least in the long-term. Similarly, program 3 is more sustainable in the long term than programs 1 &2. So in prioritizing between the three programs, the decision maker would have to decide which of the criteria carries more weight than the other. If program sustainability is more crucial than attraction of private sector investment, then program 3 would be implemented first. This is what makes the decision making process more interactive and not necessarily focused on just the outcomes of the ranking process alone.

Assignment of weights to Criteria:

A more elaborate ranking exercise would involve assignment of weights to the different criterion depending on their perceived relative importance by the decision maker and then multiplying the individual scores in the matrix above by the corresponding weights and summing them to get the final totals against which the ranks would be assigned.

5.3 Conclusion

Based on this ranking exercise the sequencing of implementation of the development programs proposed in the Mara Investment Strategy would be as follows:

(1) Implement the Mara River Basin Wildlife Management and Tourism Development Program first followed by the IWRM, Water Security and Environment management programs.

(2) Despite the above raking results, it should emphasized that the program ranking above would change with a change in evaluation criteria or with an assignment of weights to the different criterion. For example, it came out clearly, and makes sense for that matter, that the IWRM program should be implemented first to put in place the necessary enabling environment for joint implementation of the other programs. During this same period pre-feasibility and feasibility studies for the other development programs would be undertaken in preparation for their full implementation during the subsequent phases.

(3) In prioritizing between equally ranked programs, the decision maker would have to decide which of the criteria carries more weight than the other. Since equally ranked program options do not necessarily have identical scores against all criteria, the decision maker would decide which criterion is more important under the prevailing circumstances and use that as the basis for his choice among equally ranked program options.

Detailed Score Sheets (1=Low; 3=Medium; 5=High)

Criteria 1 - Transboundary Dimension

	Score	**Remarks**
Program 1 – MRB IWRM Program	5	Program includes basin-wide activities targeting all stakeholder groups in the catchment.
Program 2 – MRB Water Security Program	5	Program includes basin-wide assessment studies and structural and non-structural water security enhancement measures.
Program 3 – MRB Environment Mgt. Program	5	Program includes basin-wide environment management measures.
Program 4 – MRB Wildlife management and Tourism Development Program	5	Program includes transboundary wildlife management activities targeting biodiversity conservation and tourism development in the entire basin.
Program 5 – MRB Food Security Program	1	Program includes activities that will mainly be implemented through national food security programs.
Program 6 – MRB Infrastructure Development Program	1	Most of the activities under the program will be implemented through national infrastructure development programs.

Criteria 2 – Regional Benefits

	Score	Remarks
Program 1 – MRB IWRM Program	5	Program has basin-wide benefits to be shared equally by all stakeholders in the basin.
Program 2 – MRB Water Security Program	5	Program includes basin-wide assessment studies and structural and non-structural water security enhancement measures which will benefit the entire basin.
Program 3 – MRB Environment Mgt. Program	5	Program includes basin-wide environment management measures targeting the entire basin and which will benefit all stakeholders in the basin.
Program 4 – MRB Wildlife management and Tourism Development Program	5	Program includes transboundary wildlife management activities targeting biodiversity conservation and tourism development in the entire basin with significant regional benefits.
Program 5 – MRB Food Security Program	3	Though program includes activities that will mainly be implemented through national food security programs, there is significant potential for basin wide food security benefits as food items are freely traded in the basin regardless of their origin.
Program 6 – MRB Infrastructure Development Program	3	Though most of the activities under the program will be implemented through national infrastructure development programs, some of the infrastructure like roads will benefit all basin riparians by facilitating free movement of people and goods in the entire basin.

Criteria 3 – Positive program impacts (Socio-economic and environmental)

	Score	Remarks
Program 1 – MRB IWRM Program	5	This program will have significant positive socio-economic and environmental impacts in the catchment.
Program 2 – MRB Water Security Program	5	Improved water security results in sustainable water related investments (irrigation, hydropower, water supply, etc) and increased economic benefits from such investments. This also contributes to environmental protection since environmental water requirements are taken care of.
Program 3 – MRB Environment Mgt. Program	3	The program has significant positive environmental benefits as it directly addresses the current problem of environmental degradation in the basin. Though the economic benefits may not be immediate, a healthy environment also translates into significant socio-economic benefits for the basin riparians as it supports sustainable development and a healthy riparian population.
Program 4 – MRB Wildlife management and Tourism Development Program	5	Tourism is one of the major economic activities in the basin that heavily depends on the basin's unique biodiversity. Sustainable management of the basin's wildlife resources will result in a thriving tourism industry which will greatly contribute to the basin's socio-economic development. Sustainable wildlife management goes hand-in-hand with sound environmental

		management practices. Therefore the program will inevitably have significant environmental benefits.
Program 5 – MRB Food Security Program	5	Increased agricultural, livestock and fisheries production will have significant positive socio-economic impacts accruing from increased food security and improved household incomes in the basin.
Program 6 – MRB Infrastructure Development Program	5	Improved infrastructure in the basin will significantly contribute to the socio-economic development an environmental conservation in the basin. For example increased electrification will lead to increased industrialization and reduced dependence on wood fuel. Good road networks will facilitate free movement of people and goods in the basin thus stimulating trade and commerce. Improved access to health, education, and water supply and sanitation facilities will lead to improved health and productivity of the people and also reduced pollution of the basin's water resources.

Criteria 4 – Sustainability of the program

	Score	**Remarks**
Program 1 – MRB IWRM Program	3	This program will be sustainable in the long-run as the basin riparians begin to reap the benefits of integrated water resources management.
Program 2 – MRB Water Security Program	3	This program will be sustainable because water security results in sustainable water related investments (irrigation, hydropower, water supply, etc) and increased economic benefits from such investments. However, increased water demands due to population increase will make the program unsustainable in the long run.
Program 3 – MRB Environment Mgt. Program	5	This program will be sustainable in the long run as the basin riparians begin to enjoy the benefits of a healthy environment. A healthy environment also translates into significant socio-economic benefits which the riparian population will want to protect.
Program 4 – MRB Wildlife management and Tourism Development Program	5	This program will be sustainable because of the significant economic benefits that will be derived from a vibrant tourism industry.
Program 5 – MRB Food Security Program	5	This program will be sustainable since it will be mainly community based and will have tangible benefits like increased agricultural, livestock and fisheries production which have significant socio-economic benefits accruing from increased food security and improved household incomes which the communities will want to protect.

Program 6 – MRB Infrastructure Development Program	3	This program will face sustainability challenges because of the need for significant financial resources needed to maintain the infrastructure in a functional state over time.

Criteria 5 – Potential for private sector investment

	Score	**Remarks**
Program 1 – MRB IWRM Program	1	There is very little incentive, if any, for private sector investment in this program. The private sector will only be hired to provide technical services under the program for which they will have to be paid.
Program 2 – MRB Water Security Program	3	The private sector views this as government responsibility to ensure water security in the basin before they can invest in water related infrastructure projects like hydropower and irrigation. However, once the investments have been made, the private sector will have the incentive to invest in the program to protect their investments.
Program 3 – MRB Environment Mgt. Program	1	There is very little incentive for private sector investment in this program since there are no immediate financial benefits.
Program 4 – MRB Wildlife management and Tourism Development Program	5	The private sector would be interested in investing in the tourism sector since there are immediate financial benefits.

Program 5 – MRB Food Security Program	5	The private sector will be interested in investing in commercial farming including irrigation schemes, dairy farms and aquaculture development as business ventures. This will require putting in place enabling policies, legislation and incentives favorable for private sector investment.
Program 6 – MRB Infrastructure Development Program	3	Though the private sector would not be interested in investing in social infrastructure like roads and water supply and sanitation, they have the incentive to invest in agro-processing industries, fish processing factories, schools, hospitals, etc as business ventures.

Criteria 6 – Local community participation

	Score	**Remarks**
Program 1 – MRB IWRM Program	5	There will be active local community participation in this program since they are the targeted beneficiaries of most of the planned activities under the program e.g. Capacity building, stakeholder participation, gender mainstreaming, etc.
Program 2 – MRB Water Security Program	5	Local communities will be involved in the planning and implementation of many of the program activities since they are the intended beneficiaries of the program.
Program 3 – MRB Environment Mgt.	5	There will be active local community participation

Program		since the program will be community based with most of the activities implemented by the local communities themselves.
Program 4 – MRB Wildlife management and Tourism Development Program	5	The success and sustainability of this program will rely heavily on the effective participation of local communities who are often responsible for the rampant human-wildlife conflicts and destruction of the basin's fragile ecosystems.
Program 5 – MRB Food Security Program	5	There will be active local community participation since the program will be community based with most of the activities implemented by the local communities themselves.
Program 6 – MRB Infrastructure Development Program	5	There will be active local community participation since the program will mostly benefit the local communities.

Criteria 7 – Per capita investment cost

	Score	**Remarks**
Program 1 – MRB IWRM Program	5	The per capita investment cost will be low since the program will mostly focus on policy, legal, institutional and capacity building activities with very little investment in infrastructure.
Program 2 – MRB Water Security Program	3	The per capita costs will be moderate since most of the planned investments in water storage, though high, will benefit the entire basin.
Program 3 – MRB Environment Mgt.	5	The per capita investment cost will be low since the

Program		program will mostly focus on implementation of community based environmental management activities such as tree planting, soil & water conservation, community wetlands management, etc which are not capital intensive and yet benefit all the basin riparians.
Program 4 – MRB Wildlife management and Tourism Development Program	3	The per capita cost will be moderate since most of the activities will be community based with a few targeting investment in tourism infrastructure, most of which will be undertaken by the private sector.
Program 5 – MRB Food Security Program	3	The per capita investment cost will be moderate since the program will mainly focus on implementation of community based agricultural development activities including small scale irrigation and livestock watering infrastructure, which have moderate capital requirements.
Program 6 – MRB Infrastructure Development Program	1	The per capita cost will quite high since the program will mainly focus on infrastructure development with significant initial investment costs and appreciable operation and maintenance costs.

ANNEX A – POTENTIAL MARA WATER RELATED PROJECTS

(A) Projects identified through the PMU:

TANZANIA

1. Kiagata Water Supply Project – Musoma Rural District, Mara Region

Type of Investment- Development of a new community based water supply
Location- Kiagata Division, Musoma Rural District, Mara Region,Tanzania.
The project has been proposed to cover 5 villages of Ryamisanga; Kwisaro, Kamugendi, Kyamkoma and Masurura

Description and Purpose of the Investment

The Project aims at water supply development to address the problems experienced in obtaining safe, reliable and sufficient water supply from existing sources, by the communities living in the 5 villages. The project is proposed to benefit about 15,000 people and 16,000 livestock in these villages.

Currently most of the traditional water resources eg. Water pans, streams and wells dry up during the dry season, whilst the Mara River is some 8km away and more so, heavily infested with crocodiles that often caused deaths of children and women. A number of water, related diseases such as diarrhea, dysentery and typhoid, are prevalent in the area due to use of water from these unsafe sources. Hence, the development of this proposed water supply from River Mara will go along way to addressing both the quantity and quality aspects of water availability in the 5 villages of Kiagata. There were existing efforts initiated by the community together with the area Member of Parliament and the District to develop the water supply in phases. There is an existing design complete with cost estimates and lay out of over one km of pipe work and an installed windmill.

1. Micro –catchments Development of Mara River

Type of Investment-Development of Micro-Catchments of Mara River
Location-Masurura and Kitalamanka in Mara Region Musoma district of Tanzania

Description and purpose of the Investment

To develop and access, with community co-management experimental integrated use of micro-catchments for agriculture (horticulture) through irrigation, livestock grazing, aforestation, and fishing. The project aims at building a wall across a tributary of the river and availing water for the above mentioned activities.

1. Kenyamonta Basin Irrigation Farming Project

Type of Investment-Development of a Small Scale Irrigation Scheme using improved farming methods; covering 9 villages.

Location- the Project is located in Ikongo River valley – which is a tributary of the Mara River in Serengeti District. The 3 Project sites are to be found off the main Musoma – Mugumu Road- from the Sirori Simba junction on the road towards the Mara Mine.

Description and Purpose of the Project

This irrigation farming project is aimed at contributing towards poverty and hunger eradication initiatives, among the poor of the Kenyamonta area by enabling them to better their livelihoods through an irrigation farming system.

The Project is intended to cover 9 villages surrounding the Project area. These include Kenyamonta, Iserere, Busawe, Maji Moto; Buchanchari, Nyansarumuti, Masinki, Mesaga and Iramba. These villages have a total population of 12,509 people, with 5,500 children below 18 years; and 4,000 women. Of particular focus of the Project, is empowerment of women-who are very disadvantaged in regard to the ownership of income from agricultural products. Through the Project's gender focused actions, women groups will be provided with improved farming technologies, capacity building support for income generation and participation in the local decision-making process.

Other groups to be involved in the project as beneficiaries are the unemployed youths. The Kenyamonta ward Authority has allocated the land for the 6 targeted groups at 3 sites to carry out the proposed irrigated farming activities. A proposal by professionals and estimated costs has been made.

2. Dairy Improvement, Tarime and Serengeti District Project

Type of Investment- Promotion of Dairy Animal Industry in the district

Location of the Project- the Project will be located in the Mara River catchments area- in the south and east of Tarime District and Kenyamonta area of Serengeti district, Mara Region.

Description and Purpose of the Project

The project aims at contributing towards improving the livelihoods of the resource poor farmers and communities through increased income from market oriented activities and application of appropriate technology in animal husbandry such AI services. The Project equally aims at ensuring food security and nutrition improvement of the community participants.

The project will benefit poor farmers who will receive heifer-in-trust loans and undertake appropriate dairy husbandry activities such as AI services for income generation and food security. They will then join together and form Dairy Keepers Associations for production and marketing support

KENYA

1 Development of Medium Size Earth Dams in Transmara District

Type of Investment- Development of 8 medium size dams for the provision of adequate water for human and livestock in Kirindon and Lolgorian divisions of Transmara district

Location- The project will be located in Kirindon and Lolgorian divisons of Transmara district at 8 specific sites in the area. Both divisions fall within the Mara River Basin.

Description and Purpose of the Project

The proposed development of the 8 medium size dams will go along way in meeting the needs for water for livestock and domestic consumption. During the dry seasons, several hours are wasted traveling long distances in search of water. In the process, valuable working hours are wasted, and more often lead to loss of livestock. The main objective of the initiative is to address the water needs of the communities in the area, who have ranked the provision of water as their priority. There are no reliable sources of water for human and livestock during the dry seasons. When successfully implemented, the 8 dams are expected to serve some 36,000 community members, 230,000 cattle, and 175,000 small stock.

2 Bomet Municipality Sewerage Treatment and Disposal Project

Type of Investment-Constructions of sewage drainage and Treatment Plant

Location-Bomet Municipality, Bomet District in Kenya

Description and Purpose of Investment

Bomet Municipality has no Sewage Disposal System. During rains, surface runoff from the two drains directly to River Nyangores. The residents use pit latrines; which are full during the rains and hence overflow. The Municipal Council has provided a site for the construction of a treatment, plant. There is a design complete with cost estimates for the sewerage project.

3 Environmental Conservation Project in the Mau Forest and Transmara District

Type of Investment- Environmental conservation project to address the problem of Mara River Basin catchment deforestation and human encroachment into the forests in the Mara river catchment

Location-The project will cover the entire upper Mara River catchments basin in Narok South district, Molo district (Mau forest complex) and eastern Transmara district – which is covered by indigenous forests.

Description and Purpose of the project

The Proposed project is aimed at stopping the rapid deforestation of the Mara River Catchment by encroachment of human settlements, which is having negative impacts on the river flows and water resources in general in the basin catchments.` The project include conservation of Enapuyapui swamp, the source of Mara river. The swamp is currently facing encroachment though grazing and loss of vegetation cover.

3. Construction of Olenguruone Water Supply

Type of Investment-construction of water supply and extension of distribution network

Location-Pilot shopping centre, Olenguruone Division of Molo District– Kenya

Description and purpose of the investment

This project aims at provision of water to serve the shopping centre, health centre and the local community. The design population is over 3000 people. The source of the water is Amala, the tributary of Mara River.

4 Augmentation to Mulot Water Supply

Type of Investment- Construction of treatment works and purchase of pumping system for Mulot water supply

Location-Mulot location in Mulot Division of Narok District Kenya

Description and purpose of investment

A water supply was constructed for Mulot by the Government in 1985. The water supply now is not operating due to operation and maintenance costs. This is both pumping and gravity scheme. It is 50% complete now. Water comes from Amala River a tributary of Mara.

Summary of the Investment Projects

Type of Project	Location	Category	Tentative cost (USD)
Tanzania			
1. Micro catchment Develoment for small scale irrigation.	Musoma District	National	80,000
2. Kiagata Community Based Water Supply.	Musoma District, Mara Region	National	1,850,000
3. Kenyamonta Basin Irrigation Farming Project.	5 villages, Serengeti District	National	70,000
4. Promotion of Dairy Animal Industry.	Tarime and Serengeti	National	120,000
Kenya			
5. Eight water dams for the provision of water for Human and Livestock consumption.	Kirindon and Lolgorian of Transmara District	National	220,000
6. Construction of Olenguruone (Pilot) Water Supply.	Molo District	National	310,000
7. Construction of Sewage Drainage and Treatment Plant.	Bomet Town	Regional	670,000
8. Environmental Conservation Project (river catchment deforestation and human encroachment)	Narok South, Molo and Transmara Districts	Regional	923,000
9. Construction of Treatment works and Pumping system	Mulot, Narok South District	National	175,000

for water supply.			
	TOTAL	**USD**	**4,418,000**

(B) Other Projects identified through the districts

WATER SUPPLY AND SANITATION

1. Bomet district

The water authorities in Bomet district have identified the following projects to enhance the availability and coverage of water supplies in the district:

1.1 Bomet Water Supply Project

The Bomet town water supply, with its source from Nyangores River, has a current production of 382 m^3/day and a connected population of 512. The water supply scheme is currently operated by Chemosit Water and Sanitation Company, a Water Services Provider contracted by the Lake Victoria South Water Services Board. However, the production capacity and the connected population fall far short of what would be required to meet the Millennium Development Goals for the increasing urban and peri-urban population of Bomet town. There is, therefore, need to rehabilitate and expand the supply area of the Bomet water facilities in order to contribute towards meeting the Millennium Development Goals and the Kenya 2030 Vision. On sanitation services, Bomet Town does not have a sewerage system; however, the NBI through the Mara River Basin Project is financing the design of Bomet Water Supply and Sewerage Treatment and Disposal Project. The design of the water supply is projected to supply

Project Title	Bomet Town Water Supply
Main Objective	Increase the water supply coverage in Bomet Town
Project Components	• Data collection and reconciliation on existing water supply data • Construction of new water treatment works
Project Output	• Production of Project Design Reports • Water supply and sanitation infrastructure rehabilitated and developed • Establishment of effective institutions to ensure sustainable management of the developed water and sewerage systems
Project Development Status	• The Lake Victoria South Water Services Board (LVSWSB) through the District Water Office,

	Bomet District, has identified the requirements for the rehabilitation of the water supply. • The design of Bomet town sewerage works is on-going with the financial support from the Nile Basin Initiative through the Mara River Basin Transboundary Integrated Water Resources Management and Development Project
Project Implementation Status	The LVSWSB and the Ministry of Water and Irrigation (MWI) have included this project in the 2008-2012 Development Plan under the Kenya Vision 2030
Implementing Agencies	LVWSB
Cooperating Partners	MWI, Water Services Trust Fund
Funding	Estimated cost (water component): US$ 0.2 million

1.2 Chepalungu Water Supply Project

The Chepalungu Water Supply is a rural water supply scheme whose source is Nyangores River. The water supply scheme is currently operated by Chemosit Water and Sanitation Company, a Water Services Provider contracted by the Lake Victoria South Water Services Board. The scheme has a production of 318 m^3/day and supplies 345 households. This supply level is far to low for this fast growing rural centre and its environs. In addition, there need to develop water treatment works for this scheme. There is no sewerage facilities in this rural town and the population rely on pit latrines.

Project Title	Chepalungu Water Supply
Main Objective	Increase water supply coverage in Chepalungu rural town
Project Components	• Design of full water treatment plant • Design of water supply lines • Rehabilitation of water supply scheme
Project Output	• Production of Project Design Reports • Water supply and (sanitation) infrastructure rehabilitated and developed • Establishment of effective institution to ensure sustainable management of the developed water supply and sewerage systems
Project Development Status	The Lake Victoria South Water Service Board (LVSWSB) through the District Water Office, Bomet District, has identified the requirements for the rehabilitation of the water supply scheme.

Project Implementation Status	The LVSWSB and the Ministry of Water and Irrigation (MWI) have identified and included this project in the 2008-2012 Development Plan under the Kenya Vision 2030
Implementing Agencies	LVWSB
Cooperating Partners	MWI, Water Services Trust Fund, Development Partners
Funding	Estimated cost (water component): US$ 0.3 million

1.3 Sigor Water Supply Project

The Sigor water supply is a rural water supply scheme with a production capacity of 308 m^3/day and supplying 286 households. The water supply scheme is currently operated by Chemosit Water and Sanitation Company, a Water Services Provider contracted by the Lake Victoria South Water Services Board. The scheme, with its source from Nyangores River, is unable to meet the demand in Sigor rural market and its environs. There is need to rehabilitate the water supply to meet the increasing demand.

Project Title	Sigor Water Supply Project
Main Objective	Increase water supply coverage in Sigor rural town and its environs and contribute towards meeting the MDGs on water and sanitation
Project Components	• Design of water supply lines • Rehabilitation of water supply scheme
Project Output	• Production of Project Design Reports • Water supply and (sanitation) infrastructure rehabilitated and developed • Establishment of effective institution to ensure sustainable management of the developed water supply systems
Project Development Status	The Lake Victoria South Water Service Board (LVSWSB) through the District Water Office, Bomet District, has identified the requirements for the rehabilitation of the water supply scheme.
Project Implementation Status	The LVSWSB and the Ministry of Water and Irrigation (MWI) have identified and included this project in the 2008-2012 Development Plan under the Kenya Vision 2030
Implementing Agencies	LVWSB
Cooperating Partners	MWI, Water Services Trust Fund, Development Partners
Funding	Estimated cost (water component): US$ 0.1

	million

1.4 Longisa Hospital Water Supply Project

The Longisa water supply scheme has been a single supply operation, supplying water to Longisa District Hospital only. However, the Longisa Market centre is a fast growing rural town that needs to be supplied with portable water urgently. It is proposed to expand the existing Hospital supply to include the market centre and improve the treatment works.

Project Title	Longisa Water Supply
Main Objectives	Increase water supply coverage in Longisa District Hospital and Longisa rural market centre.
Project Components	• Design for full water treatment plant • Design of water supply lines • Rehabilitation of water supply scheme
Project Output	• Production of Project Design Reports • Water supply and (sanitation) infrastructure rehabilitated and developed • Establishment of effective institutions to ensure sustainable management of the developed water and sewerage systems
Project Development Status	The Lake Victoria South Water Service Board (LVSWSB) through the District Water Office, Bomet District has identified the requirements for the rehabilitation and expansion of the water supply scheme.
Project Implementation Status	The LVSWSB and the Ministry of Water and Irrigation (MWI) have identified and included this project in the 2008-2012 Development Plan under the Kenya Vision 2030
Implementing Agencies	LVWSB
Cooperating Partners	MWI, Water Services Trust Fund, Development Partners
Funding	Estimated cost (water component): US$ 0.16 million

1.6 Kaporuso Community Water Project

The Kaporuso water supply project is a rural water supply scheme in Bomet district. The current operational level of the scheme is not sustainable and cannot provide the required water services to the community. It is proposed that a new scheme be developed that will be able to meet the water requirements of the community.

Project Title	Kaporuso Community Water Project
Main Objectives	Increase water supply coverage in Bomet district and contribute towards meeting the MDGs on water and sanitation.
Project Components	• Data collection and reconciliation • Design of a new water supply system • Rehabilitation of existing water supply scheme
Project Output	• Production of Project Design Reports • Water supply and (sanitation) infrastructure rehabilitated and developed • Establishment of effective institution to ensure sustainable management of the developed water and sewerage systems
Project Development Status	The local community and the District Water Office, Bomet District, have selected this project for the rehabilitation and development of a new water supply scheme.
Project Implementation Status	The Bomet District Water Office has identified and included this project in the 2008-2012 Development Plan under the Kenya Vision 2030
Implementing Agencies	Community
Cooperating Partners	MWI, Water Services Trust Fund, Development Partners, NGOs
Funding	Estimated cost (water component): US$ 0.06 million

1.7 Itembe Water Supply

Itembe water supply project is a new project proposal that is supported by the District Water office, Bomet. It is proposed to drill a new borehole to supply clean water to the community.

Project Title	Itembe Water Project
Main Objectives	Increase water supply coverage in Bomet district and contribute towards meeting the MDGs on water and sanitation.
Project Components	• Identification of water supply source • Design of a water supply system • Construction of the water supply
Project Output	• Production of Project Design Report • Water supply infrastructure developed

	• Establishment of effective institution to ensure sustainable management of the developed water and sewerage systems
Project Development Status	The local community, the District Water Office and the Bomet Municipal Council have selected this project for development of a new water supply scheme.
Project Implementation Status	The Bomet District Water Office has included this project in the 2008-2012 Development Plan under the Kenya Vision 2030
Implementing Agencies	Bomet Municipal Council
Cooperating Partners	MWI, Water Services Trust Fund, Development Partners, NGOs
Funding	Estimated cost (water component): US$ 0.1 million

1.8 Construction of dams in Bomet district

Dams constitute part of the water supply sources for both human and livestock in Bomet district. However, due to lack of effective maintenance, the dams have become silted-up. In other cases, the constructed dams are too small to meet the increasing water demand. In this regard, the water development authorities in Bomet District have recommended the desilting and improvement of the dams in the district.

Project Title	Development of Dams in Bomet District
Main Objectives	Increase water supply coverage in Bomet district and contribute towards meeting the MDGs on water and sanitation.
Project Components	• Identification of dams and preparation of status report for the dams • Design of new dams • Desilting/construction of the dams
Project Output	• Production of status reports for the dams • Production of Project Design Report • Water supply infrastructure (dams) constructed • Establishment of effective institution to ensure sustainable management of the developed water and sewerage systems

Project Development Status	The local communities (stakeholders) and the District Water Office, Bomet have identified dams that require to be desilted and improved
Project Implementation Status	The District Water Office is seeking for funds to investigate, prepare proposals and implement the proposed rehabilitation and expansion of the dams.
Implementing Agencies	District Water Office
Cooperating Partners	Communities, MWI, Water Services Trust Fund, Development Partners, NGOs
Funding	Estimated cost : Not costed

1.9 Construction of sanitation and sewerage facilities in Bomet district

In the past, sewerage and sanitation issues have not received the same attention as water supply in their development. However, with the formation of commercially oriented water providers, sewerage systems in urban set-ups have been transferred to most of these enterprises. In the rural areas, it is estimated that less than 50% of the population have access to adequate sanitation facilities.

The current government development policy is to ensure that the development of water supply systems go hand in hand with the development of sewerage and sanitation infrastructure. On this basis, the Bomet district water authorities have recommended the provision of sewerage and sanitation facilities in areas where water supply facilities have been identified and selected for rehabilitation.

Project Title	Development of Sewerage and Sanitation Facilities in Bomet District
Main Objectives	Increase access to safe and improved basic sanitation facilities and improve waterborne sewage collection, treatment and disposal systems in Bomet district and contribute towards meeting the MDGs on water and sanitation.
Project Components	• Development of project proposal • Design of sewerage facilities • Development of the infrastructure
Project Output	• Production of status reports for the selected sites • Feasibility studies of sewage works and sanitation facilities in the district

	• Production of Project Design Reports • Construction of sewerage and sanitation facilities.
Project Development Status	The District Water Office has proposed and recommended the construction of sewerage and sanitation facilities.
Project Implementation Status	The District Water Office is seeking for funds to investigate, prepare proposals and implement the proposed developments.
Implementing Agencies	LVSWSB
Cooperating Partners	Communities, MWI, Water Services Trust Fund, Development Partners, NGOs
Funding	Estimated cost : US $ 2.0 million

2 Transmara District

The water authorities in Transmara district have identified the following projects to enhance the availability and coverage of water supplies in the district:

2.2 Emuria Dikkir Water Supply Project

Emuria Dikkir water supply project is located in Kirindoni Division of Transmara District. The project that requires the construction/rehabilitation of a dam is proposed to provide drinking water to over 3,000 people and 10,000livestock.

Project Title	Emuria Dikker Water Supply
Main Objectives	Increase the water supply coverage area in Kirindoni Division and improve on water delivery efficiency
Project Components	• Data collection and reconciliation on existing water supply data • Rehabilitation of the water supply facilities. • Operationalise the stalled water supply scheme
Project Output	• Water supply infrastructure rehabilitated and developed • Establishment of effective institution to ensure sustainable management of the developed water and sewerage systems
Project Development Status	• The District Water Office, Transmara District, has identified the requirements for the

	rehabilitation of the water supply.
Project Implementation Status	• The District Water Office has identified this project as a priority project. • The project is partially operational
Implementing Agencies	Community
Cooperating Partners	District Water Office, MWI, Water Services Trust Fund.
Funding	Estimated cost (water component): US$ 0.0.2 million

2.3 Emarti Water Supply Project

The Emarti water supply project is also located in Kirindoni Division of Transmara District. The project that requires the construction/rehabilitation of a pan is proposed to provide drinking water to over 1,500 people and over 4,000 livestock.

Project Title	Emarti Water Supply
Main Objectives	Increase the water supply coverage area in Kirindoni Division and improve on water delivery efficiency
Project Components	• Data collection and reconciliation on existing water supply data • Rehabilitation of the water supply facilities. • Operationalise the stalled water supply scheme
Project Output	• Water supply infrastructure rehabilitated and developed • Establishment of effective institution to ensure sustainable management of the developed water and sewerage systems
Project Development Status	• The District Water Office, Transmara District, has identified the requirements for the rehabilitation of the water supply.
Project Implementation Status	• The District Water Office has identified this project as a priority project. • The project is partially operational
Implementing Agencies	Community
Cooperating Partners	District Water Office, MWI, Water Services Trust Fund.
Funding	Estimated cost (water component): US$ 0.2 million

2.5 Development of groundwater, dams and pans in Transmara District

Noting that most of the Transmara district lies within the semi-arid region of Kenya, the provision of water for both human and livestock populations is a major challenge in the region. Consequently, the water development authorities in the district have recommended the development of groundwater sources, dams and pans across the district to provide water supplies for both human and livestock.

Project Title	Development of groundwater sources, dams and pans in Transmara District
Main Objectives	Increase the water supply coverage in Transmara District and contribute towards meeting the MDGs for water.
Project Components	• Data collection and reconciliation on existing water supply data • Design of water supply systems • Development of new water supply systems
Project Output	• Project design Reports • Water supply infrastructure developed • Establishment of effective institution to ensure sustainable management of the developed water and sewerage systems
Project Development Status	• The District Water Office, Transmara District, has identified the requirements for the rehabilitation of the water supply.
Project Implementation Status	• The District Water Office has prepared draft budgets for the project
Implementing Agencies	Community, LVSWSB
Cooperating Partners	District Water Office, MWI, Water Services Trust Fund, LVBC.
Funding	Estimated cost (water component): US$ 1.0 million

(Exchange rate 1USD = Kshs. 62.00)

3 NAROK SOUTH DISTRICT

3.1 Mulot Water Supply Project

The Mulot water supply project is a rural water supply scheme in Narok South district. The current operational level of the scheme is not sustainable and cannot provide the required water services to the community. It is proposed that a new scheme be developed that will be able to meet the water requirements of the community.

PROJECT TITLE	**Mulot Water Supply**
Main Objectives	Provision of adequate and sustainable water and sanitation services to Mulot Rural Market and its environs
Project Components	• Data collection on status of existing water supply and sanitation facilities. • Data analysis and design of rehabilitation and augmentation requirements of water supply and sanitation facilities. • Procurement and implementation of project rehabilitation and augmentation activities. • Establishment of mechanism to undertake the project including institutional arrangements to ensure project sustainability • Capacity building of the institutions to manage the developed water.
Project Outputs	• Status of existing water supplies and sanitation facilities and additional interventions established. • Project Design Reports produced. • Water supplies and sanitation infrastructure rehabilitated and extended. • Established institutions to ensure sustainable management of rehabilitated and developed water supply services.
Project Development Status	The project is targeted at meeting the water needs of the fast growing Mulot Rural Market and its environs.
Project Implementation Status	Baseline information and data on status of water supplies and sanitation services is available.
Implementing Agencies	Rift Valley Water Services Board
Cooperating Partners	Ministry of Water and Irrigation, Local communities, Ministry of Local Government,
Funding	Estimated Cost: (water component) US$ 0.3 million

3.3 Lemek Water Project

The Lemek water supply project is a rural water supply scheme in Narok South district. The water supply is sourced from borehole and requires rehabilitation in order to ensure the sustainable operation of the scheme.

PROJECT TITLE	**Lemek Water Supply**
Main Objectives	Provision of adequate and sustainable water supply services to Lemek Rural Market and its environs.
Project Components	• Data collection on status of existing water supply and sanitation facilities. • Data analysis and design of rehabilitation and augmentation requirements of water supply and sanitation facilities. • Procurement and implementation of project rehabilitation and augmentation activities. • Establishment of mechanism to undertake the project including institutional arrangements to ensure project sustainability • Capacity building of the institutions to manage the developed water.
Project Outputs	• Status of existing water supplies and sanitation facilities • Project Design Reports produced. • Water supplies infrastructure rehabilitated and extended. • Established institutions to ensure sustainable management of rehabilitated and developed water supply services.
Project Development Status	The project is targeted at meeting the water needs of the Lemek Rural Market and its environs.
Project Implementation Status	Baseline information and data on status of water supplies and sanitation services is available.
Implementing Agencies	Rift Valley Water Services Board
Cooperating Partners	Ministry of Water and Irrigation, Local communities, Ministry of Local Government,
Funding	Estimated Cost: (water component) US$ 0.3 million

3.4 Morijo Loita Water Supply Project

The Morijo Loita water supply project is a rural water supply scheme in Narok South district. The water supply requires rehabilitation in order to ensure the sustainable operation of the scheme.

PROJECT TITLE	Morijo Loita Water Supply
Main Objectives	Provision of adequate and sustainable water supply services to the Morijo rural market centre and the environs.
Project Components	• Data collection on status of existing water supply and sanitation facilities. • Data analysis and design of rehabilitation and augmentation requirements. • Procurement and implementation of project rehabilitation and augmentation activities. • Establishment of mechanism to undertake the project including institutional arrangements to ensure project sustainability • Capacity building of the institution to manage the rehabilitated water.
Project Outputs	• Status of existing water supplies facilities • Project Design Reports produced. • Water supplies infrastructure rehabilitated and expanded. • Established institutions to ensure sustainable management of rehabilitated and developed water supply services.
Project Development Status	The project is targeted at meeting the water needs of the Morijo Loita community.
Project Implementation Status	Baseline information and data on status of current water supply services is available.
Implementing Agencies	Rift Valley Water Services Board
Cooperating Partners	Local communities, Ministry of Water and Irrigation, Ministry of Local Government,
Funding	Estimated Cost: (water component) US$ 0.2 million

3.5 Development of groundwater sources and rehabilitation of dams, pans in Narok South District

The provision of water for both human and livestock populations in the low potential areas of Narok South district is a major challenge. Consequently, the water development authorities in the district have recommended the development of groundwater sources and the rehabilitation of dams and pans across the district to provide the required water supplies.

Project Title	Development of groundwater sources, dams and pans in Narok South District
Main Objectives	Increase the water supply coverage in Narok South District and contribute towards meeting the MDGs for water.
Project Components	• Data collection and reconciliation on existing water supply data • Design of water supply systems • Development of new water supply systems
Project Output	• Project design Reports • Water supply infrastructure developed • Establishment of effective institution to ensure sustainable management of the developed water and sewerage systems
Project Development Status	• The District Water Office, Narok South District, has identified the need to develop new water supply sources and the rehabilitation of existing dams ans pans in the district.
Project Implementation Status	• There will be need to prepare proposals for the water supply projects
Implementing Agencies	Community, LVSWSB
Cooperating Partners	District Water Office, MWI, Water Services Trust Fund.
Funding	Estimated cost (water component): US$ 2.6 million

(Exchange rate 1USD = Kshs. 62.00)

POTENTIAL WATER RELATED PROJECTS IN TANZANIA

4.0 Musoma Rural District

The Water authorities in Musoma Rural District have identified the projects described below to enhance the availability and coverage of water supplies in the district while protecting the environment.

4.1 Water Supply for Musoma Rural District

The source of water supply in Musoma Rural is mainly from groundwater sources whereby water is abstracted mainly from shallow wells, medium and deep boreholes and improved traditional water sources. Apart from the groundwater source the other water sources for the district is rainwater harvesting through the construction of dams and water tanks. As far as the water supply coverage for Musoma Rural is concerned, only 50% of the population has access to clean and safe water. This project aims to increase the water supply coverage in Musoma Rural District to meet the national water sector target to be achieved by 2009/10 that is to increase the proportion of rural population that has access to clean and safe water to 65%. The project will involve development of new water sources by drilling boreholes, construction and rehabilitation of rainwater harvesting tanks and rehabilitation and expansion of existing water schemes.

Project Title	**Water supply for Musoma Rural district**
Main objectives	Increase the water supply coverage in Musoma Rural District to meet the national target
Project Components	• Development of new water sources by drilling 18 boreholes at Kamgendi, Wegero, Bukabwa, Buswahili, Kitaramanka, Kirumi, Kongoto, Kwisaro and Magunga villages • Construction and rehabilitation of rainwater harvestingtanks as follows: ➢ Construction of 5 rainwater harvesting tanks at Masurura, Kitaramanka sewc schools, Buswahili, Ryamisanga, Bumaswa and Buko secondary schools ➢ Construction of 4 rainwater harvesting tanks at Mirwa, and Wegero secondary schools ➢ Rehabilitation of 5 rainwater harvesting tanks at Kamgendi, Baranka, Bukabwa, Masami and Kiagata secondary school • Rehabilitation and expansion of 5 water schemes at Masurura, Bukabwa, Nyabange, Kyankoma, and Kwisaro
Project outputs	▪ Project Design Reports produced • Water Supplies infrastructure rehabilitated and developed

Project Development Status	Musoma Rural district council has already identified the villages where the 18 boreholes are to be drilled, 4 and 5 rainwater-harvesting tanks are to be constructed and rehabilitated respectively and 6 water schemes are to be rehabilitated and expanded
Project Implementation Status	Musoma Rural district council has included these projects in their budget plans 2008/09– 2010/11.
Implementing agencies	Musoma Rural District Council
Cooperating Partners	Musoma Rural District Council, Ministry of Water and Irrigation, Ministry of Regional Administration and Local Governments, Drilling and Dam Construction Agency
Funding	Estimated costs: US$ 0.9 million

4.2 Buswahili Irrigation Scheme

Buswahili Irrigation Scheme is in Buswahili village, Buswahili ward in Musoma District. At Present farmers depend partly on Buswahili dam to grow paddy but on small scale due to the small size of the dam. There is therefore need to expand the dam through rehabilitation of the embankment and improve the irrigation canals

Project title	**Buswahili Irrigation scheme**
Main objective	To improve Buwsahili Irrigation Scheme with 45 Ha for paddy production to meet food demand and surplus for sale
Project component	• Survey and engineering design • Rehabilitation and expansion of paddy dams through improving canal water accessibility and embarkment
Project out put	• Increased rice production • Improve household food security and alleviate poverty
Project development status	The project was initiated by Mara farmers (MRFIP), therefore it is easier to be sustainable
Implementing agencies	Community, District Council and development partners ✓ Ministry of Agriculture, Food security and Cooperatives ✓ Ministry of Water and Irrigation ✓ Zonal Irrigation Office ✓ NEMC & NGO's
Beneficiaries	Buswahili village with population of 2,225 people and neighborhood villages (Wegero, Kong' to & Kwisaro) having 2,293 people
Funding	Total cost USD 0.4m

4.3 Drilling of Boreholes

The project cover nine villages namely Wegero, Kirumi, Kwisaro, Kyankoma (Kiagata), Kamugendi, Buwsahili, Kong'oto, Baranga and Kitaramanka. Each village will drill three boreholes. The project will provide adequate water to 16,833 people and 75,000 cattle.

Project Title	**Improving water supply service through Drilling Boreholes**
Main objective	Provision of adequate and portable water supply services to nine community villages
Project component	➢ Create awareness on environmental conservation i.e. tree planting ➢ Carry out hydro geological survey ➢ Drilling of 27 Boreholes ➢ Installation of hand pumps ➢ Capacity Building of water users associations
Project output	➢ Adequate water supply ➢ Reduced waterborne diseases
Funding	➢ Estimated cost US $ 0.8m

4.4 Promotion of Sanitation in villages

The Proposed Project will be implemented in 14 villages for the purpose of reducing water borne diseases and environmental pollution among rural village communities in Baranga, Wegero, Kong'oto, Kyankoma, Ryamisanga, Bukabwa, Mirwa, Kirumi, Kamugendi, Kong'oto, Kwisaro, Masurura,. Buswahili and Sirori-simba villages

Project Title	**Improving VIP Latrines through construction and better use in fourteen Villages**
Main objective	Improving toilet facilities through construction and better use to control water born diseases and environmental pollution
Project component	➢ To raise awareness on the importance of sanitation in the community through:- o Meetings o Seminars/training ➢ To mobilize local communities in 14 villages for toilet construction
Project output	➢ Adequate toilet supply ➢ Reduced water and environmental pollution
Project status	➢ Demonstration has been done in other areas thus becomes easy to replicate
Implementing agency	➢ Community, District Council, development partners, Ministry of Health,NGO's/CBO's
Beneficiaries	➢ All villages along the basin
Funding	➢ Estimated cost US $ 0.4m

4.5 Reforestation and Environmental Management

The proposed project aims to create good vegetation cover curb soil erosion, siltation, and increase water quality as well as avoid deforestation. The project intends to increase income generation to 27,080 beneficiaries in the community by promoting commercial forestry.

Project Title	**Afforestation Programme**
Main objective	To raise1.5million seedlings at Mara river basin for afforestation
Project components	➢ Procurement of nurseries materials and equipments ➢ District level will raise 300,000 seedlings ➢ 1.2 million of seedlings will be raised by 9 groups ➢ Planting of trees to the villages along the basin ➢ Follow up and evaluation
Project output	Number of trees planted per villages
Project implementation status	➢ The Musoma District Office, Kirumi, Bukabwa, Ryamisanga, Masurura, Kyankoma, Kwisaro, Buswahili, Wegero, Kong'oto, Kitaramanka, Mirwa and Kamugendi villages have identified and designed the project ➢ Drawing and written proposal are available
Funding	Estimated cost US $ 0.25m

4.6 Promotion of Beekeeping

The project seeks to promotion beekeeping along the Mara River Basin as alternative source of income at household level. This will also be one of the campaigns towards conservation of forests from destruction for making charcoal as an income generation activity.

Beekeeping activities are practised in the basin in small scaleusing traditional methods.

Project title	**Promotion of Beekeeping as Income generation activity**
Main objective	To improve household incomes and promote environmental conservation through beekeeping activities.
Project component	• Training on beekeeping and establishment of beekeepers groups • Purchase of beekeeping equipment • Establishment of bee reserve areas.
Project out put	• More bee keepers trained • Adoption of beekeeping by many villages as income generating activity. • Existence of bee reserves /farms.

	• Production and sale of Honey increases
Project development status	These some demonstrations in other villages undertaken by WWF,BRA,DWD OFFICE
Implementing agencies	Community, District Council, development partners
Cooperating partners	Ministry of natural resources, SIDO, NGOs.
Beneficiaries	Villagers along the Mara River.
Funding	Estimated cost is US $ 0.1m

4.7 Development of Sustainable forest management plans

Currently, it is difficult to manage the existing forestry resources which cut across the villages in the basin. However government policy of 1998 empowers villagers along forest reserves to be involved in development and implementation of Forest Management Plans. Therefore there is need for all village governments to develop Forest management Plans for sustainable utilisation and management of forest resources.

Project title	**Development of Sustainable Forest Management plans.**
Main objective	To maintain sustainable use of the existing forest resources and control soil erosion in the basin.
Project component	• To build capacity of Village Environmental Committees to implement forest activities in sustainable manner • To promote and protection of natural forest resources
Project out put	• Joint Forest Management Plans. • By-laws governing Joint Management Plans.
Implementing agencies	Community, District Council and development partners
Cooperating partners	Ministry of Natural resource (forestry), SUA and NGOs
Beneficiaries	Villages in the Mara River Basin.
Funding	Estimated cost is US $ 0.4m

4.8 Promotion of Energy Saving Technologies

The main source of energy for cooking purposes, bricks burning, fish drying in both rural and urban areas is fuel wood. Therefore there is need for promotion of energy saving devices such as improved stoves.

Project title	**Promotion of energy saving Technology**
Main objective	Development and implementation of energy saving technology and encourage the use of alternative sources of energy
Project component	• To train and assist villagers, CBOs and groups to start commercial production of improved stoves

	• To support institutions with improved stoves
Project out put	• Improved stove in the villages • Alternative source of energy are used in the villages • Reduced exploitation of forest resources
Project development status	Demonstration have been done in other areas therefore it is easy to replicate, implementing agency community, District Council and development partners
Cooperating partners	Ministry of Natural resource (forestry), SUA and NGOs
Beneficiaries	All villages along the basin.
Funding	Estimated cost is US $ 0.2m

4.9 Fishing Farming

Promotion of fishing farming in Mara River Basin would be alternative source of the income at household level. This will also increase nutrition status of the people

Project title	**Fishing farming**
Main objective	To increase production of fish for food as well as income.
Project component	• Survey of existing fishing ponds in the basin. • Construction and stocking of fish ponds
Project out put	• Number of fish ponds constructed • Existence of fish Management Associations. • By-laws governing aquaculture
Implementing agencies	Community, District Council and development partners
Cooperating partners	Ministry of Natural resource (forestry), SUA and NGOs
Beneficiaries	Villages in the Mara River Basin.
Funding	Estimated cost is US $ 0.30m

4.10 Promotion of Sustainable Wetlands Management and Utilization

The project aims at increasing income level of communities living along the wetlands through utilisation of available resources found at the Masurura wetland. The villages covered byo this project include Kirumi, Ryamisanga, Buswahili and Kong'oto with a population of 14,476 people.

Project title	**Sustainable exploitation of Wetland Products**
Main objective	To increase income level to the community by sustainable exploitation of wetland products
Project component	• Awareness creation in the use of wetland resources effectively by:-

	✓ Use of water reeds to make mattresses, matts, hats and furniture ✓ Creating tourist centres
Project out put	• Income from wetland materials increased • Wetland materials exploited sustainably
Implementing agencies	Community, District Council and development partners
Cooperating partners	Ministry of Natural resource (forestry), SUA and NGOs
Beneficiaries	Villages in the Mara river basin.
Funding	Estimated cost is US $ 0.25m

4.11 Spring Protection

Project title	**Spring Protection**
Main objective	To reduce uses of water from the river and to make sustainable supply of water for domestic use from the natural springs.
Project component	➢ Training on water sources protection ➢ Planting of water friendly species ➢ 20 Mansory protection works ➢ Formulation, enactment and enforcement of by-laws
Project out put	Natural springs protected
Project development status	Some demonstrations have been done in other areas in the district. This can be copied to the spring in the basin.
Implementing agencies	Community, District Council, development partners.
Cooperating partners	Ministry of Water and Irrigation, Government Institutions, CBO, NGOs.
Beneficiaries	All villages along the basin.
Funding	Estimated cost is US $ 0.3m

5.0 Serengeti District

The Water authorities in Serengeti District have identified the projects described below to enhance the availability and coverage of water supplies in the district while protecting the environment.

5.1 Machochwe Water supply project:

The proposed project aim is to supply clean and adequate water to Machochwe Boarding secondary school and the neighbouring community of more than 14,470 people.

Project Title	Machochwe water supply project (MWSP)

Main objective	To supply clean and adequate water to Machochwe boarding secondary school and the neighbouring community
Project components	➢ Earth storage Dam construction ➢ Construction of sump well ➢ Construction of pump house ➢ Procurement of pump, Electrical Generator, Panel and motors ➢ Procurement and laying of pipes ➢ Procurement of material and construction of water Tank
Project output	Water supply infrastructure constructed
Project implementation status	➢ The Serengeti District Water Office and the Machochwe community have identified and designed the project ➢ Drawing and written proposal are available
Funding	Estimated cost US $ 0.939m

5.2 Ntimaro Irrigation Scheme

The Ntimaro Irrigation Scheme is in Borenga village, Kisaka Ward in Serengeti District. At Present farmers depend on rainfed agriculture and quite often end up in crop failures due to unreliable rains and poor distribution of rainfall. The obvious strategy to eliminate this problem is through rainwater harvest by contracting dam and develops an Irrigation scheme.

Project title	**Ntimaro proposed Irrigation Scheme**
Main objective	Rain water harvesting by Constructing an earthen dam with a capacity of 150,000m^3 to meet the reliable water requirement for crop growth and domestic use. Hence to increase food product and raise the standard of living for the farmers.
Project component	• Hydraulic and social data collection and reconciliation • Survey and engineering design • Construction of earthen dam to pond about 150,000m^3 of water
Project out put	• Production of project drawing and design reports. • To develop and complete Irrigation systems including Irrigation structures and conveyance net water net works. • To establish effective and sustainable institution to manage the scheme such as Water Users Association (WUA) and Irrigators Organization.
Project development status	Preliminary studies/feasibility studies have been conducted including, beneficiary awareness creation, DALDO office, DWE. This was done in 2004 when identifying potential areas for Irrigation Scheme in the

	District.
Project Implementation status	Following the preparation of District Agriculture Development Plan (DADP), DALDO's Office Identified the site by Scrutinizing the suitability and potentiality for establishing Irrigation Scheme
Implementing agencies	Community, District Council and Donor
Cooperating partners	Ministry of Food Security and Cooperative, Ministry of Water & Irrigation, Zonal Irrigation Office, National Environmental managing Council (NEMC), NGOs.
Beneficiaries	Borenga village with 472 Farm families
Funding	Estimated Cost Rain Water Harvest and Irrigation structures net work is US $ 0.650m

5.3 Mesaga Irrigation Bund

The proposed Mesaga, Irrigation Bund site is located in Mesaga village, Kenyamonta Ward, Ngoreme Division, Serengeti District in Mara Region. The project area lies at about 75km from Musoma – Kiagata Majimoto road. Geographically the Bund site lies at approximately longitude 34^0 19'21 E and latitude 1^0 41' 02" S at an average altitude of about 1250 meters above means sea level. As regards project implementation status to date – all survey and design works have been completed 2004.

Project title	**Mesaga Irrigation Bund**
Main objective	To construct an earthen bund to harvest water for Irrigation and domestic use by installation of Irrigation Structures.
Project component	• Tender advertisement and offer of Tender • Construction of dam and Irrigation structures.
Project out put	Civil works to be Commenced following design and drawing standard
Project development status	All survey and design works have been completed by Irrigation consult & General Engineering services from Moshi – Tanzania.
Project Implementation status	After completion of design work, the District Council Serengeti has included this project in the financial year 2008/2009 – 2013 Programme.
Implementing agencies	Community, District Council and Donor
Cooperating partners	Ministry of Food Security and Cooperative, Ministry of Water & Irrigation, NEM), NGOs.
Beneficiaries	Three villages of Mesaga, Magatini and Iseresere with 4,856 Farm families
Funding	Estimated Cost of the Project US $ 2.2m

5.4 Geteba Irrigation Scheme

The proposed Geteba, Irrigation Scheme site is located in Kenyamonta village, Kenyamonta Ward, Ngoreme Division, Serengeti District in Mara Region. The project area lies at about 65km from Musoma – Kiagata Majimoto road. As regards project implementation status to date – Feasibilty studies completed in 2004.

Project title	**Geteba Irrigation Scheme**
Main objective	To construct an earthen bund to harvest water for Irrigation and domestic use by installation of Irrigation Structures.
Project component	• Tender advertisement and offer of Tender • Construction of dam and Irrigation structures.
Project out put	Civil works to be Commenced following design and drawing standard
Project development status	Feasibility studies of the scheme already completed by Zonal Irrigation Office based in Mwanza.
Project Implementation status	After completion of feasibility studies .The District Council Serengeti has included this project in the Irrigation Plans.
Implementing agencies	Community, District Council and Donor
Cooperating partners	Ministry of Food Security and Cooperative, Ministry of Water & Irrigation, NEMC), NGOs.
Beneficiaries	Kenyamonta village with 456 Farm families
Funding	Estimated Cost is US $ 0.4m

5.5 Drilling Boreholes to improve water supply

The project covers four villages namely Kebanchabancha-Madukani subward, Nyansurura (secondary school), Iseresere and Gantamome. Each village will be supplied with one borehole. The project will provide adequate water to 7,678 people

Project Title	Improving water supply service through Drilling Borehole in Four Villages
Main objective	Provision of adequate and portable water supply services to Kebanchabancha-Madukani subward, Nyansurura (secondary school), Iseresere and Gantamome communities
Project component	➢ Hydro geological survey ➢ Drilling of Borehole ➢ Installation of hand pump ➢ Formation of sanitation clubs ➢ Create awareness on environmental conservation i.e tree planting
Project output	➢ Adequate water supply ➢ Reduced waterborne diseases
Funding	➢ Estimated cost US $ 0.096m

5.6 Construction of 17 Rain Water Harvesting Tanks in Schools and Health Centres:

The Proposed Project will be implemented Health and in and Education institutions which have severe problems of water supply. The targeted areas include Iramba Health Centre, Kisaka and Nyansurura Dispensaries. Primary schools include Iramba, Kitunguruma(2), Kisaka, Kenyamonta, Marasomoche, Iseresere, Hekwe and Borenga. Secondary schools are Ngoreme(2), Kitunguruma(2) and Nyansurura.

All water tanks are proposed to have the capacity of 90m^3 each. From this project 16,972 people will be supplied with water.

Project Title	**Construction of 17 RWHT in Health and Education Institutions**
Main objectives	To improve Health and Education services by providing safe and clean water To ensure availability of safe drinking water both in health and education institution
Project component	➢ Construction of concrete blocks tank 90m^3 each ➢ Fixing gutters for collecting rain water ➢ Formation of sanitation clubs ➢ Create awareness on environmental conservation i.e tree planting
Project output	➢ 17 tanks 90m^3 each are constructed
Funding	Estimated cost US $ 0.391m

5.7 Construction of Dam at Hekwe-Magatini village:

Magatini village is in Kenyamonta ward, Ngoreme Division. It is proposed to construct a dam at Hekwe sub village which faces a serious water scarcity for providing drinking water to 1800 people and 2500 animals.

Project Title	Hekwe Dam Construction
Main Objective	Increase water supply coverage in Serengeti District
Project components	➢ Topographical survey ➢ Design of the Dam ➢ Environmental impact Assessment ➢ Preparation of BOQ ➢ Construction of the embankment ➢ Trench excavation and re-filling ➢ Construction of DP's and cattle trough ➢ Formation of water user entity ➢ Create awareness on environmental conservation
Project output	➢ Project design report ➢ Environmental impact assessment report ➢ Water supply infrastructure developed ➢ Establishment of effective water user entity to

	ensure sustainable management of the constructed water facility
Project implementation status	Village community and Livestock department has identified the site
Funding	Estimated cost US$ 0.5m

5.8 Construction of 3 Charcodam at Merenga, Nyansurumuti and Kebanchabancha-Sogoti villages:

The proposed project aims to supply water to 6,233 people and 9,499 animals.

Project Title	Charcoaldam Construction in 3 villages of Merenga, Nyansurumunti and Kebanchabancha
Main objective	To provide adequate water supply for both domestic and animal use to the three village communities
Project component	➢ Topographical survey ➢ Design of the Dam ➢ Environmental impact Assessment ➢ Preparation of BOQ ➢ Construction of the embankment ➢ Trench excavation and re-filling ➢ Construction of DP's and cattle trough ➢ Formation of water user entity ➢ Create awareness on environment conservation
Project Development status	Serengeti District water office and Nyansurumuti village community identified the project
Funding	Estimated cost US$ 0.9m

5.9 Construction of Majimoto Gravity Scheme:

Majimoto village is in Busawe ward, Ngoreme Division. It is proposed to construct a water supply gravity scheme which will provide safe and clean water to 3200 people of Majimoto village.

Project Title	Majimoto gravity scheme
Main objective	To ensure availability of safe drinking water for Majimoto villagers
Project component	➢ Intake construction ➢ Construction of a concrete blocks tank 45m^3 ➢ Trench excavation and pipe laying ➢ Construction of 5 domestic points ➢ Formation of school sanitation club ➢ Create awareness an environmental conservation e.g. tree planting
Project output	➢ The gravity scheme constructed
Funding	Estimated cost US $ 0.3m

5.10 Tree Planting in the River Basin

Project title	Tree planting/Afforestation villages in the river basin.
Main objective	To rehabilitate the most affected areas due to excessive tree cutting for different uses through planting trees. This will lead to vegetation recovery and availability of trees for community uses in the future
Project component	• Awareness creation on tree planting. • Identification of areas affected by deforestation and tree species suitable for forestation. • Establishment of tree nurseries in village/schools. • Planting of trees in identified areas. • Establish management system of the reforested areas.
Project out put	• Availability of a document with references of areas. • Vegetation recovery and erosion control. • Availability of trees for different uses. • Enacted and Enforced conservation by-laws
Implementing agencies	Community, District Council and Donor
Cooperating partners	Ministry of Natural resource (forestry), SUA and NGOs
Beneficiaries	Villages in the Mara river basin.
Funding	The Estimated cost is US $ 0.80m.

5.11 Establishment of Joint Forest Management Plan

Currently, it is difficult to manage the existing forestry resources which cut across the villages in the basin.
Therefore there is a need to all villages especially those are bordered by the river to agree of how to manage this resources in sustainable manner.

Project title	Establishment of Joint Forest Management plans.
Main objective	To maintain sustainable use of the existing forest resources and control soil erosion in the basin.
Project component	• Survey of existing forest resources in the basin. • Demarcation of the area. • Establishment of Joint Community Management Plans.
Project out put	• Survey report (document). • Existence of Joint Forest Management Plans. • By-laws governing Joint Management Plans.
Implementing agencies	Community, District Council and Donor
Cooperating partners	Ministry of Natural resource (forestry), SUA and

	NGOs
Beneficiaries	Villages in the Mara river basin.
Funding	Estimated cost is US $ 0.025m

5.12 Promotion of Beekeeping as Income generation activities

Promotion of beekeeping along the Mara River Basin would be alternative source of the income at household level. This will also be one of the campaigns towards conservation of forestry from tree cutting for making charcoal in order to earn income.

Residents in the basin are not used to these types of activities, introduction and facilitation of these activities is needed.

Project title	Promotion of Income generation activities
Main objectiv	To promote environmental conservation through beekeeping activities
Project component	• Training on beekeeping and establishment of beekeepers roups through demonstration • Purchase of beekeeping equipment • Establishment of bee reserve areas.
Project out put	• Training beekeepers practising beekeeping. • Adoption of beekeeping by many villages as income generating activity. • Existence of bee reserves /farms.
Project development status	These some demonstrations in other villages undertaken under DDP.
Implementing agencies	Community, District Council, Donor.
Cooperating partners	Ministry of natural resources, SIDO, NGOs.
Beneficiaries	Villagers along the Mara River.
Funding	Estimated cost is US $ 0.25m

5.13 Development and Implementation of Energy Saving Technology

Fuel wood is mostly used both in institutions and at household level as the main source of energy for cooking, boiling water and for warming.

Introduction of energy saving technology will minimize the use of woods and charcoal for domestic use.

Project title	Development and implementation of energy saving technology
Main objective	To reduce the exploitation of forestry resources in villages.
Project component	• Training villagers. • Construction of demonstration saving stoves. • Supporting institution with improved stoves
Project out put	• Existence of stores in villages

	• Reduced exploitation of forestry resources.
Project development status	Demonstrations have been done in other areas; therefore it is easy to replicate.
Implementing agencies	Community, District Council, Donor.
Cooperating partners	Ministry of natural resources, SUA, NGOs.
Beneficiaries	All villages along the basin.
Funding	Estimated cost is US $ 0.01m

5.14 Flood Management along Mara River

Changing of the river course in some places has the great negative impact to the immediate communities due to flooding. The most affected communities include Borenga, Nyansurumunti and Hekwe

Therefore in order to protect human properties, there is a need to control the flooding being caused by the change of river course.

Project title	Managing the Change of river course (flooding).
Main objective	To establish a control mechanism in the basin to avoid flooding and change of a river course.
Project component	• Scientific survey and research on the main causes by a compliant. • Consultancy for establishment of best options for management of flooding and change of a river course. • Implementation of best options/practices.
Project out put	• Consultancy reports • Implementation of options.
Implementing agencies	Community, D/Council, Donor.
Cooperating partners	Ministry of natural resources, SUA, NGOs.
Beneficiaries	Affected community by change of the river course.
Funding	Estimated cost is US $ 0.3m

5.15 Spring Protection

Project title	**Spring protection in the basin.**
Main objectiveu8	To reduce uses of water from the river and to make sustainable supply of water for domestic use from the natural springs.
Project component	➢ Training on water sources protection ➢ Tree planting , water friendly species ➢ Enactment and enforcement of by-laws
Project out put	Protected natural springs
Project development status	Some demonstrations have been done in other areas in the district. This can be copied to the spring in the basin.
Implementing agencies	Community, District Council, Donor.

Cooperating partners	Ministry of Water and Irrigation, Government Institutions, CBO, NGOs.
Beneficiaries	All villages along the basin.
Funding	Estimated cost is US $ 0.05m

6.0 Tarime Rural District

Tarime district Council has identified the following projects to enhance the availability and coverage of water supplies and environmental protection in the district.

6.1 Drilling of Boreholes to Improve Water Supply

The proposed project aims to cover 9 villages which border Mara River. It is proposed to drill 30 new boreholes to supply clean water to the community in villages. The beneficiaries shall be villagers from Kembwi, Gibaso, Mrito, Matongo, Nyamirambaro, Sombanyasoko, Nkerege, Genkuru and Wegita. The project will serve 32,728 people.

Project Title	**Drilling of Boreholes**
Main Objectives	Increase water supply coverage in Tarime district through provision of clean, safe, affordable and sustainable water supply services and contribute towards MKUKUTA and MDGs targets.
Project Components	❖ Identification of water sources through hydro-geological survey; ❖ Design of water supply system; ❖ Drilling and Installation of hand pumps; and ❖ Strengthening of WATSANs committee for sustainability of the built water supply projects.
Project Outputs	❖ Adequate water supply; ❖ Reduction of water related diseases; and ❖ Raise household incomes and nutrition status through micro irrigation etc.
Project Development Status	The villagers have identified and selected the projects in the Opportunity and Obstacle to Development exercises and the Council incorporated in its plans for 2008 – 2011.
Project Implementation Status	The Council has included the project in District Water and Sanitation Plans 2008 -2011.
Implementing Agencies	Community and Tarime District Council
Cooperating Partners	MoWI, Development Partners and NGOs.
Funding	Estimated cost US $ 0.90m

6.2 Expansion of Bisarwi Water Supply Project

Bisarwi project has been funded by Mara River Basin Management Project. The project components which have used US $ 200,000 include construction of earth dam, construction of one domestic water point, one cattle trough and one goats and sheep trough. The village has a total population of 2692 of which only 635 people

residing in nearby sub villages shall be served. Expansion of the project shall increase coverage in the village. It is proposed to increase distribution lines and 8 domestic water points.

Project Title	**Bisarwi Water Supply**
Main Objectives	Increase water supply coverage in Tarime district through provision of clean, safe, affordable and sustainable water supply services and contribute towards MKUKUTA and MDGs targets.
Project Components	❖ Topographical survey and Design of distribution lines; Construction of storage tank 50m^3 and 8 drawing water points; ❖ Pipe laying and Strengthening of WATSANs committee for sustainability of the built water supply projects.
Project Outputs	❖ Adequate water supply; ❖ Reduction of water related diseases; and ❖ Raise household's income and nutrition status through involvement of water in gardening, irrigation etc.
Project Development Status	Feasibility study has been done and construction of the project is about to take off soon for utilizing US $ 200,000 allocated.
Project Implementation Status	Procurement processes are underway.
Implementing Agencies	Community and Tarime District Council
Cooperating Partners	MoWI, Development Partners and NGOs.
Funding	Estimated cost US $ 0.109m

6.3 Development of Proposed Nyamirambaro and Genkuru Irrigation Schemes

Dams constitute part of water supply sources for both human and livestock in Tarime District. It also serves as storage water reservoir for agriculture activities. Villagers and livestock in Nyamirambaro and Genkuru depend on unreliable and unsafe seasonal streams and ponds for their use. Furthermore, farmers depend on unreliable rains for their crops production which tend to decrease their yield. It is expected that, the scheme will serve 8,130 people, 2,374 livestock and 475 hectares.

Project Title	**Nyamirambaro and Genkuru Irrigation Schemes**
Main Objectives	Rain water harvesting by constructing 2 earth dams with a total capacity of 1,825,000m^3 for provision of clean, safe, affordable and sustainable water supply services to people and livestock hence contribute towards MKUKUTA and MDGs targets.
Project Components	❖ Identification of dam sites, hydraulic data collection and reconciliation of existing data; ❖ Detailed Survey and Design of dams; ❖ Construction of earthen dams to store

	1,825,000m^3 and other infrastructures for water supply and irrigation; and ❖ Establish Institutional management committee for sustainability of the built schemes.
Project Outputs	❖ Adequate water supply; ❖ Increase livestock production with better quality; and Raise household's income and nutrition status through involvement of water in gardening, irrigation, selling of quality livestock etc.
Project Development Status	Preliminary studies and beneficiaries' awareness sensitization have been conducted.
Project Implementation Status	Beneficiaries with assistance from the Council officials have identified the sites.
Implementing Agencies	Community and Tarime District Council
Cooperating Partners	MoWI, Development Partners and NGOs.
Funding	Estimated cost US $ 2.895m

6.4 Construction of Rain Water Harvesting Tanks

The proposed project aims to cater public institutions with critical shortage of water for their domestic use. The targeted areas in Health facilities and education institutions located in villages which border the Mara River. Each village shall have 2 rain water harvesting tanks with a capacity of 50m^3 for either a primary or secondary school and dispensary. Targeted villages are Kembwi, Gibaso, Mrito, Matongo, Nyamirambaro, Sombanyasoko, Nkerege, Genkuru and Wegita. It is expected the project to serve 14,963 people.

Project Title	**Construction of 18 Rain Water Harvesting Tanks**
Main Objectives	Improve health and education services through provision of clean and affordable water to public institutions. In so doing, villagers may copy the technology for use.
Project Components	❖ Construction of 18 concrete tanks with capacity 50m^3 each; ❖ Installation of rain gutters for collection of rain water; ❖ Construction of earthen dams to store 250,000m^3 and Formation/ Strengthening of Sanitation clubs.
Project Outputs	❖ Adequate water supply; ❖ Reduction of water related diseases; and ❖ 18 RWH constructed.
Project Development Status	Preliminary studies have been conducted.
Implementing Agencies	Community and Tarime District Council
Cooperating Partners	MoWI, Development Partners and NGOs.
Funding	Estimated cost US $ 0.486m

6.5 Afforestation in villages within the River Basin

Project Title	**Afforestation in villages within the River Basin**
Main Objectives	Protection and conserving of the most affected areas due to human activities conducted through planting of trees with water retention characteristics and establishing trees plantation for domestic use.
Project Components	❖ Awareness creation on tree planting; ❖ Identification of deforestation areas and tree species with water retention characteristics; ❖ Establish tree nurseries in villages and schools; Establish suitable management system; and Formation Environmental conserving clubs.
Project Outputs	❖ Availability of trees for different uses; ❖ Induce the knowledge to local community on the importance of forests as natural resources in their daily lives; ❖ Enact Village By-Laws for environment conservation; and Control of soil erosion as well as deforestation.
Implementing Agencies	Community and Tarime District Council
Cooperating Partners	Ministry of Natural Resources and Tourism, Development Partners, NGOs, and CBOs.
Beneficiaries	Villages in Mara River Basin
Funding	Estimated cost US $ 0.10m

6.6 Participatory Forest Management Project

The need for Participatory Forest Management is very crucial in the river basin so that villages are accountable to the natural resources within their vicinity. Therefore, the villagers need to have capacity build on management and utilisation of the forests in sustainable manner.

Project Title	**Promotion of Participatory Forest Management**
Main Objectives	Maintains sustainable use of forests natural resources in the river basin.
Project Components	❖ Survey of existing forests natural resources in the basin; Demarcating the areas; establish Participatory Forest Management Plans; and Formation Environmental conserving clubs.
Project Outputs	❖ Existence of Participatory Forest Management Plans; induce the knowledge to local community on the importance of forests as natural resources in their daily lives; Enact Village By-Laws for environment conservation.
Implementing Agencies	Community and Tarime District Council

Cooperating Partners	Ministry of Natural Resources and Tourism, Development Partners, NGOs, and CBOs.
Beneficiaries	Villages in Mara River Basin
Funding	Estimated cost US $ 0.10m

6.7 Promotion of Fish Farming

Project Title	**Promotion Fish farming**
Main Objectives	Promote fish farming through establishment of fish ponds in the villages so as to contribute to socio-economic activities hence reduce traffic demand on Lake Victoria.
Project Components	❖ Survey of area o construct ponds; ❖ Construction of ponds and introduce fingerlings; and Train community on fish culture management.
Project Outputs	❖ Constructed fish ponds; and ❖ Number of groups trained
Implementing Agencies	Community and Tarime District Council
Cooperating Partners	Ministry of Livestock and Fishing Development, Development Partners, NGOs, and CBOs.
Beneficiaries	Villages in Mara River Basin
Funding	Estimated cost US $ 0.10m

6.8 Sustainable Wetland Management

Project Title	**Promotion of Sustainable Wetland Management**
Main Objectives	Promotion and Utilization of Sustainable Wetland Management on the use of natural resources from the wetlands for income generation activities.
Project Components	❖ Train to the community living along the wetlands; Train and educate the community on the various technologies to utilize the available natural resources for their income generating activities.
Project Outputs	❖ Income generating formed groups; and ❖ Number of groups trained
Implementing Agencies	Community and Tarime District Council
Cooperating Partners	Ministry of Natural Resources and Tourisms, Development Partners, NGOs, and CBOs.
Beneficiaries	Villages in Mara River Basin
Funding	Estimated cost US $ 0.95m

6.9 Promotion Beekeeping in Mara River Basin Villages

The afforestation activities to be executed in villages within Mara River Basin will go together with promotion of bee keeping as alternative income generation activities. Such activities with other proposed ones like utilization of natural resources available in wetlands will reduce incidence on the destruction of forests within Mara River Basin for making wood charcoal.

Project Title	**Promotion Bee Keeping**
Main Objectives	Promote environmental conservation through bee keeping activities.
Project Components	❖ Trainings on bee keeping through demonstration and establishing bee keepers groups; Equipping bee keeper groups with working gears; and ❖ Establishment of bee reserves areas
Project Outputs	❖ Existence of bee reserve areas; and ❖ Number of bee keepers groups trained and formed.
Implementing Agencies	Community and Tarime District Council
Cooperating Partners	Ministry of Natural Resources and Tourism, Development Partners, NGOs, and CBOs.
Beneficiaries	Villages in Mara River Basin
Funding	Estimated cost US $ 0.05m

7.0 RORYA DISTRICT

Rorya is one of the new districts curved out from Tarime district. The district council has discussed and approved the following projects to enhance water supply and improve the standard of living of the people.

7.1 Rehabilitation of boreholes and Storage and distribution

Project name	Marasibora/ Nyachabakenye water supply
Main objective	To ensure availability of clean, safe affordable drinking water
Project components	• Borehole cleaning • Purchasing and installation of mono pump with capacity of B 820 • Purchasing and installation of diesel engine listerTS/TR3 • Rehabilitation of pump house • Rehabilitation of rising main • Rehabilitation of two storage tank with capacity of 135m each • Rehabilitation of distribution system • Rehabilitation of water domestic points • Formation of water user groups • Environmental sanitation
Project output	Pumped water supply scheme rehabilitated
Funding	**Estimated costs US$1.0m**

7.2 Drilling of four boreholes

and fitted with hand pump at Kuruya village. The population to be served will be 4682 people

Project title	Kuruya water supply(Hand Pumps)
Main objective	To ensure availability of clean, safe and affordable drinking
Project components	• Geophysical surveying(underground water investigation) • Report writing • Drilling of boreholes • Development of boreholes • Purchasing and install plain and screen casing • Pump testing • Water quality determination(physical and chemical) • Installation of complete hand pumps
Project output	Four deep boreholes will be drilled and fitted with hand pumps
Funding	**Estimated costs US$ 0.2m**

B. Establishment of a Water Resources Monitoring Network in the Mara River Basin

The availability of reliable data and information on all aspects of water resources is fundamental to proper decision-making in the utilization of the resource. Decisions must be based on reliable, relevant and up-to-date information.

In Kenya, accurate data on surface water and groundwater resources has been inadequate in both quantity and quality due to limited financial and human resources, thereby restricting the pace at which development and investment decisions can be made. The same situation pertains to the neighbouring country of Tanzania.

The hydrometric network and data recording and reporting system for monitoring and assessing the river flows and the climatological variations has deteriorated and can no longer support adequate assessment of the water resources base of the country. The same situation pertains to water quality monitoring.

To plan, manage and develop prudent uses of the water resources, effective monitoring of the availability and the quality of the resource is necessary. This is of particular importance in relation to transboundary/shared water resources.

Hydrological Monitoring implies that water quantity and water quality data is being collected continuously in order to establish water balances, to determine

long-term trends and to initiate corrective measures in case of over-exploitation or the deterioration of the resource quality.
Effective monitoring of water resources includes several components, namely:

Procedures: Data collection is only effective and comparative, if well defined measurement and evaluation procedures are followed throughout the monitoring countries.

Human Resources: With advanced state-of- the-art digital equipment, the staff of the monitoring institutions remains the most critical elements of any hydrological monitoring system. Human Resources include the all important training of the staff and the development of an incentive based HRD system.

Analysis and Dissemination: Raw data, which is collected and stored by the sensors, or is manually recorded by gauge readers, need to be analyzed in order to draw conclusions which would define any river basin management and development requirements. The data is analyzed into information which through appropriate dissemination channels become information for all stakeholders.

Institutions: In order to disseminate, share and make use of the information, proper institutional arrangements and definition of roles and responsibilities need to be developed.

The Mara River Basin lacks an effective monitoring network. The purpose of the project is to establish an appropriate and sustainable water resources monitoring network in the catchment to monitor the surface water and groundwater quantities and quality. The project will also address the climatological monitoring components in the basin. In the development of this proposal, it is recognized that economic as well as technical considerations are involved in the design of the network. The World Meteorological Organization (WMO) has defined, based on international experiences, minimum densities for different hydrological networks. For example, for mountainous regions, it is recommended to establish one rainfall station for an area ranging between 100-250 km^2 and one river gauging station for an area ranging between 300-1,000 km^2.
A summary of the water monitoring project is shown in the table below.

PROJECT TITLE	**Establishment of a Water Resources Monitoring Network in the Mara River Basin**
Main Objectives	Provision of adequate water resources data for

	management and development of the Mara River Basin
Project Components	• Data collection on status of existing water resources monitoring network • Design of rehabilitation requirements for water resources monitoring • Design of additional network • Procurement and implementation of the rehabilitation and establishment of new network activities for water resources monitoring • Capacity building of the institutions to manage the developed water resources monitoring network. • Development of water resources database • Development of modeling facilities for the Mara River basin
Project Outputs	• Status of existing water resources monitoring facilities and additional interventions established. • Project Design Reports produced. • Water resources monitoring infrastructure rehabilitated and new sites developed. • Modeling facilities for the Mara River Basin • Capacities build of personnel operating the monitoring network.
Project Development Status	The project is aimed at establishing an operational water resources monitoring network in the Mara River basin
Project Implementation Status	Minor rehabilitation of river gauging stations has been ongoing particularly in the installation of staff gauges
Implementing Agencies	Water Resources Management Authority -Lake Victoria South Regional Office –Kenya and the Ministry of Water and Irrigation in Tanzania
Cooperating Partners	Ministry of Water and Irrigation, Provincial Administration, Ministry of Local Government, National Environmental Management Authority, NELSAP
Funding	Estimated Cost: US$ 5.0 million

ANNEX B – DRAFT TERMS OF REFERENCE FOR THE PRE-FEASIBILITY STUDIES

1. BACKGROUND

The countries of the Nile Equatorial Lakes Subsidiary Action Program (NELSAP)—Burundi, D.R. Congo, Kenya, Rwanda, Tanzania, and Uganda—have identified a number of projects to eradicate poverty and promote economic growth and reversal of environmental degradation in the NELSAP region. The projects are grouped into (1) Natural Resources Management and (2) Environmental and Hydropower Development and Trade, and target investments in agricultural development, fisheries development, water resources management, water hyacinth control, hydropower development, and transmission interconnection. The activities of this program are coordinated and facilitated by a NELSAP Coordination Unit (NELSAP-CU) based in Kigali, Rwanda, in collaboration with the Nile Basin Initiative (NBI) Secretariat in Entebbe, Uganda.

The Mara River Basin Project is one of three transboundary integrated water resources management and development (TIWRMD) projects being implemented under the NELSAP/NBI framework. The others include the Kagera and the Sio-Malaba-Malakisi Transboundary Integrated Water Resources Management and Development Projects. Implementation of this project was undertaken during the period 2007/2008 resulting in the following outputs:

(a) Mara Cooperative Framework, which is a comprehensive policy, legal, and institutional framework for the sustainable management and development of the Mara basin water resources;
(b) Mara River Basin Monograph, which consolidates existing water resources related information in the Mara basin into a comprehensive information and knowledge base to guide future planning and development initiatives;
(c) Mara DSS, which is a GIS-based information and decision support tool to serve as a depository of all relevant technical data and enable Mara stakeholders to assess the implications and tradeoffs of various basin development options;
(d) Mara Investment Strategy, which contains specific intervention measures aimed at addressing the critical water resources issues and challenges in the basin and promoting environmentally sustainable socio-economic development.

2. The Mara Investment Strategy

The purpose of the investment strategy is to provide guidance and the overall framework within which stakeholders and local communities will be empowered to identify and agree upon development priorities and participate in the formulation and implementation of the subsequent projects. The investment strategy is not meant to replace the existing district and national development plans and strategies, but rather it serves to highlight critical issues and intervention measures directly relevant to the sustainable management and development of the Mara transboundary water resources.

The investment strategy emphasizes the development of transboundary projects that will enhance collaboration between local communities across the border and strengthen inter-state cooperation in the joint management and development of the shared Mara water resources. A number of specific local projects will be developed to motivate local communities to embrace integrated water resources management and to show tangible benefits of transboundary cooperation.
The proposed Investment Strategy consists of six strategic investment programs designed to address the most critical water resources related socio-economic issues and challenges in the Mara basin to ensure sustainable management and development of the catchment's water resources. Proposed transboundary investment programs include the following:

(i) Mara River Basin Integrated Water Resources Management Program;
(ii) Mara River Basin Water Security Program;
(iii) Mara River Basin Environmental Management Program;
(iv) Mara River Basin Wildlife Management and Tourism Development Program;
(v) Mara River Basin Food Security Program;
(vi) Mara River Basin Rural Infrastructure Development Program.

The proposed programs are multi-sectoral in nature and are aimed at addressing diverse critical issues that have a bearing on the sustainable management and use of the shared Mara river basin water resources. In developing the programs, due recognition was made of the fact that there are already other planned and ongoing local, national and regional programs that are trying to address some of the issues identified here. Therefore, the approach taken in formulating these programs is one that builds on the ongoing programs and seeks to create synergies to add value to the process and minimize duplication and wastage of resources. The main purpose of the proposed programs is to add a transboundary dimension to the existing and planned local and national programs by addressing specific transboundary

issues that are crucial for the basin and that are not addressed under the existing programs.

The programs are based on a comprehensive analysis of the critical water resources related issues in the basin and were arrived at through a participatory stakeholder consultative process. The programs are divided into two broad categories, i.e. Regional Transboundary Programs and National Programs. These are briefly discussed below.

(A) REGIONAL TRANSBOUNDARY PROGRAMS

(1) Mara River Basin Integrated Water Resources Management Program

One of the key challenges to sustainable integrated water resources management in the Mara basin is the lack of a comprehensive cooperative framework for the joint planning and implementation of water resources related activities in the basin by communities in the two countries. Activities in the basin are often planned with a local or national focus without looking at the basin as a whole. It is therefore important for the two countries to adopt an IWRM approach to ensure sustainable management and development of the shared Mara basin water resources. This will ensure rational and objective allocation of the basin's scarce water resources among the various conflicting and competing uses without compromising the quality of the environment.

In order to achieve this goal, this program will focus on the implementation of the proposed Mara river basin cooperative framework, capacity building plan, stakeholder participation plan and gender mainstreaming plan. This will ensure creation of the necessary enabling environment for implementation of the integrated water resources management approach in the basin. In addition, the program will also facilitate harmonization of policies, laws and institutional frameworks governing the relevant water related sectors in the two countries as recommended in the same report.

The program will also support the development of appropriate management instruments and technical tools required to support decision makers in the planning, management and allocation of water resources to competing water uses in the basin.

(2) Mara River Basin Water Security Program

Water scarcity is one of the major issues facing the Mara river basin. The situation is expected to get worse as the population increases and as demand by the different sectors out-matches the existing supply. In order to comprehensively address the catchment's water scarcity problem, this program will comprise of two major components i.e.:

(a) ***Conduct basin-wide water resources assessment studies*** – The first phase of the program will be dedicated to carrying out a comprehensive assessment of the basin's existing spatial and temporal surface- and groundwater resources availability in terms of quantity and quality. The outcomes of this assessment will give decision-makers a clear picture of how much of the "pie" there is to be shared. As part of these assessments, water demand and use studies will also be carried out to establish the existing and projected water demand for the different sectors in the basin. In addition, a comprehensive climate change study will be conducted to assess the vulnerability of basin's water resources to potential climate change impacts. The outcome of this assessment will also help in developing a Mara basin climate change adaptation and mitigation strategy as part of the basin's water security program. A basin-wide land use change study will also be carried out to establish the nature and extent of land use changes that have taken place in the basin and their impacts on the hydrology of the basin.

(b) ***Implement measures to improve water security in the basin*** – Outcomes from the water resources assessment studies will form the basis for design and implementation of comprehensive structural and non-structural measures aimed at improving water security in the basin through enhancement of water storage and water use efficiency. The measures will include, among others, the following: Construction of multi-purpose water storage facilities; conjunctive use of surface and groundwater; promote efficient water use and demand management practices; assessment of the potential for inter-basin and virtual water transfers.

(3) Mara River Basin Environment Management Program

The Mara river basin is experiencing extensive degradation resulting from excessive nutrient and agrochemical pollution from agricultural farms; untreated effluent discharges from industry and sewage outfalls; pollution from poorly disposed human excreta and other solid wastes; soil erosion due to unsustainable land use management and farming practices; encroachment of fragile ecosystems (e.g. wetlands, forests, etc.) in search of new farming land; siltation of water courses and water storage facilities due to increased sediment loads; etc.

A comprehensive basin-wide environment management program is being proposed to address the above issues and reverse the current trend in basin degradation. The proposed program will comprise several measures which if implemented will collectively address the basin-wide degradation issues and contribute towards the sustainable management of the Mara river basin water resources. The program will include the following measures:

(a) ***Control of point and non-point source pollution*** – This will mainly focus on adoption of modern farming practices to reduce agrochemical pollution; increase household sanitation coverage throughout the basin through construction of toilets and sewage treatment facilities in rural and urban areas respectively; construction of solid waste collection and disposal facilities in urban areas; and training of hotel owners and gold mine operators in efficient and cost-effective effluent treatment processes.

(b) ***Promote sustainable forest management*** – The objective of this program is to ensure sustainable management and conservation of the Mara forest resources to sustain their unique biodiversity and the significant benefits accruing to the basin riparians**.**

The program will focus on reversing the current trend in basin degradation through implementation of a basin-wide tree planting, agro-forestry, soil and water conservation, and river bank protection initiative. It will also advocate for a review of the current forest policies and management practices in the basin with a view of promoting community based forestry management practices. The program will also support a basin-wide forest survey, classification, and mapping program to establish the extent and severity of forest encroachment and degradation. In addition, the program will undertake sensitisation and training of all major stakeholder groups and local communities on sustainable management and exploitation of forest resources.

Local communities will also be encouraged to participate in the management of forests within their vicinities through development of comprehensive community based forest management plans.

(c) ***Promote Sustainable Wetlands Management*** **-** A comprehensive basin-wide wetlands inventory will be undertaken to establish the spatial distribution of wetlands and extent of wetland degradation in the basin. Communities will also be facilitated to develop community based wetlands management plans that will be the basis for community use and management of local wetland resources.

(4) Mara River Basin Wildlife Management and Tourism Development Program

The Mara ecosystem is a world famous wildlife sanctuary and contains the most diverse combination of grazing animals in the world. Sustainable wildlife management and tourism development are central to the economic development of the Mara river basin. This program is, therefore, intended to address these two aspects as part of the broad socio-economic development plan for the basin.

(a) ***Promote sustainable wildlife management*** - The objective of this component is to promote sustainable management and conservation of the Mara basin wildlife resources, a unique asset of the basin. This will focus on enhancing active local community participation in wildlife management to reduce encroachment on wildlife habitat for farming activities and thus minimize human-wildlife conflicts. The component will also support a basin-wide wildlife disease prevention and control initiative to foster timely information sharing on wildlife disease outbreaks between the two countries and facilitate joint research and wildlife disease surveillance and control programs. In addition, a study will be commissioned to better understand the relationship between temporal and spatial wildlife dynamics and the hydrology of the Mara ecosystem.

(b) ***Promote sustainable tourism development*** - The objective of this program is to enhance the tourism sector in the Mara basin as a major revenue source through diversification of tourism activities, improving on tourism related infrastructure, and strengthening of tourism management and revenue sharing mechanisms. The program will focus on improving the existing tourism infrastructure, development of untapped tourism resources such as ecotourism, historical sites, cultural shrines, caves, etc. This will be complemented with the development of a comprehensive joint marketing strategy for the tourism opportunities in the basin as a whole. The program will also address the inconsistencies in the existing tourism management policies, laws, and institutional frameworks in the Masai-Mara Game Reserve and the Serengeti National Park to ensure coordinated planning and management of tourism activities. Improvements in the tourism management mechanisms will also address the existing inequitable sharing of tourism benefits among the major stakeholders.

(5) Mara River Basin Food Security Program

Most of the households in the Mara basin depend on subsistence agriculture characterized by very low productivity and high labour intensity. This level of activity is inadequate to generate sufficient output to meet the basic food needs of the households. Poor nutrition is a very common occurrence in many households in the basin and is one of the most important health and welfare problems facing the basin.

To address the current food shortages in the basin, the following measures are proposed to be implemented under the food security program:

(a) ***Enhanced Agricultural Production –*** The objective of this component is to increase agricultural production and ensure food security in the Mara basin. The program will focus on promoting the use of improved agricultural practices such as the use of high yielding, disease resistant, and drought resistant crop varieties; adoption of simple on-farm water harvesting

techniques for supplementary irrigation; and proper use of fertilizers and other farm inputs to increase crop yield. The program will also include promotion of irrigated agriculture through provision of technical and financial support for irrigation infrastructure development, acquisition of equipment, and training in efficient irrigation water use practices. It will also include strengthening of extension services to farmers, and provision of water for livestock production.

(b) ***Enhanced Livestock Production*** - The objective of this component is to increase livestock production and ensure food security in the Mara basin. The program will mainly focus on: promotion and adoption of good livestock practices such as zero grazing, disease control, and keeping of disease resistant breeds; establishment of rural based diary and beef processing industries, and skins, hides, and leather tanning industries to add value to livestock products; investment in livestock water supply infrastructure such as Valley Dams and Tanks which will also help to control nomadism and the spread of cattle diseases; establishment of a basin-wide livestock disease control program for surveillance, prevention and control of livestock diseases in the basin.

(c) ***Enhanced Fisheries Production*** **-** The objective of this component is to increase fish production and consumption in the Mara basin and contribute to the basin's food security and diversified revenue base. The program will promote sustainable fisheries management through sensitization and training of BMUs and local communities in sustainable fisheries management practices. The program will also support aquaculture development as an alternative fisheries source. The program portfolio will also include, among others, the establishment of ice production facilities to supply ice to fishermen to preserve their fish catches and minimize losses, and the establishment of a fish gear and mesh manufacturing plant in the basin to curb the rampant use of illegal mesh sizes and gear types.

(B) NATIONAL PROGRAMS

Investment programs that are part of the investment strategy but that will be implemented under the existing national and local government development programs in the two countries include the following:

(6) Mara River Basin Rural Infrastructure Development Program

The Mara river basin is a predominantly rural basin characterized by poor rural infrastructure which is a major constraint to the socio-economic development of the basin.

In order to alleviate poverty and improve the living conditions of the riparians of the Mara basin, the following measures are proposed to be implemented under the infrastructure development program:

(a) ***Investment in Water Supply and Sanitation infrastructure***

The objective of this component is to increase access to safe and reliable water supply and sanitation services for all Mara basin riparians through implementation of water supply and sanitation projects in different parts of the basin. This will address both rural and urban water supply and sanitation needs through construction of appropriate water supply and sanitation facilities and supporting the establishment of effective operation and maintenance mechanisms for the installed facilities.

(b) ***Investment in Rural Electrification***

The objective of this component is to provide electricity access to more households and rural growth centers in the basin to reduce pressure on the forest resources and support small-scale industries and agro-processing activities. The component will support investments in the development of mini hydropower schemes in the basin and will also support investments in alternative sources of energy. This component will also promote investments in efficient energy use technologies to reduce on power consumption in households.

(c) ***Investment in Industrial development***

Significant potential still exists for industrial growth in the basin. Therefore, as part of the overall strategy for the economic development of the basin, this component will support the development of rural based agro-processing industries in the basin to enhance value addition to the agricultural products and create jobs for the basin riparians. Although most of this industrialization will be private sector driven, there will be need for the two governments to put in place the necessary enabling environment and incentives to attract private sector investment in the basin.

(d) ***Investment in Transportation infrastructure***

The Mara basin has a sparse road network comprising mostly of gravel roads, which require frequent maintenance. Most of these roads are impassable during the rainy seasons, causing serious disruption of movement of people and goods and imposing huge costs on transport service providers.

In order to facilitate trade and the easy movement of people and goods in the basin, there is need for significant investment in road infrastructure.

Specifically, there is urgent need for investment in the rural roads to help the local communities to access markets for their agricultural produce. This will increase household incomes and improve the living conditions of the local people. Easy access to markets will also help reduce post harvest losses.

(e) ***Investment in other social infrastructure***

Health Infrastructure

Water-related diseases are the most common causes of illness and death among the rural poor communities in the Mara basin. Besides water borne diseases, HIV/AIDS continues to pose a very serious public health challenge in the basin contributing significantly to morbidity and mortality and straining the public health budgets of both countries.

There is need to invest in hospitals and health centers to enable easy access of the local population to health care services. In addition, there also need to curb the spread of HIV/AIDs and eliminate the stigma of the disease by putting in place programs aimed at creating awareness on preventive measures, causes, and effects of HIV, promoting safe sex, promoting Voluntary Counselling and Testing, and providing Anti-Retroviral drugs at subsidized prices.

Education Infrastructure

Though both countries are currently implementing universal primary education, there are still significant challenges in providing quality education due to inadequate education infrastructure and well trained teachers. The same problems apply to higher levels of education.

As part of the overall strategy to improve the livelihoods of the people in the basin, there is need to invest in primary and secondary schools infrastructure and teacher training to increase pupil enrolment and improve on the quality of education in the basin. There is also need for investment in tertiary education to ensure that pupils can receive appropriate skills and knowledge to engage in meaningful employment after their education.

The Pre-feasibility Study

The pre-feasibility study of the proposed programs in the Mara Investment Strategy aims at determining whether the proposed projects are technically sound and likely to be economically, socially, and environmentally sustainable. The study is also intended to ensure that all critical Mara water resources issues and challenges are properly identified, analyzed, and assessed (with respect to their impacts). As part of the study, alternative potential

intervention measures will be identified and appraised to ensure that the projects selected for implementation are most cost effective and sustainable in the long term.

The pre-feasibility study will build on the findings and recommendations contained in the Mara Investment Strategy, the Mara Cooperative Framework Report, the Mara DSS Report, and the Mara River Basin Monograph.

The Pre-feasibility Report will set out the various program options in sufficient detail to support informed decisions on the selection of the preferred options.

Objective of the Pre-feasibility Study

The main objective of the pre-feasibility study is to provide the decision makers in Kenya and Tanzania and other relevant stakeholders in the Mara basin with sufficient information to justify acceptance, modification, or rejection of the investment programs and projects (contained in the Mara Investment Strategy) toward formulation and development of comprehensive project proposals.

Tasks/Outcomes of the Pre-feasibility Study

The following are the main tasks/outcomes of the pre-feasibility study:

(i) An analysis of the role of each proposed intervention measure in the economic, social, and environmental development of the Mara catchment;
(ii) An analysis of the relevance of each proposed intervention measure to address the existing economic, social, and environmental issues in the Mara basin. This will involve the identification and analysis of all relevant options for the proposed intervention measure.
(iii) An assessment of the feasibility of each proposed intervention measure with regard to technical, economic, financial, institutional, managerial, environmental, and socio-cultural aspects compared to other potential options.
(iv) Selection of the preferred intervention measure, detailing the expected benefits to the Mara riparians and the region in general, and providing a preliminary indication of the project activities and results, required resources, timing/phasing and estimated costs, and logical framework.
(v) An assessment of the potential sustainability of the project outputs, including availability of the necessary technical and financial resources for continued operation.
(vi) Recommendations for follow-up steps and further action for project formulation including detailed Terms of Reference for the Feasibility Study.

In undertaking the above tasks, the Consultant shall consult regularly with all key Mara stakeholder groups through consultative meetings and workshops to create consensus on the preferred investment options.

Water Resources Issues to be Assessed

The Mara River Basin is facing serious environmental problems resulting primarily from wide spread encroachment on protected forests and other fragile ecosystems in the basin due to intensive settlement and cultivation in the basin. Specifically, the basin is faced with the following water resources and environmental management problems (i) Soil Erosion and high sediment loads; (ii) Deforestation resulting from encroachment and human settlement in the Mau forest areas; (iii) Wildlife-human conflicts resulting from large-scale farming that has extended into wildlife corridors; (iv) Declining water quality and quantity due to poor agricultural practices and excessive water abstractions; (v) Pollution due to unregulated wastewater discharges, especially from mining activities, poor sanitation facilities and excessive use of agro-chemicals for pest and disease control in crops and livestock; (vi) Increased frequency and intensity of floods and droughts due to climate change and variability; (vii) Uncoordinated water resources planning and management in the basin due to lack of a comprehensive cooperative framework for the management of the basin's transboundary water resources.

The situation in the basin is further exacerbated by the weak and poorly enforced water related laws and regulations, and water resources management institutions with inadequate technical and financial capacity to monitor and ensure compliance with the set standards and regulations.

A detailed discussion of the above issues is contained in the Mara River Basin Monograph draft report.

Assessment of the Proposed Programs

(1) The Consultant shall undertake a detailed assessment of the relevance of the proposed programs to address the existing socio-economic and environmental issues in the Mara basin. This will also involve identification and analysis of all relevant development options for the proposed programs.

In undertaking this assessment, the relevance of a specific proposed intervention measure will be determined by:

(a) Its coherency and consistency with the overall macro-economic environment and national development objectives of the two countries as

specified in their PEAPs/PRSPs, National Water Sector Management and Development Plans, and other relevant sectoral plans; and

(b) Its compatibility and complementarity with other ongoing and planned water resources related projects at local, national, and regional levels.

Specifically, the consultants shall assess the following project aspects:

(i) The ways in which the proposed intervention measure responds to the Mara socio-economic and environmental requirements;
(ii) The ways in which the proposed intervention measure is consistent and coherent with the framework of the overall national development objectives and the economic, social, and environmental development polices of Kenya and Tanzania;
(iii) The number and type of beneficiaries the proposed intervention measure potentially accrues, and the expected improvement of the social, economic, and environmental situation;
(iv) All major problems experienced by the potential beneficiaries of the project and by any other parties likely to be involved, the causal interrelationships of these problems, and the inter-sectoral linkages;
(v) Other ongoing or planned regional, national, and local interventions or priorities of ministries, agencies, local governments, NGOs, and donors that may affect or be affected by the proposed intervention measure;
(vi) Information from previous studies and evaluations relevant to the proposed intervention measure.

(2) The Consultant shall assess the feasibility of the proposed programs through an analysis of the technical options consistent with the socio-economic and environmental conditions in the Mara basin. As part of this assessment, the following specific questions shall be addressed:

(i) Why is the intervention measure important to the Mara target groups and beneficiaries and the region in general?
(ii) What is the desired socio-economic and environmental impact of the proposed intervention measure in the Mara basin and the region in general?
(iii) Why do the target groups and beneficiaries need the intervention measure?
(iv) What products and services will the intervention measure deliver to the target groups and beneficiaries?
(v) What is the broad scope of activities to be undertaken and what are the associated assumptions for achieving the desired project results.

(3) For each intervention measure, the Consultant shall also give a preliminary indication of any pre-conditions for its success, an initial cost estimate for its implementation, and its possible activity phasing.

(4) The Consultant shall also highlight the potential sustainability of each proposed intervention measure based on an assessment of applicable sustainability factors.

Expertise required

The consultant's team will comprise of the following core experts: (i) a Water Resources Management specialist who shall also be Team Leader for the Study. He/she will be required to have broad water resources planning and management knowledge and experience; (ii) a Hydrologist; (iii) an Agronomist/Agricultural Expert; (iv) a Legal/Policy Expert; (v) a Socio-economist; (vi) an Institutional Development Expert; (vii) an Environmentalist/Ecologist; (viii) a Water Supply and Sanitation Expert; (ix) Financial/Investment Analyst; (x) a Forestry Expert; (xi) Wildlife Expert; and any other staff as deemed relevant for this assignment.

These experts shall have the minimum basic degree, with any additional qualifications relevant to the assignment being an added advantage. For each proposed expert, the Consultant shall submit a curriculum vita of no more than four pages.

The consultancy will require 60 person-months of consulting services.

Duration of the Study

The duration of the pre-feasibility study will be nine months.

Reporting

(1) The Consultant shall submit an Inception Report to the Client within 6 weeks after signature of the contract. The Consultant shall present the Inception Report for discussion and comments at a regional stakeholders' workshop to be organized by the client.
(2) A draft Pre-feasibility study report (six copies) shall be submitted to the Client for comments eight months after signature of the contract. The Consultant will present the draft Pre-feasibility report for discussion and comments at a regional stakeholders' workshop to be organized by the client.
(3) The Consultant shall take account of these comments in preparing the final Pre-feasibility study report which will be submitted to the Client nine months after signature of the contract.
(4) In addition to the above specific reports, the Consultant shall submit to the Client monthly progress reports during the entire duration of the study.

All reports shall be submitted in the English language and shall be accompanied by a soft copy.

Study Implementation Arrangements

The Consultant shall be directly supervised by the Mara Secretariat/Project Management Unit on behalf of the Client. Strategic guidance for the Study shall be provided by the relevant Mara Policy organs.

The Consultant shall be responsible for the timely implementation of all aspects of the study and for the delivery of the relevant reports to the Client. Furthermore, the Consultant shall operate their own project office and shall bear all accommodation, local transportation, visas, interpretations services, and other costs necessary to carry out the assignment.

The Client shall provide to the Consultant all relevant reports and documents for the assignment in both hard copy and soft copy where possible. The Client shall also support the Consultant in making the necessary arrangements for the consultative meetings and workshops. The Client shall be responsible for the collection of comments from all stakeholders and submission of the same to the Consultant.

ANNEX C – MARA BASIN ASSESSMENTS

1. Introduction

The purpose of this section is to carry out basin assessments pertinent to the proposed investment programs and intervention measures. However, in view of the wide scope of the proposed investments (e.g., water supply, sanitation, agriculture, Livestock, fisheries, ecology, energy, capacity building, etc.), and the status of the existing watershed data, the consultancy ToRs to develop a simple river basin model to analyze the benefits and impacts of the proposed intervention measures are only partially applicable.

Instead, the approach taken was to interpret the ToRs in a broader sense and develop a comprehensive information and decision support system (called Mara DSS) that can support a wide range of basin assessments through its database visualization features, GIS analysis, spatial and temporal data analysis tools, and flexible river basin models.

This section presents selected basin assessments pertaining to drought vulnerability, hydrologic impacts of deforestation and land use change, and surface water planning and management. The methods and tools underlying these assessments are discussed in detail in the Mara DSS project report.

2. Drought Vulnerability Assessment

With most of the Mara population engaged in agricultural activities, rainfall deficits are an important concern in the catchment. In this assessment, the Mara DSS was used to identify the catchment areas most vulnerable to droughts and guide irrigation investments.

The system was queried to create and plot spatial rainfall statistics. There are 34 stations inside or near the Mara Basin (Figure C.2.1), but only 12 of them have relatively long concurrent records. These stations are displayed in Figure C.2.2. The rainfall statistics are computed using the historical records from 1970 to 1986. Figure C.2.3 shows the mean spatial rainfall distribution over the whole of the Mara catchment, while Figures C.2.4 and C.2.5 depict the spatial rainfall distribution for a very dry and a very wet year. The figures show that (a) the catchment experiences high rainfall variability (the range between minimum and maximum rainfall is often larger than twice the mean), and (b) the climate becomes progressively drier and more variable from southwest to northeast. Thus, the Tanzanian part of the Mara is more vulnerable to droughts and would benefit from storage facilities (small irrigation dams and valley tanks) as advocated in the Investment Strategy. The

Mara Monograph contains additional and more detailed analysis of rainfall time series data which supports this conclusion further.

A third conclusion that can be derived from these DSS results is that the spatial density of the hydro-meteorological network is inadequate, especially in the Tanzanian part of the basin. This results in low spatial estimation resolution (with data from a few stations dominating the estimation process over large distances). Thus, improvements of the hydro-meteorological network are urgently needed as proposed under the Mara water resources monitoring and assessment project.

3. Hydrologic Impacts of Deforestation and Land Use Change

Forests are natural regulators of hydrologic extremes, acting to moderate high and augment low flows. In this assessment, the Mara DSS is used to assess whether deforestation and land use change has had any appreciable effect on the Mara hydrology.

This assessment was carried out using the Mara DSS data analysis tool which can develop models and compare various statistics of predicted and observed water resources data. The first part of the analysis is depicted on Figure C.3.1. Here, the Mara River discharges at Nyangores Station in Kenya are used for this study. The available historical measurements are from 1970 to 1994. The records are separated into an early period from 1970 to 1979 and a later period from 1985 to 1994, and plotted in the form of frequency curves. The comparison shows that the river response has changed in the last 10 years. Specifically, (a) the magnitude of high flood events increased by 10% in the recent as compared to the early period, and (b) the frequency curve of the recent period is considerably steeper. This behavior indicates that the basin has lost its capacity to retain and regulate soil moisture.

The previous observation can also be corroborated by comparing the runoff coefficients between the two periods. The runoff coefficient (ratio of rainfall to streamflow) is a more robust measure of watershed response change because it takes into account both rainfall and streamflow. Figure C.3.2 shows the 6-month moving average runoff coefficients for the two selected periods. The response patterns are quite different. The average value from the earlier period is nearly 20% higher than that of the later period. Furthermore, the earlier period exhibits a wider fluctuation range. These results provide strong evidence that the Mara hydrologic response has changed, most likely due to land use change and water withdrawals.

4. Surface Water Planning and Management

With rising water demands, a contentious issue relates to the downstream impacts of increased upstream water uses. Such impacts pertain to

agricultural, industrial, and/or domestic water supply as well as environmental and ecological water uses represented by the river flow reserve. The Mara DSS river model (Mara DSS Report) is designed to assess such tradeoffs and the associated benefits of potential intervention measures.

Typical questions related to these assessments include:

(1) How much water is available for consumptive use at individual sub-basins without impacting the shares of other sub-basins or the ability to meet downstream environmental and ecological flow regime requirements?

(2) What sub-basin and basin wide development options and management practices can potentially extend the available consumptive use budgets in each sub-basin and enable it to meet future consumptive uses while preserving basin wide environmental and ecological flow regime requirements?

An important aspect of these assessments is the characterization of the environmental and ecological flow regime requirements. While various flow regime measures can be adopted, a commonly used measure is the 7Q10 river flow statistic. The 7Q10 statistic is the 7 day minimum flow average with recurrence interval of 10 years. This statistic is determined automatically by the Mara DSS on a monthly basis (Mara DSS Report) and will be used in the following assessments.

The Mara DSS model is typically used within the following two-phase, assessment-planning process:

A. Assessment of Existing Conditions (Baseline):

(i) Determine sub-basin boundaries: These are determined based on hydrology, size/location/impact of hydraulic works, water use type, political and economic boundaries, and practical planning considerations. As a general rule, more sub-basins imply less planning flexibility.

(ii) Develop data necessary for the assessment-planning process: Determine water withdrawals (locations and amounts; agricultural, industrial, urban), water discharges (locations and amounts), water transfers in and out of the sub-basins, drainage/sewerage infrastructure (if any), and withdrawal to return ratios.

(iii) Determine flow regime requirements at each sub-basin that support flow requirements in this sub-basin as well as all downstream sub-basins.

(iv) Determine total & residual consumptive use budgets (CUBs):

- Determine current consumptive use (total withdrawals less returns);

- Determine desired water supply reliability factors;
- Determine if current consumptive uses meet the reliability targets;
- Determine the residual consumptive use budget available in each sub-basin.

B. Planning:

(v) Develop sub-basin and basin wide development options to meet current and future consumptive uses; Assess water use efficiency, reliability, and impacts:

The following steps are envisioned under this phase:

- Forecast future consumptive uses;
- Identify/adjust management practices (conservation measures, watershed management practices, introduction of basin storage, basin transfer, etc.) to augment the CUB in each sub-basin and comply with basin wide environmental and ecological flow regime requirements.

While the Mara DSS river model has the capability to carry out detailed such assessments, the range of Mara assessments that can be carried out is limited by the available data. Significant data limitations pertain to the (a) lack of long river flow records at multiple river locations, and (b) the lack of past, current and forecasted water use data. Despite these limitations, a number of useful assessments were carried out for the Mara River Basin by the Consultant and the Mara district personnel that took part in the Mara DSS training workshops.

4.1 Hydrologic Flow Data

River basin simulations are usually performed by taking a time series of inflows and simulating potential water allocation scenarios to withdrawals, storage additions/depletions, evaporation losses, and river flows. In standard practice, these time series are often derived from flows that were historically recorded within the river basin. Ideally, these time series represent unimpaired inflows; i.e., inflows that do not contain the effects of withdrawals and other human alterations of river flow. In deriving these time series, the availability of extensive and reliable flow records as well as historic withdrawals and other data related to human activity in the basin is important.

There are several monitoring stations at different locations within the Mara River Basin whose associated data were analyzed to create a flow time series. Upon analysis, it was found that the only reliable flow records in the upper part of of the Mara River Basin were at gages on the Amala (1LB02) and Nyangores (1LA03) Rivers, as depicted in Figure C.4.1. Values corresponding to -200 represent missing data points which had to be estimated using statistical methods. For time periods where only one station was missing data,

the data at the other station was used to estimate the missing data via a regression equation that was based on the historical relationship between the two gages. For time periods where neither station had data records, a historical analog approach was used to estimate the missing records. This approach is based on identifying the flows immediately after and before the data gaps, querying the historical records for time periods where the flows exhibited similar patterns, and then using flows from these time periods to fill in the data gaps. Figure C.4.2 shows the resulting Amala and Nyangores flows after the missing data had been filled. The sum of these flows gives an adequate indication of the hydrology in the upper part of the Mara River Basin. Yet, the flows were not adjusted for human-induced changes to the flow regime because adequate withdrawal records do not exist. Therefore, it is recommended to interpret the results as representing the effect of the assessment parameters in addition to the historical withdrawals made within the basin.

In the lower part of the Mara River Basin, the data at the Mara Mines monitoring station was analyzed. Unfortunately, the data is not complete and consistent enough to be used for creating inflow records. The data gaps are more frequent than at the upstream gages on the Amala and Nyangores River and there are no records after 1991. Additionally, there seem to be inconsistencies even during the periods when data is available. The flow at the Mara Mines locations is often lower than the upstream flow at Amala and Nyangores, as shown in Figure C.4.3. Though this is not physically impossible, since there could be water losses to groundwater and withdrawals, the lack of information about the magnitude of these losses makes it difficult to derive the inflows to the lower part of the basin. Consequently, it was decided that for these sample assessments, the *local* inflows of the lower part of the Mara River Basin are assumed to equal around 15% of the sum of the Amala and Nyangores flow. Though this assumption is consistent with the historical distribution of flows throughout the basin, future work should be undertaken to derive more accurate inflow time series once the relevant data becomes available.

4.2 Water Use Data

Water use data is another important component in creating relevant river basin assessments. Information regarding in-stream and off-stream water uses should be representative of the actual water uses in the basin. The Mara DSS contains a custom model (called xQy Analysis) that can be used to derive in-stream demands (reserve flows) based on the xQy statistic. Though by no means the only way of specifying reserve flows, the xQy Analysis model was used to calculate the reserve flow requirements since no other data was made available. Information on the magnitude and timing of withdrawals, both past, present, and future, was also not available. As a result, the following

assessments will use several water uses to explore the range of water use magnitudes and reliabilities that the basin can support.

4.3 Mara River Basin: Upstream-Downstream Tradeoff Studies

For the following assessments, the Mara basin is assumed to comprise two sub-basins. The first sub-basin, Basin 1, corresponds to the Kenyan part of the catchment up to the Kenya-Tanzania border. The second sub-basin, Basin 2, corresponds to the Tanzanian part of the catchment starting from the border and ending at Lake Victoria. This sub-division is convenient because it allows for analyzing inter-state tradeoffs. However, as discussed in the previous section, the inflow data are only tentative. Thus, the analysis presented herein should also be considered preliminary. It is, however, worthwhile presenting it to demonstrate (a) the range of development scenarios that may be considered to address transboundary issues and (b) the potential benefit of inter-state cooperation. In the pre-feasibility and feasibility studies, this analysis would need to be repeated after more reliable inflow data (as well as water use data) for the whole of the catchment have been generated.

4.3.1 Withdrawals vs. Reserve Flow

The Mara river data was first analyzed to determine the monthly 7Q10, 7Q20, and 7Q30 flow statistics at the downstream end of the river basin (Figure C.4.4). These flow statistics represent the 7 day average minimum flow with recurrence interval 10, 20, and 30 years respectively. Although the 7Q10 is commonly used as a river flow reserve measure, the 7Q20 and 7Q30 statistics were also estimated as part of a sensitivity analysis. The purpose of environmental regulations based on such statistics is to ensure that upstream water withdrawals do not deplete the flow reserve below these critical measures. It is noteworthy that the monthly distribution of the 7Q10/20/30 statistics is markedly variable (as opposed to constant throughout the year), following the seasonality of the Mara river flow, while the statistic magnitudes increase with the recurrence interval. Namely, the premise of the 7Qx approach is to ensure that the flow reserve requirements maintain a minimum magnitude and seasonal variability linked to the statistical distribution of the observed flows.

A slightly more advanced 7Qx analysis was used to distribute the responsibilities for meeting these reserve flow requirements among the two basins. (Figure C.4.5) This analysis ensures that the 7Qx statistics are met globally and locally throughout the river basin. This figure indicates that Basin 1 (Kenya) contributes most of the reserve flow at the outlet of the Mara River.

Figure C.4.6 depicts the tradeoff between upstream water supply (i.e., withdrawal) amount in cubic meters per second (cms) versus reliability (0 to

100% exceedence) for 7Q10, 7Q20, and 7Q30 downstream flow reserve requirements in Basin 1. (In these model runs, water withdrawals are assumed to be seasonally distributed according to the evaporative demand. Also, 1 cms = 31.536 million cubic meters per year.) The figure shows that water supply reliability drops sharply as withdrawals increase, with 14 cms being available only 70% of the time, 31 cms being available only 50% of the time, and 166 cms being available only 10% of the time (for 7Q10 flow reserve). The 7Q20 flow reserve requirement reduces the available water withdrawal by 2 to 10 cms at each reliability level relative to the 7Q10 case. An additional similar reduction is imposed by the 7Q30 flow reserve requirement.

This assessment quantifies the natural capacity of Basin 1 to support consumptive water uses (agricultural, industrial, and/or domestic) *and* environmental requirements, where consumptive uses (or withdrawals) are characterized by both withdrawal amount and reliability. The tradeoff shows that there is an inescapable relationship between these quantities. One may select to increase withdrawals, only to discover that the river can only provide the increased amount for shorter time periods. Furthermore, the adoption of a certain flow reserve requirement has direct implications on the amount and reliability of upstream withdrawals, demonstrating the need for integrated water resources planning and management. Thus, higher reserve flow requirements (for better support of the environment and the ecology) lower the amount and reliability of upstream water withdrawals. Defining the best compromise level is a decision to be made by the Mara stakeholders. The purpose (and value) of the Mara DSS is to quantify these relationships and support the decision process with factual data and information. The effect of varying reserve flow requirements on water supply reliability could also be evaluated for Basin 2, if desired.

4.3.2 Upstream vs. Downstream Withdrawals

To consider another commonly encountered planning problem, the next few assessments evaluate if upstream development in Basin 1 has a significant impact on downstream water supply reliability in Basin 2. For each of the assessments and at each basin, 7Q10 values are used as the reserve flow requirement.

Figure C.4.7 presents the baseline assessment results for Basin 1. Three different levels of demand are evaluated: 10, 20, and 30 cms. The reliability of these three demand levels are found to be 75%, 62%, and 51%, respectively.

Figure C.4.8 presents the baseline situation for Basin 2, showing that Basin 1 withdrawals directly impact water availability (amount and reliability) in Basin 2. Specifically, the reliability of a fixed Basin 2 withdrawal declines as withdrawals increase in Basin 1. For instance, the reliability of sustaining a withdrawal of 10 cms in Basin 2 decrease from 66% to 56% and 47% as the

withdrawals in Basin 1 are increased from 10 to 20 and 30 cms, respectively (Figure C.4.9). Development in the upstream Basin 1 therefore can have a significant effect on the water supply in the downstream Basin 2. These effects should be taken into account by planners in order to ensure a reliable water supply in the downstream part of the Mara River Basin.

4.3.3 The Benefits of Storage

The previous model runs establish the natural Mara River baseline capacity to support various water use levels (consumptive as well as environmental) without interventions in each of the two basins. The runs that follow focus on planning questions and seek to determine the extent to which this natural baseline can be modified through the introduction of storage facilities. The model considers storage in an aggregate sense. This storage can comprise by any number of on-stream and off-stream projects, including irrigation dams and valley tanks. The Mara DSS can be used to determine the basin storage that would be needed to raise the water withdrawal reliability to a more acceptable level while continuing to support the 7Q10 flow reserve requirement. These assessments are performed by the Mara DSS by simulating the river flow and storage filling and depletion cycles throughout the hydrologic record from 1963 to 2007 in daily time steps. The details of these computations, including the storage filling and release rules, are described in the Mara DSS report.

Storage can be introduced in Basin 1, Basin 2, or both basins at various aggregate levels to alter the baseline situation. All such possibilities can be readily analyzed by the Mara DSS. For purposes of this demonstration, storage is considered for Basin 2 because its water supply reliability is lower due to its lesser natural inflows. A relevant question is what storage level would be necessary to support a certain amount of withdrawal in Basin 2 at a desirable reliability, while meeting the flow reserve requirements. This question can be assessed by using the Mara DSS to simulate the effects of storage facilities of various sizes and looking at the resulting impacts.

The water supply reliability of meeting a demand of 10 cms in Basin 1 is 75%. Due to the lower inflows, the reliability of meeting the same demand magnitude in Basin 2 is only 66%, as shown in Figure C.4.10. The construction of storage facilities in Basin 2 could augment the local water supply and increase the reliability of meeting the desired demand in that basin. Figure C.4.11 shows the effect of constructing reservoirs of various sizes on the water resources of Basin 2. Storages of 10, 20, and 30 million cubic meters were able to increase the reliability of meeting 10 cms in Basin 2 to 77%, 80%, and 82%, respectively.

Though the storage was able to raise the water supply reliability in Basin 2, it is still dependent on the level of development in Basin 1. For instance, if the

demands in the upstream Basin 1 were closer to 20 cms, the storage calculated above would cause only a slight increase in demand reliability in Basin 2, as seen in Figure C.4.12. Successful planning in Basin 2 therefore not only involves an understanding of the local issues, but also an understanding of developments and cooperation with planners in upstream basins.

If employed properly, storage intervention measures can support higher water use levels in the catchment *and* protect the environment at the same time. The investment required to achieve this is associated with the construction and maintenance of storage facilities, and increases with the required storage. Exactly how much storage should be built depends on future water demands (both within, upstream, and downstream of a particular basin), the desired reliability, the level of environmental protection, and the available financial resources. These are issues to be addressed by the pre-feasibility and feasibility studies proposed under the Water Supply Programs of the Mara Investment Strategy. To enable the performance of these studies, a comprehensive data collection effort must first be carried out to establish (a) the current and future water uses in the agricultural, industrial, and domestic sectors, (b) reliable inflow data sets, and (c) the distributed storage potential of the Mara River basin.

4.4 Mara River Basin: Evaluating the Effects of a Proposed Water Transfer out of the Amala River

The following assessments evaluate the ability to transfer water out of the Amala River and identify the associated impacts to downstream water users.

4.4.1 Project Background

The Ewaso Ngiro South basin, which is riparian to and located to the east of the Mara, has been identified as a potential hydropower development site. The hydroelectric potential of the Ewaso Ngiro South has been recognized for many years and has been the subject of a number of studies since 1980. In 1993, a detailed feasibility study proposed schemes at Oletukat, Leshota, and Oldoko on the main Ewaso Ngiro South with an inter-basin water transfer tunnel in the head waters to provide additional generation flow. The Amala River would be the source of the water transfer. The transfer scheme would consist of a 2.6 cms mean flow water transfer from the Amala River to the Nosagami River which is a tributary of the Ewaso Ngiro South. Maximum water transfer was not to exceed 6 cms.

Concerns have been raised how the water transfer will affect the receiving Ngiro basin. Specifically, the increased flow in the Ewaso Ngiro and the seasonal regulation imposed by the storage reservoirs on the cascade would alter the inflows into Lake Natron downstream. This raises cross border issues with Tanzania and possible concerns over the changes to the ecology and

water balance at the northern end of the lake. A study of options for preventing the Amala transfer flows from reaching Lake Natron was undertaken and a pre-feasibility study to assess the viability of irrigating some 6,000 ha of rangeland downstream of Oldorko was completed in January, 2000. It is recommended that further work be undertaken, but it appears feasible that a rangeland irrigation scheme of the proposed size could redress the impacts of the upstream projects on the inflows into Lake Natron. The proposed irrigation scheme would additionally provide an important source of grazing for Masai livestock.

The water transfer scheme will also affect the Mara River Basin since water is taken out of the basin. There are two major issues that need to be addressed: (a) Does the Amala River have enough water to provide the desired water transfer, and (b) how will the water transfer impact the water resources of the Mara River Basin at and downstream of the transfer location. The following assessments show how the Mara DSS can provide valuable information in evaluating the proposed water transfer scheme.

4.4.2 Water Transfer Reliability

The first issue relates to whether or not the Amala River can actually provide the desired amount of water to be transferred into the Ngiro River. In order to evaluate the water supply potential of the Amala River, the Mara DSS was employed to model the water balance on this portion of the Mara River Basin. Streamflow records measured at the 1LB02 gage on the Amala River were chosen to represent the available natural inflow. It should be noted that, as discussed in Section 4.1 of this annex, the inflow data are only tentative and should be reevaluated once more accurate information becomes available. For instance, if the transfer location is located significantly upstream of the 1LB02 gage, then the streamflow records may overestimate the available water supply, and vice versa. Thus, the analysis presented herein should be considered preliminary.

Reserve flow requirements were also specified to maintain the ecological integrity of the Amala River and any downstream areas of the Mara River Basin. The xQy Model of the Mara DSS was employed to calculate reserve flow requirements. These requirements are based on the 7Q10 statistic and were chosen such that this statistic is met at the Amala River Basin as well as at downstream locations. Figure C.4.13 shows the reserve flow requirements.

Figure C.4.14 shows the reliability of the water supply on the Amala River under the abovementioned inflows and reserve flow requirements, aggregated over the entire simulation period from 1963 to 2007. Assuming that this is the highest priority withdrawal from the Amala River, the average desired transfer amount of 2.6 cms can only be supplied about 64 % of the time. If there were

additional withdrawals from the Amala River that take place before any transfer occurs, then the reliability of the transfer would decrease. For instance, if 5 cms are already being used for water supply within the basin, then the reliability of providing the additional 2.6 cms for the water transfer (i.e., in total 5 + 2.6 = 7.6 cms) would be reduced to 42%.

The above analysis was based on the assumption that the average water transfer rate of 2.6 cms would be maintained throughout the entire year. However, due to the seasonality of the inflows on the Amala River, the water supply reliability changes seasonally. By just focusing on the extreme months of the year, February and August, one can see that the reliability of supplying 2.6 cms varies between 31 % and 89 %, respectively (Table C.4.1).

The flow seasonality may be exploited by concentrating the water transfer during the wettest months of the year when excess water is available. For instance, if the water transfer were only taking place during the 2 wettest months of the year, then water could be transferred at a rate of 15.6 cms (2.6 * 12 / 2) during those months. This would however exceed the maximum desired transfer rate of 6 cms, so the transfer has to be spread out over several more months.

Numerous combinations of transfer schemes can be evaluated with the Mara DSS, depending on the specific planning objectives. For purposes of these assessments, the transfer schedule in Table C.4.2 was adopted. Namely, transfers of 6 cms occur during the four wettest months of the year while 1 cms is transferred during each of the other eight months. The Table also shows the reliabilities associated with each of the transfers. The average reliability over the entire horizon increases to 70 % and the reliabilities of providing the transfer in each month have become more uniform when compared to transferring 2.6 cms in each month. Note that it was assumed that the water transfer occurred before any other water withdrawals. If there were additional withdrawals from the Amala River that take place before any transfer occurs, then the reliability of the transfers would be lower.

Table C.4.1: Water Supply Reliabilities for a Constant Transfer of 2.6 cms from the Amala River

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Reliability (%)	36	31	46	73	87	83	84	89	77	70	45	42	64

Table C.4.2: Water Supply Reliabilities for a Time-varying Transfer (average 2.6 cms) from the Amala River

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Transfer (cms)	1	1	1	1	6	6	6	6	1	1	1	1	2.6
Reliability	59	65	65	84	75	61	67	75	85	83	65	61	70

So far, the assessments have been performed assuming that the reserve flow is the highest priority water use, followed by the transfer. If the transfer became prioritized higher that the reserve flow, then its reliability of being met would increase to 86% on average. However, this increase in reliability would come at the expense of reduced river flows which endanger the ecosystem and could aversely affect downstream users.

4.4.3 Impacts of Water Transfer on Mara Water Uses

The second issue pertains to how the transfer will affect the water resources within the Mara River Basin. Transfers will reduce the amount of water available to meet water supply and reserve flow requirements on the Amala River, both in magnitude and reliability. Figure C.4.15 depicts the lower end of the frequency curves of flows leaving the Amala River. The transfer alters the natural hydrograph by decreasing the amount of water in the river. If the transfer were to become the highest priority water user and take precedence over meeting the reserve flows, the decrease becomes even more significant.

The transfer also impacts water supply reliability. Using the same basin delineation as in the assessments of Section 4.3, it is found that in Basin 1, which contains the Amala and the Nyangores Rivers, the water supply reliability would decrease as a result of the transfer. Figure C.4.16 shows that the transfer would reduce the average reliability for meeting a demand of 10 cms from 75% to 73%.

Additionally, since the transfer occurs relatively far upstream in the Mara River Basin, the water resources of any downstream region will also be affected. In Basin 2, the transfer would decreases the average reliability for meeting a demand of 10 cms from 66 to 64% (Figure C.4.17).

Overall, under the stated assumptions, the impact of the proposed water transfer on the Amala and the greater Mara River are relatively small, and could be further mitigated if storage in the Amala were available. Unless, the impacts of water transfer on the receiving basin are too adverse, this study merits further investigation.

5. Conclusion

In summary, the previous assessments demonstrate that key prerequisites for effective Mara water resources planning, development, and management are (1) inter-state cooperation, (2) adoption of integrated water resources methods supported by modern information and decision support systems (such as the Mara DSS), (3) acquisition and sharing of reliable data and information, and (4) human resources development.

Figure C.2.1: All Rainfall Stations Inside or Near Mara Basin

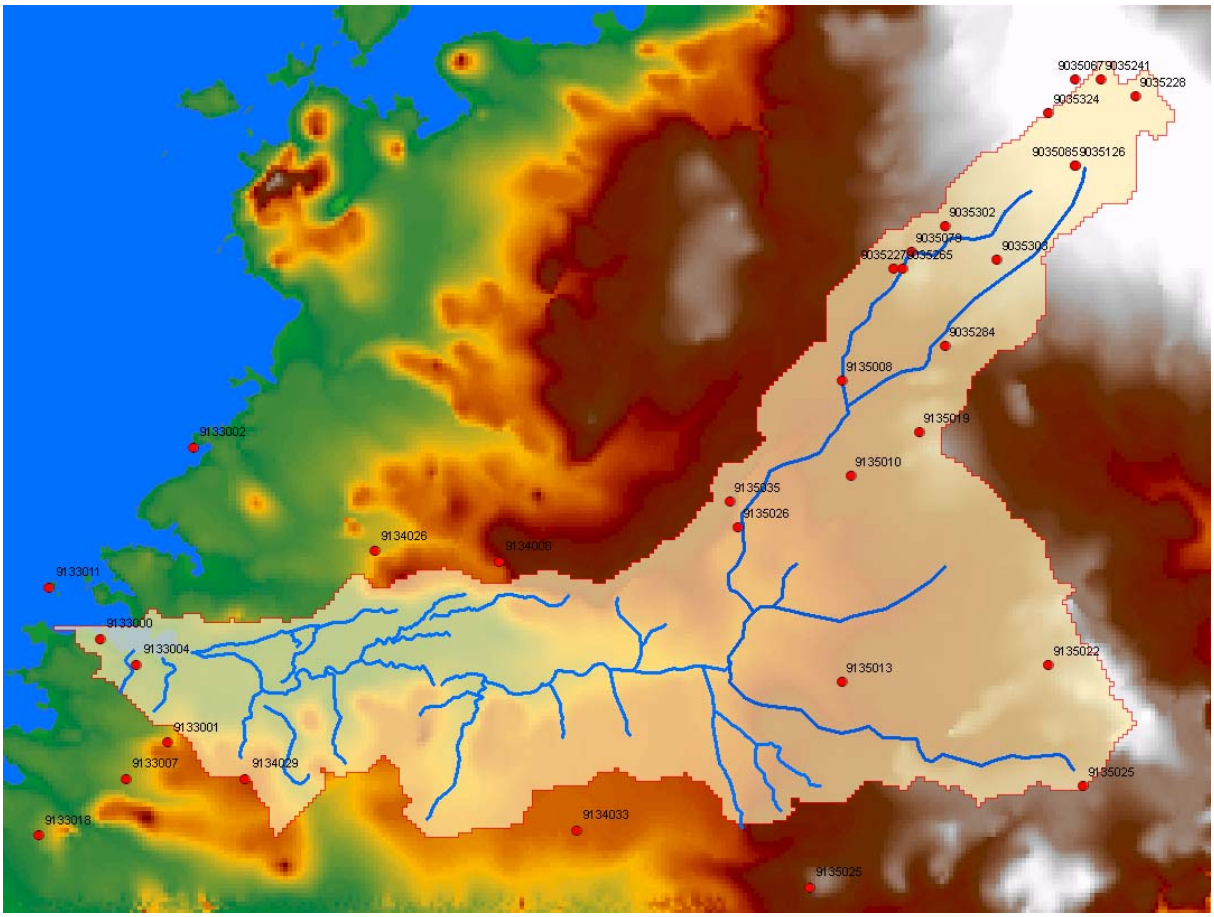


Figure C.2.2: Rainfall Stations Inside/Near Mara Basin with Records from 1970 to 1986

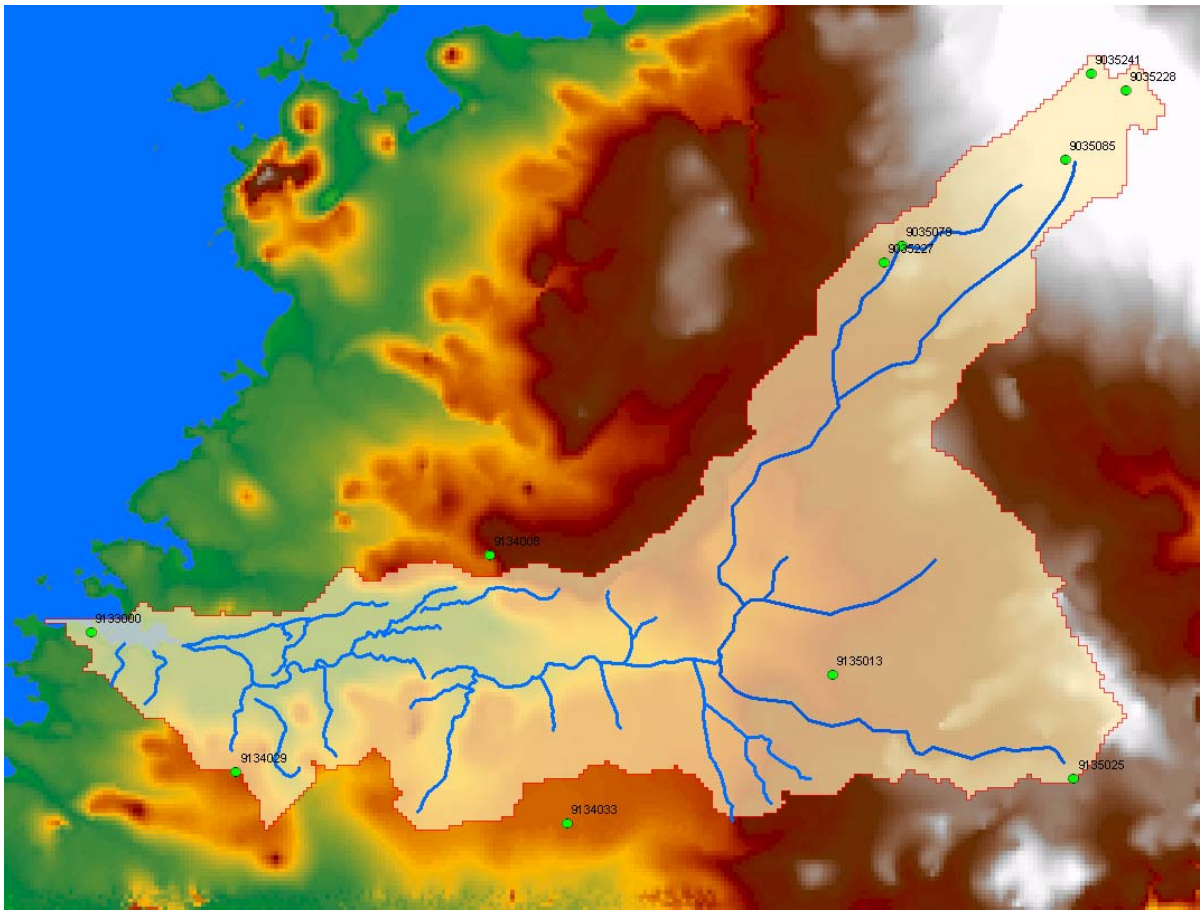


Figure C.2.3: Average Spatial Rainfall Distribution (1970-1986)

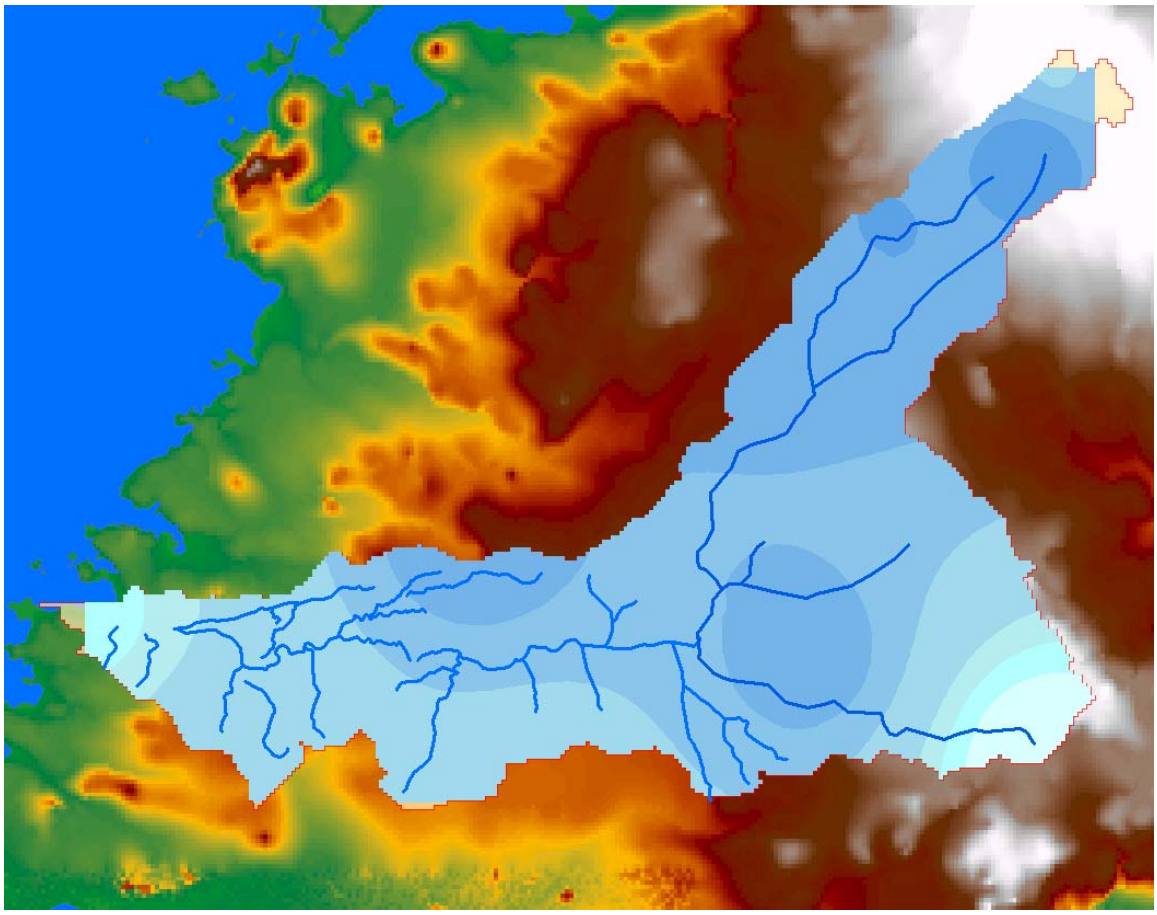


Figure C.2.4: Average Spatial Rainfall Distribution in a Dry Year (1984)

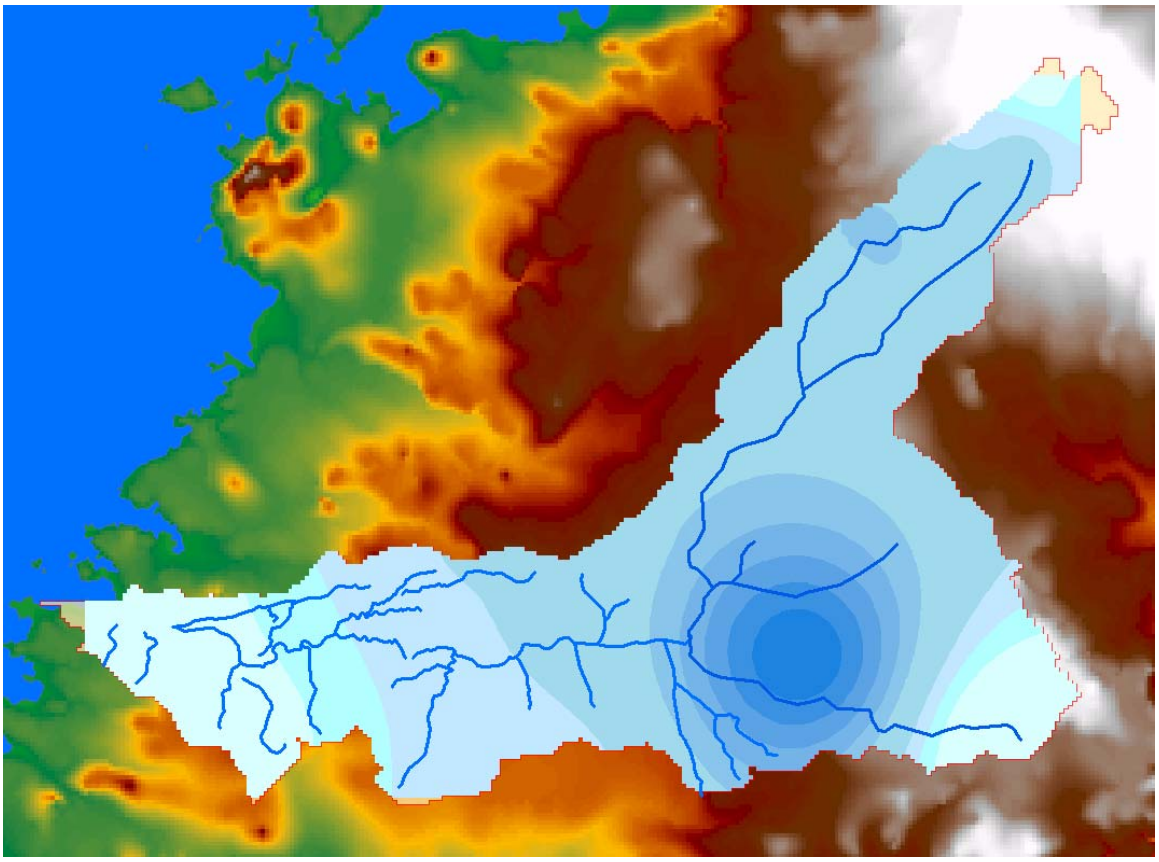


Figure C.2.5: Average Spatial Rainfall Distribution in a Wet Year (1970)

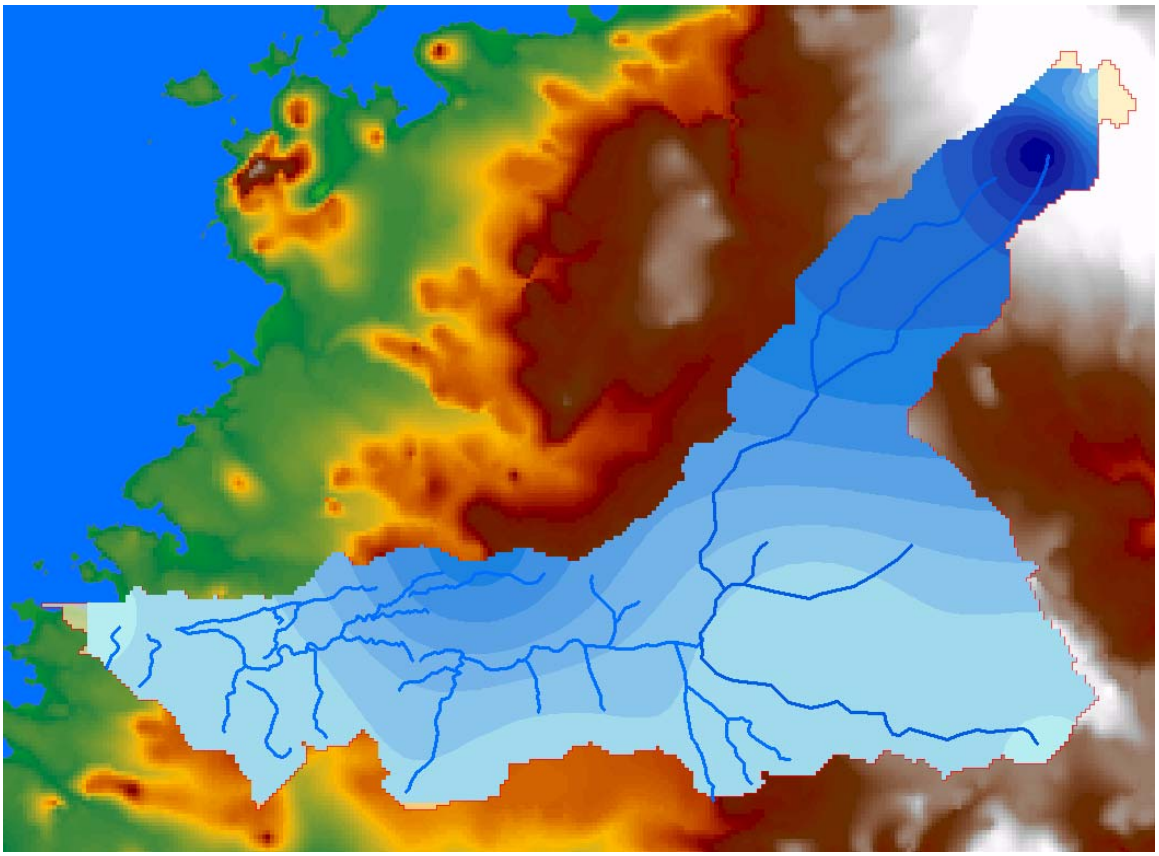


Figure C.3.1: Flow Frequency Analysis, Nyangores, Kenya

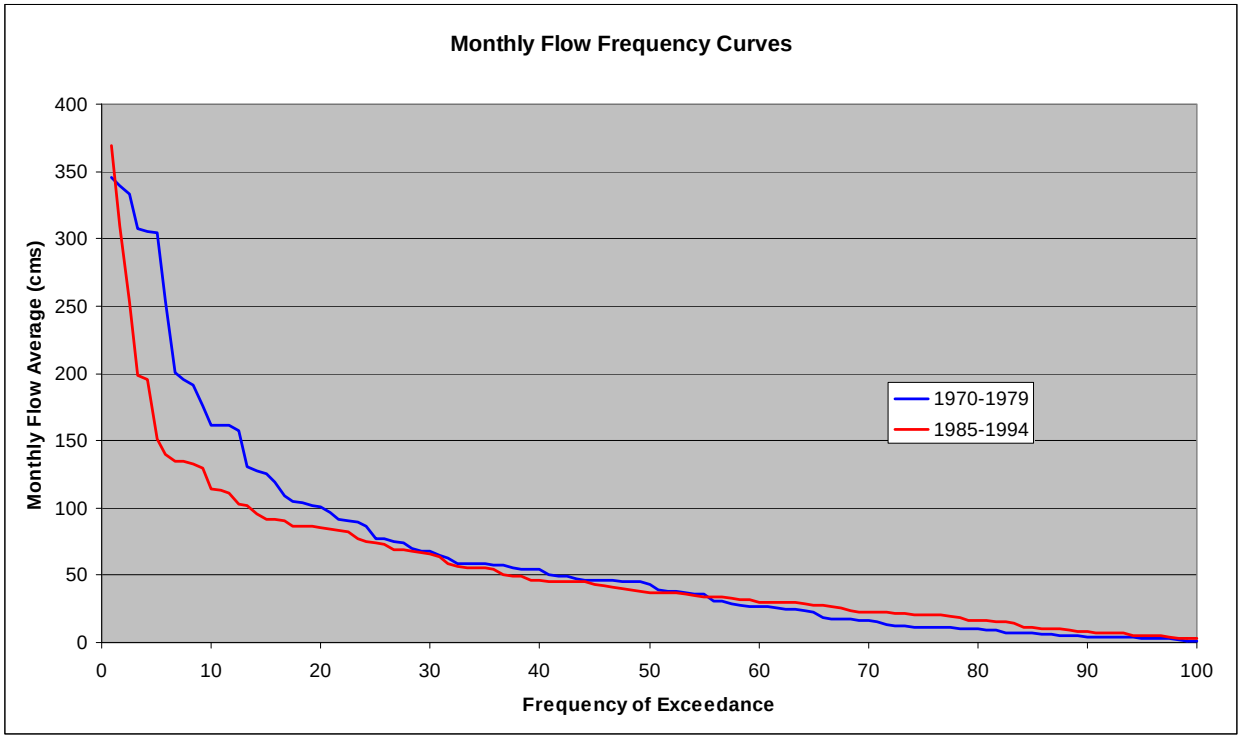


Figure C.3.2: Runoff Coefficient Study

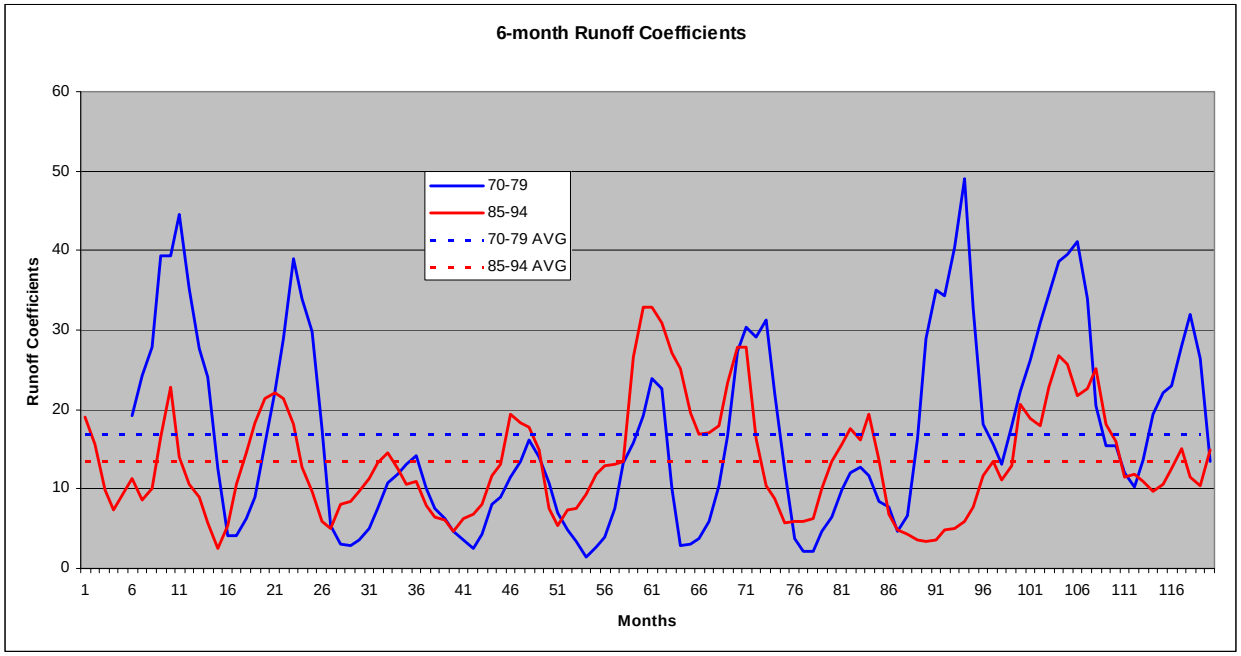
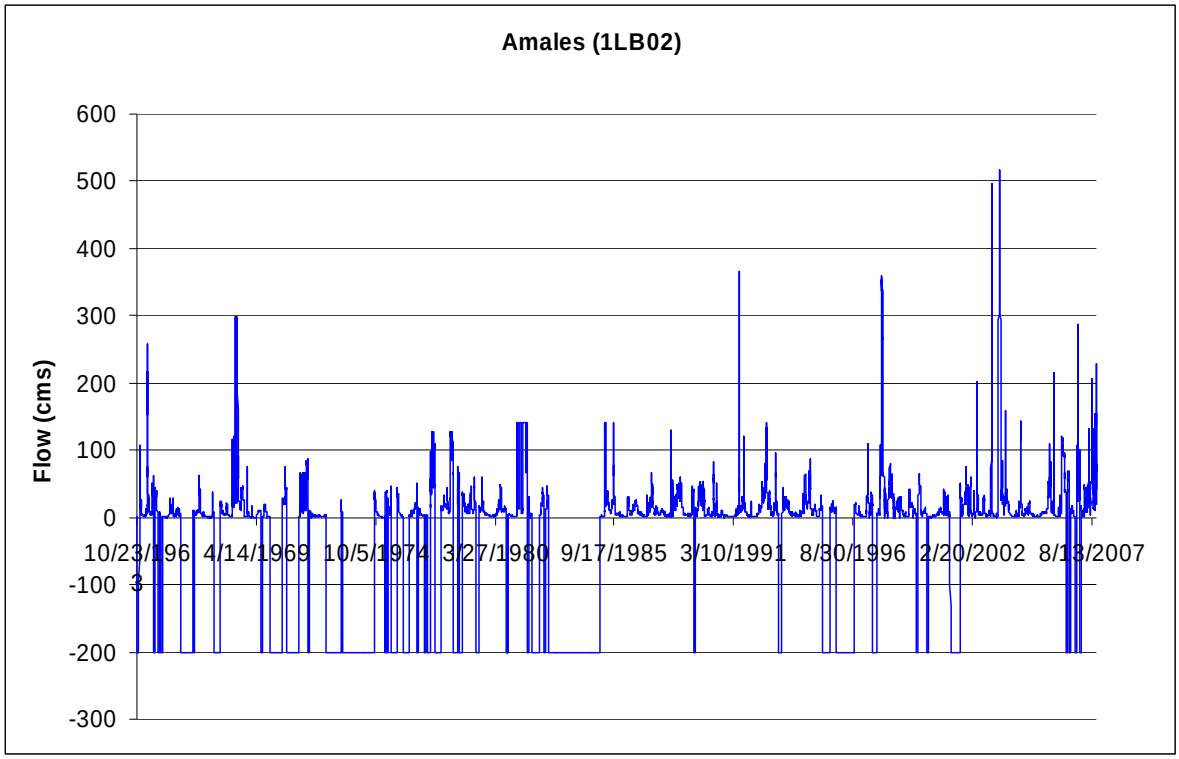


Figure C.4.1: Recorded Flow on the Amala (1LB02) and Nyangores (1LA03) Rivers



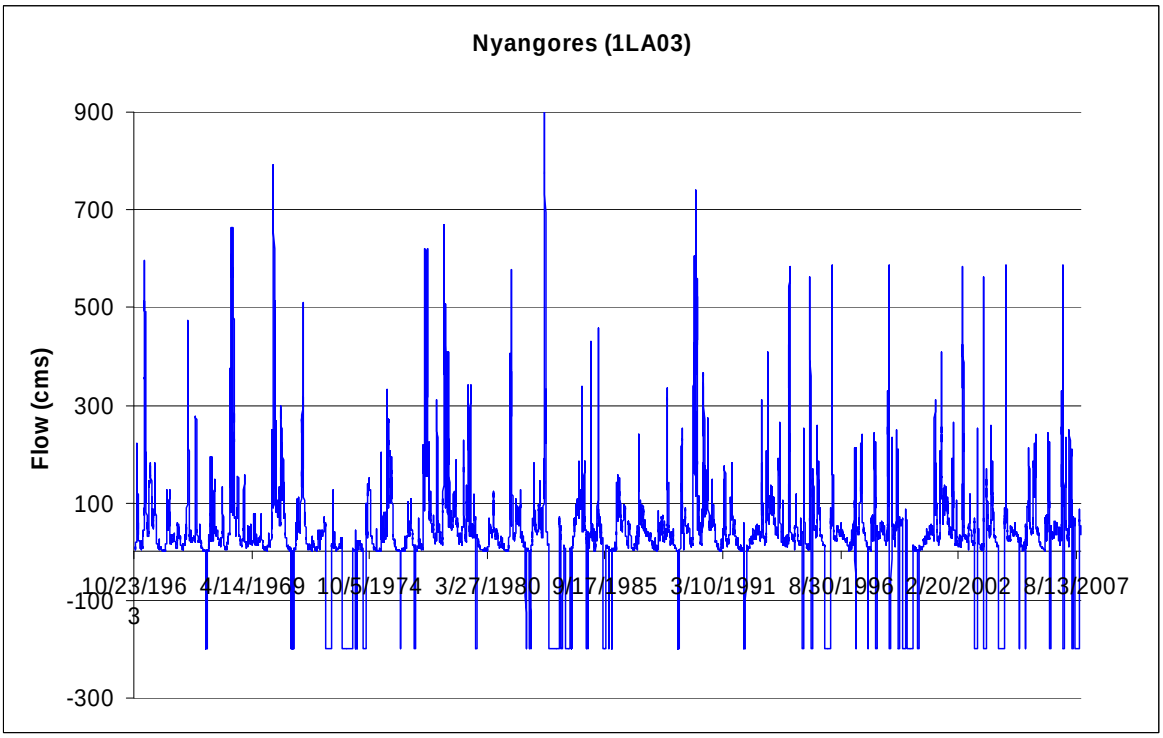
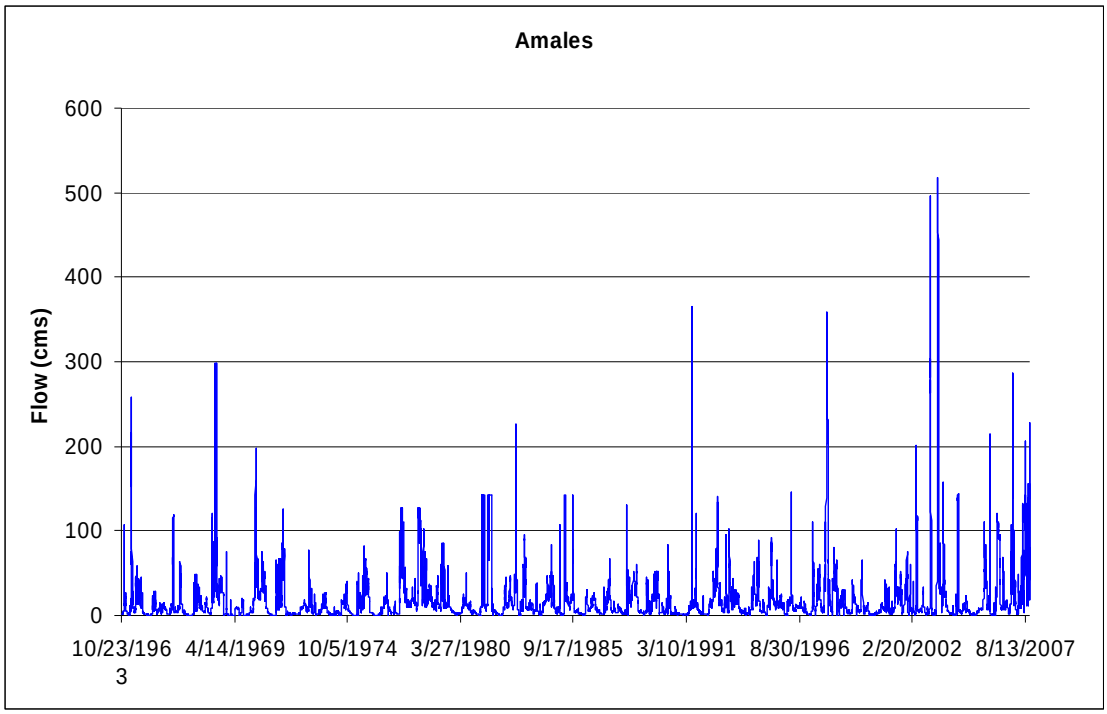


Figure C.4.2: Derived Flow of the Amala and Nyangores Rivers



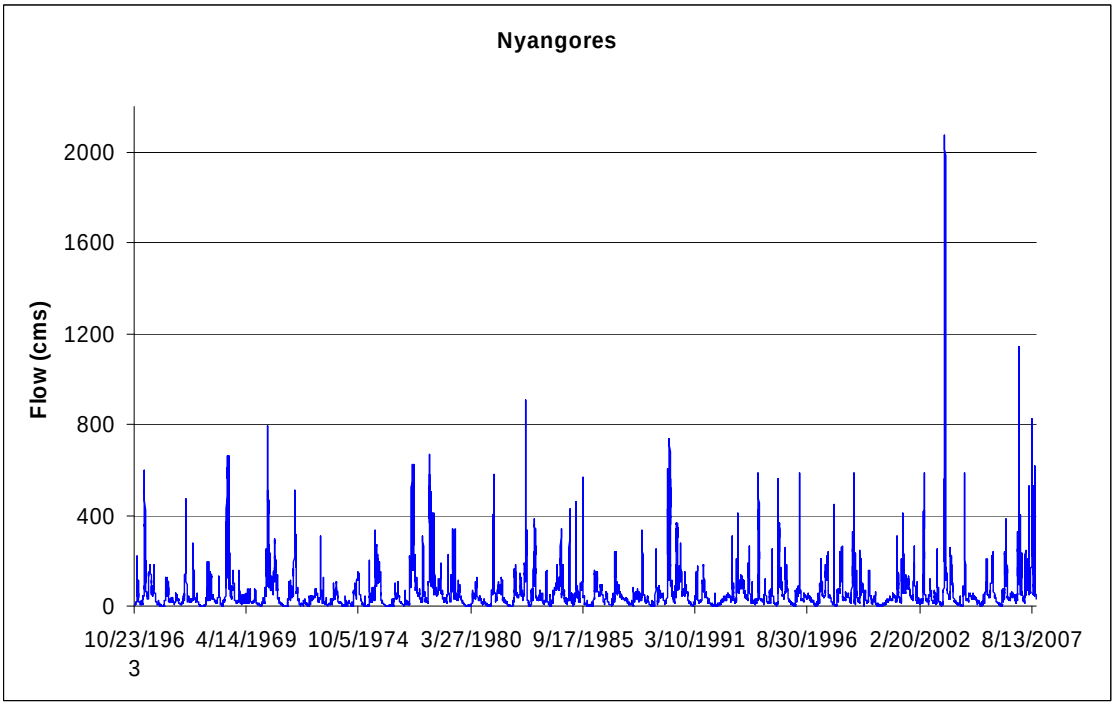


Figure C.4.3: Difference between Flow at Mara Mines and the Sum of Flows on the Amala and Nyangores Rivers

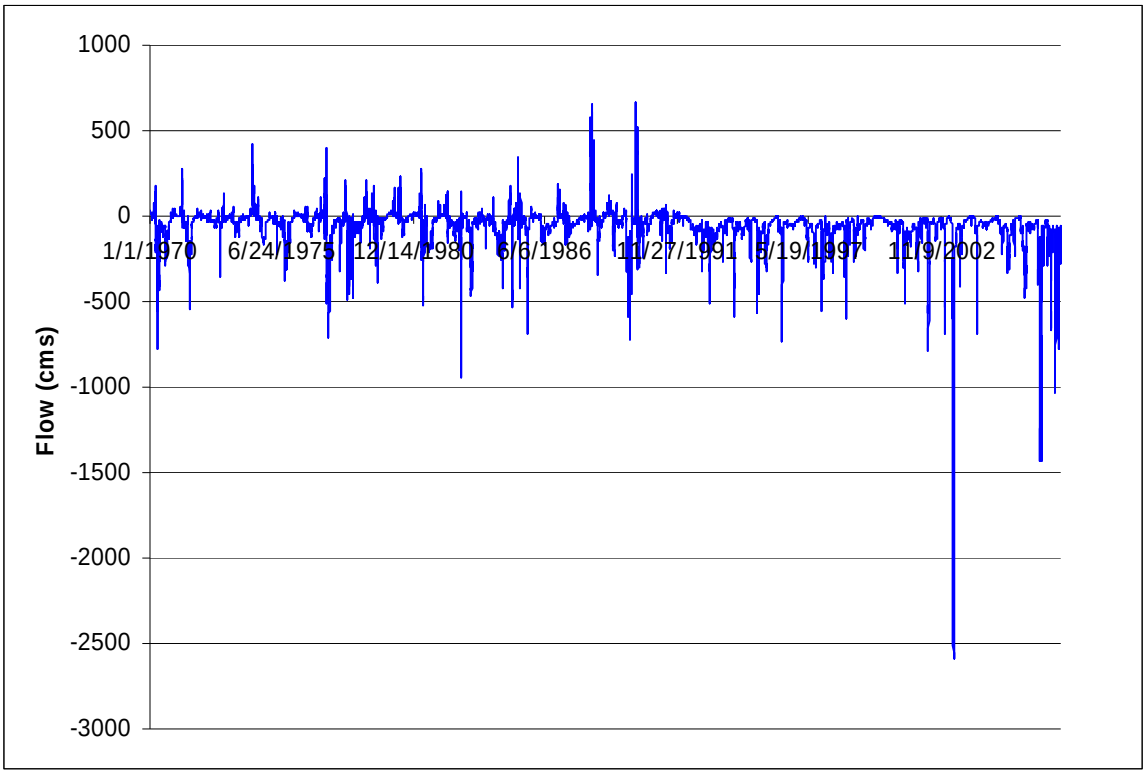


Figure C.4.4: Mara River Reserve Flow Measures at Outlet to Lake Victoria

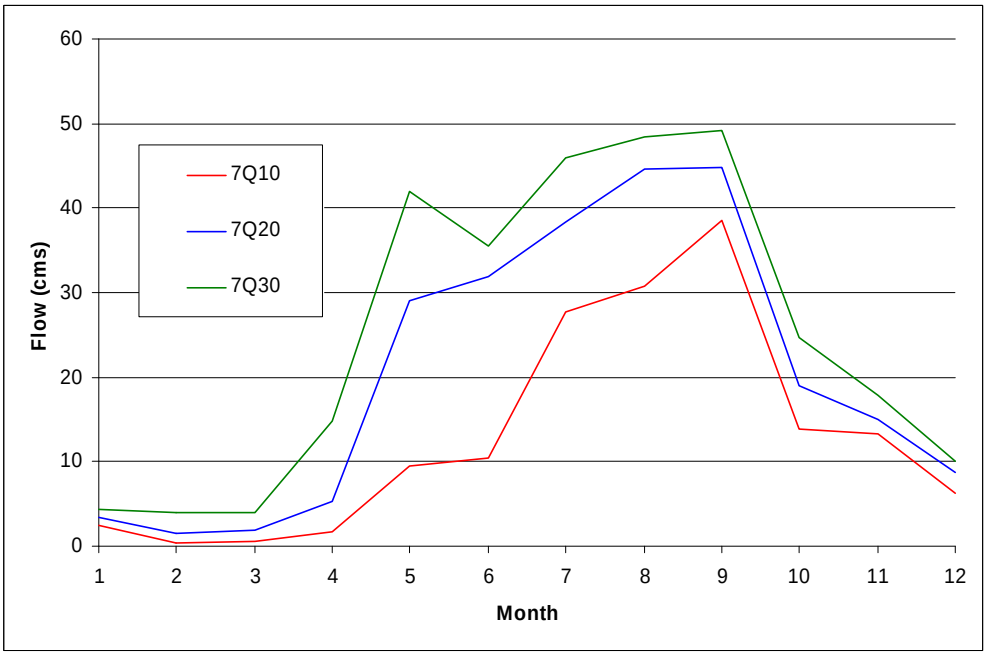
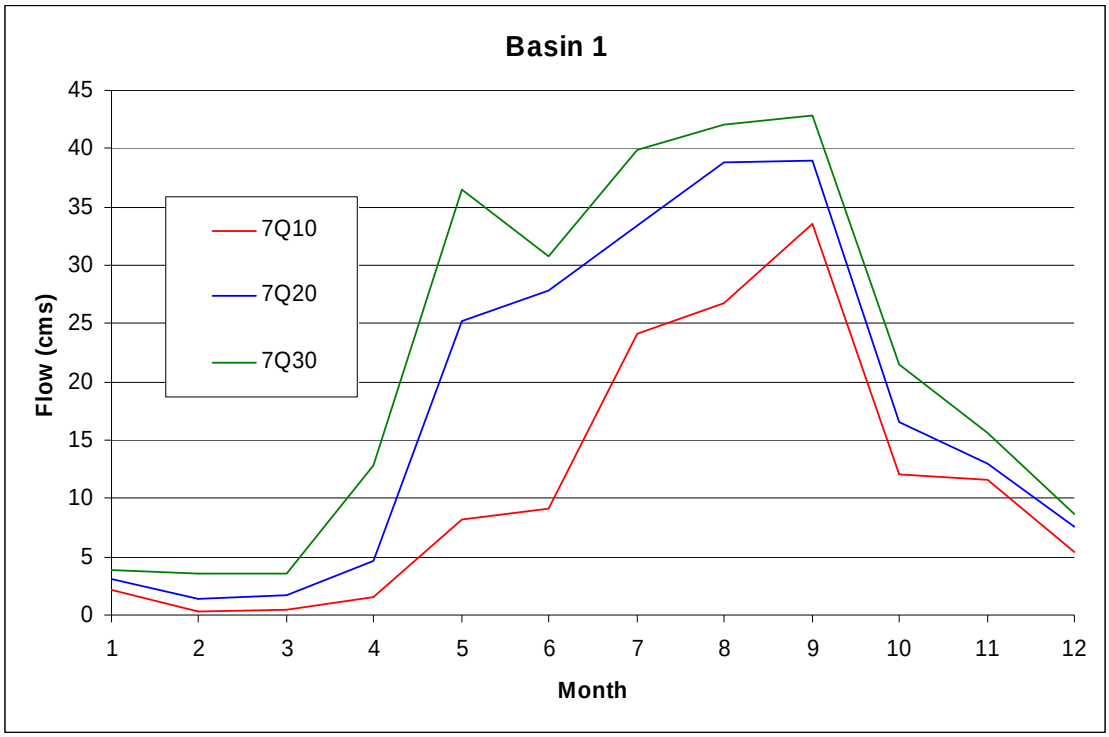


Figure C.4.5: Local Mara River Reserve Flow Measures for Basin 1 and Basin 2



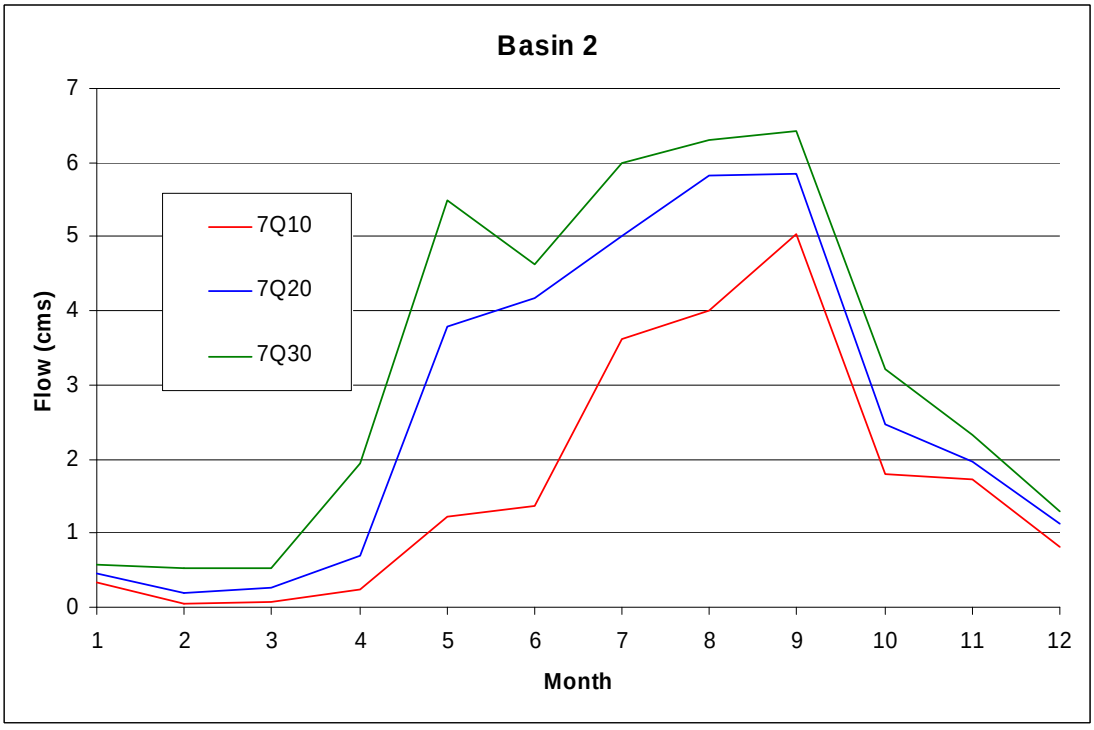


Figure C.4.6: Tradeoff of Water Supply Magnitude vs. Reliability for Different Flow Reserve Measures (7Q10, 7Q20, and 7Q30), Basin 1

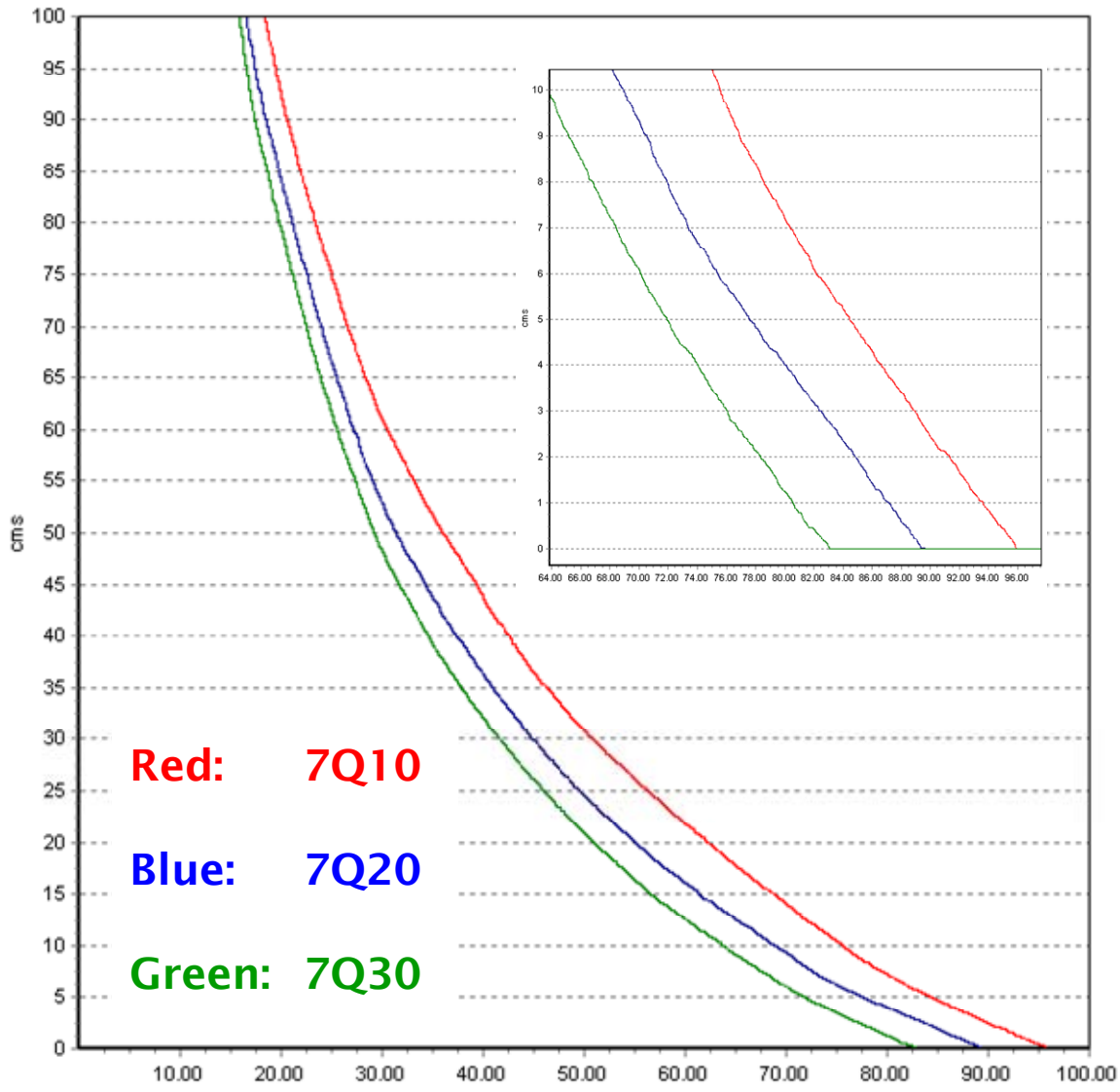


Figure C.4.7: Reliabilities of 10, 20, and 30 cms Demand Levels under Baseline Conditions and 7Q10 Flow Reserve Requirements, Mara River Basin 1

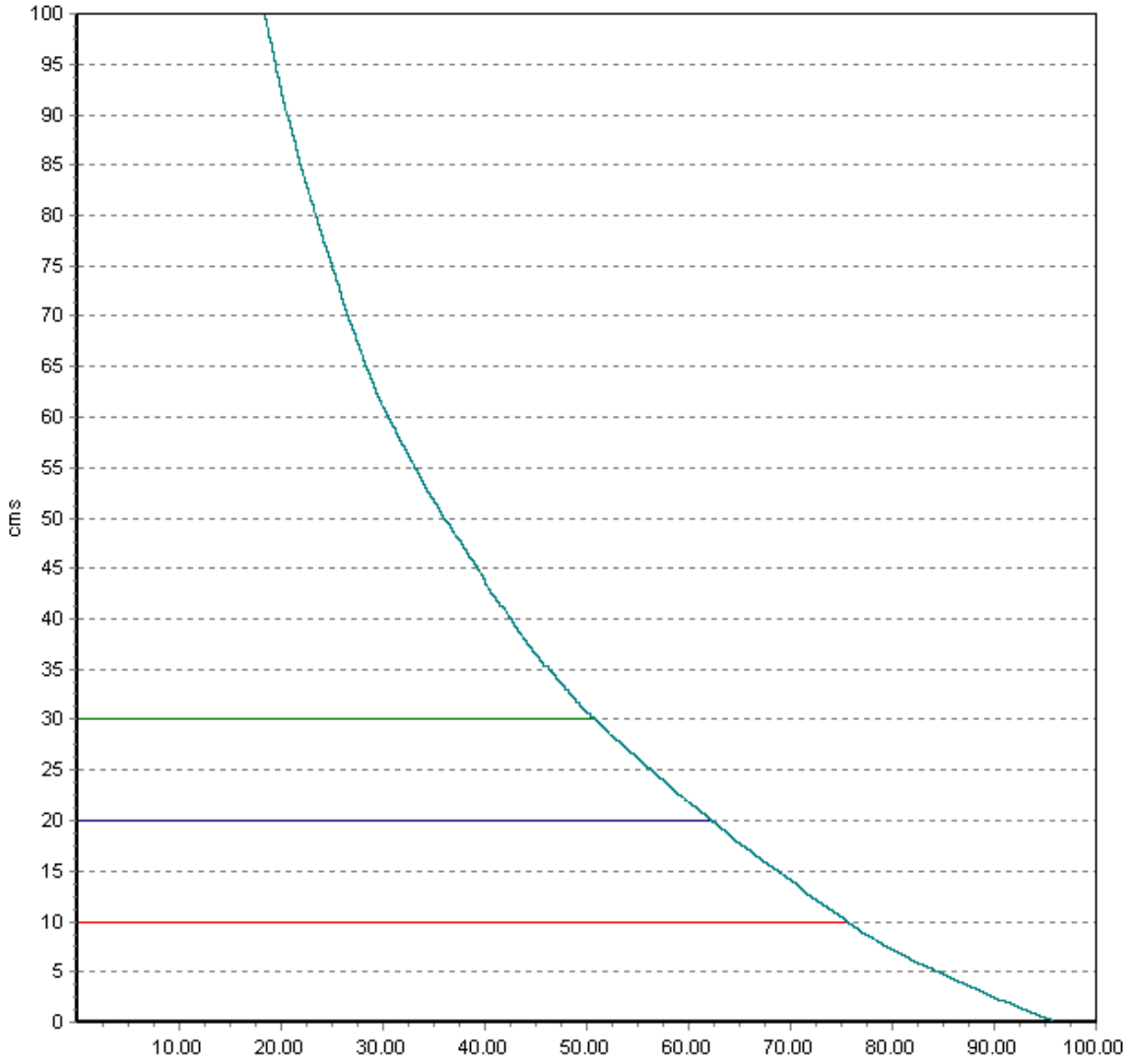


Figure C.4.8: Baseline Assessment Reliabilities for Mara Basins 1 & 2

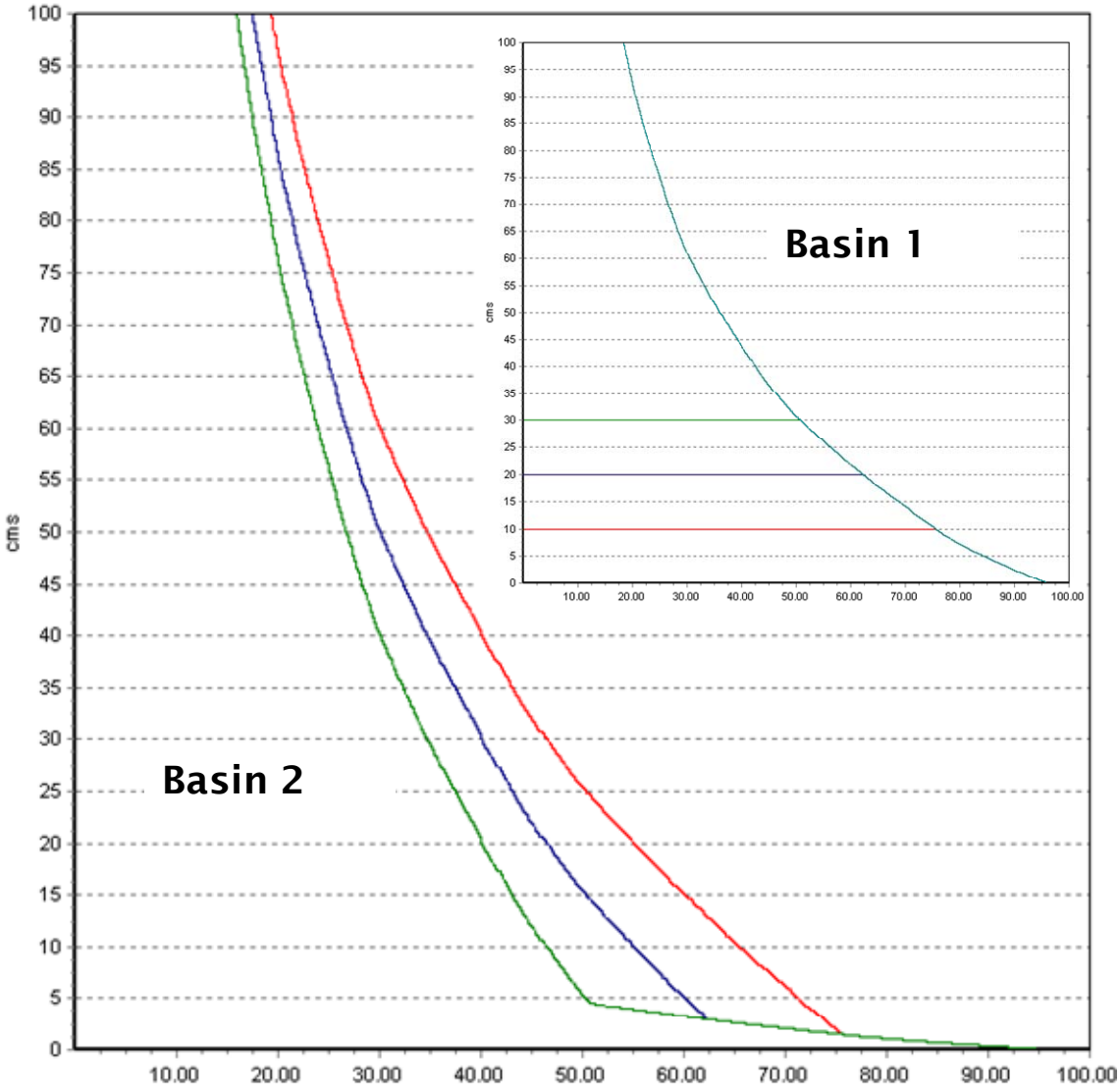


Figure C.4.9: Baseline Assessment Reliabilities for Mara Basin 2 near a Demand of 10 cms under Basin 1 Demands of 10, 20, and 30 cms

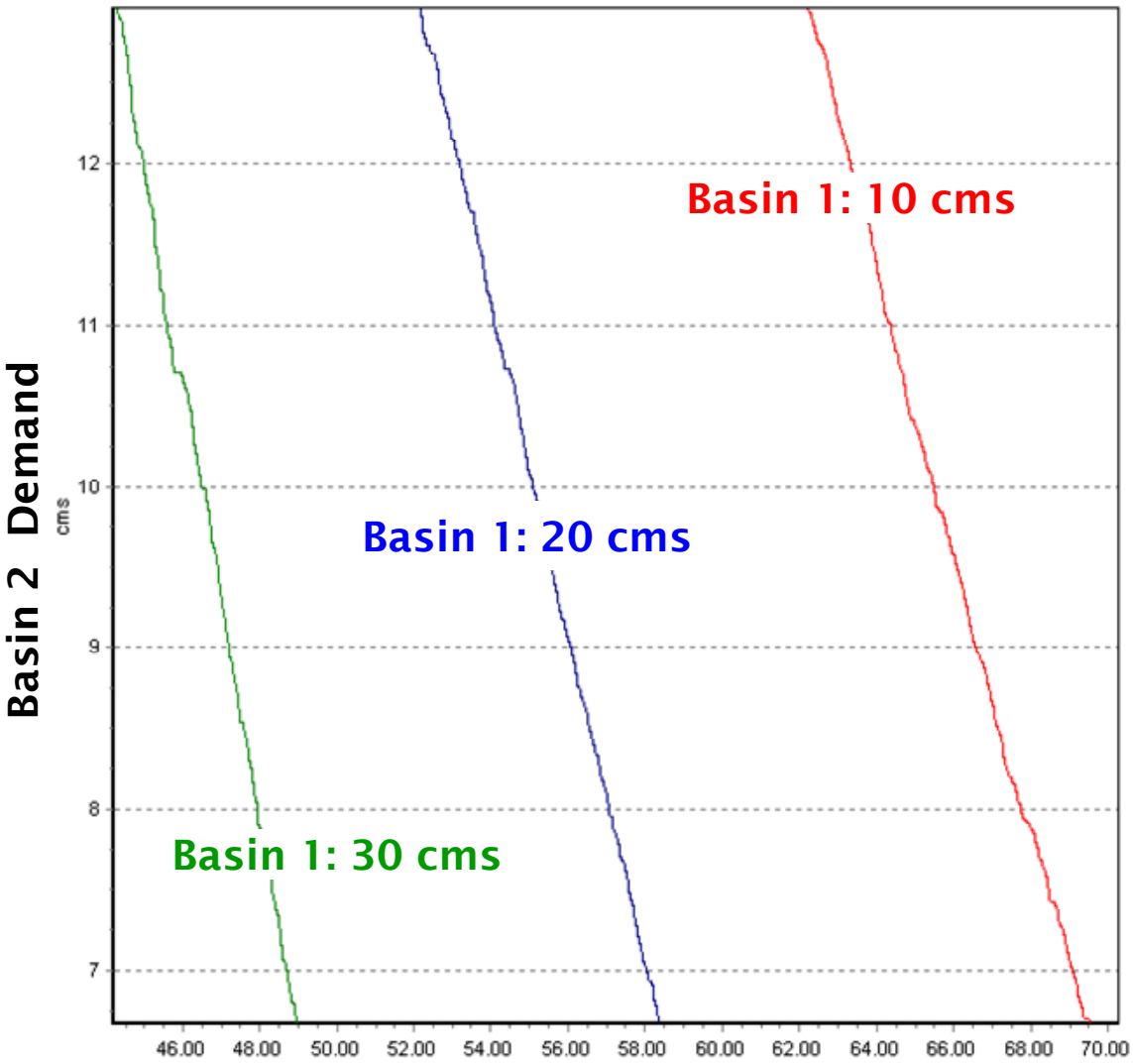


Figure C.4.10: Baseline Assessment Reliabilities for Mara Basin 1 and 2 for a Demand of 10 cms

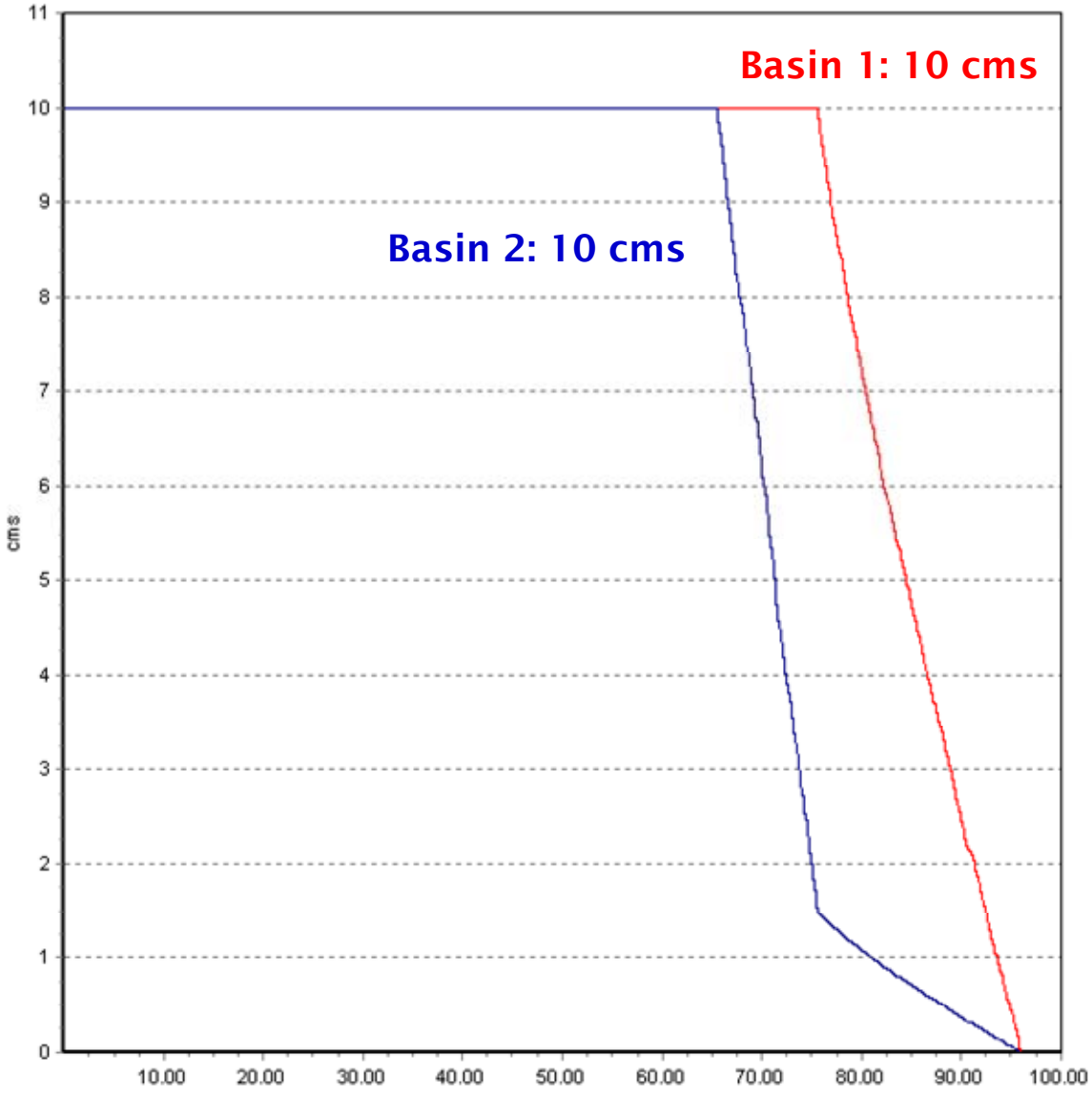


Figure C.4.11: Reliabilities for Mara Basin 2 for a Demand of 10 cms under various Storage Scenarios

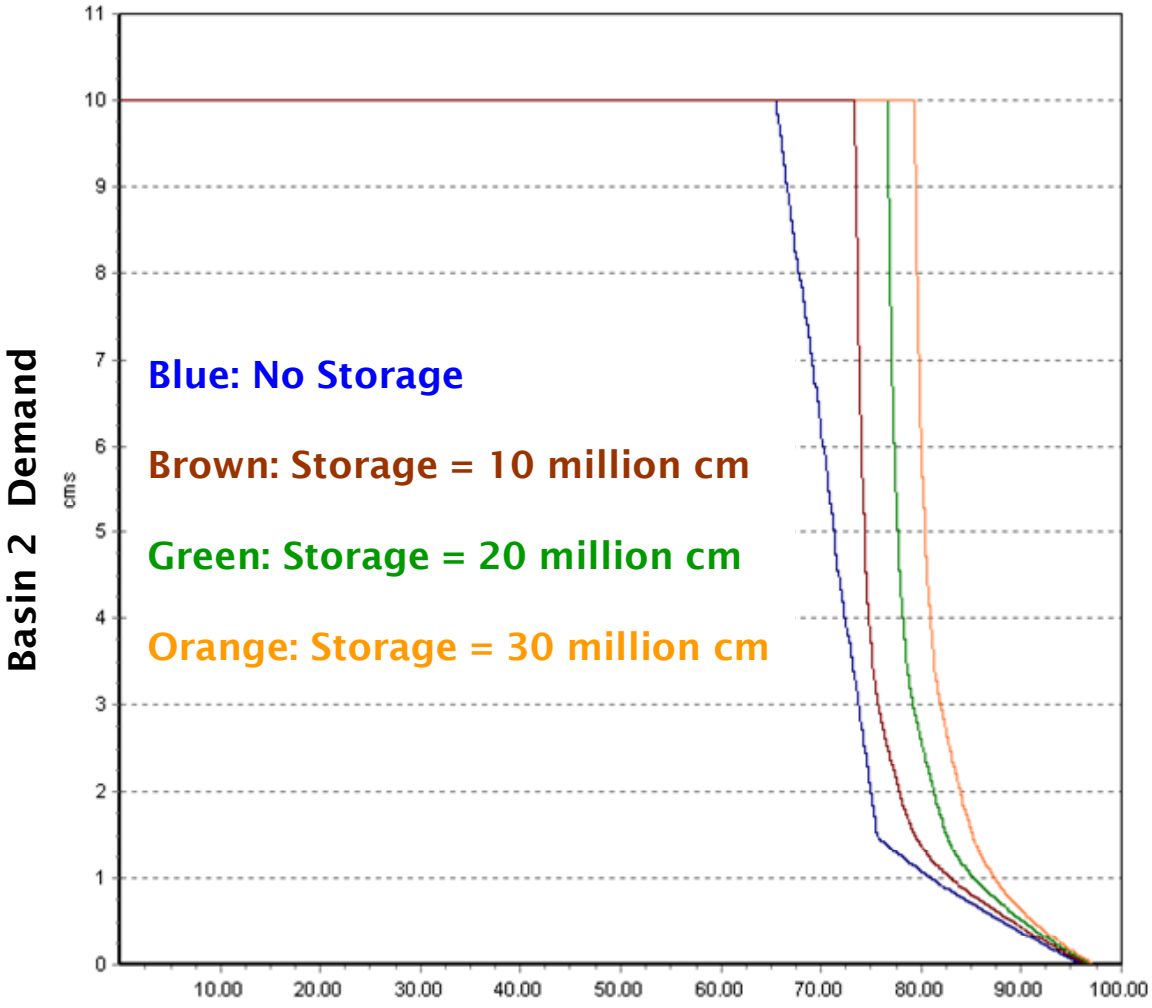


Figure C.4.12: Reliabilities for Mara Basin 2 for under various Storage Scenarios and upstream Demand Scenarios

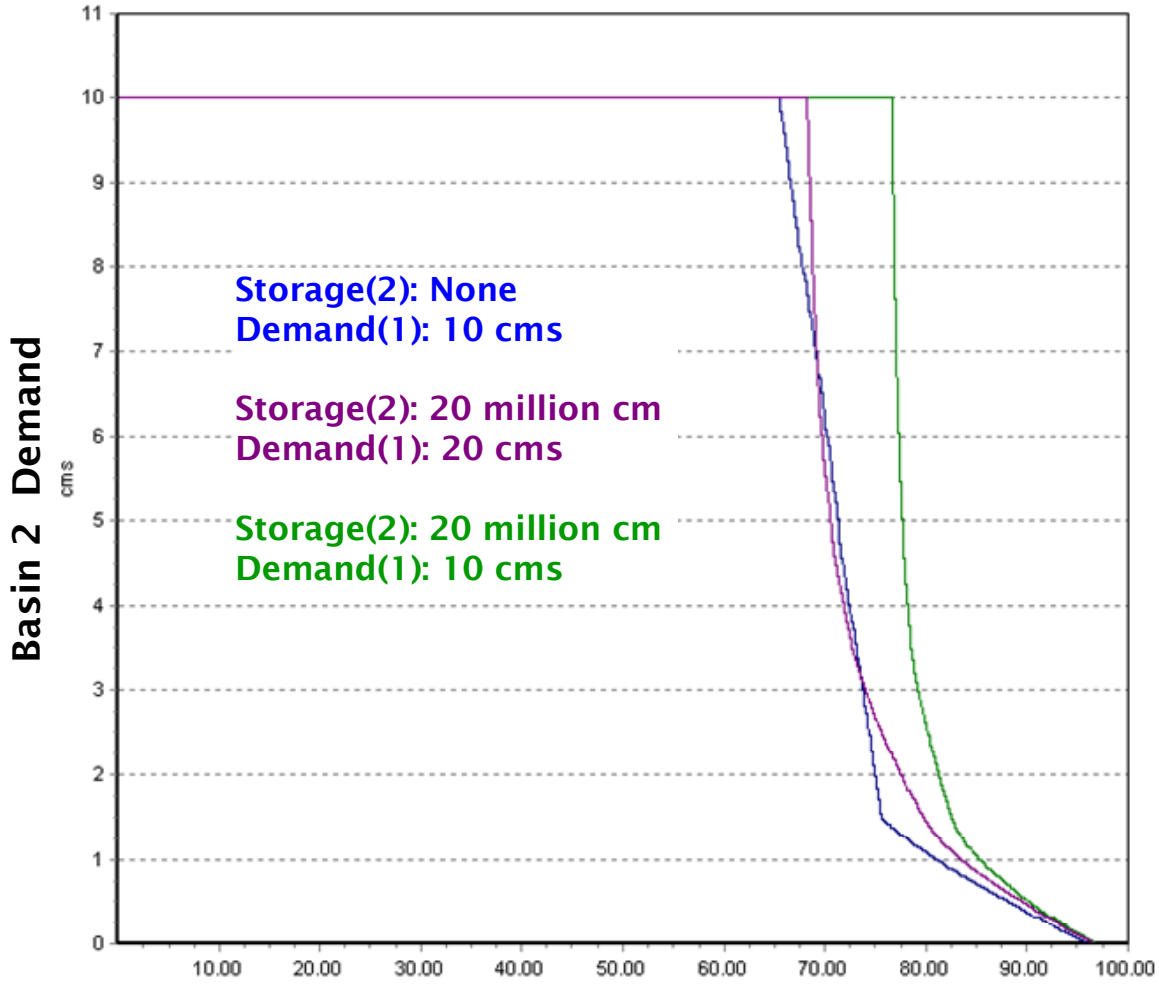


Figure C.4.13: Amala River Reserve Flow Requirements (7Q10)

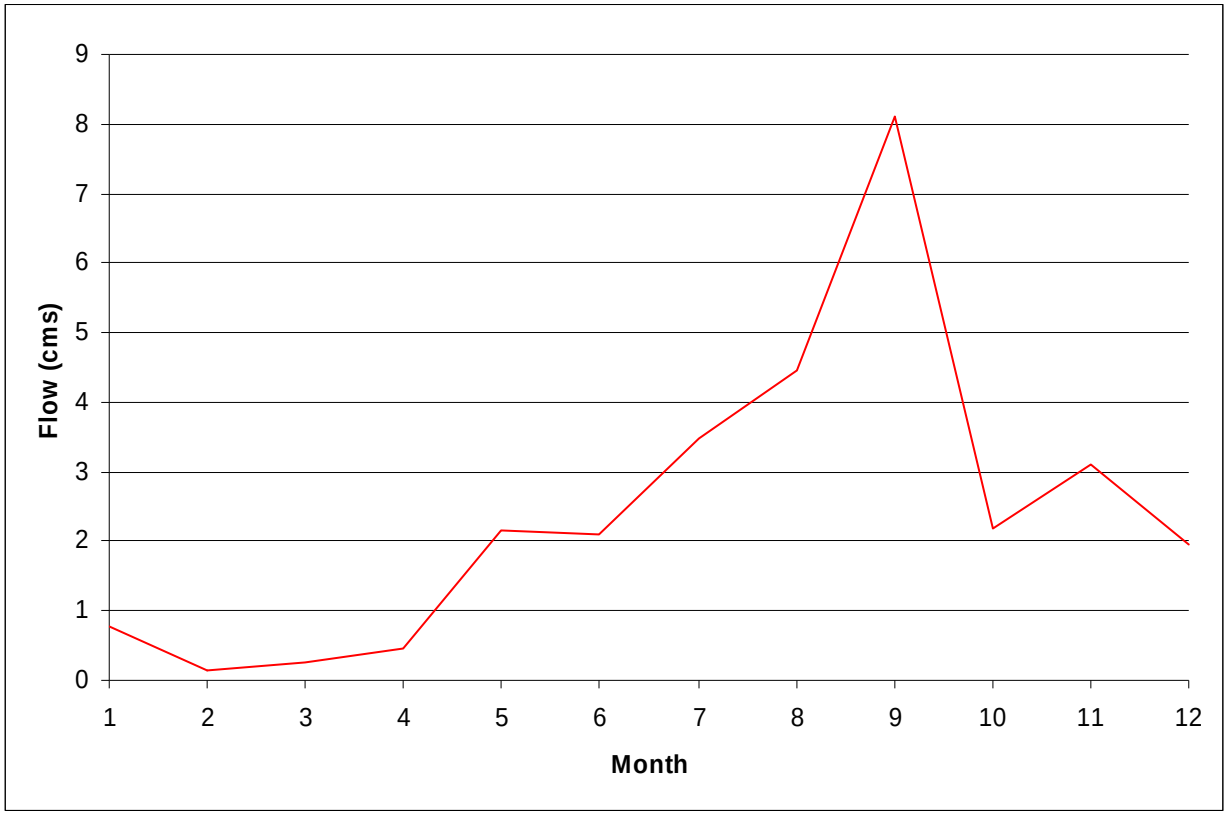


Figure C.4.14: Water Supply Reliability for a Transfer of 2.6 cms from the Amala River

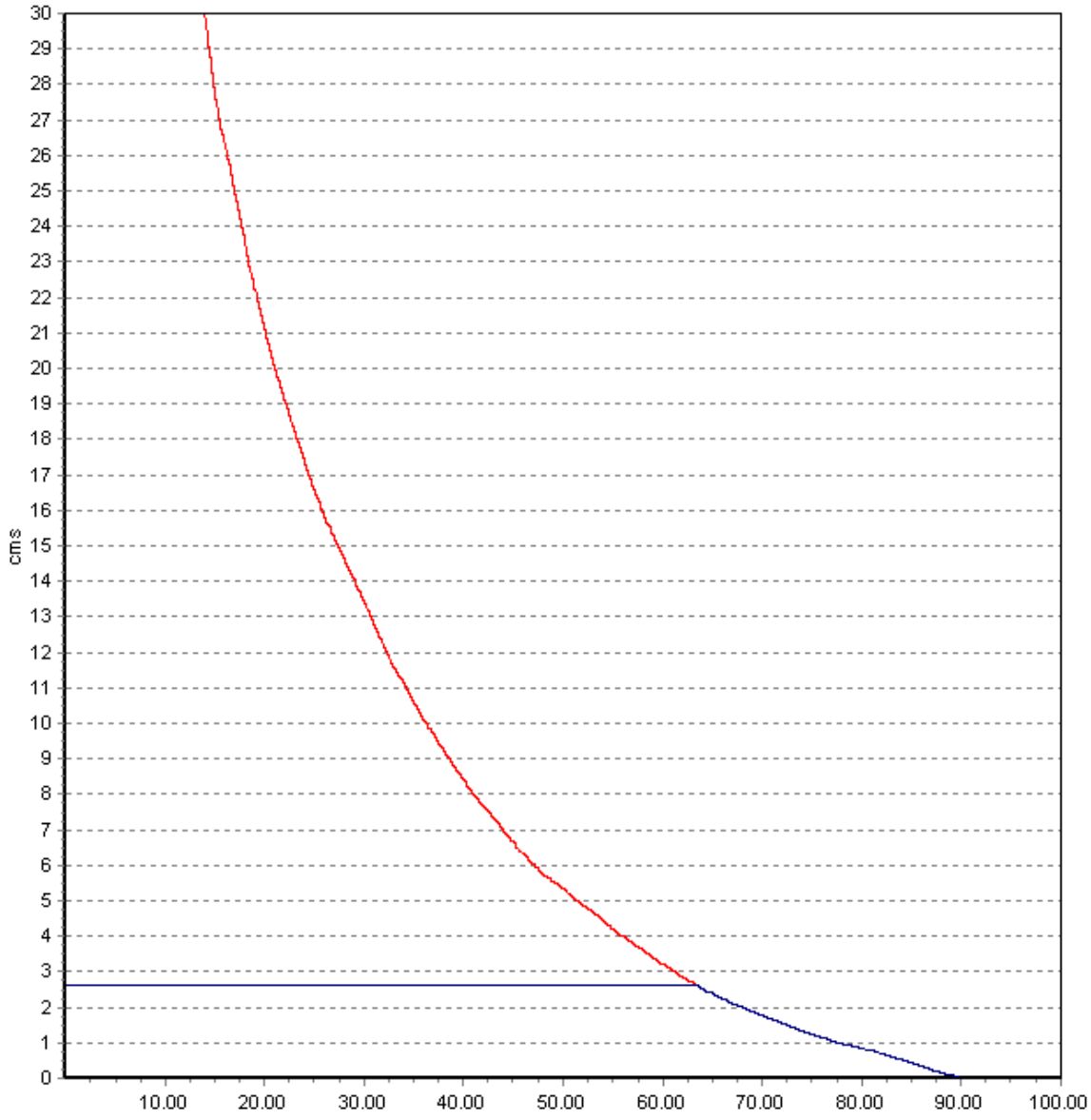


Figure C.4.15: Frequency Curve of River Flows at Outlet of the Amala River

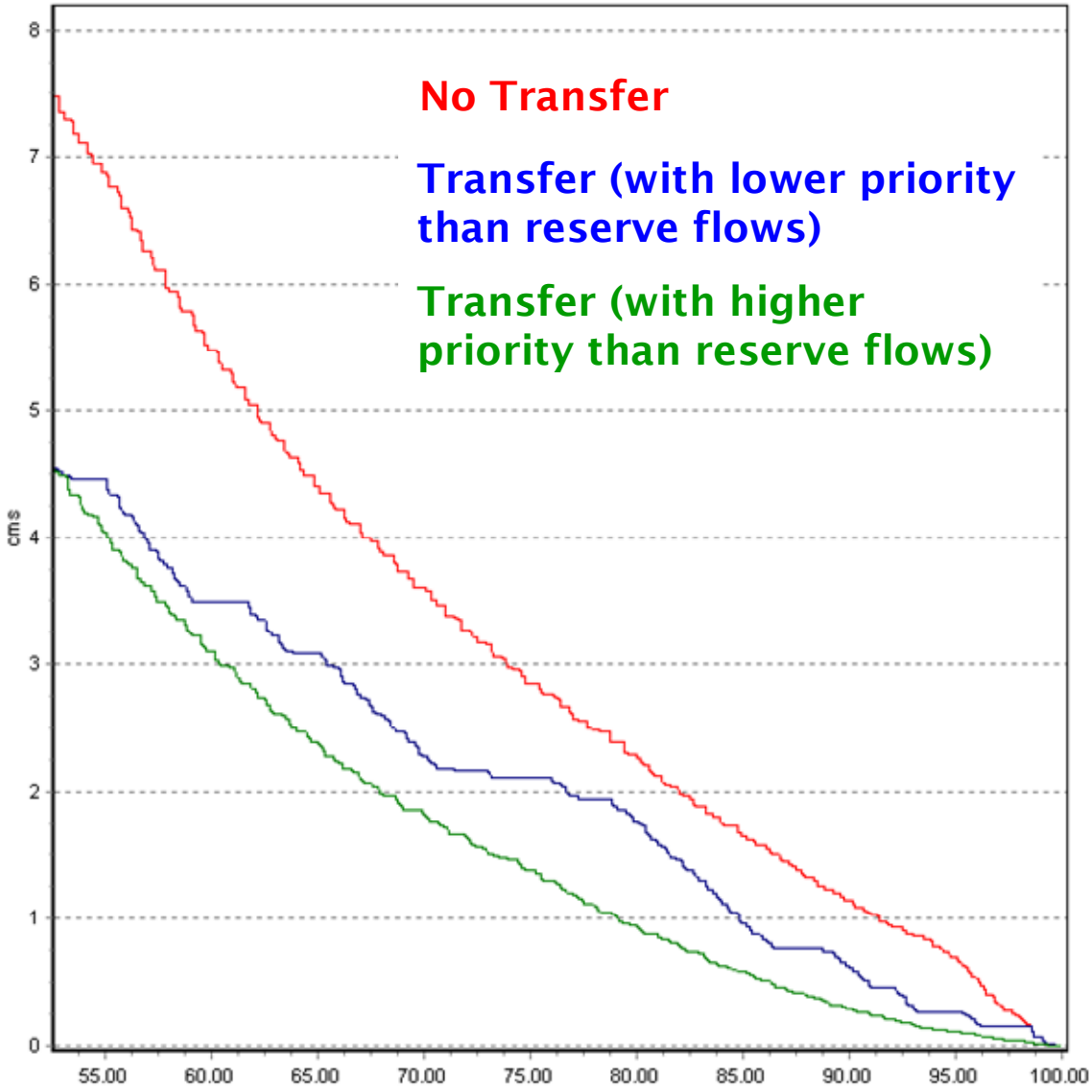


Figure C.4.16: Reliabilities for Mara Basin 1 for a Demand of 10 cms

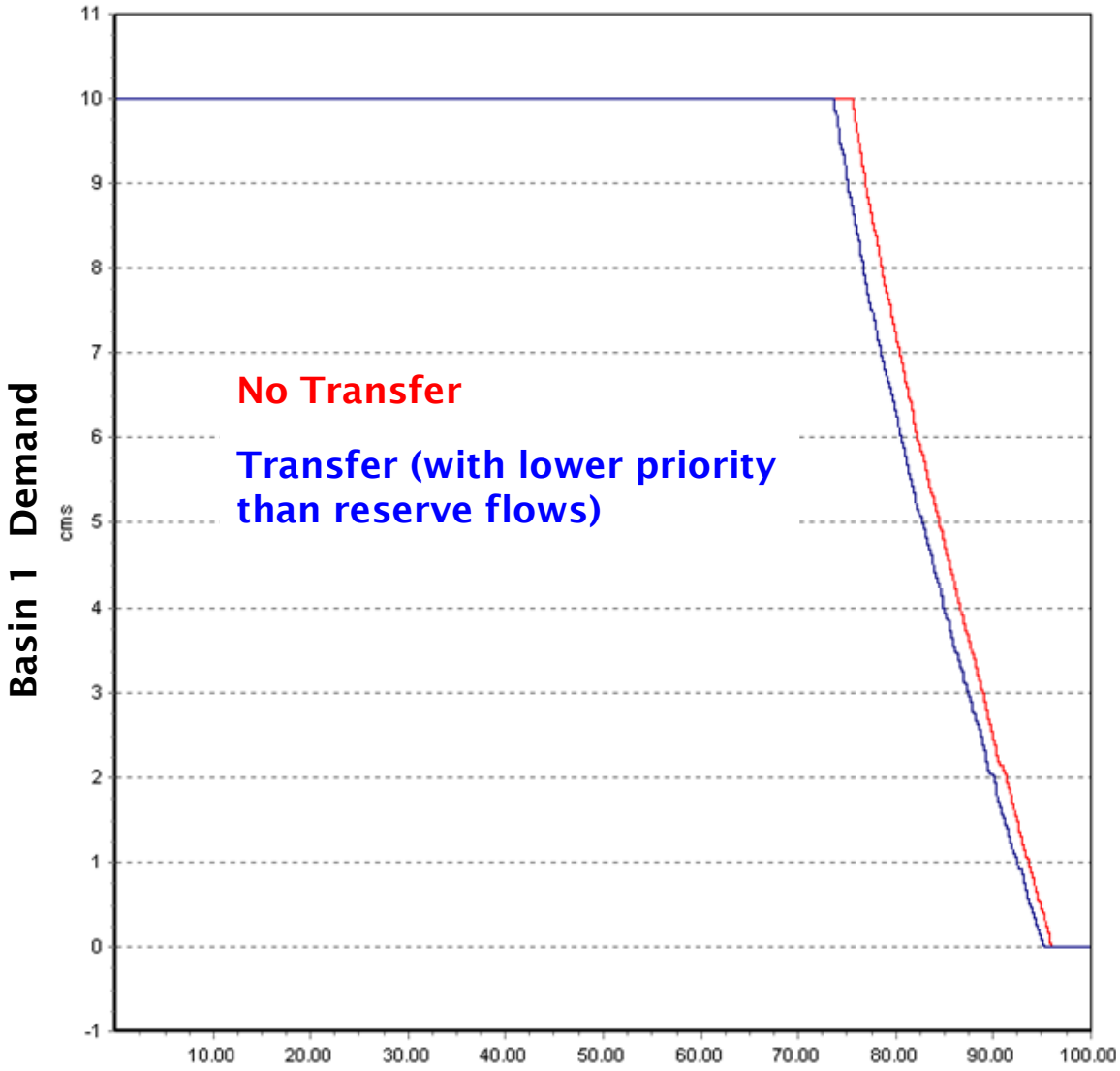
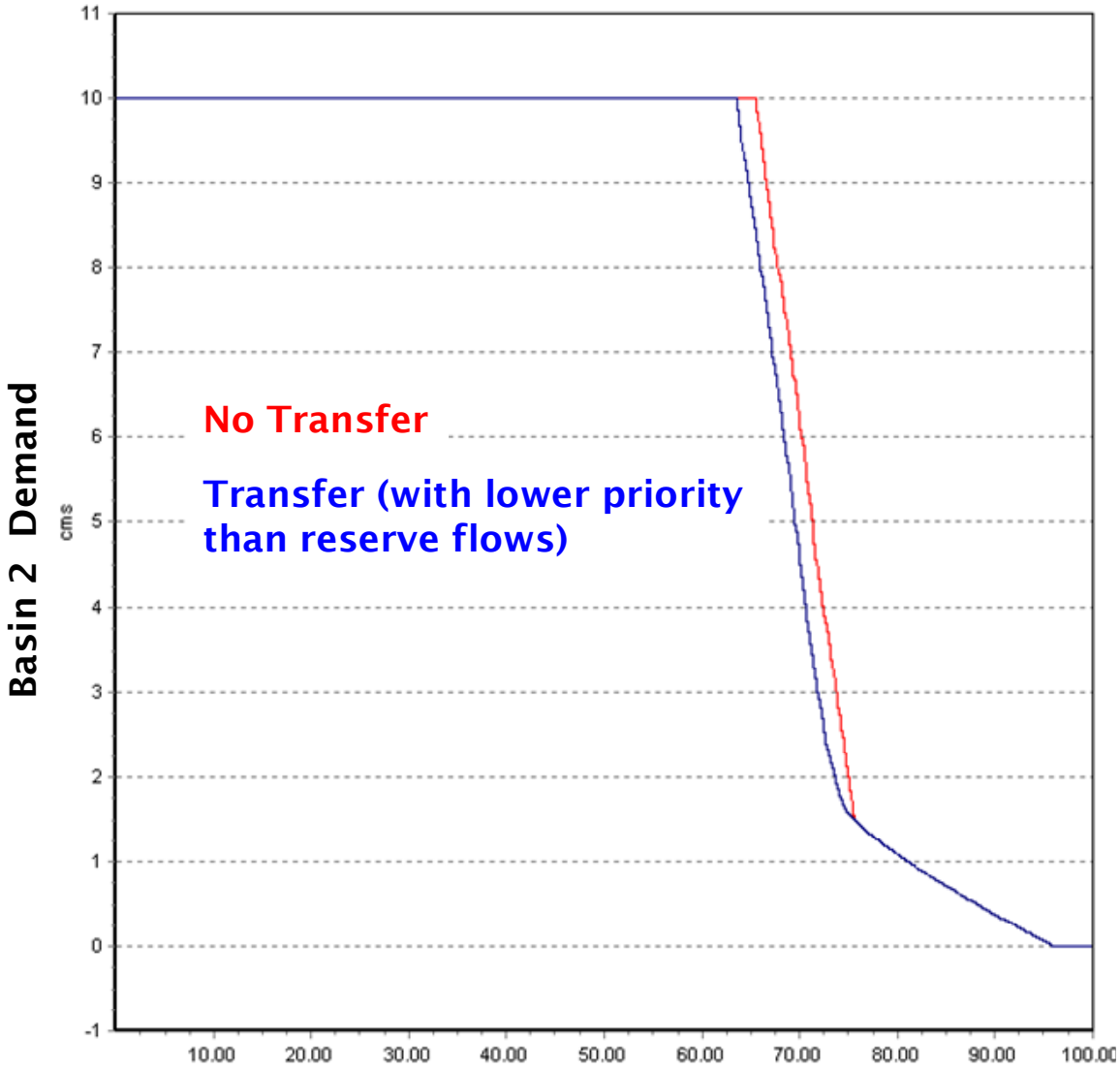


Figure C.4.17: Reliabilities for Mara Basin 2 for a Demand of 10 cms



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