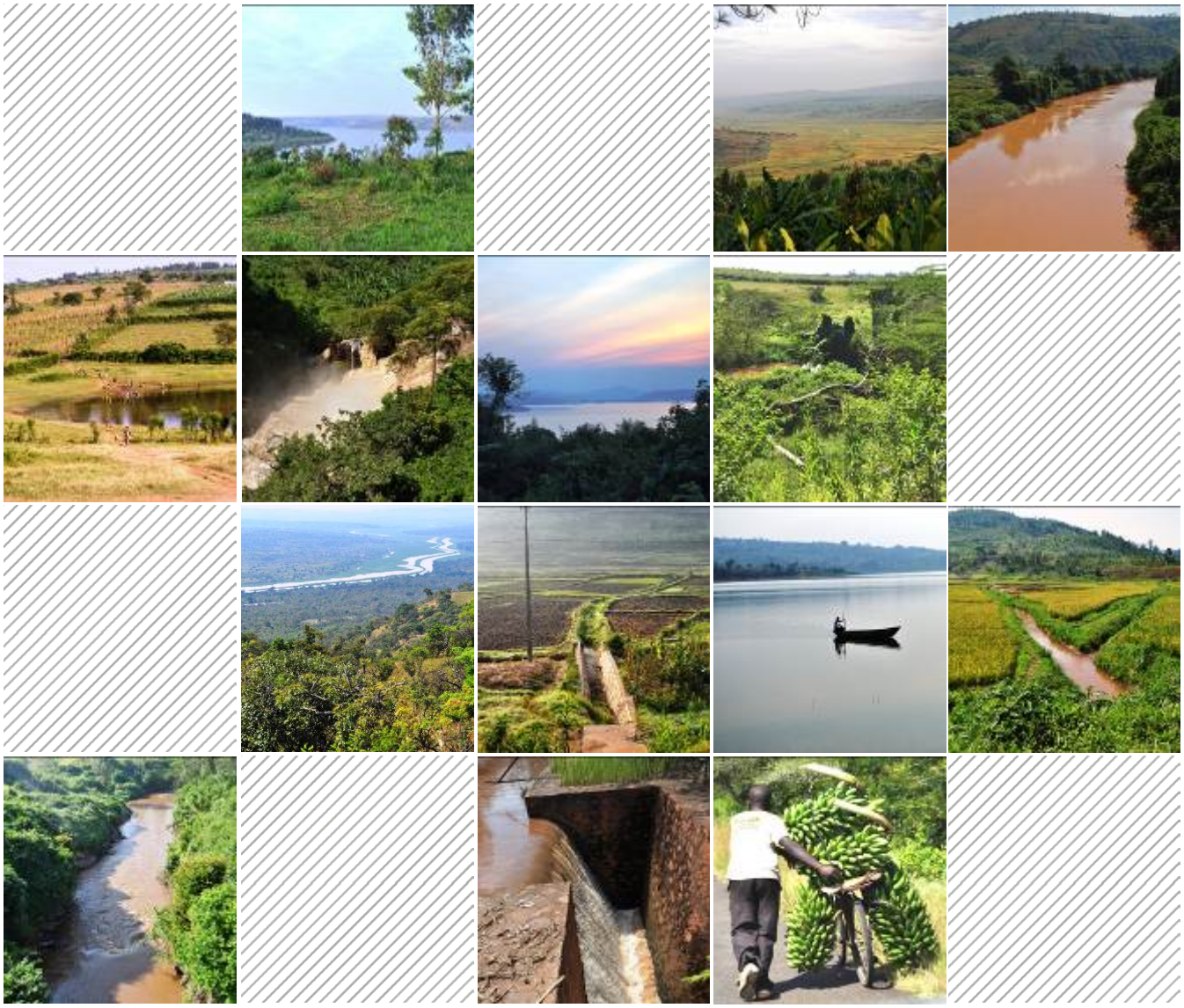

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Development of a Basin-wide IWRM-based Development Plan for the Kagera Basin

Submitted by:
Aurecon AMEI Ltd
Ebène House 3rd floor
33 Cybercity, Ebène, Mauritius

Contact Person:
Erik van der Berg
T: +27 21 526 5790 **F:** +27 21 526 9500
E: erik.vanderberg@aurecongroup.com

Submitted to:
Kagera River Basin PMU
NELSAP, NBI
P O Box 7054
Kigali
Rwanda

Submission date: December 2012

WEMA Consult (T) Limited
WEMA TWINS, 3rd Floor, Bagamoyo Rd,
Wazo-Tegeta, Basihaya Area,
Box 6737 Dar es Salaam, Tanzania
T: +255 22 263 0539 **F:** +255 22 2630534
E: info@wemaconsult.com

IWRM-based Basin Development Plan

Final

Report No: 7322/108392

Nile Basin Initiative

Nile Equatorial Lakes Subsidiary Action Program

Kagera River Basin Management Project

IWRM-BASED BASIN DEVELOPMENT PLAN

Consulting Services for

Development of a Basin-wide IWRM-based Development Plan for the Kagera Basin

Burundi, Rwanda, Uganda and Tanzania

Contract No.: Kagera/2011/S/BDP-01
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Prepared by: **Aurecon AMEI Ltd**
Address: P O Box 494, Cape Town, South Africa
Tel: 021 526 9400
Fax: 021 526 9500
E-mail: erik.vanderberg@aurecongroup.com

In Association with: **WEMA Consult (T) Ltd**
Address: PO Box 67371, Dar Es Salaam, Tanzania
Tel: +255 22 263 0539
Fax: +255 22 263 0534
E-mail: machibya@wemaconsult.com

December 2012

Executive Summary

I. INTRODUCTION

(i) Context of this Report in the Consultancy

The overall objective of the Consultancy is to ***establish a sustainable framework for the joint management of the water resources of the Kagera River Basin and prepare for sustainable development oriented investments***, in order to improve the living conditions of the people and to protect the environment.

The consultancy assignment specifically aims to:

a. Establish baseline conditions in the Kagera Basin (Diagnostic Assessment);
b. Assess water resources and water use of different sectors (Diagnostic Assessment);
c. Formulate and evaluate alternative development options that will meet those demands (Strategic Planning);
d. Recommend specific Water Resources Management and Development Options (Strategic Planning);
e. **Develop a sound and environmentally sustainable Integrated Water Resource Management (IWRM) Development Plan (Basin Development Plan); and**
f. **Translate the IWRM Development Plan into an Implementation Strategy and Action Plan to realize the Development Plan (Basin Development Plan).**

This is the ***IWRM-based Basin Development Plan (BDP) Report*** which addresses the 5th and 6th specific objectives of the assignment.

(ii) Overview of the Kagera Basin

The Kagera River Basin, a sub-Basin of the Lake Victoria Basin and Nile River Basin, comprises four riparian countries, namely Tanzania, Uganda, Rwanda and Burundi. It is significant that most of Rwanda (84%) and about half of Burundi falls within the Basin. Rwanda and Tanzania share almost 70% of the Basin area.

The Basin population is estimated at 16.4 million people and is expected to increase to 28.8 million people by 2032 (assuming a continuation of the current trends). Burundi and Rwanda have the largest shares of the Basin population at 47% and 34% respectively. The majority of the populations of Rwanda (75%) and Burundi (61%) reside in the Basin, whilst relatively small percentages of the populations of Tanzania and Uganda reside in the Basin. Urban populations are growing rapidly as a result of natural population increases as well as rural-urban migration.

II. BDP PORTFOLIO OF PROGRAMMES / PROJECTS

The project portfolio included in the BDP has been described in the Strategic Planning Report of this Consultancy, inclusive of structural investment projects and supporting non-structural projects.

The project locations are depicted in **Figure I**.

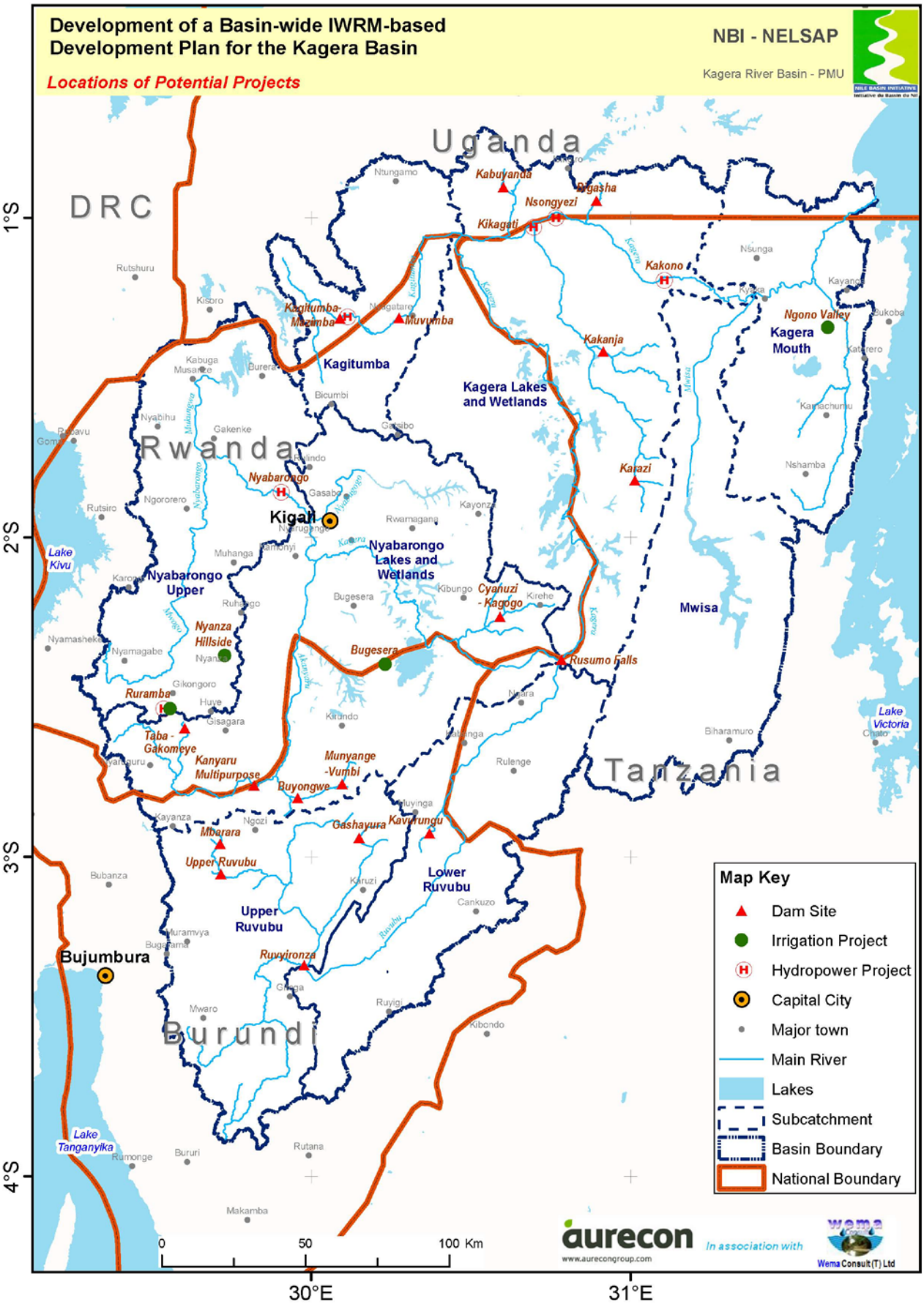


Figure I: Project locations

III. BASIN DEVELOPMENT PLAN

The IWRM-based Basin Development Plan entailed the development of a Basin Implementation Plan, monitoring and evaluation mechanisms, a Basin Development Plan and all the supporting elements including an investment programme, institutional framework, risk assessment and framework for dispute prevention.

(i) Basin Implementation Plan

The Implementation Plan for the Basin represents the Strategic Framework within which the BDP will be implemented. The Implementation Plan forms a subset of the BDP. During the compilation of the Implementation Plan, the strategies and targets were revisited, comments from stakeholders were taken into account, and the Implementation Plan was updated accordingly.

The Implementation Plan is presented in table format, according to the 5 strategic areas. Each of the 23 Strategies under the 5 Strategic areas has been expanded as follows:

- Targets (sub-strategies), with associated
- Activities (implementation actions);
- Indicators (for monitoring and evaluation), to measure outcomes of Activities,
- Timeframes: Short (1-5yr), Medium (6-10yr) or Long (11-20yr) for implementation of Activities;
- Responsibility, at Basin Scale, National Scale, Local Scale and Other Stakeholders for implementation of the Plan; and
- Costing / Funding Source, per Activity.

(ii) Monitoring and Evaluation

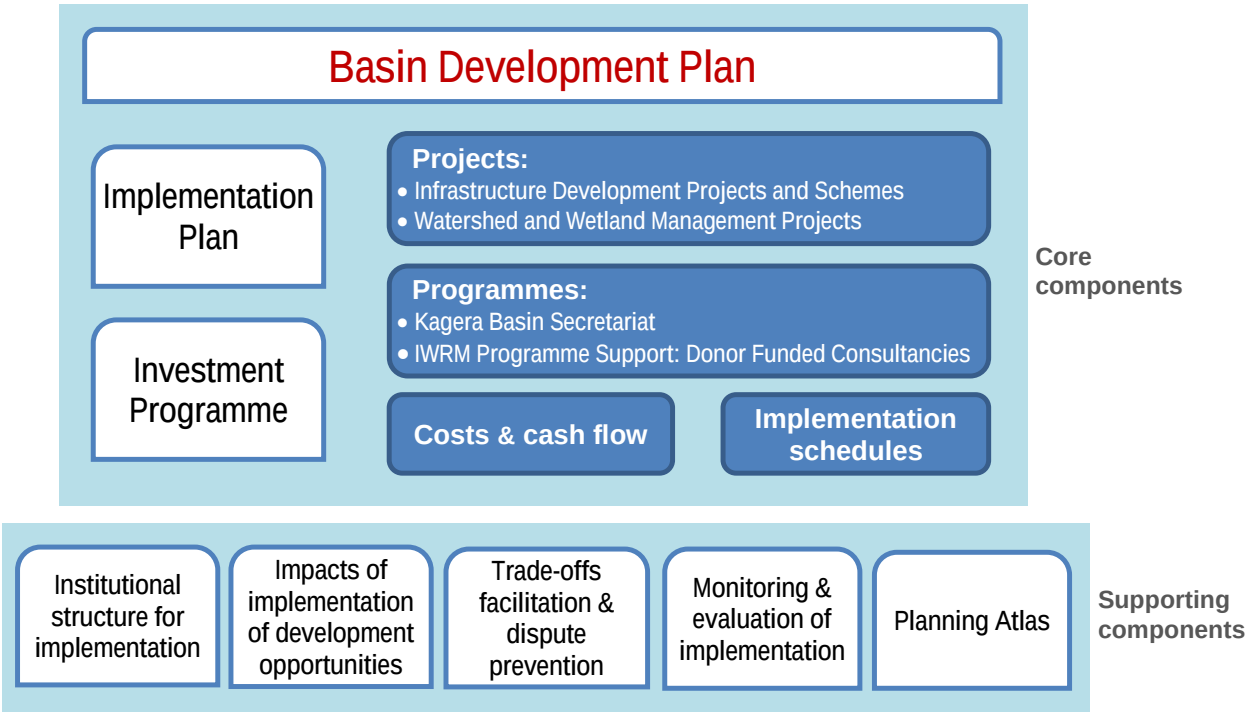
Monitoring and evaluation (M&E) is essential to ensure that implementation is on track, to measure short and long term impacts and to evaluate the impacts in order to modify the plan or its implementation (as necessary). M&E will be guided by the specific result-based indicators described in the Implementation Plan. For the projects/programmes, this will include M&E of progress in terms of implementation programmes and actual against planned expenditure, among others. More detailed step-wise M&E indicators should be identified for each projects/programme so that progress can be adequately tracked and evaluated.

The reporting system, to be implemented by the Basin Secretariat, would have to be designed in such a way that progress is tracked for the individual activities of the BDP. Problems encountered and the measures taken to address the problems should be reported on a quarterly and annual basis. In addition, systematic periodic evaluation and objective assessment of the progress made towards the achievement of the overall goal of the BDP should be done.

(iii) Introduction to the Basin Development Plan

The BDP recommends the further evaluation or implementation of mainly a number of large scale investment projects aimed at stimulating sustainable socio-economic growth and reversal of environmental degradation in the Kagera River Basin, with a main focus on large scale water storage dams for multipurpose uses. Using the principles of IWRM, the BDP will promote the coordinated development and management of water and related resources, in order to maximise economic and social welfare without compromising the sustainability of the water resources in the Basin.

The Kagera BDP is composed of the following components:



(iv) Investment Programme

Costs for the various projects and programmes were obtained from existing reports, where available. Where costing gaps were identified, estimates were made based on assumed unit costs. The implementation schedules of the various development options were derived from the reports of the investigations undertaken, where this was available. Where such information was not available, best estimations were made, based on the type and size of schemes. These have been estimated for pre-feasibility and feasibility studies, and for Implementation (design/ESIA and construction). A preliminary investment programme, based on the project screening, was presented at the November stakeholder workshop and then refined based on feedback from the Basin countries.

The Investment Programme for structural projects is shown in **Table I**.

Table I: Investment programme for projects

		Scheme	Country	Estimated Construction Cost (million US$)	Estimated Total Cost (million US$)	Score From Screening[1]	Phasing of Capital Expenditure (Costs in million US$)																			Short Term (1 - 5 years)	Medium Term (6 - 10 years)	Long Term (11 - 20 years)
							1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20			
Hydropower schemes		Ruvyironza Multipurpose Dam	Burundi	237	271	11			3.6	3.6	3.6	7.9	7.9	7.9	79.0	79.0	79.0										11	182	79
		Nyabarongo Multipurpose Dam	Rwanda	589	666	7	8.8	8.8	19.6	19.6	19.6	117.8	117.8	117.8	117.8	117.8										77	589	0
		Ruramba Small Hydropower Project	Rwanda	13	15	4	0.8	0.8	4.3	4.3	4.3															15	0	0
		Kakono Hydropower Project	Tanzania	414	474	11	6.2	6.2	6.2				13.8	13.8	13.8	103.4	103.4	103.4	103.4								19	145	310
		Rusumo Falls Run of River Hydropower	Tanzania/Rwanda	235	258	23	11.7	11.7	78.3	78.3	78.3																258	0	0
		Kikagati Hydropower Project	Uganda/Tanzania	60	66	16	3.0	3.0	20.0	20.0	20.0																66	0	0
		Maziba Small Hydropower project	Uganda	2.5	3	13	0.0	0.0		0.1	0.1	0.1	0.6	0.6	0.6	0.6											0	3	0
		Nsongyezi 39 MW Hydropower Project	Uganda/Tanzania	160	178	10	2.4					8.0	8.0	53.3	53.3	53.3											2	176	0
Multipurpose Projects	Larger Dams	Upper Ruvubu Dam	Burundi	160	181	7				2.4	2.4	5.3	5.3	5.3	40.0	40.0	40.0	40.0									5	96	80
		Kanyaru Dam	Burundi/Rwanda	351	391	12	5.3	11.7	11.7	11.7	87.8	87.8	87.8	87.8													128	263	0
		Muvumba Dam	Rwanda	131	148	8	2.0	2.0		4.4	4.4	4.4	26.2	26.2	26.2	26.2	26.2										13	109	26
		Kakanja Dam	Tanzania	13	15	3		0.2	0.2	0.2						0.4	0.4	0.4	3.3	3.3	3.3	3.3					1	0	14
		Kagitumba-Mazimba Dam	Uganda/Rwanda	77	87	5			1.2	1.2				2.6	2.6	2.6	19.3	19.3	19.3	19.3							2	8	77
	Smaller Dams	Gashayura Dam	Burundi	67	76	9	1.0	1.0	2.2	2.2	2.2	16.8	16.8	16.8	16.8												9	67	0
		Kavurugu Dam	Burundi	28	32	2						0.4	0.4	0.4	0.9	0.9	0.9	7.0	7.0	7.0	7.0						0	3	29
		Taba-Gakomeye	Rwanda	40	1	9	0.6	0.6																			1	0	0
		Mbarara Dam	Burundi	34	39	1		0.5	0.5	0.5	1.1	1.1	1.1	8.5	8.5	8.5	8.5										3	28	9
		Munyange-Vumbe Dam	Burundi	54	62	1						0.8	0.8	0.8	1.4	1.4	1.4	1.4	18.0	18.0	18.0						0	5	57
		Karazi Dam	Tanzania	54	61	3	0.8	0.8	1.8	1.8	1.8	13.5	13.5	13.5	13.5												7	54	0
		Bigasha Dam	Uganda	60	69	6	0.9	0.9	0.9	2.0	2.0	2.0	15.0	15.0	15.0	15.0											7	62	0
		Kabuyanda Dam	Uganda	33	37	3			0.5	0.5	1.1	1.1	1.1	8.3	8.3	8.3	8.3										2	27	8
Irrigation Schemes		Buyongwe	Burundi	124	4	9	1.9	1.9																			4	0	0
		Bugasera Irrigation	Burundi/Rwanda	46	46	13	9.2	9.2	9.2	9.2	9.2																46	0	0
		Nyanza Hillside Irrigation	Rwanda	64	64	5		16.0	16.0	16.0	16.0																64	0	0
		Ruramba Irrigation	Rwanda	2	2	7			0.0	0.0	0.0	0.4	0.4	0.4	0.4												0	2	0
		Ngono Valley	Tanzania	51	53	9	0.8	0.8	10.2	10.2	10.2	10.2	10.2														32	20	0
Other		Mutobo Pipeline	Rwanda	300	300	5	75.0	75.0	75.0	75.0																	300	0	0

Pre-feasibility	Feasibility	Admin and Finance, ESIA and Design	Construction

Funding requirements differ significantly, depending on the type of project and programme to be implemented. The programmes proposed generally are a much smaller cost when compared to the costs of implementing the large infrastructure projects. As a result, the associated funding mechanisms are very different. Self-sufficient projects which have a potential to create revenue could be funded by the private sector or in a public-private-partnership with the government. Smaller water supply and irrigation schemes would mostly have to be donor funded.

Table II: Summary of costs for projects and programmes

Area of investment	Short term 1 – 5 years US$ million	Medium term 6 – 10 years US$ million	Long term 11 – 20 years US$ million
A. KAGERA BASIN SECRETARIAT			
Secretariat	4.5	6.0	15.0
Sub-total Kagera Basin Secretariat	**4.5**	**6.0**	**15.0**
B. IWRM PROGRAMME SUPPORT: DONOR FUNDED CONSULTANCIES			
Creating an enabling environment	1.5	2.6	1.0
Basin water management	0.7	0.7	0.4
Livelihood and socio-economic development	1.2	1.5	1.8
Environmental protection, land and disaster management	0.5	0.5	1.1
Sub-total Donor funded consultancies	**3.9**	**5.3**	**4.2**
C. INFRASTRUCTURE DEVELOPMENT PROJECTS AND SCHEMES			
Hydropower Schemes	448	1094	389
Multipurpose projects – Larger Dams	148	477	197
Multipurpose projects – Smaller Dams	28	246	102
Irrigation schemes	146	22	0
Other projects	300	0	0
Sub-total Infrastructure development schemes	**1070.1**	**1838.5**	**688.7**
D. WATERSHED AND WETLAND MANAGEMENT PROJECTS			
Watershed Projects	424.6		
Wetland Projects	64.0		
Management	43.2		
Sub-total watershed and wetland management projects	**531.8**	**0.0**	**0.0**
TOTAL	**1610.4**	**1849.8**	**707.9**

(v) Institutional Structure for Implementation

The institutional structure for implementation for the Kagera BDP was developed using a framework that takes into consideration the Kagera governance framework and governance structure. The governance framework is determined by historical, constitutional, economic, social, political and physical conditions of the Kagera River Basin and its riparian states. The governance structure is determined by water related law, policy and organizational (administration) elements. The water law aspects of the institutional structure include inter-governmental responsibility, water rights and accountability provisions and mechanisms. The water law policy aspect includes specific policy issues such as project selection, water

pricing and cost recovery, and user and private participation. The water administration aspects of the institutional structure cover the organizational, financial, and managerial structures including the regulatory apparatus and conflict resolution mechanisms.

(vi) Impacts of Implementation of Development Opportunities

No development comes without impacts – these should primarily be positive but there are always some that are negative. The central impact is the volume of water used and how this might affect the Kagera River and inflows into Lake Victoria. This must be balanced against the positive uses to which that water is put – for hydropower, domestic water use, and irrigation. Local negative impacts may be both environmental (on biodiversity, environmental flows, water quality) and social (number of people displaced, loss of livelihoods) – these relate both to inundation and to the type of development project. Run of river hydropower schemes, having limited associated storage, generally have the least impact.

Most impacts can be mitigated but mitigation alone does not necessarily make a project acceptable. Ensuring that environmental flows are maintained is an important mitigatory measure that will be demanded by most funding agencies or investors.

Under a high growth scenario, dams will result in added consumptive use of 392 million m^3/a and new irrigation schemes a further 100-200 million m^3. Many thousands of homes will need to be relocated. On the positive side 200MW (1660 GWh/a) of electricity will be generated, 3.5 million people could benefit from improved water supply, and well over 20 000 ha will be put under irrigation. The total cumulative impact on the Kagera River is estimated at 500 million m^3/a, or 7% of the mean annual runoff.

(vii) Trade-offs Facilitation and Dispute Prevention

The implementation of the BDP is likely to result in significant and rapid changes to the river Basin. Such changes often result in tensions which could escalate to conflict if not properly managed. Adequate institutional structures need to be put in place to implement strategies for dispute prevention. Possible disputes that could arise in the implementation of the BDP have been identified as well as the recommended strategies to prevent these.

Water resources are a common pool resource with many competing users at varying scales (transboundary, national and local scales). The users compete for various aspects of water including quantity, quality and timing - these aspects may be used as trade-off between users. Trade-off is about how much a user is willing to give up in order to get a little more of what the user wants the most. Trade-offs allow water sector users to benefit equitably from the limited resource. To a large extent trade-offs are more common and required when there is water scarcity. Currently water scarcity is not a major problem in the Kagera but trade-off on other aspects of water and natural resources management are necessary. Trade-off facilitation mechanisms pertinent to the Kagera BDP were identified.

(viii) Risks and Risk Management

The approach adopted for the risk assessment of the implementation of the BDP firstly comprised the determination and listing of risk scenarios that are anticipated for the successful implementation of the BDP. The PESTILE approach was used in which risks are categorised as political, economic, social, technological, institutional, legal or environmental. All the identified risk scenarios have been evaluated for Significance and Ranking utilising a Risk Assessment Procedure. Mitigation measures are identified and the process is repeated for a post-mitigation scenario in order to determine to what extent the risk profile could be improved through mitigation. Risk performance is tracked by means of using a 'risk ratio'.

(ix) Kagera Planning Atlas

The Kagera Basin planning atlas is included as a separate Annexure to the BDP Report. The atlas includes all the maps generated during the consultancy. All the spatial data used has been organised in a GIS database, which is submitted together with the atlas. Care was taken to create or update metadata for each dataset used, and an explanatory text on the content and structure of the database has been provided, together with the database, to guide users.

Contents

FIGURES

TABLES

ANNEXURES

Aurecon electronic file reference:

P:\Projects\108392 Kagera Basin Development Plan\3 Delivery\08a FINAL Reports & Other Deliverables\Final Reports - MSWord\Kagera BDP Report - Final.docx

ABBREVIATIONS AND ACRONYMS

AfDB	African Development Bank
BDP	Basin Development Plan
CFA	Cooperative Framework Agreement
DRIFT	Downstream response to imposed flow transformation
DSS	Decision-support system
EAC	East African Community
EF	Environmental flows
ENSAP	Eastern Nile Subsidiary Action Plan
GDP	Gross Domestic Product
GIS	Geographic information system
GNI	Gross National Income
Ha	hectare
HPP	Hydro power plant
ICP	International Cooperating Partners
IMS	Information Management System
ISO	International Organization for Standardization
IWRM	Integrate Water Resource Management
IWRMD	Integrated Water Resource Management Development
JPA	Joint Project Agreement
l/s	Litres per second
m	metre
mm	millimetre
MW	Megawatt
m^3	Cubic metres
km^2	Square kilometres
kWh	Kilowatt hours
Kagera-Com	Kagera Council of Ministers
Kagera ICP Forum	Kagera International Cooperating Partners Forum
Kagera-TAC	Kagera Technical Advisory Committee
KOBWA	Komati Basin Water Authority
LHDA	Lesotho Highlands Development Association
LVBC	Lake Victoria Basin Commission
MAR	Mean annual runoff
masl	metres above sea level
M&E	Monitoring and Evaluation
MDG	Millennium development goals
MINAGRI	Ministry of Agriculture and Livestock, Rwanda
MINITERE	Ministère des Terres, de l'Environnement, des Forêts, de l'Eau et des Ressources naturelles
MoU	Memorandum of Understanding
NBI	Nile Basin Initiative
NELCOM	Nile Equatorial Lakes Committee
NELSAP	Nile Equatorial Lakes Subsidiary Action Programme
NEL-TAC	Nile Equatorial Lakes Technical Advisory Committee
NILETAC	Nile Basin Technical Advisory Committee
NILECOM	Nile Basin Council of Ministers
NGO	Non-Governmental Organisation
OECD	Organisation for Economic Cooperation and Development
PESTILE	Political, Economic, Social, Technical, Institutional, Legal or Environmental
PMU	Project Management Unit
PPP	Public-private partnerships
RSA	Risk Scenario Assessments
TAC	Technical Committee
TANESCO	Tanzania Ministry of Energy, Ministry responsible for Water and Tanzania Energy Authority
RAP	Relocation Action Plan
RBO	River Basin Organisation
REC	Regional Economic Communities
SADC	Southern African Development Community

SHPP	Small hydro power plant
SPV	Special Purpose Vehicle
SWOT	Strengths, weaknesses, opportunities and threats
TAC	Technical Committee
TSC	Technical Steering Committee
UNDP	United Nations Development Programme
USD	American Dollars
WSS	Water Supply and Sanitation Schemes
WUA	Water Users Association
ZRA	Zambezi River Authority

IWRM-BASED BASIN DEVELOPMENT PLAN

1. INTRODUCTION

1.1 Brief Description and Context of the Consultancy

The overall objective of the Consultancy is to ***establish a sustainable framework for the joint management of the water resources of the Kagera River Basin and prepare for sustainable development oriented investments***, in order to improve the living conditions of the people and to protect the environment.

The consultancy assignment specifically aims to:

a. Establish baseline conditions in the Kagera Basin (Diagnostic Assessment);
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d. Recommend specific Water Resources Management and Development Options (Strategic Planning);
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f. **Translate the IWRM Development Plan into an Implementation Strategy and Action Plan to realize the Development Plan (Basin Development Plan).**

This is the ***IWRM-based Basin Development Plan Report*** which addresses the 5th and 6th specific objectives of the assignment.

1.2 Objective of this Phase of the Consultancy

Figure 1-1 on the following page illustrates the workflow for the study and Basin Development Plan (BDP), indicating the various tasks undertaken, the stakeholder workshops held and the deliverables. The Basin Development Plan Task (Task No 4 as shown in the Figure) shows the specific activities under this task, which it aims to address, namely:

a. Updated and agreed IWRM Basin strategy.
b. Basin Implementation Plan.
c. Monitoring and evaluation mechanism.
d. Basin Development Plan.
e. The long term investment programme (costing and financial arrangements for implementation).
f. Institutional aspects and implementation modalities.
g. Impacts of implementation on development opportunities.
h. Trade-offs facilitation and dispute prevention.
i. Risks and risk management.
j. Kagera Planning Atlas.

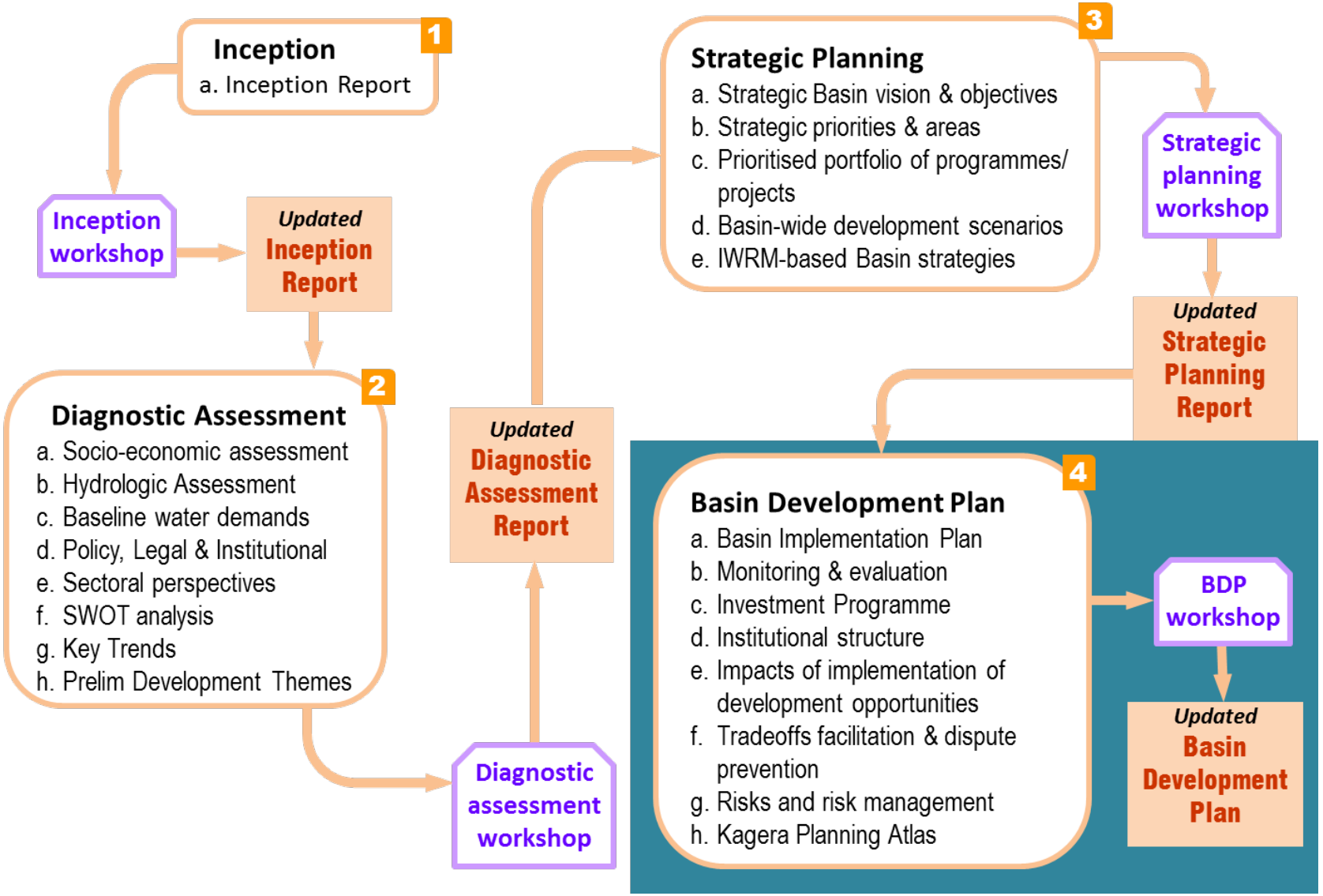

Figure 1-1: Workflow of the study phases

1.3 Approach to this Phase of the Consultancy

The workflow for the various activities undertaken in these tasks and how these link with the previous deliverables is illustrated in **Figure 1-2**.

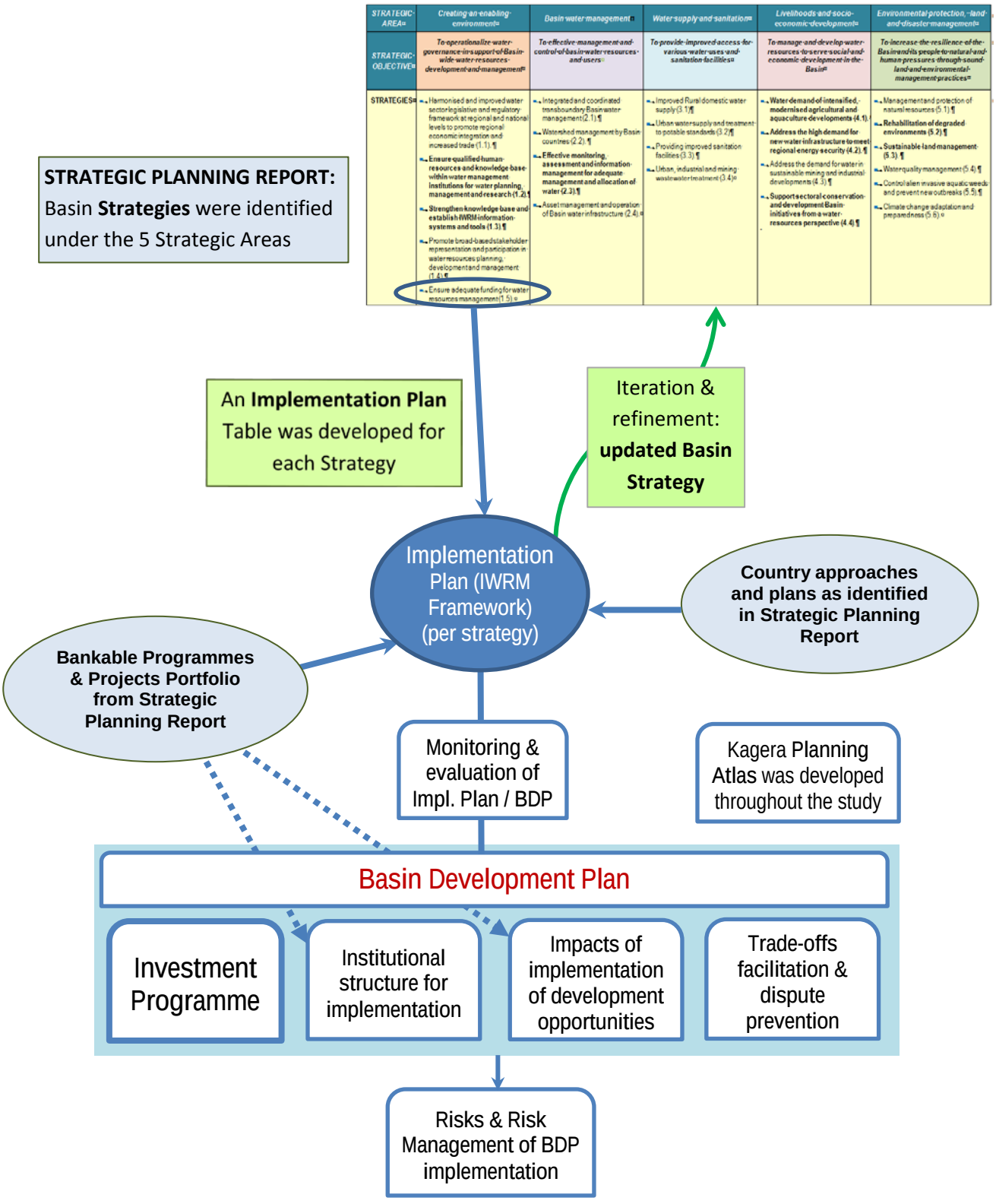

Figure 1-2: Workflow for the activities of the Basin Development Plan Task

Following the identification of Basin strategies in the Strategic Planning Report (2nd Interim Report) for this Consultancy, an **Implementation Plan** table was developed for each of the 23 Basin strategies identified. For each strategy, targets ("sub-strategies") were developed. These align with the targets listed under the strategy descriptions in the 2nd Interim Report. Activities ("Actions") were then developed under each Target. Indicators, timeframes, responsibilities and costing/funding sources were then identified for each Activity.

A Monitoring and Evaluation (M&E) mechanism was then developed.

The **Basin Development Plan** was then developed, consisting of:

- Investment Programme
- Institutional structure for implementation
- Impacts of implementation of development opportunities
- Trade-offs facilitation & dispute prevention

Following the identification of the Projects and Programmes in the Investment Programme, this was scrutinised to formulate an institutional functions and structure for the implementation of the Basin Development Plan. This institutional structure addresses the Basin and regional organisations, as well as the line functions of the Ministries and Departments of the Basin countries. Associated costing and financial arrangements for implementation were proposed.

The impacts of the implementation of development opportunities was largely compiled from information obtained or generated as part of the Bankable Projects and Programmes activity, undertaken under the 2nd Interim Report, and the finalisation of the Environmental Flows activity, for the development schemes sites. Mechanisms for trade-off and dispute prevention are recommended.

Implementation risks were evaluated and mitigation measures for risk management were identified, relating to the implementation of the Basin Development Plan.

The maps and other spatial information used and developed as part of this Consultancy were then described, and an associated A3-sized Basin Planning Atlas was produced.

1.4 Stakeholder engagement

A preliminary Kagera stakeholder list was compiled from available information sources and included under Annexure 2 of the Diagnostic Assessment Report of this Consultancy. The list was continually updated as the Consultancy proceeded and was finalised at the end of the Consultancy. The final Kagera stakeholder list has been included in **Annexure A.**

1.5 The Kagera Database

Early in the project a large volume of data and information was handed over, amounting to some 54 GB of information. In addition, many additional reports and other documents were sourced during the undertaking of this Consultancy. To make the information in the reports easily accessible to project team members and other users, a cataloguing software package was used to compile a hyperlinked and searchable catalogue of the reports. The software extracts the file properties of each Word or pdf document into a tabulated database. This process is described in the Diagnostic Assessment Report of this Consultancy, in Section 2.3.

The information was written to three DVDs, initially one for PDF documents and one for Word documents. Each DVD included a hyperlinked HTML file listing the information on the DVD. Copies of the DVDs were distributed to project members and a ReadMe file was also distributed with the DVDs that explained to users how to search the literature database. A third DVD was written which contained approximately 100 additional reports collected.

1.6 The Layout of the Report

The report is structured in ten chapters, as follows:

CHAPTER 1: Introductory chapter, presenting a brief description and context of the study, and an overview of the methodology used for this Phase of the Consultancy.

CHAPTER 2: A brief, summary overview of the Kagera Basin and the Basin countries.

CHAPTER 3: Basin Implementation Plan.

CHAPTER 4: Monitoring and evaluation.

CHAPTER 5: Introduction to the Basin Development Plan.

CHAPTER 6: Investment programme.

CHAPTER 7: Institutional structure for implementation.

CHAPTER 8: Impacts of implementation of development opportunities.

CHAPTER 9: Trade-offs facilitation and dispute prevention.

CHAPTER 10: Risks and risk management.

CHAPTER 11: Kagera planning atlas.

2. OVERVIEW OF THE KAGERA BASIN

This chapter comprises six sections. The first section deals with issues of relevance to the Consultancy objectives, followed by Section Two on Basin location and population. Section Three addresses the Basin resources and Section Four the socio-economic situation in the Basin. Pressures threatening Basin resources are summarised in Section Five, while the future of the Basin is addressed in Section Six.

2.1 Relevance to the consultancy objectives

This Chapter provides an overview of the Kagera Basin and Basin countries. It summarises work done in earlier reports of this consultancy to complement the Basin Development Plan.

2.2 Location and population

The Kagera River Basin, a sub-Basin of the Nile River Basin, comprises four riparian countries, namely Tanzania, Uganda, Rwanda and Burundi (see **Table 2-1**). **Table 2-2** shows the Kagera Basin in terms of area coverage. It is significant that most of Rwanda (84%) and about half of Burundi falls within the Basin. Rwanda and Tanzania share almost 70% of the Basin area.

The Basin population is estimated at 16.4 million people. Burundi and Rwanda have the largest shares of the Basin population at 47% and 34% respectively. The average 2012 population density is 278 people/km^2 and is expected to increase to 28.8 million people with an average population density of 488 people/km^2 in 2032. The majority of the populations of Rwanda (75%) and Burundi (61%) reside in the Basin, whilst relatively small percentages of the populations of Tanzania and Uganda reside in the Basin.

Table 2-1: Area facts of the Kagera River Basin riparian countries

Country	Area (km^2)	Area (km^2) falling within the Basin	Area within Kagera Basin as % of the country	Area within the Basin as % of the area of Kagera Basin
Burundi	27,834	13,790	49.5	22.8
Rwanda	26,338	21,630	82.1	35.8
Tanzania	945,087	20,680	2.2	34.2
Uganda	241038	4,400	1.8	7.3
Total	**1,240,297**	**60,500**		

Source: BRL Ingénierie (2008) with some modification

Table 2-2: Basin population in 2012

Country	Country population in 2012 (millions)	Population residing within the Basin in 2012 (millions)	Population within the Basin as a % of the country	Population within Basin as a % of the of the Basin population
Burundi	9	5.5	61.1	34
Rwanda	10	7.5	75.0	47
Tanzania	45	1.3	2.9	14
Uganda	34	2.0	5.9	4
Total	**98**	**16.4**		

Source: NBI (2012)

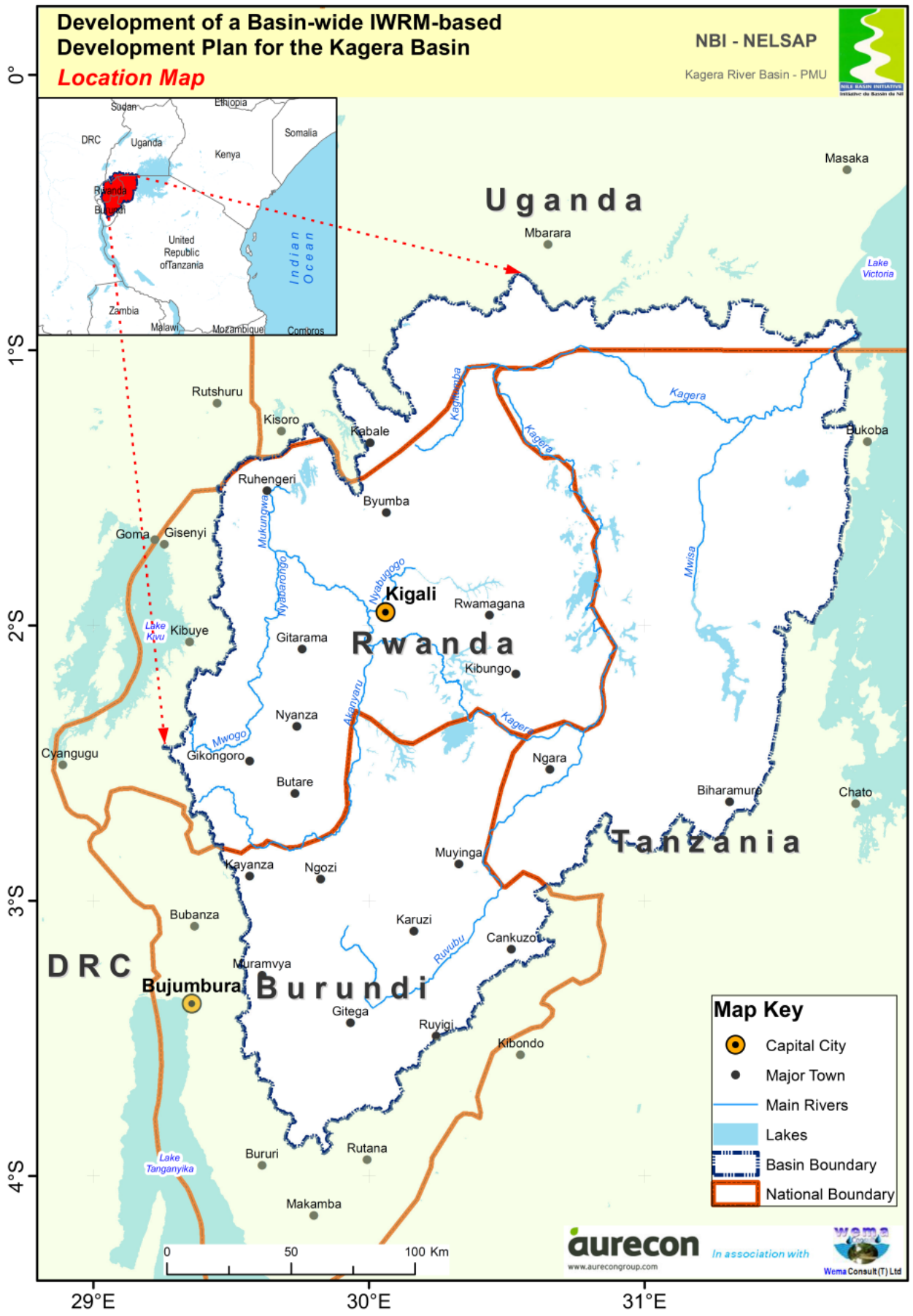

Figure 2-1: Location of the Kagera River Basin

Based on these population figures, it is clear that the spatial distribution of population in the Basin is uneven. The distribution is influenced by a number of factors including climate, rainfall, soil fertility, internal resources, peace and security and social and economic opportunities. However, water availability (in the form of large water bodies or rainfall) appears to overshadow other factors. One major issue of concern with regard to population in the area is the high dependency ratio. A relatively small number of the productive population is responsible for supporting a large number of dependents.

2.3 Basin resources

The Kagera River contributes about 34% of total river inflow into Lake Victoria. The river is fed by three main tributaries which are the Nyabarongo River, the Akanyaru River and the Ruvubu River. All three rivers rise on the Congo-Nile Divide, and then run through the hills and mountain foothills. Almost all of the runoff is generated in the upper half of the catchment, referred to as the Congo-Nile, including its related mountains and foot slopes as well as the hills to the east of it (BRL Ingénierie, 2008; FAO, 2009).

About 48% of the Basin's area is used for agricultural activities whilst 26% is natural vegetation of which 2% is covered by closed forest. Water bodies including wetlands occupy about 5% of the total Basin area. Rangelands for pasture lands occupy about 15% of the total area of the Basin. Wetlands are used for off-season gardening as well as for providing water for livestock (BRL Ingénierie, 2008).

The great biological diversity of the Kagera Basin arises from the remarkable variability of its geophysical features and the vast expanse of its watershed. The considerable Basin resources provide the riparian communities with diverse goods and services, and support the livelihood of a large proportion of the Basin population.

The Basin's water and related environmental resources provide a wide range of societal goods and services. Generally, water plays a central role in social and economic development processes of the Basin countries. It influences all sectors of the economy including domestic, agriculture, livestock, fisheries, wildlife, industry, energy, recreation as well as urbanization. It also plays a pivotal role in poverty alleviation. Apart from sustaining a rich diversity of natural ecosystems, the Basin's water resources are critical for meeting the basic needs related to water supplies for domestic and industrial requirements, and for sanitation and waste management for its people. Furthermore, according to NBI (2012) environmental resources in the Basin also plays a key role in maintaining climate stability, protecting water catchments, controlling flooding, enhancing ground water recharge, controlling soil erosion, maintaining soil fertility and purifying wastewater. It suffices to say that water resources are critical in enhancing community livelihood in the region and the degree to which they are relied upon varies from country to country.

2.4 Socio-economic situation

It is estimated that the total cultivated land area in the Basin is around 2 200 000 hectares. Of this Burundi, Rwanda, Tanzania and Uganda account for 27%, 43%, 21% and 8% respectively (BRL Ingénierie, 2008). Agriculture is the main economic activity responsible for economic growth and poverty reduction in the Basin. Generally the sector contributes between 20% and 45% of the Gross Domestic Product (GDP) of the Basin countries. In Tanzania the sector has recorded the highest average growth rate of 4% between 2008 and 2010 and thus contributes about 27% to the overall GDP (Mashindano and Maro, 2011). The Rwandan agricultural sector grew by 3.2% between 2010 and 2011 accounting for 31% of the GDP (MINAGRI 2011). Uganda registered about 2.6% growth in agriculture in 2008/2009 with a 20% share in the GDP (RoU, 2010). The growth rate of agriculture in Burundi was less than 3% between 2006 and 2010 but it contributed about 45% to the GDP (AfDB, 2011). However, despite contributing a larger share to the GDP, agricultural growth in Burundi is low and volatile compared to other countries in the Basin.

Agriculture in the Basin is often characterised by poor farming practices, severe land degradation, weak agricultural extension and limited services, which leads to low productivity. In addition the agriculture sector in the Basin is largely rain-dependent. According to BRL Ingénierie (2008) about 94% of the

agricultural sector is rain-fed whilst marshland agriculture without irrigation/drainage infrastructure accounts for 5%. Marshlands irrigation with drainage infrastructure accounts for 1% and plains agriculture schemes with reservoirs or river water intakes is less than 1%. Due to dependency on direct rainfall, the availability of agricultural water for crops is prone to the vagaries of weather. Such climate vulnerability extends into the livelihoods of the majority of farming households surviving on rain-fed agriculture and thus escalates poverty.

Poverty is therefore a major constraint to economic development in the area. According to the United Nations Development Programme (UNDP) Human Development Report of 2011, all four riparian countries fall in the low human development category. The countries are also characterized by low gross national income (GNI) which is below the average for African countries ($1,966). This situation results in the relatively high rate of poverty in the Basin. According to NBI (2012) and the UNDP Human Development Report (2011) the GNI for Rwanda, Tanzania, Uganda and Burundi are $1,364; $1,328; $1,124 and $368 respectively. Furthermore these reports indicate that more than 50% of the population in the Basin lives below the poverty line of $1.25 per day, specifically about 77%; 68%; 29% and 81% of the population in Rwanda, Tanzania, Uganda and Burundi respectively. It should be kept in mind that the incidence of poverty is higher in rural areas than in urban areas.

Access to electrical energy is limited and biomass is almost the only source of energy available. Energy is prohibitively expensive and is not readily available in rural areas. Available information indicates that electricity consumption per capita in the Basin countries is generally low when compared to the rest of the world. According to NBI (2012) all Basin countries had per capita electricity consumption of less than 200 kWh/a in 2011 compared to 10 000 kWh/a in the industrialized world. Per capita consumption in Burundi, Rwanda, Uganda and Tanzania is 24, 33, 82 and 127 kWh/year respectively. The low electrification rate is a major constraint to economic development. NBI (2012) notes that access to cheap electricity plays a significant role in poverty reduction and in promoting economic productivity. In addition it is obvious that the low electrification rate is a cause of environmental degradation due to the Basin population's dependency on biomass as a source of energy.

The Basin countries have however recently embarked on reforms aiming at improving macro-economic management, liberalizing markets and trade and opening a window for private sector activities. In addition efforts have been made to improve governance and fighting against corruption. Rwanda has, to a large extent, successfully improved governance and controlled corruption. This situation has resulted in Rwanda currently being regarded as the 3rd easiest country to do business in in Africa. Rwanda has managed to attract investors as a result. This illustrates the importance of the existence of an enabling environment. It is obvious that other Basin countries have a challenge in enhancing their enabling environments to attain the desired economic development.

2.5 Pressures threatening Basin resources and other issues of concerns

Despite the endowment and importance of the resources in the Kagera Basin, these resources are currently under increasing pressure from a combination of both natural and man-made factors. Available information indicates that agricultural land is being degraded; water quality is declining; wetlands and forests are being lost; natural resources are being exploited at rates beyond their natural recovery rates; pollution from urban, industrial, and agricultural sources is increasing; waterborne diseases are spreading; and the harmful impacts of floods and droughts are intensifying factors (NBI, 2012, World Bank 2010, BRL, 2008, LVEMP, 2012, Mngodo and Fumbuka, 2012). Generally the prevailing threats have a direct impact on human health and welfare while others undermine peoples' ability to secure their livelihoods, with the poor being the most vulnerable. The most prominent threats are summarized below.

2.5.1 Soil erosion

Soil erosion in the Basin, particularly in the upstream highlands, is a serious issue of concern with regard to agricultural productivity and environmental management. The magnitude of the problem is aggravated by the mountainous topography and unsustainable land use practices in the face of unprecedented population pressure on land, coupled with poverty of the majority of the Basin community.

2.5.2 High population pressure

High population growth in the Basin results in various pressures on the available land. BRL Ingénierie (2008) and NBI (2012) describe the impacts of high population pressure on the Basin's resources. It is clear that high population growth leads to increased use of the Basin's resources often placing their sustainability in jeopardy.

2.5.3 Deforestation

Deforestation is also one of the major threats to the Basin's resources. Major causes include expansion of agricultural land, urbanization, bush fires and need for wood as energy as more than 90% of the Basin's population depend on biomass for fuel (Ngaga, 2011).

2.5.4 Invasive species

Invasive species can be plants, animals and micro-organisms that occur outside their natural range. These species are considered a threat in the Basin, as they are able to proliferate quickly if there is no form of natural control and they thus colonize the host environment. The most significant invasive species in the Basin is water hyacinth which affects the water bodies in the Kagera River and Lake Victoria (NELSAP, 2012). Water hyacinth mats prevents sunlight and oxygen from penetrating the water column and reaching submerged plants and animals, thus reducing biological functions. Furthermore according to NBI (2012) the hyacinth mats cause public health problems.

2.5.5 Climate change and variability

Climate change is currently considered to be one of the major threats to the sustainability of natural resources, not only in the Kagera Basin but also in the world. This is so because climate change makes it difficult to provide the needs of the population at the optimal level, because it alters the timing, availability and quality of water resources (World Bank, 2010). To adapt to climate change the NBI (2012) points out that species will be compelled to shift habitat ranges or migration patterns. In addition climate change affects plants and animals through the emergence and increase of diseases. Species not able to evolve or shift their habitat ranges are quickly at risk of extinction or suffer drastic loss of habitat. In addition, climate change may affect rainfall patterns and thus water resource availability in the Basin.

2.5.6 Other issues of concern

The Kagera Basin countries are confronted with other issues which, if not properly addressed, will continue to create uncertainty about the sustainability of resources in the Basin. These issues include weak institutional arrangement of natural resources and corruption, which constrain proper management of natural resources.

2.6 The Future of the Basin

Based on the current situation and trends in the Basin, it is clear that there are serious issues which need to be addressed if sustainability of the Basin resources is to be attained. There are indicators that water demand in the area will increase tremendously up to 2032 as the region strives for economic development, poverty alleviation and reversing environmental degradation.

There are twelve key driving factors in the region that are going to impact the region significantly. These driving factors are population pressure, poverty, climate change, change in land use, governance, political stability, market access and commodity prices, industrialisation and diversification, availability of energy, international economic climate and access to information and availability of technology. These drivers will have an impact on the integrity and functioning of the Kagera River Basin, causing several changes in the areas of concern for the riparian countries.

Based on the driving factors thee key areas of concern in the Basin countries include, among others, Basin-scale integration, natural resource development, food insecurity, environmental and land degradation, policies and institutions, stakeholder engagement and capacity building, and impacts of

Basin activities on Lake Victoria. It is clear from the above that concerted efforts of various Basin stakeholders are very urgently needed to reverse negative trends and thus sustain the valuable resources in the region for the betterment of the community as a way of attaining sustainable development. Having a Basin-wide IWRM Development Plan is of great importance to achieve the region's dream of economic development, poverty reduction and reversal of environmental degradation.

3. BASIN IMPLEMENTATION PLAN

The chapter consists of three sections. Following the introductory section the second Section provides an overview of the Implementation Plan, while Section Three describes the elements of the Plan.

3.1 Relevance to the Consultancy Objectives

The IWRM-based Basin Implementation Plan follows from an integration of the strategy, development scenarios, and project portfolio into a coherent and consistent plan. This takes into consideration the member country priorities, socio-economic aspects, regional objectives and which enables poverty alleviation within the Kagera member countries among others. This forms the full IWRM Framework for the management of the water resources of the Kagera Basin.

3.2 Overview of the Implementation Plan

The following five ***Strategic Areas*** were identified as key to achieving the ***Vision*** of the Basin Development Plan:

Area 1	Creating an enabling environment
Area 2	Basin water management
Area 3	Water supply and sanitation
Area 4	Livelihoods and socio-economic development
Area 5	Environmental protection, land and disaster management

The activities and strategies were integrated into the 5 ***Strategic Areas***, as described in the Strategic Planning Report of this Consultancy.

During the compilation of the Implementation Plan, the strategies and targets were revisited, comments from stakeholders were taken into account, and the Implementation Plan was updated accordingly. The finalised strategies are as follows:

No	Strategic Area / Strategy
1.	**Creating an Enabling Environment**
1.1	Harmonised and improved water sector legislative and regulatory framework at regional and national levels to promote regional economic integration and increased trade
1.2	Ensure qualified human resources and knowledge base within water management institutions for water planning, management and research
1.3	Strengthen knowledge base and establish IWRM information systems and tools
1.4	Promote broad-based stakeholder representation and participation in water resources planning, development and management
1.5	Ensure adequate funding for water resources management
2.	**Basin water management**
2.1	Integrated and coordinated transboundary Basin water management
2.2	Watershed management by Basin countries

No	Strategic Area / Strategy
2.3	Effective monitoring, assessment and information management for adequate management and allocation of water
2.4	Asset management and operation of Basin water infrastructure
3.	**Water Supply and Sanitation**
3.1	Rural domestic water supply
3.2	Urban water supply and treatment to potable standards
3.3	Providing improved sanitation facilities
3.4	Urban, industrial and mining wastewater treatment
4.	**Livelihoods and Socio-economic Development**
4.1	Water demand of intensified, modernised agricultural and aquaculture developments
4.2	Address the high demand for new water infrastructure to meet regional energy security
4.3	Address the demand for water in sustainable mining and industrial development
4.4	Support sectoral conservation and development Basin initiatives from a water resources perspective
5.	**Environmental Protection, Land and Disaster Management**
5.1	Management and protection of natural resources
5.2	Rehabilitation of degraded environments
5.3	Sustainable land management
5.4	Water quality management
5.5	Control alien invasive aquatic weeds and prevent new outbreaks
5.6	Climate change adaptation and preparedness

3.3 Elements of the Implementation Plan

The Implementation Plan is presented in Table format, according to the 5 strategic areas. Each of the 23 Strategies under the 5 Strategic areas has then been expanded as follows:

a) Targets (sub-strategies), with associated
b) Activities (implementation actions);
c) Indicators (Monitoring and Evaluation), to measure outcomes of Activities,
d) Timeframes: Short (1-5yr), Medium (6-10yr) or Long (11-20yr) for implementation of Activities;
e) Responsibility, at Basin Scale, National Scale, Local Scale and Other Stakeholders for implementation of the Plan;
f) Costing / Funding Source, per Activity.

This is illustrated in **Figure 3-1**.

The Implementation Plan tables have been included under **Annexure B**.

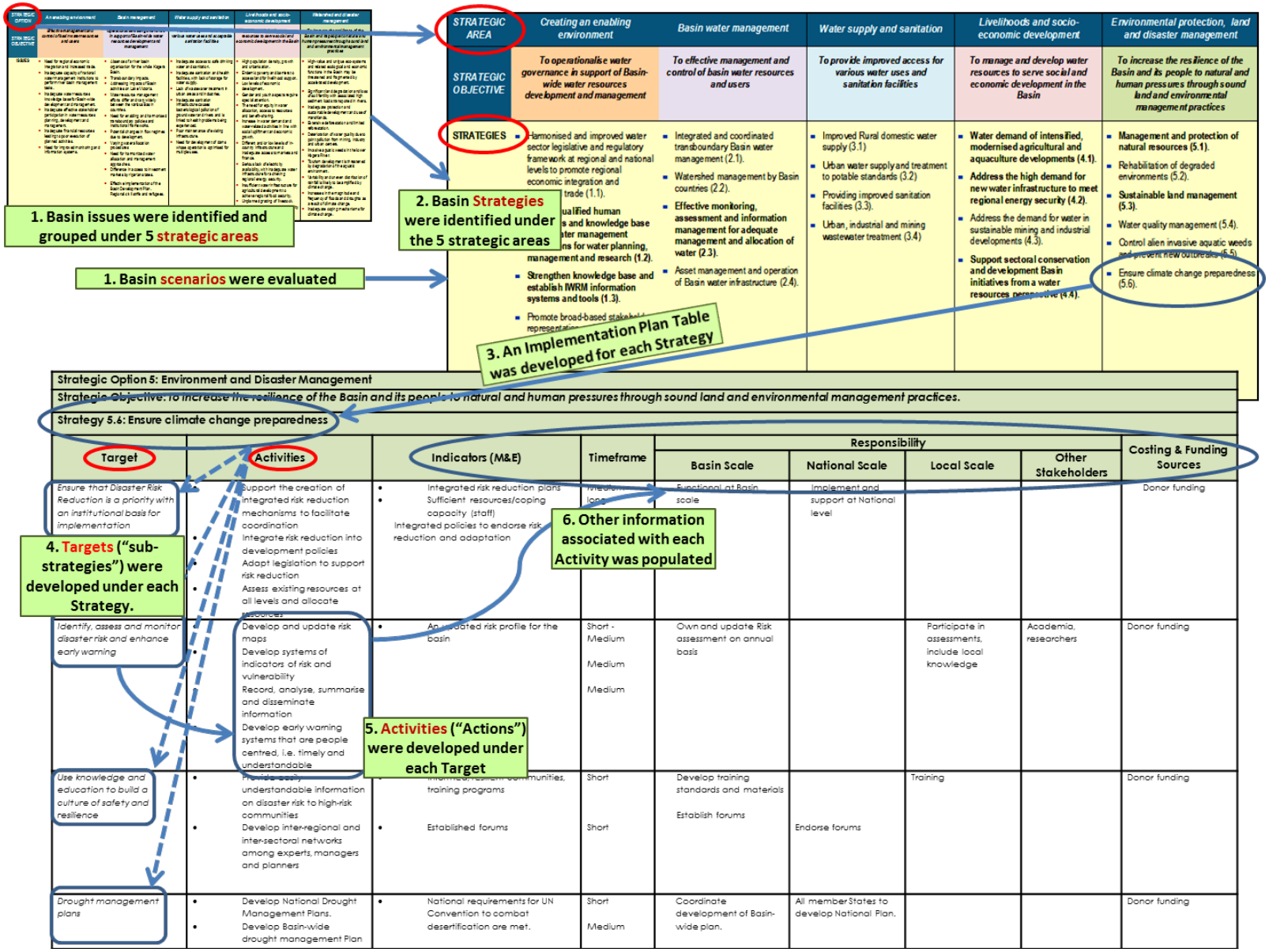

Figure 3-1: Explanation of the development of the Implementation Plan

4. MONITORING AND EVALUATION

The chapter consists of nine sections. Following the introductory section the Section 2 deals with the monitoring and evaluation system, Section 3 with the monitoring framework Section 4 with the targets and indicators, Section 5 with the procedures for evaluation and feedback, Section 6 with data management, Section 7 with reporting and Section 8 with communication. The final section provides an M&E sheet example.

4.1 Relevance to the Consultancy Objectives

"A good monitoring and evaluation process helps to ensure that an IWRM strategy and Development Plan meets its main objective of fostering positive change, and also that the strategy can adapt to evolving needs and conditions (GWP, 2002)" This section discusses the proposed system and procedures for monitoring and evaluating the implementation of the BDP.

4.2 Monitoring and Evaluation System

Monitoring and evaluation is essential to ensure that plan implementation is on track, to measure short and long term impacts and to evaluate the impacts in order to modify the plan or its implementation (if necessary) (GWP, 2004). The Organisation for Economic Co-operation and Development (OECD) defines *monitoring* to be "a continuous function that uses the systematic collection of data on specified indicators to provide management and the main stakeholders of an on-going development intervention with indications of the extent of progress and achievement of objectives and progress in the use of allocated funds". An *evaluation* is an exercise undertaken at regular intervals to 'provide information that is credible and useful, enabling the incorporation of lessons learnt into the decision making process."

Key components of the monitoring and evaluation (M&E) system should be the selection of the indicators and ensuring feedback of the results into the decision-making and implementation processes. In simple terms, M&E is necessary to ensure that implementation takes place with the intended results and impacts. A proper M&E system, whose results are shared among stakeholders, also fosters accountability and transparency, and is likely to generate broad-based support for the plan implementation. It is essential that there is full consistency between the goals, objectives, strategies, activities and the chosen indicators.

M&E systems can be costly[1] and often require significant human, data and financial resources. It is therefore necessary to develop an efficient, effective and sustainable system, which can be implemented within existing or planned for resources and line functions. The data and their interpretation should be rigorous and robust; it is important to measure what is valued, not value what is being measured. Interpreting and acting on the data is as important as data collection.

It is extremely important that the Strategies and Plans are monitored and evaluated on a regular basis. How often, and when, monitoring is carried out will be dictated by what is being measured – environmental improvements will have different timescales to budget expenditure. First of all, member states and stakeholders need to know whether progress is being made and what the achievements have been at any given moment. M&E will also provide everyone with indications of where delays or diversions are being experienced, so these can be addressed. Monitoring also provides an evidence base to show funders that you are using their money effectively, to identify where more funding is required to tackle new issues, or try new actions where stubborn problems remain. Formal monitoring results are often shared with wider stakeholders and funders, whilst informal monitoring will be restricted to those managing the process.

[1] The costs of no M & E may be considerably higher when plan implementation is ineffective and inefficient.

Lastly, and most importantly, the Strategies and Plans are “living documents” and should not stay static, as circumstances are not static. M&E allows for timely adjustments and/or updates. Ideally the IWRM Strategy and Plan should be reviewed and updated every five years. Use the results of monitoring to identify what can and cannot be achieved when revising the plan.

4.3 Monitoring Framework

The M&E should focus on the implementation issues (are activities implemented according to planning) and the results (e.g. is water used more efficiently?).

M&E can aid the successful implementation of the Basin Development Plan (BDP), ensure that targets and goals set out in the BDP are achieved and problems regarding implementation are detected early and addressed. Monitoring of the BDP and achievements will be done on the basis of the Implementation Plan and identified progress indicators.

Monitoring and evaluation will be guided by the specific result-based indicators described in the Implementation Plan. For the projects, this will include M&E of progress in terms of implementation programmes and actual against planned expenditure, among others. For individual projects/programmes, more detailed step-wise M&E indicators should be identified for each projects/programme so that progress can be adequately tracked and evaluated.

The reporting system, to be implemented by the Basin Secretariat, would have to be designed in such a way that progress is tracked for the individual activities of the BDP, problems encountered and the measures taken to address the problems are reported on a quarterly and annual basis. In addition, systematic periodic evaluation and objective assessment of the progress made towards the achievement of the BDP overall goal will be done.

4.4 Targets and Indicators

The evaluation is based on the monitoring results and possible additional data collected and provides feedback into the decision making process and may lead to adjustments in the plan and its implementation. Good targets and indicators, stakeholder participation in monitoring process as well as good feedback mechanisms are essential for effective M&E.

4.5 Evaluation and Feedback (who will do monitoring of the plan?)

The monitoring results need to be annually evaluated. The findings should be discussed in the PMU and RBO need to ensure that implementation remains on schedule and yield good results. The findings of the evaluation need to be incorporated in the member country’s development planning cycle (mid-term review and national and district development plans) and in the plans of major stakeholders. Evaluation may lead to modification of the IWRM-BDP Plan or its implementation.

4.6 Managing data

As reporting on indicators will be carried out by different institutions, it is important to ensure the data collected is managed and stored in an accessible format and place. The Information Management System identified in the Implementation Plan, is an ideal location for this data storage.

4.7 Reporting

Reporting takes two forms. The first relates to reporting on progress on the Implementation Plan as whole. This should be undertaken by a task team that meets bi-annually. The second relates to the reporting on the achievement of the specific actions and targets. It is important to report on progress of the activities and targets using the indicators. The timeframe for carrying out assessments must be realistic, i.e. it must provide time for projects to be implemented and take effect. A standard reporting

timeframe is 2-3 years, depending on the targets and the longevity of the Implementation Plan. It is important to note that the institutions that were tasked specific activities are responsible for reporting on the activity specific indicators. This may result in several institutions reporting on the same target.

4.8 Communicating

It is important to ensure the effective communication of progress against the targets, to all stakeholders involved, as well as the general public is carried out in order to build trust in the Basin IWRM Development Plan. Communication can take the form of newspaper articles, updated progress chart on a webpage or regular newsletter.

The overall responsibility for the development of the M&E component should sit with the TSC and it would be outlined in the Institutional Organisation and Governance Strategy. Data and information needs would have to be coordinated with the Information Management Strategy, while the Secretariat would be responsible for ensuring implementation and coordinating or carrying out the actual monitoring on a regular basis.

4.9 Monitoring & Evaluation sheet

The format of an M&E Sheet would be fairly similar to the implementation table, i.e. the columns of targets, activities, the indicators, and a scoring column and notes/progress column, and a date column. This is then used as a scorecard, and can be kept as records to follow progress. It would be useful to arrange the activities into time-order as well i.e. short, medium and long, so it is easy to follow what should be done immediately.

A scoring matrix would be needed, so that the same rating can be used in the future and not be subjective. Possible scoring types could include:

- Measurement against set targets, e.g. expressed as % or numbers achieved
- Fixed measurement e.g. hectares or number of schemes
- Qualitative / subjective evaluation, which could e.g. be on a scale from 1 to 5

An M&E example from the implementation plan is shown in **Table 4-1** below.

Table 4-1: Monitoring and Evaluation example

Strategic Option 4: Livelihoods and Socio-economic development					
Strategic Objective: *To develop and manage water resources to serve social and economic development in the Basin.*					
Strategy 4.1: Water demand of intensified, modernised agricultural and aquaculture developments					
Target	Indicators (M&E)	Timeframe	Responsibility		
			Basin Scale	National Scale	Local Scale
c) Irrigation and drainage	• Irrigation development plan (Basin master plan) in place • Area under irrigation in ha • Efficiency of water use • New irrigation projects implemented	Quarterly data and annual evaluation	NELSAP and Kagera Secretariat – evaluation, assessment and feedback	Data management and evaluation	Provide information

An example associated M&E sheet is shown in **Table 4-2**

Table 4-2: Monitoring and Evaluation example sheet

Strategic Option 4: Livelihoods and Socio-economic development					
Strategic Objective: *To develop and manage water resources to serve social and economic development in the Basin.*					
Strategy 4.1: Water demand of intensified, modernised agricultural and aquaculture developments					
Target	Activities	Indicators (M&E)	Scoring	Notes/progress	Date
c) Irrigation and drainage	a. Develop the Basin's irrigation master plan in which lands best suited to irrigation are defined and a long term irrigation development plan put forward for discussion with stakeholders. Opportunity to be linked to needs.	Irrigation development plan (Basin master plan) in place	Yes/no	Note progress on development of irrigation master plan.	Capture date
c) Irrigation and drainage	b. Existing irrigation schemes evaluated and indicated improvements implemented.	Area under type of irrigation in ha (or alt. number of improvements)	X hectares	Notes on improvements for existing irrigation schemes	Capture date
c) Irrigation and drainage	c. Plan for the expansion of irrigation within the limitations of Basin water use.	Studies completed	No of studies	Notes on irrigation expansion	Capture date
c) Irrigation and drainage	d. Seek optimal use of irrigation water through crop selection, improved irrigation methods and WC/WDM	Efficiency of water use	Scale from 1 to 5	Notes on efficiency improvements achieved	Capture date
c) Irrigation and drainage	e. Implement planned irrigation projects - as per the proposed development programme (construction of dams and introduction of more diversion. Refer to the list of proposed implementation projects.	New irrigation projects implemented (alt. status of implementation)	No of projects	Notes on schemes & associated progress	Capture date

5. INTRODUCTION TO THE BASIN DEVELOPMENT PLAN

The chapter consists of three sections. Following the introductory section, Section 2 introduces the Basin Development Plan. Section 3 describes the prioritised BDP strategies, while Section 4 explains the components of the Plan and how they inter-relate.

5.1 Relevance to the Consultancy Objectives

The Basin Development Plan is the key project deliverable. The purpose of the Kagera BDP is to identify, categorise and prioritise projects and programmes at the basin level. The BDP has several supporting components, to ensure that the plan can be effectively implemented.

5.2 Introduction to the Development Plan

There is a need to develop a package of structural and non-structural options as a contribution towards providing security of access to water and an environment that is resilient to change. Basin-wide environmental and socio-economic objectives and baseline indicators, against which to judge and apply future developments have been developed. There is also a critical need to strengthen basin management and in particular, a strong programme of institutional, technical, organisational and human resource capacity building for sustainable Basin development.

A key output of this evaluation is the Basin Development Plan which recommends the further evaluation or implementation of mainly a number of large scale investment projects aimed at stimulating sustainable socio-economic growth and reversal of environmental degradation in the Kagera River Basin, with a main focus on large scale water storage dams for multipurpose uses.

Using the principles of Integrated Water Resources Management (IWRM), the BDP process will promote the coordinated development and management of water and related resources, in order to maximise economic and social welfare without compromising the sustainability of the water resources in the Basin.

5.3 Prioritised Basin Development Plan Strategies

As documented in Chapter 3 of the 2nd Interim Report (Strategic Planning Report) of this Consultancy, the Specific Strategic Objectives for the Basin are:

a) Human capital and knowledge base;
b) Improved rain fed agriculture productivity (land use productivity);
c) Increased irrigated agriculture;
d) Hydropower development; and
e) Fisheries and aquaculture development.

The BDP strategies that link to the specific strategic objectives are shown in **Table 5-1** below.

Table 5-1: Basin Development Plan Strategies

Specific Strategic Objectives	Strategies	Targets
Human capital and knowledge base	Ensure qualified human resources and knowledge base within water management institutions for water planning, management and research (Strategy 1.2)	• Training and capacity building • Practical and focused research and technology development • Infrastructure Management staffing • Learnerships in water resource management
	Strengthen knowledge base and establish IWRM information systems and tools (Strategy 1.3)	• Information Management System
	Effective monitoring, assessment and information management for adequate management and allocation of water (Strategy 2.3)	• Information requirements • Monitoring networks for climate, surface water and groundwater
Improved rain-fed agriculture productivity (land use productivity)	Water demand of intensified, modernised agricultural and aquaculture developments (Strategy 4.1)	• Rain-fed agriculture management • Runoff water harvesting • Water storage structures
	Support sectoral conservation and development Basin initiatives from a water resource perspective (Strategy 4.5)	• Sustainable farming practises, technologies, and development initiatives
	Rehabilitation of degraded environments (Strategy 5.2)	• Rehabilitation
	Sustainable land management (Strategy 5.3)	• Optimising water use through sustainable agriculture to avoid degradation and loss of productivity.
Increased irrigated agriculture	Water demand of intensified, modernised agricultural and aquaculture developments (Strategy 4.1)	• Irrigation and drainage
Hydropower development	Address the high demand for new water infrastructure to meet regional energy security (Strategy 4.2)	• Energy resources developed (hydropower)
Fisheries and aquaculture development	Water demand of intensified, modernised agricultural and aquaculture developments (Strategy 4.1)	• Aquaculture and sustainable fisheries • Fish-production habitat management

5.4 Components of the Development Plan

The Kagera Basin Development Plan is composed of the following components:

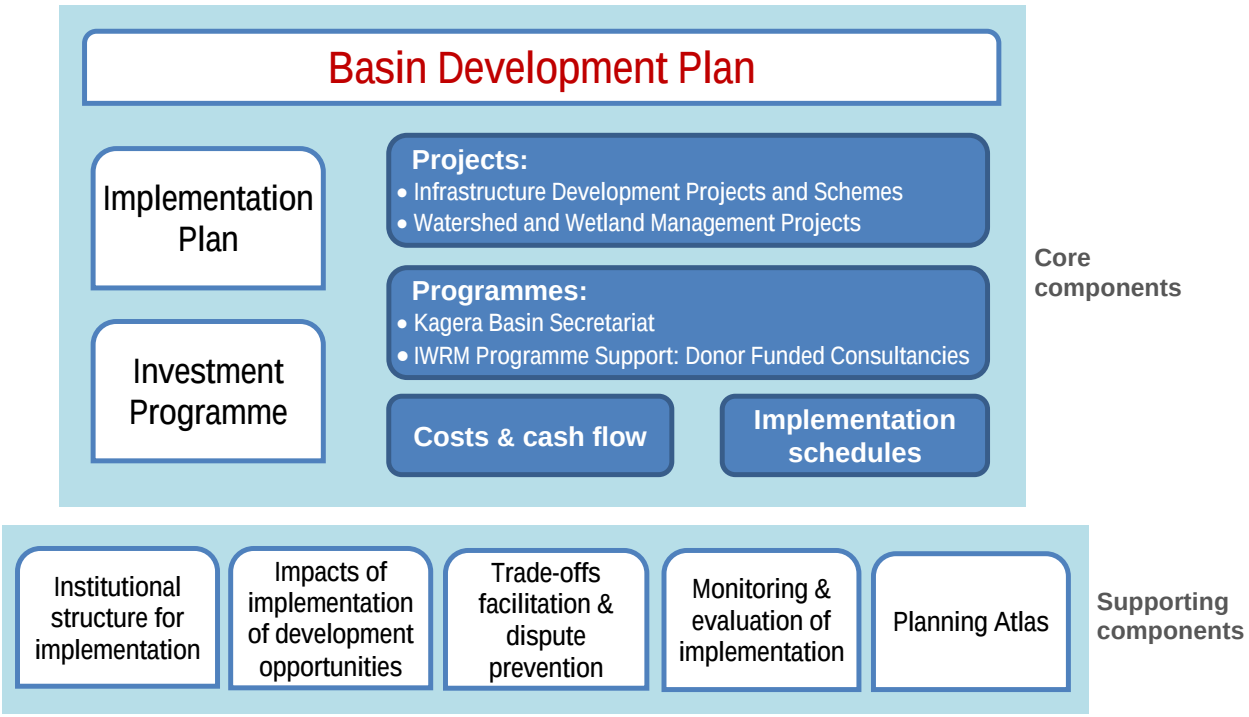

Figure 5-1: Components of the Basin Development Plan

These components are addressed in separate Chapters of this report, with supporting information in the Annexures.

6. INVESTMENT PROGRAMME

This chapter comprises six sections and addresses the costing and financial arrangements for implementation, as well as providing implementation schedules and cashflow for the recommended projects and programmes. Following the introductory section, Section Two explains the cost estimates. Section Three deals with the funding requirements for the projects and programmes, Section Four presents the apportionment of costs between the Basin countries, Section Five discusses the costs for infrastructure development projects and a summary of the costs and funding modalities is presented in Section Six.

6.1 Relevance to the Consultancy Objectives

This chapter refers to the costs related to actions in the Implementation Plan. It further provides an overview of the costs needed to implement the BDP, summarised for the short, medium and long term. Options and levels of funding are also described.

6.2 Cost Estimates

6.2.1 Consistency of Information Check

The previous investigations of the selected schemes described in various reports by others are summarised in **Annexure C** of the Strategic Planning Report of this study. In cases where the information provided in these reports appeared to be inconsistent with the assumptions made in this study, revised figures were determined as indicated in Chapter 4 of the Strategic Planning Report. The procedures for checking the consistency of the information provided in the reports were described in the Strategic Planning Report.

6.2.2 Costs of Schemes

The available reports on infrastructure evaluation provide cost estimates for the various dams; however significant gaps in the information provided by most of these previous investigations are the costs of the infrastructure that would be served by the proposed dams. The following are examples of this infrastructure:

- In the case of the hydropower schemes the estimates generally make provision for the cost of the dam and the hydropower installation but do not provide for the costs of power lines and transformer equipment.
- None of the investigations provide estimates for the costs of the irrigation schemes. It is recognised that in some areas the existing irrigators may already be served by rudimentary schemes however to make full use of the proposed dams, main canals or other distribution systems should be provided as well as appropriate systems to effectively distribute the water on the farms/lands.
- The costs of treating, pumping, storing and distributing water to the domestic users has not been determined. As most of the areas to be served are currently rural the costs of distributing water to these distributed communities would be very high unless it is envisaged that new towns will be developed.
- The costs of the hydropower installations at the small and large dam schemes were not determined.
- Compensation costs have not been determined.
- Costs relating to Operation and Management have not been determined.

The above information should be included in any future studies and the provision of this infrastructure should also form part of any development project. Very approximate estimates of the additional infrastructure for irrigation and water supply have been made.

Information should also be provided on the human and other resources necessary to operate and maintain schemes and the associated operation and maintenance costs, as well as opportunities for cost recovery.

6.2.3 Indicative estimated costs to cover key costing gaps

In view of the importance that the capital costs of schemes will have on the screening of options it was decided to provide very approximate indications of the costs of the irrigation, domestic supply and hydropower infrastructure proposed by the various investigations, adjusted if deemed necessary by the screening check described in Section 4.3.1 above. For simplicity and transparency it was decided to base the cost estimates on those for the Strategic Planning Report as follows:

- Hydropower has been based on a capital cost of US$ 3,000/kW of installed peak power capacity. This rate per kilowatt was previously used for determining the cost of hydropower installations at the smaller and larger dams.
- Irrigation capital costs were previously based on the estimated cost of main distribution pipelines. The costs per hectare varied considerably depending on the valley width and the height of the dam. Most of the schemes proposed in the most recent reports indicate that the water would be distributed by canal. For purposes of the screening assessment it has been assumed that the irrigation infrastructure would cost US$ 2500/ha.
- The capital costs of domestic water supply infrastructure that were previously determined were based on a treatment works, pumps, rising mains, reservoirs and distribution pipelines. The costs per person served were in a narrow range with an average of US$ 250 /person. This rate has been utilised for determining the costs for the current selection process.

6.2.4 Implementation programmes

The implementation programmes of the various development options were derived from the reports of the investigations undertaken, where this was available. Where such information was not available, best estimations were made, based on the type and size of schemes. These have been estimated for Pre-feasibility and Feasibility studies, and for Implementation (Design/ESIA and Construction). Administrative, procurement and financing activities have been assumed to be included in these programmes. Pre-feasibility Study costs were assumed to 1.5% of the capital cost of the scheme with Feasibility Stage costs estimated at 3.0%. Design and construction supervision costs were estimated at 10% of the construction cost.

Table 6-1 shows the recommended implementation programmes and costs for the various projects, according to the Basin priorities. A preliminary programme based on the project screening was proposed at the November stakeholder workshop and then refined based on feedback from the Basin countries. The colours represent the project stages as follows:

Pre-feasibility	Feasibility	Admin and Finance, ESIA and Design	Construction

A breakdown of the costs and phasing for the remainder of the BDP (excluding the projects) is presented in **Table 6-2**. In addition, **Table 6-3** presents a summary of the priority projects proposed (2012) for the first five-year implementation phase of a Watershed and Wetlands Management Programme (KIWMP). Note that projects which do not tie up with the specific objectives of the BDP were excluded. The report only gives costs and phasing for the first 5 years.

Table 6-1: Pre-feasibility, feasibility, design and implementation costs for Kagera Basin projects

		Scheme	Country	Estimated Construction Cost (million US$)	Estimated Total Cost (million US$)	Score From Screening[1]	Phasing of Capital Expenditure (Costs in million US$)																			Short Term (1 - 5 years)	Medium Term (6 - 10 years)	Long Term (11 - 20 years)
							1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20			
Hydropower schemes		Ruvyironza Multipurpose Dam	Burundi	237	271	11			3.6	3.6	3.6	7.9	7.9	7.9	79.0	79.0	79.0										11	182	79
		Nyabarongo Multipurppose Dam	Rwanda	589	666	7	8.8	8.8	19.6	19.6	19.6	117.8	117.8	117.8	117.8	117.8											77	589	0
		Ruramba Small Hydropower Project	Rwanda	13	15	4	0.8	0.8	4.3	4.3	4.3																15	0	0
		Kakono Hydropower Project	Tanzania	414	474	11	6.2	6.2	6.2				13.8	13.8	13.8	103.4	103.4	103.4	103.4								19	145	310
		Rusumo Falls Run of River Hydropower	Tanzania/Rwanda	235	258	23	11.7	11.7	78.3	78.3	78.3																258	0	0
		Kikagati Hydropower Project	Uganda/Tanzania	60	66	16	3.0	3.0	20.0	20.0	20.0																66	0	0
		Maziba Small Hydropower project	Uganda	2.5	3	13	0.0	0.0		0.1	0.1	0.1	0.6	0.6	0.6	0.6											0	3	0
		Nsongyezi 39 MW Hydropower Project	Uganda/Tanzania	160	178	10	2.4					8.0	8.0	53.3	53.3	53.3											2	176	0
Multipurpose Projects	Larger Dams	Upper Ruvubu Dam	Burundi	160	181	7				2.4	2.4	5.3	5.3	5.3	40.0	40.0	40.0	40.0									5	96	80
		Kanyaru Dam	Burundi/Rwanda	351	391	12	5.3	11.7	11.7	11.7	87.8	87.8	87.8	87.8													128	263	0
		Muvumba Dam	Rwanda	131	148	8	2.0	2.0		4.4	4.4	4.4	26.2	26.2	26.2	26.2	26.2										13	109	26
		Kakanja Dam	Tanzania	13	15	3		0.2	0.2	0.2						0.4	0.4	0.4	3.3	3.3	3.3	3.3				1	0	14
		Kagitumba-Mazimba Dam	Uganda/Rwanda	77	87	5			1.2	1.2				2.6	2.6	2.6	19.3	19.3	19.3	19.3							2	8	77
	Smaller Dams	Gashayura Dam	Burundi	67	76	9	1.0	1.0	2.2	2.2	2.2	16.8	16.8	16.8	16.8												9	67	0
		Kavurugu Dam	Burundi	28	32	2						0.4	0.4	0.4	0.9	0.9	0.9	7.0	7.0	7.0	7.0						0	3	29
		Taba-Gakomeye	Rwanda	40	1	9	0.6	0.6																			1	0	0
		Mbarara Dam	Burundi	34	39	1		0.5	0.5	0.5	1.1	1.1	1.1	8.5	8.5	8.5	8.5										3	28	9
		Munyange-Vumbe Dam	Burundi	54	62	1						0.8	0.8	0.8	1.4	1.4	1.4	1.4	18.0	18.0	18.0						0	5	57
		Karazi Dam	Tanzania	54	61	3	0.8	0.8	1.8	1.8	1.8	13.5	13.5	13.5	13.5												7	54	0
		Bigasha Dam	Uganda	60	69	6	0.9	0.9	0.9	2.0	2.0	2.0	15.0	15.0	15.0	15.0											7	62	0
		Kabuyanda Dam	Uganda	33	37	3			0.5	0.5	1.1	1.1	1.1	8.3	8.3	8.3	8.3										2	27	8
Irrigation Schemes		Buyongwe	Burundi	124	4	9	1.9	1.9																			4	0	0
		Bugasera Irrigation	Burundi/Rwanda	46	46	13	9.2	9.2	9.2	9.2	9.2																46	0	0
		Nyanza Hillside Irrigation	Rwanda	64	64	5		16.0	16.0	16.0	16.0																64	0	0
		Ruramba Irrigation	Rwanda	2	2	7			0.0	0.0	0.0	0.4	0.4	0.4	0.4												0	2	0
		Ngono Valley	Tanzania	51	53	9	0.8	0.8	10.2	10.2	10.2	10.2	10.2														32	20	0
Other		Mutobo Pipeline	Rwanda	300	300	5	75.0	75.0	75.0	75.0																	300	0	0

[1] For details of the screening methodology refer to the Kagera River Basin Strategic Planning Report

Table 6-2: Programme and Cashflow for capital costs of Programmes

COST ITEM	Comment	Professional person months	Total Cost (US$)	Programme	Short Year 1 - 5	Medium Year 6 - 10	Long Year 11 -20
A. KAGERA BASIN SECRETARIAT			**25,500,000**		**4,500,000**	**6,000,000**	**15,000,000**
	Number of staff allowed for ('Light' institutional staffing)			S, M, L	3	4	5
Secretariat and facility	Continuous		25,500,000	S, M, L	4,500,000	6,000,000	15,000,000
B. IWRM PROGRAMME SUPPORT: DONOR FUNDED CONSULTANCIES							
B1: CREATING AN ENABLING ENVIRONMENT			**5,040,000**		**1,476,000**	**2,556,000**	**1,008,000**
Strategy 1.2: Ensure qualified human resources and knowledge base within water management institutions for water planning, management and research	Significant training and capacity building required	48	1,440,000	S, M, L	576,000	576,000	288,000
Strategy 1.3: Strengthen knowledge base and establish IWRM information systems and tools	Setting up systems	60	1,800,000	S, M	360,000	1,440,000	
Strategy 1.4: Promote broad-based stakeholder representation and participation in water resources planning, development and management	Especially support for sub-Basin management	60	1,800,000	S, M, L	540,000	540,000	720,000
B2: BASIN WATER MANAGEMENT			**1,800,000**		**720,000**	**720,000**	**360,000**
Strategy 2.3: Effective monitoring, assessment and information management for adequate management and allocation of water	Setting up MIS components	60	1,800,000	S, M, L	720,000	720,000	360,000
B3: LIVELIHOOD AND SOCIO-ECONOMIC DEVELOPMENT			**4,500,000**		**1,170,000**	**1,530,000**	**1,800,000**
Strategy 4.1: Water demand of intensified, modernised agricultural and aquaculture developments	High priority - pre-feasibility/feasibility	60	1,800,000	M, L	360,000	720,000	720,000
Strategy 4.2: Address the high demand for new water infrastructure to meet regional energy security	Very high priority - Pre feasibility/feasibility	90	2,700,000	S, M,L	810,000	810,000	1,080,000
B4: ENVIRONMENTAL PROTECTION, WATERSHED & DISASTER MANAGEMENT			**2,160,000**		**540,000**	**540,000**	**1,080,000**
Strategy 5.2: Rehabilitation of degraded environments	Implement Pilots	36	1,080,000	S, M, L	270,000	270,000	540,000
Strategy 5.3: Sustainable land management	Implement Pilots	36	1,080,000	M, L	270,000	270,000	540,000
B TOTAL			**$39,000,000**		**$8,406,000**	**$11,346,000**	**$19,248,000**

Table 6-3: Watershed and wetlands projects costs by component and project

Project type	ID	Project Description	Cost (million US$)	Phasing of Capital Expenditure (Costs in million US$ per year)				
				1	2	3	4	5
WATERSHED PROJECTS			**424.6**	**48.8**	**59.7**	**95.8**	**103.6**	**110.9**
Burundi	B01	Integrated Water Resources Management, Akanyaru Sub-watershed	145.4	15.7	20.4	33.8	36.2	39.3
	B02	Stabilisation of banks of watercourses to reduce erosion and siltation	68.0	8.3	9.6	16.0	16.7	17.3
	B03	Hill irrigation and rainwater harvesting in Cankuzo, Karuzi, Muyinga and Ruyigi Prov.	60.1	4.0	8.1	13.5	15.0	16.5
Rwanda	R01	SWC on terraces, Soil Improvement, Increased Fodder & Fruit Trees in Nyaruguru District, Akanyaru Sub-watershed	50.7	5.8	6.3	10.6	12.9	15.1
	R03	Sustainable Fishing at Lake Muhazi	0.6	0.4	0.2			
Tanzania	T01	Soil conservation in the Karagwe and Ngara Districts	33.5	5.0	5.2	7.5	7.9	7.8
	T03	Protection & conservation of water sources in Kagera sub-basin in Tanzania	23.6	3.7	3.7	5.2	5.5	5.4
Uganda	U01	Land rehabilitation in Isingiro District, Kikagate	10.1	1.4	1.5	2.3	2.4	2.6
	U02	Integrated Water Resource Management (IWRM) Project, Rakai District	15.9	2.5	2.6	3.7	3.8	3.4
	U03	Integrated Water Resource Management Project, Maziba River watershed, Kabale district	16.9	1.9	2.1	3.2	3.3	3.4
WETLANDS PROJECTS			**64.0**	**9.2**	**9.8**	**15.5**	**15.1**	**14.9**
Burundi	BW1	Protection of wetland ecosystems through environmental flows and sustainable abstractions	0.7	0.2	0.1	0.1	0.1	0.1
	BW2	Alternate livelihoods for wetland communities through an ecosystem approach	1.1	0.2	0.2	0.2	0.2	0.2
	BW3	Impacts on wetlands of water harvesting and development of groundwater resources	0.8	0.0	0.2	0.2	0.2	0.2
Rwanda	RW1	Protection of wetland ecosystems through environmental flows and sustainable abstractions	0.7	0.2	0.1	0.1	0.1	0.1
	RW2	Artificial wetlands for sustainable urban drainage	1.1	0.2	0.2	0.2	0.2	0.2
Tanzania	TW1	Ruwakajunju, Ngoma and Rshwa Lakes Fisheries Project	4.4	0.8	0.9	1.3	0.7	0.6
	TW2	Robust Evidence Base for informed Wetlands Management Decision Making	4.1	0.7	0.8	0.9	0.8	0.9
	TW3	Flood Management in Bigomba & Burigi Valleys, Ngara & Muleba Districts	21.1	2.7	2.8	4.7	5.2	5.7
Uganda	UW1	Robust Evidence Base for informed Wetlands Management Decision Making	1.0	0.2	0.2	0.2	0.2	0.2
	UW2	Payments for wetland ecosystem services	0.8	0.1	0.2	0.2	0.2	0.2
	UW3	Alternate livelihoods for wetland communities through an ecosystem approach	13.9	1.9	2.1	3.2	3.3	3.4
Transboundary Wetlands	KIWMP1&2	Transboundary Wetlands Management Projects	14.1	1.9	1.9	4.3	3.7	3.0
MANAGEMENT			**43.2**	**12.3**	**11.9**	**6.4**	**6.5**	**6.2**
Programme Management		Kagera Integrated Water Management Project - NELSAP	34.1	11.3	10.2	4.3	4.2	4.1
Capacity Building and Institutional Strengthening		NELSAP	9.0	1.0	1.6	2.1	2.3	2.2
TOTAL PROGRAMME COST		**All project and operational expenses**	**531.8**	**70.3**	**103.0**	**139.6**	**146.7**	**153.0**

Source of information: Feasibility Study for an Integrated Watershed Management Program for the Kagera River Basin, LTS, 2012

6.3 Funding Requirements

Funding requirements differ significantly depending on the type of project and programme to be implemented. The programmes proposed generally are a very small cost when compared to the costs of implementing the large infrastructure projects. As a result, the associated funding mechanisms are very different.

6.3.1 The Kagera Basin Secretariat

The Secretariat is discussed under the institutional arrangements section. The intention is to keep the secretariat light. For costing purposes it is anticipated that the Secretariat would initially operate with three full time staff members and this number could increase to up to five members depending on the workload.

6.3.2 IWRM programmes

Integrated water resource management and related programmes are required to support the specific strategic objectives, towards achieving the Basin vision.

These IWRM programmes do not generate direct revenue and will not be funded by the private sector. These are public functions and must be funded by riparian states supported by donor grants.

Usually the donors will choose to fund the utilisation of PSPs.

The national governments can provide staff to manage these programmes (i.e. funding in kind) as well as a certain level of monetary funding.

For costing purposes it has been assumed that aspects of these IWRM programmes would be implemented as PSP consultancy appointments, e.g. as pilot projects. A rate of US$ 30 000 per person month has been allowed as an all-in charge.

The cost of country staff allocations and internal government budgets has not been included in the cost estimates.

6.3.3 Financially self-sufficient infrastructure investment projects

Financially self-sufficient infrastructure projects include larger dams and hydro-electric plants.

These programmes have the potential to generate revenue, could be self-sufficient to varying degrees, and could be funded either wholly by the private sector in in a PPP with government.

However, initial work is required to prepare these projects for investment by the private sector. This initial preparatory work includes feasibility studies, regulatory approvals and procurement of PPPs. The initial work does not directly generate revenue, could be classified as a governance function, and should be funded by riparian states or by donor grants.

The cost of this initial preparatory work can however be capitalised into the cost of the eventual PPP project and recovered from the PPP over time.

Cost recovery would be through take or pay agreements entered into between PPPs and the national energy supplier or large towns.

These investment programmes have been costed individually.

6.3.4 Water supply schemes

Water Supply and Sanitation Schemes (WSS) supplying centres of monetary based commerce, such as large towns and cities, can be financially self-sufficient, but may require an initial preparatory investment by national governments or through donor grants, very much along the lines of the infrastructure investment projects discussed above. It is unlikely that revenue generated from smaller schemes supplying domestic water to smaller rural towns would be sufficient to recoup substantive capital costs.

Smaller schemes could however achieve sustainability of operations and maintenance. In other words it is proposed that national governments and donors should fund the capital costs of smaller schemes but that the operations and maintenance costs should be recovered from users.

Note that water supply schemes have not been included in the proposed investment programme.

6.3.5 Irrigation schemes

Irrigation schemes can be divided into three components, the dam, the distribution pipelines and canals, and the on-land irrigation systems.

The dams require a major investment, most likely beyond the reach of the farmers. It is proposed that the national governments and the donors fund the capital cost of the dam as well as any associated infrastructure for conveyance to the farms (pipelines and canals). The on-land irrigation systems however will have to be funded by the farmers with small direct loans from the land bank.

It is also proposed that farmer associations be established to operate these irrigation schemes, and operate and maintain the dams (but not construct the dams or bulk infrastructure). These farmer associations can be financially supported by an agriculture bank (or land bank). The agriculture or land banks would be an intermediary between the commercial banking system and the farmer associations. The agriculture banks would be established by the national governments with donor support.

Cost recovery is through sale of agricultural produce, again supported by the farmer associations or cooperatives established for each irrigation scheme.

6.4 Apportionment of the costs of joint programmes between riparian states

Where a part of a programme falls wholly within one riparian state, such as a measuring weir of a joint data collection network or a local education programme which forms part of a larger basin wide education programme, then it could be agreed that the country in which that sub-programme falls could fund the full cost of that work or sub-programme.

However where programmes are centralised, then an approach is required to apportion shared costs. Examples would be the cost of establishing and maintaining the Secretariat and its centralised programmes such as that of centralised data collection and storage, centralised basin wide planning etc. The riparian states would have to agree on how these costs would be shared in an equitable manner.

6.5 Allocation of costs of infrastructure development projects

Where a full project falls within an individual state then that state would take responsibility for the full cost of the project.

However where a project supplies benefits to two or more countries (e.g. a large hydro project) then the states affected should enter into a bi-lateral cost and benefit sharing agreement that determines the allocation of costs and benefits before construction commences.

6.6 Summary of costs and funding modalities

A summary of costs and proposed funding modalities for the various categories of activities are indicated in **Table 6-4**.

Table 6-4: Summary of BDP costs and funding modalities

Area of investment	Funding source	Short term 1 – 5 years US$ million	Medium term 6 – 10 years US$ million	Long term 11 – 20 years US$ million
A. KAGERA BASIN SECRETARIAT				
Secretariat		4.5	6.0	15.0
Sub-total Secretariat		**4.5**	**6.0**	**15.0**
B. IWRM PROGRAMME SUPPORT: DONOR FUNDED CONSULTANCIES				
Creating an enabling environment	• Monetary contributions from Riparian Countries. • Management of studies by staff from Riparian state national government departments through staffing allocation. • In-kind (staff secondment). • Donor funding for PSPs.	1.5	2.6	1.0
Basin water management		0.7	0.7	0.4
Livelihood and socio-economic development		1.2	1.5	1.8
Environmental protection, land and disaster management		0.5	0.5	1.1
Sub-total Donor funded consultancies		**3.9**	**5.3**	**4.2**
C. INFRASTRUCTURE DEVELOPMENT PROJECTS AND SCHEMES				
Hydropower Schemes	• National Governments and Donors fund project preparation, estimated at 15% of cost. • Vendor funding through PPPs for construction and operations costs. • Cost recovery through take or pay agreements with national electricity providers in case or energy and/or towns in case of water supply.	448	1094	389
Multipurpose projects – Larger Dams		148	477	197
Multipurpose projects – Smaller Dams	• National Government and donors fund full capital cost. • Operations costs recovered through water sales.	28	246	102
Irrigation schemes	• Government and Donors fund full capital cost of dam. • Farmer associations established to fund irrigation pipelines and canals, supported by government sponsored land bank or irrigation bank as intermediary between funding sources and farmer associations. • Individual Farmers fund on-land irrigation supported by land bank. • Commercial agriculture under security of land leases where sufficient land and size of irrigation scheme makes this appropriate.	146	22	0
Other projects	• National Government and donors fund full capital cost. • Operations costs recovered through water sales.	300	0	0
D. WATERSHED AND WETLAND MANAGEMENT PROJECTS				
Sub-total Infrastructure development schemes		**1070.1**	**1838.5**	**688.7**

Area of investment	Funding source	Short term 1 – 5 years US$ million	Medium term 6 – 10 years US$ million	Long term 11 – 20 years US$ million
Watershed Projects	• Bilateral Government Donor Financing. • Multilateral development and climate change financing, including through regional coordinating bodies (Multilateral Development Banks, GEF, Adaptation Financing). • Private sector (ecosystem service/carbon) financing.	424.6		
Wetland Projects		64.0		
Management		43.2		
Sub-total watershed and wetland management projects		**531.8**	**0.0**	**0.0**
TOTAL		**1610.4**	**1849.8**	**707.9**

7. INSTITUTIONAL STRUCTURE FOR IMPLEMENTATION

This chapter comprises three sections. Section One presents the relevance of this chapter to the consultancy objectives. Section Two describes the institutional structure for implementation.

7.1 Relevance to the Consultancy Objectives

Sustainable policy, legal and institutional frameworks are an important part of an IWRM Strategy and Plan. Institutions are the vehicle for cooperation of Member States in the implementation of IWRM Plans and such institutions require adequate and appropriate policy and legal frameworks which they would operate under. This chapter addresses the responsibilities assigned to actions in the Implementation Plan. It provides an overview of the institutional structure for implementation of the BDP, and deals with institutional aspects and implementation modalities.

7.2 Institutional Structure for Implementation

7.2.1 Background

During the Diagnostic Assessment Phase of the project various cooperative frameworks for the Nile Basin pertaining to the Kagera Basin were examined and analysed. National cooperative frameworks in each of the four Kagera Riparian Member States were examined. Regional cooperative frameworks for the Nile Basin Initiative and its subsidiary Programmes, the Nile Equatorial Lakes Subsidiary Action Plan (NELSAP) and the Eastern Nile Subsidiary Action Plan (ENSAP), were also assessed. The cooperative frameworks of the Regional Economic Communities (RECs); the East African Community (EAC) and Southern African Development Community (SADC) were assessed, including the Lake Victoria Basin Commission (LVBC). A number of regional and international water agreements were analysed in order to understand the legal status of any proposed Kagera cooperative framework. These cooperative frameworks were assessed in terms of their strengths and weaknesses, with the aim of arriving at a sustainable cooperative framework for the Kagera to address the following key development challenges:

- Poverty,
- Economic development, and
- Environmental degradation.

This consultancy has developed a Basin-wide IWRM Based Basin Development Plan (BDP) with a portfolio of bankable projects that will help address the development challenges outlined above. A sustainable cooperative framework is at the core of the implementation plan for the IWRM Plan.

NELSAP has engaged a separate consultancy to develop the institutional structure for the Kagera River Basin. Therefore this consultancy aims not to duplicate that work but to compliment it by focusing on the institutional structure for the implementation of the Kagera BDP. Institutional structures for the implementation of specific aspects of the Kagera BDP are covered in the various sections of the plan. In the Implementation Plan (Chapter 3), institutional structures are specified for each of the strategies outlined in the Implementation Plan. Institutional roles and responsibilities are defined at Basin, National and Catchment levels and well as the roles for other stakeholders such as the Private Sector, NGOs and Donors, Research and Academic institutions. In **Annexure B** of the Implementation Plan, legal and institutional roles and responsibilities are recommended for each of the projects identified in the plan. In this Chapter the consultant will focus on the overall institutional structure for the implementation of the Kagera BDP with particular emphasis on the specific priority strategic objectives of the Kagera BDP, namely;

- Human capital and Knowledge base;
- (Land use productivity) improved rain-fed agriculture productivity;
- Increased irrigated agriculture;
- Hydropower development; and

- Fisheries and aquaculture development.

7.2.2 The basis for institutional framework

In defining the institutional structure for water resources management it is essential to consider that river basin natural resources are interdependent and water resources is the cement that bind these resources together. The institutional structure should take into account both the resource management as well as the resource use aspects of the natural resource. In economics basin resources are classified as common pool resources with non-excludability and subtractability characteristics. In the basin sense, common pool resources include surface and groundwater, water infrastructure (irrigation systems, dams, boreholes, etc.), fisheries and wild life, rangeland and other natural resources. These have non-excludability characteristics in that they may potentially be used by more than one individual or agent simultaneously or sequentially where exclusion would be difficult or costly to achieve (Myungsuk Lee 1994). The non-excludability characteristics refer to the technical and economic feasibility of controlling access to the resources by potential users. The joint use of the natural Basin resources reduces the amount available to each individual (subtractability). The level of consumption or exploitation of basin natural resources affects the ability of other users to consume or exploit the resource. If the non-excludability and subtractability characteristics of basin natural resources are not managed, it leads to a sub-optimum solution or social dilemma (Messick and Brewer 1983) with consequences such as conflict and environmental degradation. Institutions are therefore created to manage common pool resources for the common good of all.

7.2.3 Analytical framework for water institutions

Water institutions can be defined by a structured set of legal, policy, and organizational rules, conventions, and practices that are within a well-defined environment. Water institutions can be analysed by distinguishing the institutional structure (governance structure) aspects from the institutional environment (water governance framework) aspects. The water environment or water governance framework is determined by historical, constitutional, economic, social, political and physical conditions of the country or basin. On the other hand the institutional structure or governance structure is determined by water related law, policy and organizational elements. The institutional structure can further be unpacked broadly into three categories, namely; achieve water law, water policy, and water organisation or administration.

Water law gives full legal backing to water policy as well as providing the operational framework and enforcing power for water administration including its regulatory arrangements. Water law aspects include inter-governmental responsibility, water rights and accountability provisions and mechanisms. The legal provisions related to inter-governmental responsibility in the water sector are derived from the overall constitutional division of power between the central and state governments as well as other co-basin states. The issue of water rights as a mechanism for allocation and accountability assumes importance with increasing scarcity and conflicts both at the macro level of regions and sectors as well as at the micro level of communities, and individual users. Accountability provisions and mechanisms are effected through a legal rights system. When the law defines water rights, in effect, it defines not only the legal boundaries but also the physical and economic boundaries of each water user and their effects on other users. Water rights systems help to minimize conflicts amongst users.

Water policy relates to the declared statements as well as the intended approaches of the central and state governments for water-resource planning, development, allocation, and management. It includes statements not only on the overall policy framework but also on specific policy issues such as project selection, water pricing and cost recovery, and user and private participation. Project selection criteria policies take into account issues such as project internal rate of return (IRR) or cost benefit ratios. Cost recovery policies define whether the full project investment cost has to be recovered which would include operation and maintenance costs (O&M) as well as the proportion of interest on investments. Water pricing policies pertain to fundamental issues relating to how water is perceived, that is, a common good or a commercial good or both. Water user participation is an integral aspect of IWRM. The policies on

user participation address the core aspects of water management including water management formations such as catchment management agencies, water user associations etc. Privatization policies address private sector participation in the water sector mainly as a result of lack of financial investments and poor financial performance of water projects and the need for the privatization of private public sector enterprises.

It is worth noting that the general and specific water policies within the water sector cannot be dealt in isolation of policies in other related sectors because they are often influenced by other sectoral policies such in agriculture, public finance, and basic needs.

Water administration covers the organizational, financial, and managerial structures including the regulatory apparatus and conflict resolution mechanisms, which are directly connected to the water sector. The organizational framework deals with how the water sector institutions are organised at various levels. Fundamentally it deals with ensuring that no one institution plays the role of a referee and a player at the same time. It deals with the establishment of various water administration institutions with specific roles and responsibilities. The financial aspect deals with the institutional roles for financing water infrastructure operations and includes financing, cost recovery and management aspects. It specifies institutions responsible for the management of donor funds amongst other. In most countries the financing of the capital investment in the water sector is the responsibility of the government which receives funds from fiscus as well as from donors. Regulatory mechanisms relate to the nature of water administration (centralised or decentralised systems). Regulatory mechanisms are about the organizational arrangement for enforcement and monitoring of water use. Conflict resolution mechanisms are structures aimed at resolving water user and inter sectoral water allocation conflicts. These include water tribunals and other similar institutional structure that are prescribed in water legislation.

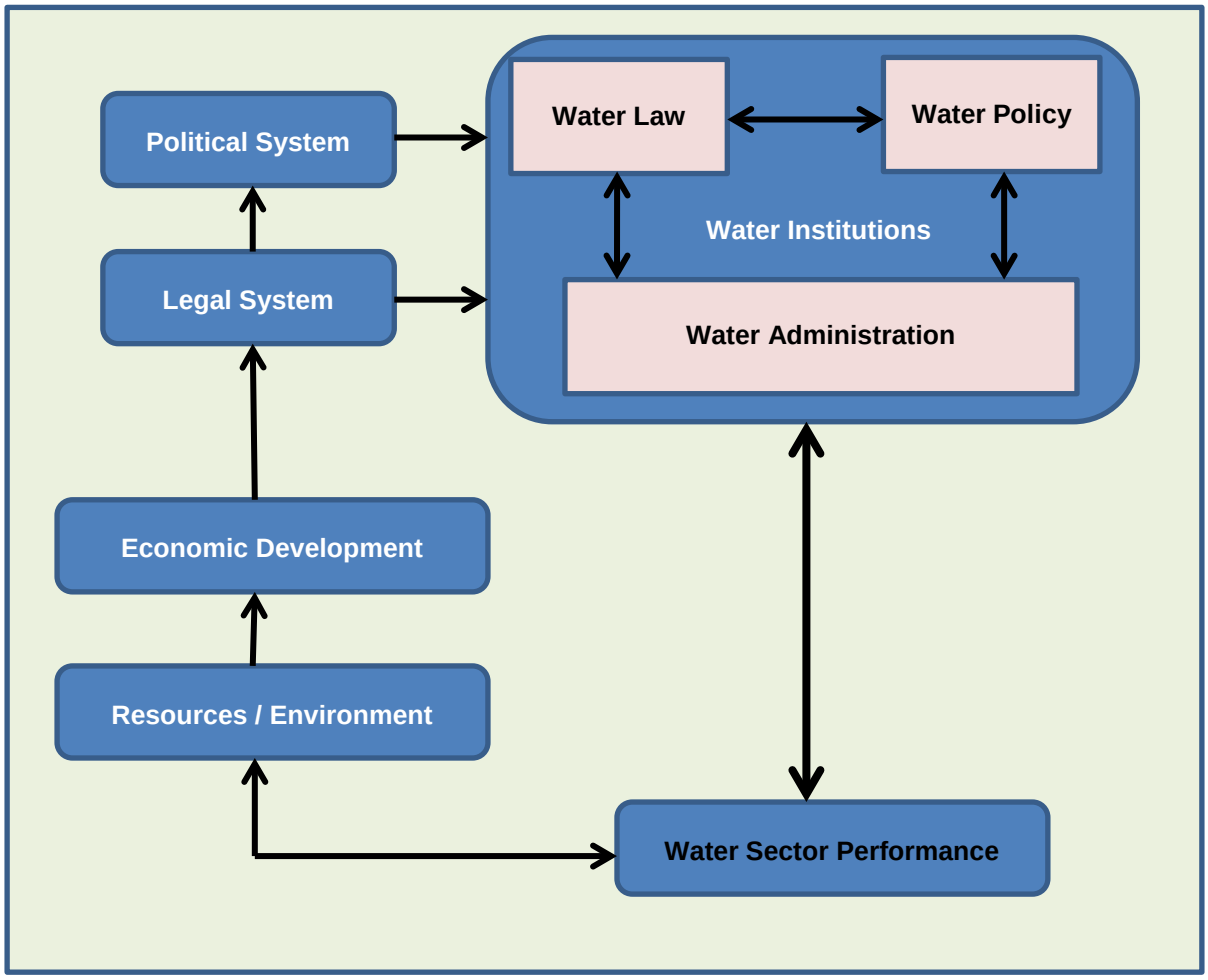

Figure 7-1: Schematic representation of Analytical Framework for Water Institutions (adapted from Saleth and Dinar (1997:10)

The institutional structure for the implementation for the Kagera BDP will be defined through the described framework and will focus on the aspects of water law, water policy and water administration. This will be considered at basin, national and catchment levels.

7.2.4 Institutional Structure for implementation of the Kagera BDP

Table 7-1 below defines the institutional structure for the Kagera BDP parameters of water law, policy and administration as described in the preceding section. These parameters broadly encompass the roles and responsibilities in the Kagera BDP that the institutions have to undertake. The reason for adopting a clustering approach for the institutional structure for implementation, using the framework defined above, is to define the institutional structure for implementing the Plan, as opposed to components of the Plan. The institutional structure for the implementation of components of the Plan is contained in the Implementation Action in respect of each of the IWRM strategies and in **Table 7-2**for the specific priority strategies. **Annexure C** contains the recommended legal and institutional roles for each of the projects in the Plan.

In reading **Table 7-1** on the institutional structure for implementation of the Kagera BDP it is worth pointing out the following. Where an agency such as NELSAP is stated as the responsible institution, the institutional structures (NEL-COM, NEL-TAC, etc.) and their mandates are maintained. Where the Ministry of Water is indicated as the ministry responsible for an action, the government organizational structure and their mandate are maintained. This includes the role of the three arms of government (legislature, executive and judiciary) as well as any other mandated institution that the stated ministry has to cooperate or obtain approval from in order to effect its responsibility.

Table 7-1: Institutional Structure for Implementation for the Kagera Basin Development plan

Water Law				Water Policy				Water Administration			
Institutional Structure Aspect	**Institutional Roles and Responsibilities**			**Institutional Structure Aspect**	**Institutional Roles and Responsibilities**			**Institutional Structure Aspect**	**Institutional Roles and Responsibilities**		
	Basin	**National**	**Catchment**		**Basin**	**National**	**Catchment**		**Basin**	**National**	**Catchment**
Intergovernmental Responsibility	NELSAP to facilitate the harmonisation of intergovernmental laws based on international best practice (IWRM Principles)	National Ministry for Water to develop and enforce water laws based on national constitutional mandates	Catchment Agencies and Water Authorities to implement intergovernmental responsibilities within their catchment	***National Water Policy***	NELSAP to advise on harmonization of national policies	Ministries of Water to develop water policy in line with international norms	Catchment Agencies and Water Authorities to implement national polices	***Organizational Framework***	NELSAP to develop harmonised IWRM based guidelines for organizational frameworks for water administration for Member States	Ministries of Water to develop IWRM based water sector organizational frameworks	Catchment Agencies and Water Authorities to adhere to organisational frameworks
Water Rights	NELSAP to facilitate the harmonisation of water rights laws based on international best practice (IWRM Principles)	National Ministry of Water to develop water rights legislation in line with national and constitutional mandates	Catchment Agencies and Water Board / Utilities to implement Water Rights legislation within their catchment	***Project selection criteria***	NELSAP to develop harmonised criteria for project selection at basin level taking into consideration IWRM principles and Member States priorities	Ministries of Water to develop national project selection criteria based on national priorities taking cognizes of basin level project selection criteria	Catchment Agencies and Water Authorities to implement national and basin project selection criteria	***Financing and management***	NELSAP to develop guidelines for the harmonisation of water sector financing and management for Member States	Ministry of Water to develop national guidelines for water sector financing and management in line with national requirement and NELSAP guidelines	Catchment Agencies and Water Authorities to implement water financing and management
Accountability provisions and mechanisms.	NELSAP to facilitate the harmonisation of develop laws on water user rights provisions and mechanisms based on international best practice (IWRM Principles)	Ministries of Water to develop laws on water user rights provisions and mechanisms within the legal rights systems	Catchment Agencies and Water Authorities to comply with water laws on accountability provision and mechanisms	***Pricing and cost recovery***	NELSAP to develop guidelines for the harmonisation of pricing and cost recovery policies for Member States	Ministries of Water to develop national policies for water pricing and cost recovery in line with NELSAP guidelines	Catchment Agencies and Water Authorities to implement policies on water pricing and cost recovery	***Regulatory Mechanisms***	NELSAP to develop guidelines for harmonisation of regulatory mechanisms	Ministry of Water to develop national water regulatory mechanisms	Catchment Agencies and Water Authorities to adhere to regulatory mechanisms for the water sector
				User and private sector participation	NELSAP to develop guidelines for the harmonization of national policies on water user participation and privatization policies in the water sector	Ministries of Water to develop national policies on water user participation in the water sector as well enact policies privatization in line with the guidelines developed by NELSAP and taking into consideration other national economic realities	Catchment Agencies and Water Authorities to adhere to water user participation and privatization policies	***Conflict Resolution***	NELSAP to develop enhance conflict resolution mechanisms at basin level and harmonise national ones	Ministries of Water to develop national mechanisms for conflict resolution	Catchment Agencies and Water Authorities to adhere to conflict resolution mechanisms

Table 7-2: Roles and responsibilities related to specific strategic objectives

Specific Strategic Objectives	Strategies	Targets	Roles and Responsibilities	
			Basin	National / Local
Human capital and knowledge base	Ensure qualified human resources and knowledge base within water management institutions for water planning, management and research (Strategy 1.2)	Training and capacity building	NELSAP to identify capacity building requirement	Member States to strengthen programmes to address capacity building needs
		Practical and focused research and technology development	NELSAP to identify areas of focused research and technology development	Member States and their institutions to strengthen place programmes
		Infrastructure Management staffing	NELSAP to identify requirements for infrastructure management	Member States to implement infrastructure management staffing requirement
		Learnerships in water resource management	NELSAP to source funding for learnership	Member States to develop learnership programmes
	Strengthen knowledge base and establish IWRM information systems and tools (Strategy 1.3)	Information Management System	NELSAP to develop and maintain basin information management system	Member States develop and maintain national information management systems
	Effective monitoring, assessment and information management for adequate management and allocation of water (Strategy 2.3)	Information requirements	NELSAP to identify information requirements	Member States to develop programmes
		Monitoring networks for climate, surface water and groundwater	NELSAP to develop and maintain basin wide monitoring networks	Member States to develop nationwide monitoring networks
Improved rain-fed agriculture productivity (land use productivity)	Water demand of intensified, modernised agricultural and aquaculture developments (Strategy 4.1)	Rain-fed agriculture management Runoff water harvesting Water storage structures	NELSAP to develop strategies Kagera Basin	Member States to strengthen harmonised policies and programmes
	Support prioritised sectoral conservation and development Basin initiatives from a water resource perspective (Strategy 4.5)	Sustainable farming practises, technologies, and development initiatives	NELSAP to develop basin wide strategies	Member States to strengthen harmonised policies and programmes
	Rehabilitation of degraded environments (Strategy 5.2)	Rehabilitation	NELSAP to identify vulnerable areas and develop basin wide strategies	Member States to strengthen national policies and programmes
	Sustainable land management (Strategy 5.3)	Optimising water use through sustainable agriculture to avoid degradation and loss of productivity.	NELSAP to develop strategies	Member States to harmonise and strengthen policies and programmes
Increased irrigated agriculture	Water demand of intensified, modernised agricultural and aquaculture developments (Strategy 4.1)	Irrigation and drainage	NELSAP to develop a strategy for increased irrigation and drainage	Member States to e harmonised and strengthen policies and programmes
Hydropower development	Address the high demand for new water infrastructure to meet regional energy security (Strategy 4.2)	Energy resources developed (hydropower)	NELSAP to accelerate the NELSAP energy development programme	Member States to strengthen policies and programmes for energy development
Fisheries and aquaculture development	Water demand of intensified, modernised agricultural and aquaculture developments (Strategy 4.1)	Aquaculture and sustainable fisheries	NELSAP to put in place strategies for promoting sustainable fisheries	Member States to develop programmes for promoting sustainable fisheries
		Fish-production habitat management	NELSAP to identify fish production habitats and develop strategies for their management	Member States to develop programmes for promoting fisheries habitat management

8. IMPACTS OF IMPLEMENTATION OF DEVELOPMENT OPPORTUNITIES

This chapter summarises the costs and benefits (positive and negative impacts) that have been identified for the various development schemes - as evaluated in the Strategic Planning Task, 'Prioritised Portfolio of Programmes / Projects' activity (refer to Chapter 4 of the Strategic Planning Report that precedes this document). Impacts on Environmental Flows are discussed in terms of the cost : benefit equation.

Ensuring that environmental flows are maintained is but one of many possible mitigatory measures and one that will be demanded by funding agencies or investors. Project selection has eliminated developments that are considered to be fatally flawed and/or where the negative impacts reflect too heavily against benefits and render the project unsustainable. Project design should optimise project benefits and minimise negative impacts, and mitigatory measures are specific to individual projects. This chapter takes these issues up to country and basin scale.

8.1 Relevance to Consultancy Objectives

With this consultancy required to 'develop a sound and environmentally sustainable IWRM Development Plan' the impacts of proposed developments becomes a central theme. Impacts may be defined in terms of costs and benefits both to society (often through the economy) and to the environment. With Basin Sharing central to development objectives, costs and benefits need to be evaluated at both local and Basin scale, and in the context of NELSAP and the NBI to the overall system. Consideration must also be given to opportunity cost, both immediate and long-term – requiring a strategic perspective.

8.2 Development opportunities and how these differ

This Basin Study has reviewed the many significant development opportunities proposed over the past thirty years. These need to be considered in the context of developments implemented or attempted - particularly if an equity audit is to be undertaken of how resource use and impacts are shared throughout the Basin.

The focus of this Basin Development Plan is **water**, and this is the key impact for evaluation. Water resource development projects of very different forms, shapes and sizes have been assessed. A major focus of this consultancy has been on 'bankable projects' - ranging from hydropower schemes, smaller and larger dams, to irrigation abstraction schemes, pipelines and water quality protection. As demands on the water resource grow the supportive catchment (watershed and marshland) and other management programmes become ever more critical to the resource and in the mitigation of impacts.

Development is shaped by the dynamics of demand (water requirement) and supply. There is growing recognition that water is not the main driver in development but is responsive to development and that it should be utilised to meet identified needs or demands. Water must first and foremost be provided to meet basic human needs, then in response to user requirements. Only in the event of true surplus (of water and investment funds) should water be used as a focus around which new development is built. That water is seen to be used in supplying existing demand has a critical influence on impact assessment. Population growth, urban planning, agricultural planning and forestry development are all part of this dynamic.

In this Basin Development Plan the following development opportunities have been fitted into the following broad categories:

- Hydropower plants – large, small, run of river, sometimes with significant associated storage
- Larger dams (with classification based on dam capacity of >30 million m^3, rather than wall height
- Smaller dams. These all have a wall height of < 15m and a capacity of <30 million m^3
- Irrigation schemes. Most irrigation schemes under this portfolio in the Kagera Basin are associated with dams, but this is a category to cover those schemes dependent on direct abstraction, typically through diversion weirs.

- Other water resource related projects (of which fisheries, aquaculture and the Mutobo pipeline have been selected, the remainder being water quality management and drinking water supply), which are typical projects and should be viewed as programmes to implement.
- Watershed and wetlands rehabilitation and management. A watershed and marshlands development programme – with a focus on rehabilitation and sustainable development, has been developed (2012) and forms a vital complement to this study.

8.3 The nature of impacts

Impacts may be positive or negative, direct or indirect, short-term or long-term, expected or unexpected, and of local and/or basin or even system-wide, concern. All development has an impact and even activities aimed at rehabilitating and restoring the environment should be evaluated critically. Schemes interrupting the flow in rivers and involving large volumes of water are, quite naturally, of major concern to the shared use of the Kagera River.

Positive benefits include:

- Food security – both on the land and national food security.
- Improved livelihoods through agricultural opportunities. Food security, resilience to disaster and climate change, cash cropping, water for livestock, time spent fetching and carrying are amongst many social benefits.
- Reliable power supply. This is essential to manufacturing industries and mining and brings great benefit to lifestyle. Lighting is an important facet in education. Electric power means less reliance on fuelwood and charcoal, less pressure on forest resources, and more chance of maintaining catchment cover, the feedback loop being less erosion, better infiltration, rehabilitation and improved raw water resources.
- Stimulation of the economy.
- Regional development including transport and communications infrastructure.
- Meeting basic human needs and Millennium Development Goals.
- Domestic water supply and sanitation in both urban and rural situations – with concomitant health and time saving benefits.
- Water quality. This may improve through the trapping of sediments. Mitigation measures aimed at reducing sedimentation (watershed rehabilitation projects) can only have a positive impact.
- Flood attenuation.

On the negative side these impacts include:

- Availability of water downstream – opportunity cost to other downstream users, inflow to Lake Victoria and the Nile Basin. Flows will be reduced through consumption and evaporation. The timing of flows may also be impacted.
- Environmental costs:
    - to biodiversity (direct losses due to inundation).
    - through changes to ecological or environmental flows in rivers (downstream impacts through reduced quantity and quality).
    - through development consequent on the availability of water. This would typically the loss of biodiversity where previously unused land is development for irrigation, utilisation of wetlands, etc.

  These costs must be balanced against the environmental benefits that come with the provision of livelihoods).

- Loss of homes, land, cultural assets, and infrastructure – most especially the need for resettlement and relocation.
- Alteration in patterns of sediment delivery. This may be both positive and negative (see discussion on ecological flows)
- Water quality. The intention associated with dams and irrigation schemes is to introduce higher input of high-value agriculture and this will bring increased non-point source pollution through the runoff of fertilisers and pesticides. Manufacturing, industry and mining all have negative impacts on the quality of water, but these can be minimised through design and management.

Opportunity costs are often neglected in this equation and this is all the more reason for integrated basin development. Each development has a hydrological and an environmental impact and these are cumulative downstream and in the system. The Basin Development Plan has the responsibility of getting it right first time – if optimal long-term utilisation of water resources is to be achieved.

Sustainability is critical: Failure to maintain a development in a functional state (as in the case of the Maziba Gorge SHPP and even the original Kikagati HPP) has deep-seated negative impacts, both to the economy and to society. This is even more serious for irrigation.

The consequences of growth: Economic strength and economic growth are likely to lead to an influx of people from outlying areas. Growth is a positive benefit but growth centres can have a localised negative impact as people migrate from outlying areas, resulting in change, and in centres of wealth and centres of poverty. Movement of people can take pressure off the land from which they have migrated, but can add to conflict at growth points. An unintended consequence, and one that encapsulates the 'development dilemma', is that pushing the 'resource use envelope' (maximising the use of water, for example) allows people to temporarily forget the limitations to the overall resource; this is a region that, at a reasonable standard of living, cannot easily sustain a larger population than it already has.

8.4 Environmental flows

All rivers, after abstraction and use, should be left with sufficient water for the continued environmental functioning of that system. This is the environmental flow, and the guarantee of this flow is a requirement of most funding and investment agencies. Environmental flows are aimed at ensuring that rivers continue to provide social, health, economic and environmental benefits that would be lost if river function deteriorates beyond a certain tipping point.

The design and operation of any dam or project must therefore take account of the environmental flow requirements of the river downstream. Water should be released to the river downstream of any dam to mimic the natural seasonality of the river. This may affect the utilisable yield and the generation of hydropower.

Very few of the various project plans in the project portfolio have made provision for environmental flows, however many do have a hydropower component that could provide such flows. It is recommended that all further studies should address this requirement.

Environmental flows are also required where rivers are seasonal, or have very low dry season flows. In these rivers the environmental flows should ideally not be more than the actual natural flow that would be expected within that season. This means that the release of stored water to generate power in the low season may also be limited, constraining operations and contributing to the difficulty in managing variable power output. Hydropower plants generating peaking power usually exceed this requirement – but this excess water will probably be taken up by small-scale irrigators downstream.

In the case of releases for hydropower or irrigation, the river ecology may be disturbed if the river channel is used as a conduit for the released water.

The specialist reports on the EF Tool for the Kagera Basin (also refer to Chapter 4 of the Diagnostic Assessment Report) and on the assessment relating to the identified schemes have been included in **Annexure D**.

8.4.1 Impacts of planned hydropower plants on environmental flows

The impacts of large proposed hydropower schemes have been summed up as follows in the Environmental Flows component of the Strategic Planning Report:

- The hydropower schemes all have very little storage, and no consumptive use is planned, so they have little impact on the MAR downstream.
- The hydropower schemes are mostly run-of-river schemes aimed at base load power generation, so there will be no peaking power.
- With little or no storage there is no opportunity to influence seasonality. Wet and dry season flows are expected to be near-natural, except for Ruvyironza HPP (the Ruvyironza Dam can retain 50% of MAR). The schemes also have little or no opportunity to capture flood flows. Mid-level floods, and peak wet season flows, can be expected to be near natural.
- Scheme structures will not hold back sediment beyond some of the coarser elements of suspended load sediment.

In summary, run of river schemes have little impact on environmental flows and, with small impoundments, social and ecological impacts are generally low. This makes these projects investor friendly and all of the schemes planned for the Kagera River are recommended for further feasibility or implementation as a result.

8.4.2 Impacts of dams on environmental flows

The impact of a dam on environmental flows is governed largely by the size of the dam in relation to the MAR. Given that larger dams tend to be built on the larger rivers, and smaller dams on smaller rivers the relationship does not differ much and the impact of these dams can be discussed as one category. In reality the larger dams proposed for the Basin) have storage capacities of between 50 – 96 % of MAR, whilst the smaller dams have storage capacities of between 50-60% of MAR. These dams will all influence seasonality, will trap mid-level floods, will delay the onset of wet season flows, and will trap the coarser sediments passing through. Wet season flows will be lower than natural, but dry season flows may well be higher – particularly if hydropower is also being generated.

8.4.3 Impacts of irrigation schemes on environmental flows

Irrigation schemes may more easily slip the net of environmental flow requirements – yet it is just as crucial that operating rules are set for diversion and pump abstraction schemes as it is for dams. In fact more so, as diversion schemes are not in a position to capture excess wet-season flows and utilise this stored water in the dry season. It is the temptation of diversion schemes to abstract all the available water during the dry season (when flow it is at its lowest) for use (when demand is highest). Planning for these irrigation schemes must take this into account, and allow an irrigated area that can always be irrigated during a drought year. The concept of “Assurance of Supply” is useful here. If a 75% assurance of supply is acceptable to farmers then sufficient land may be allocated for full irrigation three years out of four, on the understanding that (on average) every fourth year there will not be sufficient water to both irrigate all lands fully whilst still allowing a 20% release of dry-season flow. Farmers should therefore then expect water restrictions one year out of four. The alternative would be to irrigate a smaller area with a greater assurance of supply.

The management of environmental flows requires precise and strict operating rules, a good knowledge of the hydrology, and if possible real-time monitoring of actual inflows so that releases and off-takes can be correctly modulated. This will take discipline and monitoring. Moderating this process will be an essential function of watershed authorities.

8.5 Other environmental impacts

8.5.1 Impacts on biodiversity

Having dealt with environmental flows, which are essential for maintaining both plant and aquatic diversity in and adjacent to streams, the other key impacts of water resource infrastructure development and use

on biodiversity are through inundation, and also the losses that are consequent on resulting development activity (irrigation, mining, habitation). Biodiversity impacts are a direct function of (a) the surface area of the impoundment (b) the extent of natural vegetation remaining within the basin (c) the level of endemism, and (d) the area of new land that is expected to go under irrigation. The movement of people into a development area is also likely to place pressure on local biodiversity, although improving local economies may well mean less demand on local resources (typically fuelwood) for livelihoods. The movement of people to new areas of development should help to relieve pressures elsewhere - with the Muvumbe Dam (Ngatare Water Resources Development Project) a case in point.

8.5.2 Sediment

Sediment flows have been noted under environmental flows. Sediment is an important part of marshland ecosystems but the rapidly accelerated soil erosion and degradation that is being experienced in the Basin has long led to excessive sediment. Dams will trap and hold coarser sediments and will eventually become defunct as they fill up. Some dams have an expected lifespan of as little as 50 years and the worst cases have not been recommended for construction at all. Others (such as Munyange-Vumbe) are low priority options due to sedimentation risk and yet other dams have been planned with excess capacity (allowing for a large 'dead storage), adding to cost but at least allowing for an acceptable lifespan – although 50 years is not very long.

The key mitigation of sedimentation should be the afforestation, reforestation, agricultural water management (run-off prevention and maximisation of infiltration), and rehabilitation programmes that must be put in place – especially in watersheds where infrastructure is planned. The prospective placement of infrastructure should be conditional on the implementation of upstream land management programmes. Such land management will not reduce sediment production entirely. Given high population pressures, intensive land use, and livestock densities, to bring sediment down to 'natural' levels is an impossible dream – but remains the benchmark to aspire to.

8.5.3 Impacts on wetlands

Wetlands are essential as sediment traps, as water quality filters and also as areas rich in their own ecology and biodiversity. Losses are to irrigation, damage through excessive sedimentation, inundation etc.

8.6 Socio-economic impacts

The key social impact is the loss firstly of homesteads, and secondly of productive (often already irrigated) lands to inundation. In country as densely populated as the Basin States it is difficult to find land that is not densely populated – making the siting of dams very difficult from the perspective of human disruption. Added to this is the paradoxical call, made strongly in this Basin Development Plan, to site projects on the basis firstly of identified need – and that identified need will be where poverty is highest and there is often the greatest density of people.

It would appear, from the pre-feasibility and feasibility studies reviewed, that relocation of large numbers of people is an accepted "fact of life" if dams are to be built. However the cost (and conflict) of relocation has not been adequately considered, despite the requirement for Reallocation Action Plans. Steps that need to be taken include the setting of norms and guidelines for relocation, and principles whereby people who are moved off the land do not suffer negatively from the development. One principle is that those who lose land should be priority beneficiaries under the new land to be irrigated. This is all very well for irrigation schemes – but more problematic where a development is principally for hydropower or for the provision of water to towns and cities.

The resettlement requirement figures for some of the proposed development are disconcertingly divergent in different studies. It is plain that the Nyabarongo Dam (Nyabarongo II) would require the relocation of 6000 households and that this project will have to be considered and costed very carefully given this impact. Others dams (Ruvyironza and Kanyaru) may have larger impacts, as can be seen from the table below.

Table 8-1: Impacts of dam location on local inhabitants

Dam / Project	Country	Impact	Comment
Kakono	Tanzania	Will require resettlement but numbers not known	No information
Rusumo 1323.5masl dam	Tanzania/Rwanda	Very large numbers of people	Run of river option selected
Rusumo Run of River	Tanzania/Rwanda	Very few people affected	
Kikagati 16 MW Run of River	Uganda/Tanzania	Very low social and environmental impact	
Nsongyezi 39 MW	Uganda/Tanzania	Limited	Preferred over larger options. Relocation Action Plan (RAP)
Nyabarongo II	Rwanda	6000 houses, 1500 ha agriculture	
Ruvyironza	Burundi	8500 houses	
Kagitumba-Mazimba	Uganda/Rwanda	Lands, people	No information provided
Kakanja	Tanzania	Large area	No information
Kanyaru	Burundi/Rwanda	8500 people	
Muvumbe	Rwanda	1400 people	
Upper Ruvubu	Burundi	unknown	No information
Gashayura	Burundi	0	Zero (probably not correct) but small numbers favour this project
Kabuyanda	Uganda	Few	No good information
Karazi, Kavaruga, Mbarara	Tanzani, Burundi, Burundia	unknown	No information
Munyange-Vumbe	Burundi	Few inhabitants, but densely cultivated	

Not only is the “number of people affected” very differently accounted for in different studies, but Google searches of the terrain do not show the population densities reflected in other studies for Ruvyironza and Kanyaru (acknowledging that the mapping may be outdated). This suggests that far more detailed, house-to-house social surveys are required before any decisions can be taken on infrastructure development for these schemes.

Some detail is provided in identification and pre-feasibility studies on the area of land inundated and whether this was farmed or not. Frequently information is limited to “plantations”, “fields”, or “coffee trees” which does not advise on whether the land was highly productive or whether it was irrigated.

This is critical information; if a dam is to be constructed for irrigation, then it is the net irrigable area that should weight decision-making when assessing benefits. This should be a central aspect in all future terms of reference.

8.7 Cumulative benefits

Benefits include power generated and the service this provides to the population - especially where connected to national grids, water supply to people (with Muvumbe reaching perhaps 300 000 people), irrigated land and a stimulated economy. These benefits are listed in Tables 4.4, 4.5 and 4.6 in the Strategic Planning Report and summarised in **Table 8-2**. **Table 8-3** presents a summary of the total potential water supply and power supply per country.

On average, a total of 386 Mm^3/a of water could be supplied to the Basin for irrigation and domestic use by the proposed dams which equates to 34 300 ha and 3.4 million people. In addition, 1 703 GWh/a of power could be generated.

It can be seen from the plot of demands against potential supply for the above portfolio of projects shown in **Figure 8-1** that these projects have little impact on the overall demand and that a far bigger push is needed in order to make a significant difference to the needs of the Kagera Basin.

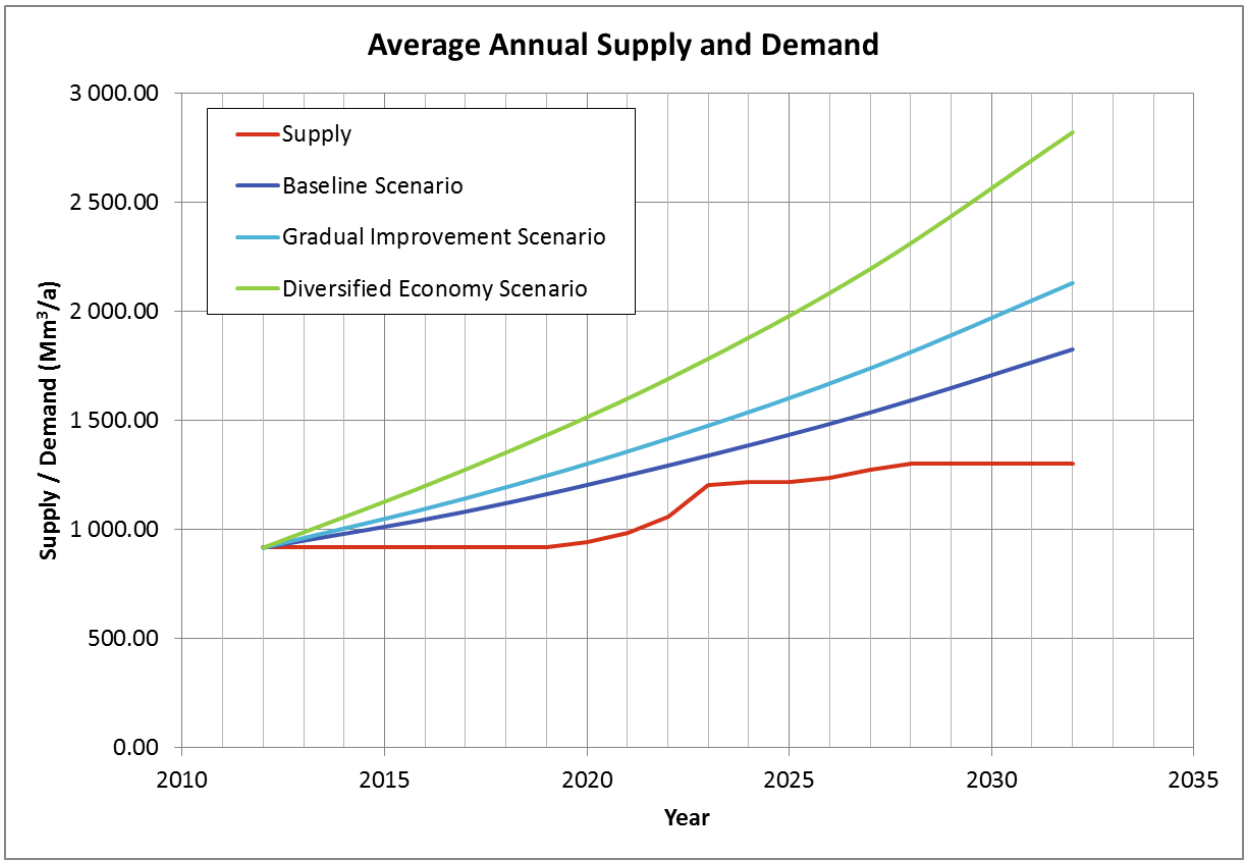

Figure 8-1: Annual Average Supply and Demand for All Scenarios

Table 8-2: Summary of project benefits

HYDROPOWER DAMS								
Hydropower Dam	**Kakono Hydropower Project**	**Nsongyezi 39 MW Hydropower Project**	**Nyabarongo Multipurpose Dam**	**Rusumo Falls Run of River Hydropower**	**Ruvyironza Multipurpose Dam**	**Kikagati Hydropower Project**	**Maziba Small Hydropower project**	**Ruramba Small Hydropower Project**
Sub-catchment	Kagera Lakes and Wetlands	Kagera Lakes and Wetlands	Nyabarongo Upper	Kagera Lakes and Wetlands	Upper Ruvubu	Kagera Lakes and Wetlands	Kagitumba	Nyabarongo Lakes and Wetlands
Countries	Tanzania	Uganda and Tanzania	Rwanda	Rwanda and Tanzania	Burundi	Uganda and Tanzania	Uganda	Rwanda
Consumptive use (million m^3/a)			70.2		35.4			
Irrigated Area (ha)			2 612		1 800			
Domestic Supply Population			1 642 710		264 531			
Peak Power (MW)	53	39	20	46	28	16	1	3
Average Energy (GWh/a)	426	309	134	401	106	115	7	

LARGER DAMS					
Large Dam	**Kagitumba-Mazimba Dam**	**Kakanja Dam**	**Kanyaru Dam**	**Muvumba Dam**	**Upper Ruvubu Dam**
Sub-catchment	Kagitumba	Kagera Lakes and Wetlands	Nyabarongo Lakes and Wetlands	Kagitumba	Upper Ruvubu
Countries	Uganda and Rwanda	Tanzania	Rwanda and Burundi	Rwanda	Burundi
Consumptive use (million m^3/a)	15.2	30.3	26.4	85.0	17.6
Irrigated Area (ha)	178	2 493	12 479	2 198	8 137
Domestic Supply Population	46 728	12 000	614 202	29 788	154 613
Peak Power (MW)	10.7	0.3	14.5	2.9	3.6
Average Energy (GWh/a)	81.3	2.1	84.3	16.7	21.3

SMALLER DAMS								
Small Dam	**Karazi Dam**	**Bigasha Dam**	**Kabuyanda Dam**	**Taba-Gakomeye Dam**	**Gashayura Dam**	**Kavuruga Dam**	**Mbarara Dam**	**Munyange-Vumbi Dam**
Sub-catchment	Kagera Lakes and Wetlands	Kagera Lakes and Wetlands	Kagera Lakes and Wetlands	Nyabarongo Lakes and Wetlands	Upper Ruvubu	Lower Ruvubu	Upper Ruvubu	Nyabarongo Lakes and Wetlands
Countries	Tanzania	Uganda	Uganda	Rwanda	Burundi	Burundi	Burundi	Burundi
Consumptive use (million m^3/a)	9.0	5.4	11.2	8.3 potential	33.4	11.4	9.7	25.5
Irrigated Area (ha)	500	430	435	900 potential	1 212	452	489	900
Domestic Supply Population	125 000	168 000	73 009	468 000 potential	170 720	47 764	79 783	10 000
Peak Power (MW)			0.1		0.4	0.3	0.1	0.2
Average Energy (GWh/a)			1		3	2	1	1

Table 8-3: Summary of potential power supply and water supply per country

Country	**Burundi**	**Rwanda**	**Uganda**	**Tanzania**
Total Potential Water Supply (million m^3/a)	159	197	32	39
Total Potential Power Supply (GWh/a)	218	717	513	1253

8.8 EIA and SEA

Environmental Impact Assessment

Impacts of many developments can be mitigated, but never eliminated. Every project must be subjected to an Environmental Impact Assessment (EIA) and Social Impact Assessment (SIA), or more frequently in the basin States to an ESIA (Environmental and Social Impact Assessment). Further to this, and where people require relocation in consequence of a project, a Relocation Action Plan must be prepared. Fulfilling the requirements of an EIA or ESIA study does not necessarily mean that the project can go ahead. It is the responsibility of an ESIA not only to propose the most effective mitigating measures but to indicate whether these will be adequate to reduce impacts to levels that can be tolerated by the environment, accepted by the affected society, and bring the project into bankable status as required by funding or investment agencies.

Strategic Environmental Assessment

Stakeholder members of this project Steering Committee (in particular Tanzania) have suggested that all programmes and projects should be subject to Strategic Environmental Assessment.

For a process to be regarded as an SEA it should:

1) clearly define its objectives at the outset and identify the decision-makers;
2) involve effective participation of stakeholders;
3) produce succinct analysis of the issues and report firm recommendations, and finally,
4) the process should not end until the decision-makers have given a clear statement of how they intend to respond to the findings and recommendations.

EIAs are applied to projects and SEAs to Plans and Programmes. In a perfect world an SEA would have first been undertaken for the Kagera Basin as, or for example, in the case of the Mara Basin. This could still be done. An SEA would not be limited by existing plans but would review the overall potential and constraints – political, social, economic, financial and environmental, and provide a framework for the best way forward.

This Basin Development Plan has, within the limits of its terms of reference, sought to provide a strategic view of the Basin, also within the context of the Nile System. The principles of SEA have as far as possible been followed.

8.9 Regional impact on the hydrology

Adapted from Section 4.8 in the Strategic Planning Report

Cumulative (cascading) impacts

Projects are intended only to bring benefit, but can also result in opportunity costs, or can severely impact on other planned projects – upstream or downstream. There are not many examples of this in the Kagera Basin at this stage, partly because most dams are relatively small, but also because the large hydropower projects are based on run of river, and are hence non-consumptive.

- The Nyabarongo I Dam on the Mwogo River does not impact on the Nyabarongo II scheme on the Nyabarongo River downstream.
- The proposed Kagitumba-Mazimba Dam (Uganda) could well have a negative impact on the downstream potential Muvumba Dam (Rwanda).
- There is little point in constructing the Mbarara Dam and also the Upper Ruvubu on the same system in Burundi. It is for this reason that the Mbarara Dam is not considered further for implementation.

Cumulative (total) impacts

The consumption of water from all the possible Larger and Smaller Dams described in this report, together with the evaporation from these reservoirs and from the various Hydropower scheme reservoirs, would total about 550 million m^3/annum, or approximately 7% of the annual flow of the Kagera River into Lake Victoria. Given that only some of these dams are likely to be built, the total impact on flow will be less than this, although increasing run of river irrigation could add to this again.

The impacts of the proposed schemes on the flow regime in the rivers should be modelled using a tool such as the Mike Basin Water Allocation Model, however as many of the dams are located on the smaller tributaries, this model will have to be refined and detailed. Ideally, rainfall-runoff modelling should be done rather than simply scaling the available flow records as is currently the case in the model set-up. There is much more value in conducting detailed hydrological assessments as part of each scheme's feasibility investigations rather than doing high level rough checks for the Basin as a whole.

Of more immediate concern is the potential impact of developments on water quality, although this has not been assessed in this Consultancy. The largest impact is likely to be the additional leaching of herbicides, pesticides and especially fertilisers that are part and parcel of high intensity irrigated agriculture. The rapid growth of invasive water weeds in response to eutrophication consequent on fertilisers contained in return flows are an important cost to be factored into development planning.

The positive impacts of watershed management interventions and particularly the potential reductions in sediment loads that could be achieved by improved land use practice must be weighed against the above possible impacts on Lake Victoria. This is a typical issue for strategic environmental assessment.

If the recommended ecological flows are released from Smaller and Larger Dams then there should be limited environmental impacts on the river systems below the dams. The proposed Hydropower projects on the Kagera River would also have little impact if these are developed as run of river projects, as is currently proposed for the Rusumo Falls project and for other hydro schemes.

Other and different projects are sure to be added to the development programme in the future, and it will be important to keep an account of total cumulative impacts as development proceeds.

8.10 Recommendations

Some recommendations in managing impacts:

- Run of river projects have less negative impacts on the environment and society. This applies to both hydropower and diversion schemes for irrigation.
- Planning for and maintaining environmental flows are critical in securing project funding. Operating rules for environmental flows must be carefully set and strictly adhered to.
- Environmental flows are commonly understood for dams but less so for run of river abstraction projects. This must not be neglected and operating rules must be strictly applied here too.
- Rehabilitation of upstream watersheds should be a condition for all infrastructure development and costed into infrastructure proposals.
- Norms, principles and guidelines should be developed and set to guide decision-making and to assist Relocation Action Planning.
- Detailed social surveys – particularly to determine exactly how many people would be affected by a dam development – should be an early and essential component of pre-feasibility and feasibility studies.
- Detailed assessments of assets lost to inundation – grazing, cropping land and irrigated land – should also be part of all feasibility Terms of Reference. Irrigation benefits from projects should always be expressed as net benefits, with due cognisance taken of land lost. Compensation should, where possible be offered on a hectare for hectare basis.
- Environmental and Social Impact Assessments and Relocation Action Plans are essential in providing for mitigatory measures, but this alone does not necessarily make a project acceptable. ESIAs should result in reduced social and environmental costs, but cannot eliminate these. A

final decision on a project does not only require an EIA but needs to consider whether impacts can be mitigated to acceptable levels. Mitigatory measures must, in turn, become a condition of licensing the development, and must be enforced.

- Strategic Environmental Assessment cannot be structured as part of a Basin Development Plan but would be extremely valuable adjunct. An SEA should ideally be undertaken for the Kagera Basin. This would have been better as a preparatory exercise to this BDP, but would still provide valuable guidance to future basin development.

9. TRADE-OFFS FACILITATION AND DISPUTE PREVENTION

This chapter deal with dispute prevention strategies that are necessary for the implementation of the Kagera Basin Development Plan. The chapter discusses the types of disputes that may arise in the implementation of the Plan as well as specific strategies and tools for dispute prevention. The chapter also discusses trade-off facilitation strategies that can be used in the implementation of the Plan to deal with limited water resources in time and space.

This chapter consists of eight sections. The first section deals with issues of relevance to the Consultancy objectives, followed by an introductory section. Types of disputes and the factors affecting water disputes are discussed next. This is followed by a discussion on dispute prevention strategies and tools in Section 5. Section 6 deals with trade-off facilitation and Section 7 with types of trade-offs. Strategies and trade-off facilitation tools are presented in Section 8.

9.1 Relevance to the Consultancy Objectives

Facilitation of trade-offs and prevention of disputes between the Basin countries is important for the effective implementation of the Development Plan. Because of the transboundary nature of the Basin, as well as competing sectoral and user needs for the water and other natural resources, trade-off and dispute strategies and mechanisms are important for the implementation of the Kagera Basin Development Plan.

9.2 Introduction

Under **Chapter 7** we discussed the nature of basin natural resources, in particular water resources, as a common pool with both non-excludability and subtractability characteristics. These characteristic have to be managed to avoid sub-optimal solutions to the sustainability of the resources. If water resources are poorly managed, they could lead to a social dilemma with consequences such as conflict and a compromised natural environment. Dispute prevention is at the core of sustainable water and natural resources management. In dealing with dispute and disputes it is important to consider these in the broader political, social, ethical and religious context. Water is seldom a single cause of dispute but it can exacerbate existing tensions and therefore must be considered within the larger context of dispute and peace.

9.3 Types of disputes

There are numerous underlying reasons for water related disputes including power struggles and competing factors affecting water related disputes.

The implementation of the Kagera BDP is likely to result in significant and rapid changes to the Kagera River Basin and institutional strategies need to be strengthened to deal with this rapid change.

9.4 Dispute prevention strategies and tools

Table 9-1 details the possible types of disputes that could arise in the implementation of the Kagera BDP. The table also recommends specific strategies for preventing such disputes from occurring and offers possible tools for dispute prevention.

Table 9-1: Strategies for possible dispute prevention

Basin				National / Local			
Possible type of Dispute	**Effect of Dispute**	**Recommended Dispute Prevention Strategy**	**Possible Dispute Prevention Tools / Mechanisms**	**Possible type of Dispute**	**Effect of Dispute**	**Recommended Dispute Prevention Strategy**	**Possible Dispute Prevention Tools / Mechanisms**
Lack of Basin Cooperation Agreements (e.g. Treaties)	Agreements spell out each Member State rights and responsibilities under the Kagera cooperative framework and their absence could lead to conflict.	Kagera Member States to sign and ratify Kagera cooperation agreement	Negotiation between Member States in areas of the agreement where there may be disagreements	Weak, conflicting sometimes contradictory policies to manage and regulate water use	Weak water management policies lead to inability of water management institutions to manage water resources	Member States to strengthen water management policies	Implement the recommendations of the studies on harmonisation of national policies
Weak institutional structures and capacities for cooperation at NELSAP	Weak institutional structure and capacities will cause water institutions to be unable to effectively prevent water disputes	Strengthen NELSAP institutional structure, mandate and capacities	Implement the recommendation of the study on Institutional arrangements for collaborative management and development of transboundary water resources of the Kagera	Weak human, technical and financial resources at national water management institutions	Lack of capacity (human, technical, financial, managerial, etc.) in national water management institutions renders them ineffective in preventing disputes.	Member States to strengthen the human, technical and financial capacities of national water management institutions	Implement the recommendations of the study on the harmonisation of national
Unilateral Action on transboundary watercourses (e.g. hydropower)	Unilateral action by Member States such including project development without prior notification of other basin states can cause water disputes	Compliance by Member States to international water laws (e.g. International Law on Non-Navigational Uses of International Watercourses), and IWRM principles	NELSAP to monitor the compliance of Member States to international water laws and promote basin approach to water resources management and development	Inequitable water allocation policies and lack of transparency in water allocation mechanisms	Inequitable water allocation between social groups increases the risk of public protest	Strengthen national water allocation policies and mechanisms	Implement the recommendations of the studies on harmonisation of national policies
Lack of credible and reliable water resources information system at Basin level	Lack of reliable, credible database and information system can lead to disputes amongst Member States	NELSAP to strengthen the credibility of database and information systems	Promote Basin wide information systems (e.g. Nile DSS) and other common database systems	Inequitable distribution of costs and benefits of water infrastructure	Inequitable distribution of costs and benefits from water resources development project such as dams and irrigation schemes can cause environmental, economic and social impact leading to disputes	Strengthen national water pricing and cost recovery policies, laws and mechanisms	Implement the recommendations of the studies on harmonisation of national policies
Disparities in stakeholder capacities	Disparities in stakeholder capacities can lead to mistrust	NELSAP to promote programmes for stakeholder capacity development	Promote river basin dialogues and similar stakeholder participation forums.	Lack of credible and reliable water resources information system at national level	Lack of reliable, credible database and information system can lead to disputes amongst users	Ministries of Water to develop and strengthen water resources information systems especially access	Enhance the reliability and access to national water resources information and databases (Nile DSS)
Dispute between upstream and downstream Riparian States on opportunities and impacts on water resources in the Plan	Disputes can arise when upstream Member States promote the principle of equitable use while downstream states emphasis the principle of no significant harm.	NELSAP to promote the basin approach to water resources development and management including adherence to international law principles on equitable use and obligation not to cause appreciable harm	Promote IWRM principles on basin approach and educate Member States on international water laws and principles Promote the principle of benefit sharing between Member States Promote EIA and SEA studies for projects	Disparities in stakeholder capacities at national level	Disparities in stakeholder capacities can lead to mistrust between users leading to disputes	Ministries of Water to promote programmes for stakeholder capacity development	Promote forums for national water dialogues including at sector and project levels
Dispute between Member States on Basin project priorities in the Kagera Basin Development Plan	Dispute can arise if Member States have no decision support systems to help them in the selection and prioritization of Projects in the Kagera	NELSAP to promote the application of decision support models in project identification and selection for the Kagera	Promote the use of water resources technical tools such as decision support models (e.g. multi-criteria decision analysis models), and others (e.g. TWO Tool)	Dispute between water users and water user sectors on a project		Water Ministries to promote the use of decision support models in project identification and selection	Promote the use of water resources technical tools such as decision support models and others (e.g. TWO Tool)

9.5 Trade-off facilitation

Trade-off is an important aspect of natural resources management. Natural resources management is management of a common pool resource where you cannot exclude new entrants from using the resource; as the resource is utilised, it gets diminished either in quantity, quality or timing. Water and natural resources users have different requirements, some of which lie outside the water sector itself. For example, some users are more concerned about the quality of water resources (e.g. ecosystems) while others are concerned about its availability on time (e.g. runoff river hydropower schemes). Trade-off is about how much a user is willing to give up in order to get a bit more of what the user wants the most. Trade-offs allow water users to benefit equitably from the limited resource.

9.6 Types of trade-off

Basin states have different water use priorities which are often dictated by economic, social and political objectives. Upstream Basin states may have tourism and energy as their priority while downstream Basin states may have agriculture, industry or navigation. There are numerous types of trade-offs in water and natural resources. These trade-offs can be between Member States, between users, between water use sectors or even between one river basin and another. They can also be between project options or within options in a project.

9.7 Strategies and tools for trade-off facilitation

To a large extent trade-offs are more common and are required when there is water scarcity. Currently water scarcity is not a major problem in the Kagera Basin, but trade-offs on other aspects of water and natural resources management are necessary. **Table 9-2** details trade-off facilitation mechanisms that are considered applicable and pertinent to the Kagera BDP.

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Table 9-2: Trade-off facilitation mechanisms pertinent to the Kagera Basin Development Plan

Basin		National/Local	
Trade-off	**Facilitation Mechanism**	**Trade-off**	**Facilitation Mechanism**
Member States to trade-off aspects of national severity with respect to water resources management, to NELSAP in return for conflict avoidance and efficient water resources management	Agreements for the establishment of NELSAP and transfer of national right to it	Project proponents to trade-off economic design of infrastructure such as dams by putting features to protect the environment	Process facilitated through Environmental Impact Assessments
Member States to trade-off aspects of national responsibility with respect to basin development, to NELSAP in return for better access to development funds	Agreements for the establishment of NELSAP and transfer of national right to it	Communities trade-off natural resources and their assets, to dam developer, by allowing dams development inundate their land and other properties in return for employment and economic development	Process facilitated trough Environmental, Economic and Social Assessment Studies
Upstream countries to trade-off their rights to consumptive water use (e.g. irrigation), to downstream States in return for increased environmental protection for tourism initiatives	Through the Kagera Basin Development Plan upstream Member States have pronounced their preference for hydropower and environmental protection		
Member States and NELSAP to trade-off a decline in river ecosystem in return for improved economic development through agriculture	Process facilitated through proper ecological studies in Environmental Impact Assessment Studies		

10. RISKS AND RISK MANAGEMENT

This chapter comprises seven sections. The first section deals with issues of Relevance to the Consultancy objectives, followed by Section Two which introduces the concept of risk management. Section Three presents an approach to risk assessment, Section Four discusses the identification of potential risks and Section Five describes the assessment of these risks. Section Six explains the subjectivity in assigning significance. The risks profile is shown in Section Seven, while Section Eight shows the risk performance. Section Nine addresses risk reporting and communication.

10.1 Relevance to the Consultancy Objectives

Risk evaluation of the implementation of the BDP leads to understanding of the associated risks, and as a result increases the probability of success of implementation of the plan. As a result this reduces the probability of failure and the uncertainty of achieving the overall objectives of the Basin i.e. the Basin Vision.

10.2 Introduction to risk assessment

Risks related to the Kagera Basin Project span several critical elements that need to be identified, assessed and evaluated. The categories of risk which pertain to this project primarily include, but are not limited to, political, economic, social, legal, environmental and institutional. The broader question of risk as well as the management of risk needs to be fully understood given the complexity of the drivers, stakeholders and upstream/downstream users of the Kagera Basin. To further contextualise, “risks” are fundamentally different from “impacts” in that risk, in its simplest terms, is the 'effect of uncertainty on objectives'. Impacts on the other hand are the result of an action or sequence of actions. Risk(s) and Impact(s) can have both beneficial consequences (upside) and threats to success (downside).

Figure 10-1: Level of risk management

The focus of good risk management is the contextualisation, identification, assessment and treatment of these risks. The objective is to maximise sustainable value to the implementation of the Basin Development Plan (BDP) and the Kagera Secretariat. By reviewing the risks it increases the probability of success of implementation of the plan and reduces both the probability of failure and the uncertainty of achieving the overall objectives of the Basin i.e. the Basin Vision. Risks can occur at different stages in the project lifecycle, i.e. at the strategic or planning stage, the implementation stage or the operational stage as indicated in Figure 10-1. For the purposes of this risk analysis, the Implementation Risks have been reviewed.

Successful risk management focusses on the following eleven key principles:

1. Creates and protects value;
2. Is an integral part of all organisational processes;
3. Is part of decision-making;
4. Explicitly addresses uncertainty;

5. Is systematic, structured and timely;
6. Is based on the best available information;
7. Is tailored;
8. Takes human and cultural factors into account;
9. Is transparent and inclusive;
10. Is dynamic, iterative and responsive to change; and
11. Facilitates continual improvement of the organisation

The following sections outline the context of risk in the Kagera Basin, identification and assessment of potential risks, the risk profile for implementing the BDP and lastly reporting and communicating on risks.

10.3 Kagera Basin Risk Assessment Methodology

The approach adopted for assessing the potential risks is in accordance with international best practice methodologies such as ISO 31000: 2009. The assessed risks are graphically depicted in the form of a Risk Profile which provides a risk spectrum in accordance with the risk classification thereby assisting management to prioritise steps that are required to reduce significant risks to ensure continual improvement.

Risk assessment is part of the wider field of risk management as illustrated in **Figure 10-2** below.

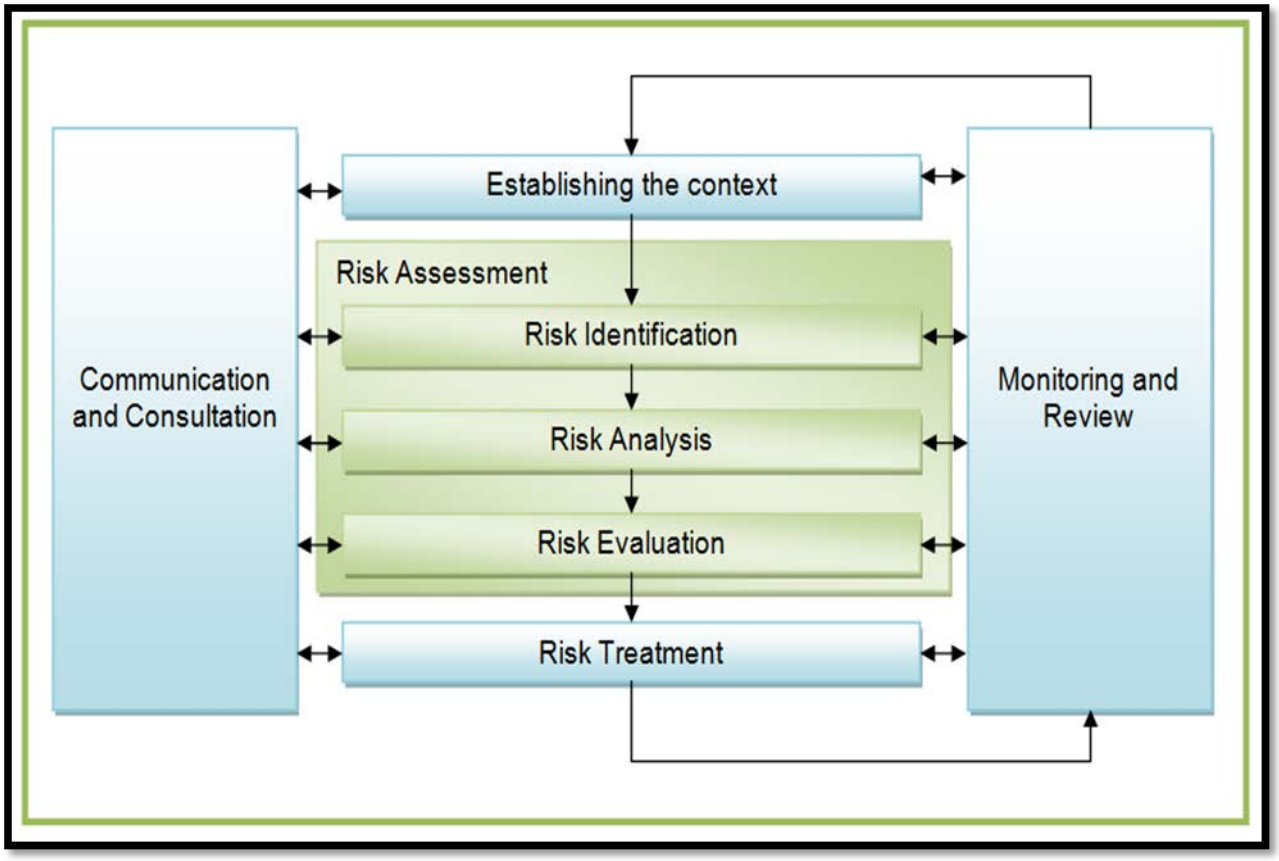

Figure 10-2: The contribution of risk assessment to the risk management process

The initial step comprises the determination and listing of risk scenarios that are anticipated for the successful implementation of the IWRM strategies and BDP. All the identified risk scenarios have

been evaluated for Significance and Ranking utilising a Risk Assessment Procedure. The procedure works on the principle of allocating numbers to probability (risk scenarios) and severity of the anticipated environmental and socio-economic impact that are multiplied to arrive at a total number.

The total number is then allocated as a significance rating. The ranking of the significance ratings is the logical final step. Finally, a complete risk profile is depicted in graphical format, which can be used as a performance indicator measurement. This Risk Assessment process thereby becomes more powerful as time progresses. Ultimately, the risk rating will change over time depending on what abatement technologies and mitigatory measures have been put into place.

10.4 Identification of Potential Risks

Risk identification sets out to identify the exposure of the implementation of the BDP to uncertainty. Key risks can have both external and internal drivers. Further, they can be categorised in types of risk such as Political, Economic, Social, Technological, Institutional, Legal or Environmental (PESTILE).

The **PESTILE Analysis** is a tool that is used to identify and analyse the key drivers of change in the strategic environment, and is considered suitable to assess the risk of implementing the Development Plan. The tool provides an approach to the assessment of the current environment and potential changes.

The PESTILE Tool is applied by:

- Listing and evaluating PESTILE factors.
- Identifying the implications of events noted in the analysis, and assessing their impact.
- Events can then be classified by their importance or criticality.

The risk identification was carried out per strategic option and strategy of the Basin Development Plan and categorized according to PESTILE. **Table 10-1** shows the definition of risk categorisation, while **Table 10-2** shows the Risk Identification.

Table 10-1: Definition of risk categorisation (PESTILE)

Political	Political factors are concerned with how and to what degree a government intervenes in the economy. Specifically, political factors include areas such as tax policy, labour law, environmental law, trade restrictions, tariffs, and political stability. Political factors may also include goods and services which the government wants to provide or have provided (merit goods) and those that the government does not want to be provided (demerit goods or merit bads).
Economic	Often the political factors spill over into economic factors. For example, tax is usually decided by politicians, based on a mixture of political and economic factors. Interest rates, in many countries are decided by a central bank, but political factors may still be important. Other economic factors include exchange rates, inflation levels, income growth, debt & savings levels (which impact available money) and consumer & business confidence.
Social	Social factors include the cultural aspects and include health consciousness, population growth rate, age distribution, career attitudes and emphasis on safety.
Technological	Technological factors include technological aspects such as R&D activity, automation, technology incentives and the rate of technological change. They can determine barriers to entry, minimum efficient production level and influence outsourcing decisions. Furthermore, technological shifts can affect costs, quality, and lead to innovation.
Institutional	These factors include aspects relating to organisations and institutions, and issues relating to staff and training. It can include attitudes, work ethics, management style, institutional culture and institutional mechanisms.

Legal	These factors include the treaties, international law, discrimination laws, consumer law, antitrust law, employment law, and health and safety law. They can affect how the Kagera Basin operates, its costs, and the demand for its usage.
Environmental	These factors include ecological and environmental aspects such as weather, climate, and climate change, which may especially affect basin projects of this nature as well as tourism, farming, and insurance. Furthermore, growing awareness of the potential impacts of climate change is affecting how strategic projects of this scale are managed to ensure a sustainable yield.

Table 10-2: PESTILE elements considered for Kagera risk categorisation

Political • Trading policies • Funding, grants and initiatives • Basin state lobbying/pressure groups • Shareholder/ stakeholder needs/ demands • International pressure groups • Wars and conflict • Difference in national policies • Government term and change, leadership structures (risk of delay) • Inter-country relationships/attitudes • Management style • Organisational culture • Sectoral development	**Social** • Staff engagement • Customer values • Attitudes and opinions • Media views and negative publicity • Major events and influences • Ethnic/religious factors • Ethical issues • Demographics (age, gender, race, family size) • Lifestyle changes • Population shift • Education • Immigration/emigration • Health • Role models (benefits)
Technological • Associated/dependent technologies • Information and MS • Ineffective communication systems (internet) • Collaboration tools • Innovation potential (benefits) • Technology access, licensing, patents Intellectual property issues • Energy uses/sources/fuels • Transportation (constraint) • Waste removal/recycling	**Environmental/ Ecological** • Environmental issues(unpack) • Environmental regulations ESIA • Environmental protection values for Stakeholder/ investor / water users • Global factors **Economic** • Market values • Donor funding • Fraud and corruption • Global economy • Funding/finance mechanisms • Economic (Sectoral) development preferences
Institutional • Attitudes to work • Work ethics • Leadership attitudes • Management style • Organisational culture • Compliance & Enforcement mechanisms	**Legal** • Current & future legislation and regulations • Regional/international legislation and policy • Regulatory bodies and processes

10.5 Assessment of Risks

An assessment of each risk identified it carried out to determine the **Risk Estimation**. Risk estimation can be quantitative, semi-quantitative or qualitative in terms of the probability of occurrence and the possible consequence. Risk Scenario Assessments (RSA) makes use of probability ratings. With reference to **Table 10-3** below, RSAs are considered within the following criteria.

Table 10-3: Assessment criteria of probability

Key word	Description of situation	Value
Expected	Occurs often as part of the process	**13**
Probable	Known to occur occasionally	**8**
Unusual	Known to have occurred during process, but not normally anticipated	**5**
Less Likely	Has happened somewhere (operating experience from other sites)	**3**
Remote	Should not occur within the basin's life	**2**

Once the probability (RSA) has been determined the severity needs to be assessed, by utilising the criteria as provided in **Table 10-4** below. It should be noted that activities and associated aspects can have multiple impacts that e.g. range between Occupational Health and Safety, Environment and Socio-Economic.

The weighting criteria were firstly allocation values so that the risks could be further assessed. An alternative would be to assign a qualitative judgment e.g. low or medium, although it is easier to process the risks further with the assigned values. The weighting criteria were derived by ensuring that they present a reasonable spread of risks for both probability and severity, with greater emphasis placed on the severity. Note that the increase of assigned values with increasing risk is not linear. The model has not been tested in terms of changing the weighting.

The result of the **Risk Analysis** process is then used to generate a risk profile which provides a graphical representation of the distribution of risks as per the risk classification. The risk profile thus depicts risks in order of significance requiring attention. As such, the intent is to mitigate the significant risks by introducing intervention measures. Examples include technological innovation (engineering), resource management strategies, maintenance programmes and user policy agreements. **Risk treatment** is the process of identifying implementation measures to modify and reduce the risk. This includes mitigation measures for risk control as well as measures for risk avoidance, risk transfer, risk financing, etc.

The detailed Risk Analysis including the identification, consequence, probability, treatment and severity rating is detailed in **Annexure E.**

Table 10-4: Assessment Criteria for Severity per Risk Category

KEYWORD	POLITICAL	ECONOMIC	SOCIAL	TECHNOLOGY	LEGAL	ENVIRONMENTAL	VALUE
Disaster	No political collaboration between all four countries causing total failure of the project. Severe political instability compromising the projects long-term sustainability. Threat of war.	Complete breakdown of the economic system on a regional or national scale.	Impact extends well beyond the limitations of Areas of Direct and Indirect Influence.	Complete breakdown of the design and functionality of the basin and downstream impacts are catastrophic.	Legal violation in multiple countries. Treaty violations that threaten the project's success.	Large Scale pollution. Severe press reaction. Impact will only cease after operational life of activity.	32
Serious	No political collaboration between all some of the countries causing project success risk. Political instability compromising the projects short-term sustainability.	Severe disturbance of the economic system at a regional scale or greater.	Impact on Areas of Direct and Indirect Influence.	Regional scale or greater impact caused due to operational and/or design flaws.	Legal violation. Impact to some of the neighbouring countries with impacts triggering legislative thresholds.	Medium pollution. Environment negatively affected but can be reversed in relative short time (<1 year). Require external resources to mitigate. Local and even national press reaction.	16
Important	Political reaction on a national level, however manageable within normal structures.	Significant disturbance of the economic system at a local or regional scale.	Regional Impact or within the Area of Direct Influence i.e. Municipal district scale.	Significant disturbance a local or regional scale due to operational and/or design challenges. Mitigatable.	Risk of legislative thresholds being exceeded which may require significant resources to reverse.	Small Scale and local pollution without apparent permanent or medium term effect on the environment. Local press reaction. Can be dealt with own resources.	8
Noticeable	Minor political challenge which is easily managed through political structures, forums and trans-boundary agreements.	Some disturbance of the local economic environment.	Localised Impact affecting a neighbourhood.	Some disturbance due to operational and/or design imperatives.	No legal violation however continued practices may cause interventions by state departments to ensure the successful operation of the project.	Minor pollution to the environment. Local reaction.	4
Insignificant	No political impact.	Some economic impact on a local scale, or limited to a localised market.	Limited impact to one family or house.	Limited impact caused by design and operational regimes.	No legal violation, activities are well within thresholds.	Potential threat to the environment. No visible or actual environmental damage can be found. Threat that has been well contained. Little or no local reaction.	2

Upon completion of the probability and severity assignment the values are then multiplied to arrive at a **significance ranking** which ranges between Very High to Very Low. **Table 10-5** provides the risk matrix within which all significance ranking possibilities can occur, and **Table 10-6** provides the associated **Risk Classification**.

Table 10-5: Overall Risk Matrix

RISK MATRIX		Probability Weights	2	3	5	8	13
Severity	Weights		Remote	Less Likely	Unusual	Probable	Expected
	32	Disaster	64	96	160	256	416
	16	Serious	32	48	80	128	208
	8	Important	16	24	40	64	104
	4	Noticeable	8	12	20	32	52
	2	Insignificant	4	6	10	16	26

Table 10-6: Risk Classification

Descriptor	Range
VERY HIGH	> 128
HIGH	80-128
MEDIUM	26-64
LOW	10-24
VERY LOW	4-8

The initial risk is subjected to proposed mitigatory measures as informed by specialist input to arrive at the current risk classification. As such, the current risk classification factors in the proposed mitigatory measures which then informs the significance ranking.

The risk matrix has five distinct classifications as shown in **Table 10-7**. The descriptive decision criteria are provided upon which the appropriate mitigatory measures need to be considered and actioned. Note: the **residual risk** is the risk that exists after mitigation measures are in place.

Table 10-7: Decision Matrix

Category Risk	Description	Criteria for implementation of Recommendations / Suggestions
Very High	Risks in this category should be eliminated. The recommendations are considered obligatory and is the responsibility of the director of the business or the enterprise	Immediate implementation.
High	Risks in this category should be minimised. The recommendations are considered obligatory and the responsibility of the general management area business or enterprise.	Implementation period with maximum of 1 (one) year.
Medium	One can live with this level of risk scenarios, but this should be reduced in the long term. The recommendations are considered mandatory and liability management of the area.	Implementation period with maximum of three (3) years.
Low	Scenarios with a level of risk considered tolerable but can be reduced in steps with low investment. The suggestions are not considered mandatory. The assessment of implementation is the responsibility of management area.	Implementation if the cost is low with low effort.
Very Low	No steps required. Risk is appropriately managed.	Not applicable.

All risks that are classified as **Medium and High** (including Very High, if applicable) are deemed significant and therefore require Objectives, Targets and Programmes to reduce the risks to within acceptable / tolerable risk levels.

10.6 Subjectivity in Assigning Significance

Despite attempts at providing a completely objective and impartial assessment of the risk implications of proposed development activities, risk assessment processes can never escape the subjectivity inherent in attempting to define significance. The same subjectivity problem applies to the determination of risk using qualitative measures in the absence of enough information to conduct quantitative risk analysis. The determination of the significance of a risk depends on both the context and intensity of that risk. Since the rationalisation of context and intensity will ultimately be prejudiced by the observer, there can be no wholly objective measure by which to judge the components of significance, let alone how they are integrated into a single comparable measure.

This notwithstanding, in order to facilitate informed decision-making, risk assessments must endeavour to come to terms with the significance of the potential risks associated with particular development activities and aspects. Recognising this, this Consultancy has attempted to address potential subjectivity as follows:

- Being explicit about the difficulty of achieving complete objectivity in the determination of significance, as outlined above;
- Developing an explicit methodology for assigning significance to impacts and outlining this methodology in detail. Having an explicit methodology not only forces the assessor to come to terms with the various facets contributing towards the determination of significance, thereby avoiding arbitrary assignment, but also provides the reader of the Risk Assessment with a clear summary of how the assessor derived the assigned significance; and
- Wherever possible, differentiating between the likely significance of potential risk as experienced by the various affected parties.

Although these measures may not totally eliminate subjectivity, they provide an explicit context within which to review the assessment of risks. The risk numbers in terms of probability and severity was

assigned by core team members of the consultant team. Ideally, this scoring exercise should be revisited by representatives of the Basin countries, possibly in an anonymous scoring team session.

10.7 Risk Profile

In order to determine the overall risk profile, cognisance is taken of the specialist impact assessment results as well as the risk scenario assessment. The risk profiles as shown in **Figure 10-3** and **Figure** 10-4 are the result. The Post-Mitigated Negative Impact Profile yield an impact profile ranging at the Medium to Very Low negative impact range. It is however important to note that should the mitigatory measures as outlined by the specialist team not be implemented, or not be successful, it would directly affect the risk ratings.

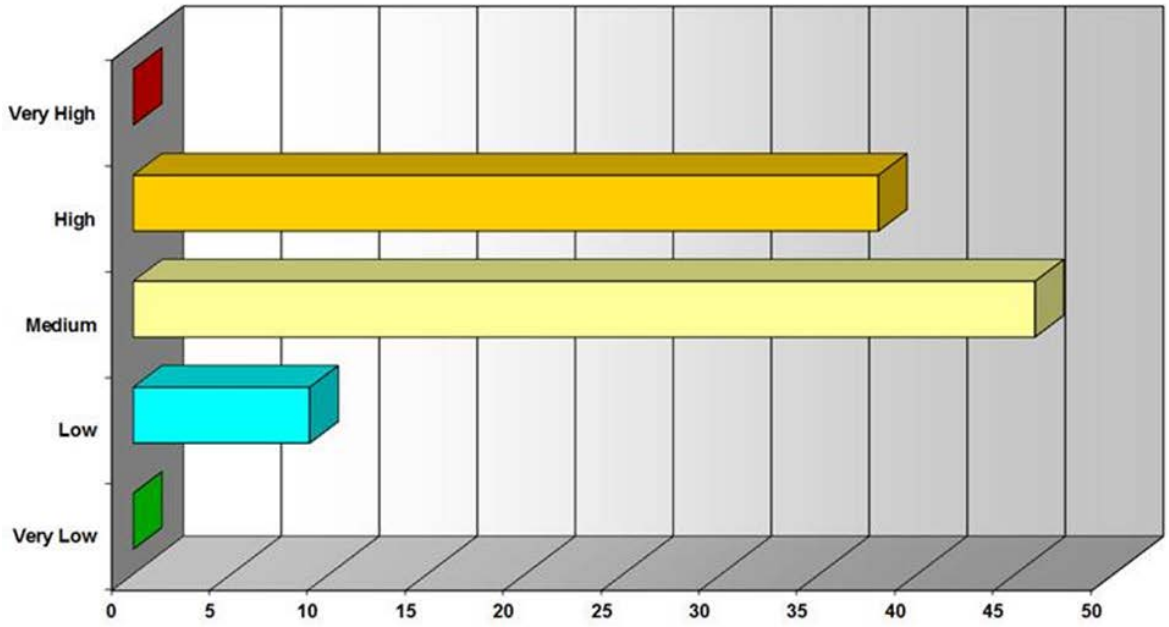

Figure 10-3: Risk profile for BDP Implementation pre-mitigation

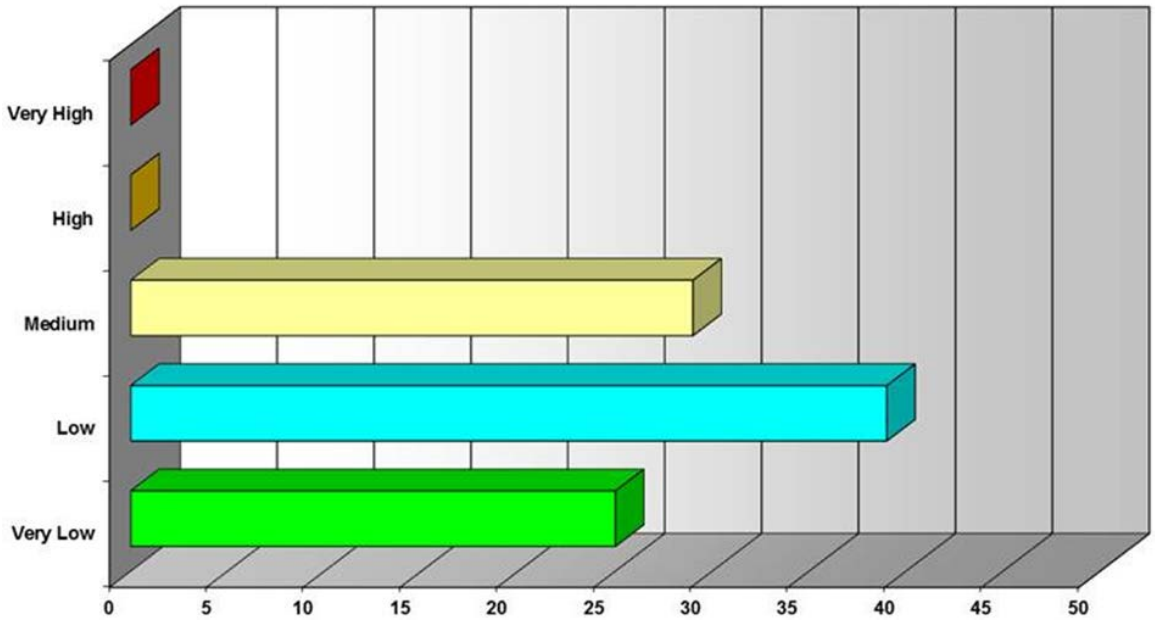

Figure 10-4: Risk Profile for BDP implementation post-mitigation

10.8 Risk performance (Risk Ratio)

Risk performance is tracked by means of using a 'risk ratio'. The risk ratio is an arithmetical calculation between the 'initial risk' (risk exclusive of mitigatory measures, also known as the worst case scenario) and the 'current risk' (inclusive of mitigatory measures that will be in place at the time of construction, operation and decommissioning).

The risk ratio is based on an approach which comprises assessing a particular activity utilising the probability and severity tables provided in Section 10.5, exclusive of mitigatory measures that are currently in place at the time of the assessment.

The second phase requires that the same risk scenario be reassessed utilising the probability and severity tables provided in Section 10.5 of this report however inclusive of mitigatory measures that are expected to be in place. It cannot be stressed enough at this juncture that the mitigation measures included in this phase of the assessment should ideally be those in place and not of a hypothetical nature (proposed mitigatory measures).

The net result in most cases is that the impact classification will be lower than the initial assessment which allows for a risk ratio opportunity i.e. the progression in terms of risk reduction made between the Initial Risk Value and the Current Risk Value.

Risk Ratio Formula: Current Risk Value ÷ Initial Risk Value = Risk Ratio (resulting in a numerical value between 0 and 1)

The intent would be to achieve as close an impact classification to zero as possible. The risk ratio therefore becomes a useful tool to prove risk reduction over time as the reassessment of the BDP activities can be undertaken at planned intervals as called for. In essence, the risk ratio provides a measurement that can be used to track risk performance, risk reduction or an increase in risk over time. At present, an overall pre-mitigation risk performance rating of 19.8% is envisaged, and an overall (successful) post-mitigation risk performance rating of 5.4% is envisaged, as depicted in **Figure 10-5**.

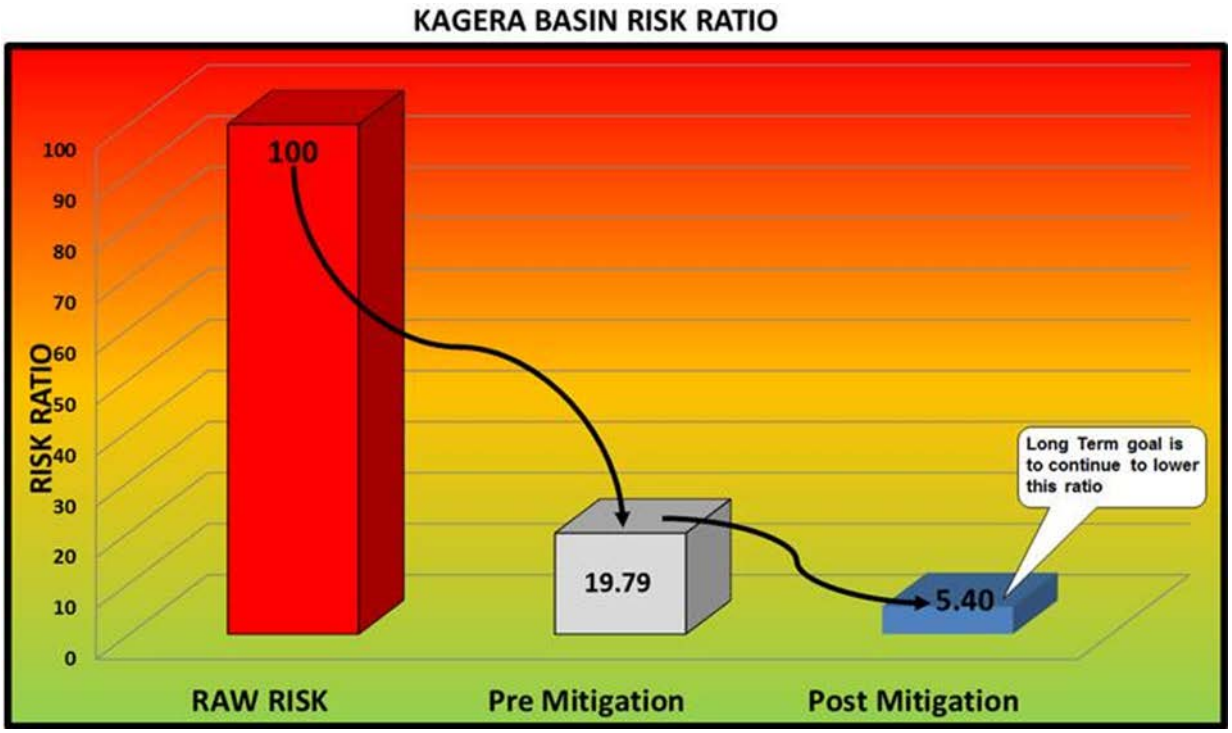

Figure 10-5: Kagera Risk Ratio

Specific deliverables with associated timelines need to be set and the appropriate control programmes (action plans) need to be developed to mitigate the risks over a defined time period. Accountabilities and responsibilities form an integral part of this phase of the project as it ensures that human capital is adequately tasked to proactively plan for reducing the risk scenarios to a point at which the BDP IS implemented at an efficient rate of risk tolerance.

10.9 Risk Reporting and Communication

Different levels within NELSAP, the Kagera Secretariat, EAC or Basin member states need to address different aspects of the risk management process. Further, reporting on risk management, both at the national and basin level to various stakeholders, will build trust in the effective management of the Basin by member states, the Nile Basin and donor agencies funding implementation of the Basin Development Plan.

11. KAGERA PLANNING ATLAS

This chapter consists of five sections. The first section deals with issues of relevance to the Consultancy objectives. Section Two provides an introduction and Section Three discusses existing geospatial information and information gaps. The GIS database inventory and metadata is discussed under Section Four, while Section Five provides the list of spatial maps produced in this study.

11.1 Relevance to the consultancy objectives

In the execution of this Consultancy, and in support of the Basin Development Plan, there was a need to generate additional spatial information and supporting datasets, mainly in the form of Basin GIS mapping.

11.2 Introduction

River basin systems comprise a wide spectrum of physical, biological and socio-economic components, with complex spatial, temporal and regulatory interactions. River basin management and planning, therefore, is intrinsically geographic as it involves the handling of various forms of spatial data and information. In the framework of this assignment, GIS tools and techniques were used to provide for the collection, storage, analysis and presentation of spatial information, so as to enhance our understanding of the basin physical system, and judging how management actions might affect the system.

The main objective of GIS analysis was to assemble a GIS database and to develop a basin planning atlas, consisting of a map collection depicting the current and future state of the basin water resources as well as the location of the proposed basin-wide development projects vis-à-vis the spatial distribution of on the basin water resources over the planning horizon.

11.3 Existing Geospatial Information and Information Gaps

Considerable spatial data and information for the Kagera River basin have been collected in previous studies commissioned by the Client. The Consultant was provided with a copy of all the available data at the beginning of the assignment, most importantly the Kagera GIS database assembled during the basin monograph and the online Kagera river data repository[2]. Additional GIS data was sourced from various research and consultancy studies about the region, the Consultant's own GIS archive as well as other relevant institutions.

Through a critical review of relevant reports and the existing GIS database, quality check and a gap analysis was undertaken to identify additional spatial information and supporting datasets that are needed for the execution of this consultancy, and in support of the Basin Development Plan.

Overall, the data provided by the Kagera Basin monograph GIS database was of good quality. Although no ground-truthing was been carried out, most of the important physical features appeared to be reasonably represented over the basin. Suspiciously represented features were verified against information from other resources, such as Google Earth and expert knowledge of the region, and the necessary adjustments were made.

It is important to note that much of the available dynamic dataset, such as population and livestock, dated before 2006 and were thus outdated. These datasets were accordingly updated, based on the available most recent information, such as recent publications/reports. Where no recent data was available, projections were made by respective experts using appropriate techniques.

[2] http://www.elmed-rostov.ru/Projects/Kagera/Main/index.php

11.4 GIS Database Inventory and Metadata

An ESRI ArcGIS desktop software platform (version 10) was used to process, analyse and present the data. The Geographic Coordinate System: GCS_WGS_1984 has generally been used for data presentation, and where geometrical calculations were required, the Arc 1960 - UTM Zone 35 South projection was adopted. A number of raster and vector operations were carried out to derive useful spatial information and to produce maps that have been included in various sections of the report and included in the planning atlas.

The final compiled Kagera Basin planning atlas is presented separately in **Annexure F**. The atlas includes all the maps generated from the diagnostic assessment, through scenario analysis and project planning. All the spatial data used has been organised in a GIS database, which is also submitted together with the Kagera Basin atlas.

Care was taken to create or update metadata for each dataset used, and an explanatory text on the content and structure of the database has been provided, together with the database, to guide users. In addition, a description of the content of each dataset, including the method used and the data source is presented in **Annexure G**.

11.5 Planning Atlas

The following is a full list of the maps contained in the planning atlas.

Table 11-1: ***List of the maps contained in the planning atlas***

No	Description
1	Location map of the study area within the region
2	Administrative map (provincial and district boundaries) of the Basin member countries
3	Administrative map with major urban centres and their respective populations in 2012
4	Mean annual rainfall distribution
5	Surface water potential per sub-catchment : Incremental MAR
6	Surface water potential per sub-catchment : Cumulative MAR
7	Groundwater Potential : Aquifer productivity (L/s)
8	Groundwater Potential : Depth to groundwater table (m)
9	Groundwater Potential : Groundwater storage depth (mm)
10	Current (year 2012) population distribution
11	Projected 2017 Population distribution
12	Projected 2022 Population distribution
13	Projected 2027 Population distribution
14	Projected 2032 Population distribution
15	Livestock population density distribution (year 2012)
16	Cultivation coverage (erosion risk)
17	Forest Cover
18	Protected Areas
19	Location of Potential projects
20	Location of potential projects vs. Rainfall Distribution
21	Location of potential projects vs. 2012 population distribution
22	Location of potential projects vs. 2032 population distribution

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ANNEXURES

Annexure A:
Stakeholder List

	TANZANIA					BURUNDI					RWANDA					UGANDA				
Sector/ Field	Department /Institution	Location	Contact Person	Position	Contact Details	Department/ Institution	Location	Contact Person	Position	Contact Details	Department /Institution	Location	Contact Person	Position	Contact Details	Department/ Institution	Location	Contact Person	Position	Contact Details
Agriculture	RAS Kagera				raskagera@yahoo.com											NAADS	Kampala			P.O.Box 25235, Kampala +256 414/312 345440/345065/345066 info@naads.or.ug
	Ministry of Agriculture, Food Security and Cooperatives	Dar es Salaam	Wilson Kalumuna	Zonal Irrigation Engineer												NARO	Entebbe			P.O.Box 295, Entebbe +256 41 320512/320341/32018/321070 dgnaro@infocom.co.ug dgnaro@naro.go.ug
		km	Mr Karim	Director Food security																
	Ministry of Livestock and Fisheries Development		Kajitanus Osewe	kajitanusosewe@yahoo.com	+255755166226	IFAD	Bujumbura	Sylvestre Sezikeye			ISAR	Kigali	Jonas Mugabe	Deputy Director General	P.O.Box 5016, Kigali 250 087 47932 info@isar.rw	Ministry of Agriculture, Animal Industry and Fisheries	Kampala	Mr. Jonas Mugabe	Minister	P.O.Box 34518, Kampala +256 414 531411 ps@agriculture.go.ug
						Ministry of Water, Environment, Spatial Planning and Urbanism	Ngozi	Lazare Nsaguye	Chef de Antenne Provinciale du Genie Rural		MINAGRI – LWH Project	Kigali	Dan Folta	Irrigation Specialist	P.O. Box 621, Kigali, Rwanda +250 782737424 eng.com dfolta@folta-eng.com					
						MINAGRIE	Bujumbura	Therence Niyondagara	Director General for mobilization for self-development and agricultural extension		MINAGRI		Jean Claude Musabyimana	Task force Irrigation	O788612942 mussaclo@gmail.com					
Mining	RAS Kagera				raskagera@yahoo.com	Ministry of Energy and Mines	Bujumbura	Anicet Sindaye	Advisor							Ministry of Energy and Mineral Development	Kampala	Henry Bidasala - Igaga		+256 414 311111 / 233910 / 232598 / 234733
	Ministry of Energy and Minerals	-	Permanent Secretary	-	km@mem.go.tz						MINIRENA			Mining Sector	P.O.Box 3502 Kigaliz +250 252 582628 info@minirena.gov.rw					
Forestry	Ministry of Natural Resources and Tourism	Dar es Salaam			P.O.Box 9372, Dar es Salaam +255 22 2864230 / 1872 ps@mnrt.go.tz	Ministry of Water, Environment, Spatial Planning and Urbanism	Bujumbura	Marie Assumpta	Regional Inspector of Forest							NFA	Kampala	Xvier Nyindo Mugumye	National Forest Management Specialist	P.O.Box 70863, Kampala +256 414 230365/6 info@nfa.org.ug
	-	-	Mr Jafari A Omary		jao1709@yahoo.com						MINIRENA			Forestry Sector	P.O.Box 3502 Kigaliz +250 252 582628 info@minirena.gov.rw	National Forestry Resources Research Institute	Kampala			P.O.Box 1752, Kampala 256 712 161161 naforridir@infocom.co.ug naforri@gmail.com
	-	-	Mr Ramadhan Massele		maelson2004@yahoo.com						MINIRENA		Lyliose Umupfasoni	Director of Environment , water Resources and Forest	0788355174 umupfasoni@gmail.com					
	RAS Kagera				raskagera@yahoo.com															
Fishing	LIVEMP II		Mr Omary I. Myanza		wamuyanza@gmail.com						MINAGRI	Kigali	Alphonse Ntamitondero	PAIGELAC		National Fisheries Research Institute	Jinga			P.O.Box 343, Jinja 256 43 121369 director@firi.go.ug firi@firi.go.ug
	RAS Kagera				raskagera@yahoo.com											Ministry of Agriculture, Animal Industry and Fisheries	Kampala			P.O.Box 34518, Kampala +256 414 531411 ps@agriculture.go.ug
	Ministry of Livestock and Fisheries Development		Kajitanus Osewe	kajitanusosewe@yahoo.com	+255755166226															
Energy / Power Generation (Hydropower)	RAS Kagera				raskagera@yahoo.com	Direction Generale de l'hydraulique et des energies rurales	Bujumbura	Cyprien Simbananiye	Director General		MININFRA	Kigali	Emma Francoise Isumbingabo	Minister of State in Charge of Energy and Water	P.O.Box 24, Kigali +250 585503 info@mininfra.gov.rw	Ministry of Energy and Mineral Development	Kampala	Henry Bidasala - Igaga		+256 414 311111 / 233910 / 232598 / 234733

	TANZANIA					BURUNDI					RWANDA					UGANDA				
Sector/ Field	Department /Institution	Location	Contact Person	Position	Contact Details	Department/ Institution	Location	Contact Person	Position	Contact Details	Department /Institution	Location	Contact Person	Position	Contact Details	Department/ Institution	Location	Contact Person	Position	Contact Details
	Ministry of Energy and Minerals	-	Permanent Secretary	-	km@mem.go.tz	Water and Electric Authority (REGIDESO)		Mr. Liberat Nsabimama		nsablib@yahoo.fr	MININFRA	Kigali	Emmanual Hategekimana	Director of Energy, Water and Sanitation		Ministry of Energy and Mineral Development	Kampala	Julius Namusanga Wamala	Senior Energy Officer	+256 414 311111 / 233910 / 232598 / 234733
											MININFRA	Kigali	Mr. Vincent de Paul Kabalisa		kabalisa@hotmail.com	Electricity Regulatory Authority	Kampala	Declane K. Centenary	Manager, Project Planning and Development	Plot 15 Shimoni Road, Nakasero, P.O.Box 10332, Kampala. Tel:+256 41 4 341852/341646
											Ngali Energy	Kigali	Ntare Karitanyi	Managing Director	+250(0)788791196 Work: +250(0)280305002 ntare.karitanyi@ngali.com P.O Box 7189 | Kigali-Rwanda	Kikagati Power Company Ltd.	Kikagati	Inge Stølen	Managing Director	(+256) 789 690 438 / (+47) 920 27 577 inge.stolen@tronderenergi.no
																Maziba Hydropower Project		Mr. Laurn Bamanya		bamanya@uedcl.co.ug
																Coyne et Bellier/Tractebel Engineers,		Mme. Nathalie Tomczak	4 Small Multipurpose Dams	nathalie.tomczak@gdfsuez.com
Industry	RAS Kagera				raskagera@yahoo.com	Ministry of Commerce, Industry and Tourism					Ministry of Trade and Industry	Kigali			P.O.Box 73, Kigali info@minicom.gov.rw	MTTI		Hon Amelia Kyambadde	Minister of Trade Industry and cooperatives	+256 414 231 104
	Ministry of Industry, Trade and Marketing															MTTI		Hon James Mutende	Minister of State for Industry and Technology	+256 414 346 048
	Chamber of Commerce, Industry and Agriculture	Kagera			+28 222 0673 kagera@tccia.com											National Chamber of Commerce and Industry	Kampala			Okit 1A, Jiira Road. Mulago Kampala +256 75350 3035 info@chamberuganda.com
Urban areas	Ministry of Lands, Housing and Human Settlements Development	Dar es Salaam			ps@ardhi.go.tz						MININFRA	Kigali			P.O.Box 24, Kigali +250 585503 info@mininfra.gov.rw	Ministry of Lands, Housing and Urban Development				
	RAS Kagera		Mr Seif Hussein		s_hussn@yahoo.com or raskagera@yahoo.com															
Environ-ment			Mr Jafari A Omary		jao1709@yahoo.com	INECN	Bujumbura	Francois Ndabahagamye	Département de l'environment, recherche, education environnmentale	INECN, B.P. 56, Gitega Burundi +257 403031	MINITERE	Kigali		Secretary General		Institute of Natural Resource and Environment	Kampala	Hillery Mwesigwa	Lecturer	
	Prime Minister's Office: Dept. Environment		Mr Muyungi																	
	Ministry of Natural Resources and Tourism	Dar es Salaam	Wildlife Division	Technical Adviser John Ballarie swmtanzania@gmail.com +255755799632	ps@mnrt.go.tz	Ministry of Water, Environment, Spatial Planning and Urbanism	Bujumbura	Jean Claude Nwari	Nation Programme on Erosion Control		MINIRENA	Kigali	Theogene HABAKUBAHO	Environment Sector	00250 788643982 hteogene@yahoo.fr					
			Dept. Tourism	Mr Nzuki							MINIRENA		Lyliose Umupfasoni	Director of Environment , water Resources and Forest	0788355174 umupfasoni@gmail.com	NEWPLAN Limited		Jovah Ndyabarema	Environment and Social Sector Division Division Manager	Crusader House Box 7544 Kampala +256 414 340243/4|Mob: +256 782 44 09 42 jovah@newplan.ug
			Mr Ramadhan Massele	-	maelson2004@yahoo.com						REMA		Remy DUHUZE Norbert	Director of Environmental Regulation and Pollution Control	0788612725 dunoremy@yahoo.com					
	University of Dar es Salaam		Victor Kongo	Stockholm Environmental Institute: Institute of																

	TANZANIA					BURUNDI					RWANDA					UGANDA				
Sector/ Field	Department /Institution	Location	Contact Person	Position	Contact Details	Department/ Institution	Location	Contact Person	Position	Contact Details	Department /Institution	Location	Contact Person	Position	Contact Details	Department/ Institution	Location	Contact Person	Position	Contact Details
				Resource Assessment																
	RAS Kagera				raskagera@yahoo.com															
GIS Data	RAS Kagera		Mr Seif Hussein		s_hussn@yahoo.com or raskagera@yahoo.com	IGEBU		Aloys Syori	Chief of Service, Photogrammetry	IGEBU BP 331, Bujumbura +257 40 2625										
Ground-water	Ministry of Water	Dar Es Salaam	Mr Hosea Sanga '+255786456779 +255713456779	Director Water resources	mowmaji@maji.go.tz or mow@maji.go.tz	IGEBU	Gitega	Stephan Valley	German coordinator of the project	+2572240262 Stephan.Valley@bgr.de										
	Ministry of Water		Mr Sanga Hosea	Hydrogeologist	hoseasanga@yahoo.com	ROBUCO	central Burundi (Gitega) and Kirundo (NE)			25722214817			Odilo MUKIZA	Groundwater Expert	00250 788418945 odilonrw@yahoo.com					
	RAS Kagera				raskagera@yahoo.com	BTC	Bujumbura			+257 22 22 39 31 representation.bdi@btcctb.org										
	Sub basin Office in Bukoba		Mr John Ndalahwa		ndalahwaj@yahoo.com															
	Basin Office in Mwanza		Mr Muhabuki	-	lvbwomza@gmail.com,															
Hydrology	Ministry of Water	Dar Es Salaam		Director Water resources	mowmaji@maji.go.tz or mow@maji.go.tz						RADA	Kigali	Revenen Harindintwali	Chef de Unite, Water and Soil Management	+250 252 55 102 618					
			Mr Sanga Hosea		hoseasanga@yahoo.com						MINIRENA /RNRA	Kigali	NDEKEZI F. Xavier	Hydrological Expert	00250 788610295 ndexavier@yahoo.com					
	Min Water	Sub-Basin Lake Victoria Basin: Kagera River Basin									Rwanda Natural Resources Authority	Kigali	Achille Ngombwa	Water Database Manager	00250 788892470 angombwa@yahoo.com					
	RAS Kagera				raskagera@yahoo.com						ISAR	Butare	Leon Nabahungu	Head of soil and water management	P.O.Box 5016, Kigali 250 087 47932 info@isar.rw					
	Tanzania Meteorological Agency		Dr Emanuel Mpeta	empeta@yahoo.co.uk, +255784645337, +255713313226	P.O.Box 3056, Dar es Salaam +255 22 2460706-8 met@meteo.go.tz						MINIRENA/RNRA		Francois Xavier Ndekezi		O788610295 ndexavier@yahoo.com					
											MINIRENA/RNRA	Kigali		Water Sector						
Water Admin-istration																Ministry Water and Environment		Dr Callist Tindimugaya	Commissioner, Water Resources Planning and Regulation, Directorate of Water Resources Management	+256 414321342 callist.tindimugaya@mwe.go.ug Plot 10 Mpigi Road, Entebbe
	Ministry of Water	Dar Es Salaam		Minister of Water	P.O.Box 9153, Dar es Salaam +255 022 2452036 wm@mowi.go.tz	Ministry of Water, Environment, Spatial Planning and Urbanism	Bujumbura	Evariste Rufuguta	Advisor		MINIRENA	Kigali	Kamanzi Stanislas	Minister of Natural Resources	skamanzi@gov.rw	WRMA	Entebbe	Joseph Aseka	Assistant Commissioner, Regulations	
	Ministry of Water		Callistus Mponzi	Economist Water Resource Management		Ministry of Water, Environment, Spatial Planning and Urbanism	Bujumbura	Denise Ndayishimiye	Advisor to the Minister		Rwanda Natural Resources Authority	Kigali	Francois Xavier Tetero	Watershed Management Coordinator	fteterov@yahoo.fr	Directorate of Water Development	Kampala	Sottie Bomukama	Director	
		National Project coordinator: LVEMP II (Tz)	Mr Pius Mabuba	+0787654320 pbmtz2005@gmail.com				Ms Ndorimana Emmanuel	DG Water Resources Management and Sanitation	+257 79300965 ndorimel@yahoo.fr	Ministry Natural Resources,	Kigali	Lyliose Umupfazoni	Director of Environment and Water	+250 788300016 umupfasoni@gmail.com	WRMD	Entebbe	David Cheptoit	Water Officer	PO Box 19 +256 414 321342 / 320914
		Former Director of Water Resources at Min Water	Mr Washington Mutayoba	wmutayoba@iwayafrica.com							Rwanda Natural Resources Authority	Kigali	Kabalisa Vincent de Paul	DDG/Water	00250 785545307 kabalisa@hotmail.com	WRMD	Kampala	Tom Kanyike	Senior Water Officer	

	TANZANIA					BURUNDI					RWANDA					UGANDA				
Sector/ Field	Department /Institution	Location	Contact Person	Position	Contact Details	Department/ Institution	Location	Contact Person	Position	Contact Details	Department /Institution	Location	Contact Person	Position	Contact Details	Department/ Institution	Location	Contact Person	Position	Contact Details
		Ag. Director Water Resources	Lister R.E. Kongola	+255 755661427 lrek52@yahoo.com												WRMD	Entebbe	Wilson Kyonsigira	Assistant Commissioner	PO Box 19 +256 414 321342 / 320914
																WRMD	Entebbe	Nebert Wobusobozi	Commissioner	PO Box 19 +256 414 321342 / 320914
																MoWE	Kampala	Eng. Mugisha Shillingi	Director of Water Resource Management	
Water Supply and Sanitation	Ministry of Water	Dar Es Salaam		Director Urban water supply and sanitation division	P.O.Box 9153, Dar es Salaam +255 022 2450001 dcwss@mowi.go.tz	Ministry of Water, Energy and Mines (MWEM)			Directorate General for Water and Energy (DGEE)		MININFRA	Kigali	Emmanuel HATEGEKIMANA	Water , Energy and Sanitation Policy Lead	00250 788620930	MoWE	Kampala	Catherine Kemigisha	Engineer - Water for Production	
						Water and Electric Authority (REGIDESO)		Liberat Nsabimana		Email: nsablib@yahoo.fr Tel: +257-22253078	Energy, Water and Sanitation Authority (EWSA)				Water Department: 0788307412, tminani@ewsa.rw	MoWE	Kampala			Ministry of Water and Environment P.O.Box 20026 Kampala - Uganda Tel: +256 414 505942 Email: mwe@mwe.go.ug Website: www.mwe.go.ug
									Directorate General of Rural Water and Electricity (DGHER)		MININFRA/RNRA		Benoit Nyiligira	M&E PNEAR Project & RPSC Member	0788416803 benigira@yahoo.fr	National Water and Sewerage Corporation (NWSC)	Kampala			Head Office, Plot 39, Jinja Road, Tel: +256-414-315000, Fax: +256414234802
						Services Techniques Municipaux (SETEMU)					MINIRENA		Lyliose Umupfasoni	Director of Environment , water Resources and Forest	0788355174 umupfasoni@gmail.com					
						General Directorate of Water and Energy	Bujumbura		Director	Tel: +25722229555 Email: ipressadi@yahoo.fr										
						REGIDESO				+25722221169										
						DGHER	Gitega			+25722403119										
Water Quality (incl. health and food production)	Ministry of Water	Dar Es Salaam	Ms Nadhifa Sadick	Director Water Laboratory	siranadhifa@yahoo.com, or dwls@mowi.go.tz	Ministere de la Sante Publique	Bujumbura	Venant Kavuyimbo	Environmental Health		Ministry of Heath					WRMA	Entebbe	Nicholas Azza	Assistant Commissioner, Water Quality	
	RAS Kagera				raskagera@yahoo.com	Ministry of public health										WRMD	Entebbe	Louis Mugisha	Data Analyst, Water Quality	PO Box 19 +256 414 321342 / 320914
	Institute of Agriculture				SARI@habari.co.tz															
		ARI Maruku, Kagera	Dr Nkuba	KM																
	Water Lab Kagera		Mr Marco Vitta		vitta.marco@yahoo.com															
	LIVEMP II		Mr Omary I. Myanza		wamuyanza@gmail.com															
Socio-Economic	TAMISEMI in Dodoma				eenyanda@yahoo.com and theodoramollel@yahoo.com ps@pmoralg.go.tz	MINIT	Bujumbura	Omer Ndayishimige	Director of the population department		RSSA	Kigali	Ignacie Tunushime	Coordinator		Ministry of Health				
	RAS Kagera				raskagera@yahoo.com						MINECOFIN	Kigali	Claude Kanyamahonga	Expert	+0250 252 596002 mfin@minecofin.gov.rw					
	Ministry of Health and Social Welfare		Mr Ndaskoi	Director: Women, children and community development	mndaskoi@yahoo.com, +255769698655															
Climate Change	RAS Kagera				raskagera@yahoo.com	IGEBU	Gitega	Evariste Sinarinze	Consultant, Water Resource Management, Hydrology and	IGEBU BP 331, Bujumbura +257 40 2625	RDB		Sebastian Dusabeyezu	Senior Environment Analyst and National Focal	O788517589					

	TANZANIA					BURUNDI					RWANDA					UGANDA				
Sector/ Field	Department /Institution	Location	Contact Person	Position	Contact Details	Department/ Institution	Location	Contact Person	Position	Contact Details	Department /Institution	Location	Contact Person	Position	Contact Details	Department/ Institution	Location	Contact Person	Position	Contact Details
									Climate Change					Point of Climate change						
	LIVEMP II		Mr Omary I. Myanza		wamuyanza@gmail.com															
Wildlife, Conserva-tion and Protected Areas	RAS Kagera				raskagera@yahoo.com						MINITERE	Kigali	Antoine Kapiteni	Coordinator of Integrated Management of Critical Ecosystems Project		Wildlife Conservation Society				
	Ministry of Natural Resources and Tourism			Wildlife Division	P.O.Box 9372, Dar es Salaam +255 22 2864230 / 1872 ps@mnrt.go.tz						MINITERE	Kigali	Paul Ouedraogo	Technical Assistance, Integrated Management of Critical Ecosystems Project		Uganda Conservation Foundation				
	Tanzania Forest Conservation Group				PO Box 23410 Dar es Salaam, Tanzania +255 22 2669007 tfcg@tfcg.or.tz						ACNR	Kigali	Serge Nsengimana	Coordinator	P.O.Box 4290, Kigali +250 252 580 283 info@acnrwanda.org	Uganda Wildlife Authority				P.O. BOX 3530, Kampala +256 414 355000 / 312 355000 info@ugandawildlife.org
											ORTPN	Kigali	Fidele Rugandekwe	Director of Conservation						
Lakes and Wetlands	Ministry of Natural Resources and Tourism			Wildlife Division	P.O.Box 9372, Dar es Salaam +255 22 2864230 / 1872 ps@mnrt.go.tz															
	Ministry of Natural Resources and Tourism		Imani Nkuwi inkuwi@yahoo.co.uk +255 655999191	National Wetlands Working Group	P.O.Box 9372, Dar es Salaam +255 22 2864230 / 1872 ps@mnrt.go.tz															
	Ministry of Natural Resources and Tourism			National Wetlands Steering Committee	P.O.Box 9372, Dar es Salaam +255 22 2864230 / 1872 ps@mnrt.go.tz															
Institutional Arrange-ments / Legal	RAS Kagera				raskagera@yahoo.com						Ministry of Foreign Affairs and Cooperation	Kigali	Etienne Nkerabigwi	Legal Advisor	+250 599128 / 599129 / 599130			Prof Albert Muma	Lead institutional consultant	
	TAMISEMI in Dodoma				eenyanda@yahoo.com and theodoramollel@yahoo.com ps@pmoralg.go.tz						MINALOC	Kigali	Fidele Kayira	Coordinator of UBUDEHE Programme	minister@minaloc.gov.rw					
Financial / Funders	Ministry of Finance				P.O Box 9111, Dar es Salaam +255 22 2111174-6											Ministry of Finance, Planning and Economic Development				P.O.Box 8147, Kampala+256 414 707000
District Authorities																				
NBI Projects						NBI / IGEBU	Gitega	Gabriel Ndikumana	National DSS Specialist for Burundi	IGEBU BP 331, Bujumbura +257 40 2625	Nile Basin Discourse Forum	Kigali	John GAKUMBA	National Coordinator	00250 782792690	Ministry of Foreign Affairs	Kampala	Nurh Byarufu	First Secretary and Desk Officer for NBI Issues	
											RNRA	Kigali	Remy Muganga	Nile TAC Member	00250 788521209	Uganda Nile Discourse Forum	Kampala	Sarah Naigaga		
													NYIRAKAMANA Jacqueline	NNFPO & National Liaison Officer	0788453909 jnyirakamana@nilebasin.org					
Lake Victoria Projects						Ministry of Water, Environment, Spatial Planning and Urbanism	Gitega	Anicet Nkurikiye	Minister Advisor / Regional Project Steering Committee Chair		EWSA / MININFRA	Kigali	Benoit Nyirigira	Regional Project Steering Committee Member	00250 788416803					
						Ministry of Water, Environment, Spatial Planning and Urbanism	Bujumbura	Evariste Rufuguta	Advisor											
Consultants	LTS International		Mr. James Peter	Feasibility Study for	peter.s@ethionet.et	LTS International		Mr. James	Feasibility Study	peter.s@ethionet.et	LTS International		Mr. James Peter	Feasibility Study	peter.s@ethionet.	LTS International		Mr. James	Feasibility	peter.s@ethionet.et

	TANZANIA					BURUNDI					RWANDA					UGANDA				
Sector/ Field	Department /Institution	Location	Contact Person	Position	Contact Details	Department/ Institution	Location	Contact Person	Position	Contact Details	Department /Institution	Location	Contact Person	Position	Contact Details	Department/ Institution	Location	Contact Person	Position	Contact Details
			Sutclife	an Integrated Watershed Management Program for the Kagera River Basin				Peter Sutclife	for an Integrated Watershed Management Program for the Kagera River Basin				Sutclife	for an Integrated Watershed Management Program for the Kagera River Basin	et			Peter Sutclife	Study for an Integrated Watershed Management Program for the Kagera River Basin	
	(Kagera) Water allocation model assignment		Dr. Joel Nobert	Institutional Specialist	nobert@wrep.udsm.ac.tz njoelk@yahoo.com nobert@udsm.ac.tz	NBI	Bujumbura	Denis Barandemaje	CBSI Nation Project Coordinator								Entebbe	Vincent Ssebugwawo	National DSS Specialist	
			Dr. Tom Downing Mr. Mica Longanecker	Climate change vulnerability assessment for the Kagera basin	tdowning.cc@gmail.com micalonganecker.gcap@gmail.com / mlonganecker@climateadaptation.cc											Newplan Consulting Engineers	Kampala, Uganda	Michael Daka	Kikagati & Nsongyesi Projects	Daka.michael@gmail.com daka@newplan.ug

Colour Code:	Blue	Provided by Nation Liaison Officers
	Green	Internet Sourced Information
	Black	Information from Page 321 to 329 of the Monograph (Consultation List)
	Red	Attendees of Inception Workshop
	Orange	Provided by Specialist
	Purple	New stakeholders added after first interim report

Annexure B:
Legal and Institutional Implementation Plan

ANNEXURE B:

LEGAL AND INSTITUTIONAL IMPLEMENTATION PLAN (for Projects and Programmes of the IWRM-based Kagera Development Plan)

Table 1: Framework for Identification of Project Implementing Institutions

Project Type Parameters	
Project	*This is a programme of once off initiatives followed by operation and maintenance*
Programme	*The programme involves the implementation of several projects with no definitive completion date with one or more projects to be implemented at several locations*
Large and Complex	*The programme involves more than one discipline requiring specialized professional input*

Project Location Parameters	
Transboundary	*The project significantly impacts or benefits to more than one country*
National / Regional	*The project located in one country and has no significant impact or benefit to other countries*
Local Area	*The project is situated in a local area of the country and has no significant impact or benefit to the entire country*

Implementation Parameters	
Multi-country	*Project requires agreements between countries*
Multiple Ministries	*The project components primarily concern multiple ministries*
Single Ministry	*The project components primarily concern one ministry only*

Table 2: Analysis Tool for the Identification of the Legal and Institutional Implementation Plan

Name of Project or Programme	Project Description	Country where Project is located	Significance of impacts (Social and Environmental)	Significance of Benefits	Sectors involved in the project		Estimated project amount (size and complexity)	Recommended Institutional Arrangement for Implementation		Recommended Legal Arrangement for Implementation
					Primary	Secondary		Primary	Secondary	
Hydropower schemes										
Kakono Hydropower Scheme	A run-off river hydropower scheme.	Tanzania	Limited impact except local inundation	Significant low cost power supply to the region	Energy	Agriculture, Water Resources and Environment	Medium size project, Cost yet to be determined	National Ministry of Energy and Power Authority with involvement of Ministry responsible for water	National Ministry of Agriculture	Requires Diplomatic Notification of project to Basin States
Kishanda Valley Hydropower Project	Complex diversion scheme, 180MW hydropower	Tanzania	Significant, flows out of Kagera river.	Significant power supply to national grid	Energy	Water Resources	Large size. Cost yet to be determined	Tanzania Ministry of Energy, Ministry responsible for Water and Tanzania Energy Authority (TANESCO)	Tanzania Ministry of Environment Ministry of Environment	Notification of other Kagera Member States through diplomatic channels and providing all environmental impact reports.
Rusumo Falls (Run-off River)	A run-off river hydropower scheme. 46MW hydropower on the Tanzania/Rwanda border.	Tanzania	Limited impact downstream. Limited local inundation.	Significant power supply to national grid	Energy	Water Resources	Capital cost was estimated to be US $217 million. Firm energy of 254 GWh/a, secondary energy of 147 GWh/a and average energy of 401 GWh/a.	• NELSAP – Rusumo Falls Hydropower Joint Project Coordination Unit • Ministries of Energy, Water and Energy Authorities from Burundi, Rwanda and Tanzania	Ministries of Environment from Burundi Rwanda and Tanzania	• Agreement between Burundi, Rwanda and Tanzania - signed a Joint Project Agreement (JPA) in 2006 for preparation stage. • Agreement needs to be extended to cover implementation stage. • Notification of other Kagera Member States giving all environmental impact reports
Nsongyezi (85MW)	51m high dam wall, Capacity of 47 million m^3, 85MW hydropower capacity,	Uganda	Socio-Economic impacts still to be determined.	Significant power supply to national grid and to Burundi, Rwanda and Uganda.	Energy	Water Resources	No costing has been done, nor funding, sourced. Average annual energy 370GWh	Uganda Ministry of Energy and Energy Authority (TANESCO) and Ministry responsible for Water	Uganda Ministry of Environment	Notification of Kagera Member States through diplomatic channels providing all environmental impact reports
Nsongyezi (65MW)	41m high dam wall, Capacity 18 million m^3, 65MW hydropower capacity,	Uganda	Socio-Economic impacts still to be determined.	Significant power supply to national grid and possibly Burundi, Rwanda and Uganda.	Energy	Water Resources	No costing has been done, nor funding sourced. Average annual energy 280GWh	Uganda Ministry of Energy and Energy Authority (TANESCO) and Ministry responsible for Water	Uganda Ministry of Environment	Notification of Kagera Member States through diplomatic channels providing all environmental impact reports
Nsongyezi (39MW)	69MW hydropower capacity,	Uganda	Social and Environmental study is not yet completed	Social and Environmental study is not yet completed			Capital cost for this project is unknown. The scheme would generate an average annual energy of 280Gwh/a	Uganda Ministry of Energy and Energy Authority (TANESCO) and Ministry responsible for Water	Uganda Ministry of Environment	Notification of Kagera Member States through diplomatic channels providing all environmental impact reports
Nyabarongo Dam and Hydropower	48m high dam wall. 20MW hydropower.	Rwanda	Very significant inundation. Moderate impact on the flow in Nyabarongo river.	Significant power supply to national grid. 18Mm^3 Water supply (would have to be pumped upstream), 60.1 Mm^3 Agricultural water	Energy	Agriculture, Water Supply	Capital cost of USD 169,870,597. Annual generation is 133.8GWh.	Rwanda Ministry Responsible for Water, Energy and Agriculture (Energy, Water and Sanitation Authority)	Rwanda Ministries of Environment, Rwanda Water Supply Utility	Diplomatic notification of Kagera Member States through diplomatic channels providing all environmental reports
Ruvyironza Dam and Hydropower	A 58.9m high dam and hydropower scheme. Estimated generation capacity of 28MW	Burundi	No significant impact	Power supply to national grid of Burundi. Secondary use of water for irrigation and domestic use	Energy	Agriculture, Water Supply and agriculture	The total capital cost for this project is estimated to be USD 237 million. Average annual energy of 106 GWh/year. Irrigation potential to be 1800 Ha and an amount of 264,531 people can be served with domestic	Burundi Ministry of Water and Ministry of Energy	Burundi Ministry of Environment, Water Utilities and Agriculture	Notification of Kagera Member States through diplomatic channels and providing all environmental reports

Name of Project or Programme	Project Description	Country where Project is located	Significance of impacts (Social and Environmental)	Significance of Benefits	Sectors involved in the project		Estimated project amount (size and complexity)	Recommended Institutional Arrangement for Implementation		Recommended Legal Arrangement for Implementation
					Primary	Secondary		Primary	Secondary	
							water.			
Kikagati Hydropower Project	An 11.5m high dam wall with crest length of 170m. Possible generation capacity of 16MW	Uganda	Very limited environmental impact, as the water is diverted through a short canal (150 meter and the release into the river again immediately.	Benefit of bringing electricity to Murongo village and a more stable power supply for the local community in Uganda	Energy	None	The total capital cost is unknown. Average annual energy of 115 GWh/year.	Uganda Ministry of Energy	Uganda Ministry of Environment	Notification of other Kagera Member States through diplomatic channels and providing all environmental reports
Maziba Small Hydropower Project	Refurbish and Upgrade of existing 1MW to 1.18MW	Uganda	Limited environmental disruption. The addition of a fish ladder would improve the situation.	Electricity supply by the Maziba SHPP would be back-up for Kabale and for energy supply to the national grid.	Energy	None	The total capital cost for this project is estimated to be USD 3 million. Average annual energy of 7 GWh/year.	Uganda Ministry of Energy	Rwanda Ministry of Environment	Notification of other Kagera Member States through diplomatic channels and providing all environmental reports
Ruramba Small Hydropower Plant	A 35m high dam wall with headrace canal of 1060m. Generation capacity of 3.42MW	Rwanda	Quite a large impoundment (also for irrigation) has quite an impact.	Would provide electricity for lighting and household purposes.	Energy	None	The total capital cost for this project is estimated to be USD 13 million.	Rwanda Ministry of Energy and the Energy, Water and Sanitation Authority	Rwanda Ministry of Environment	Notification of other Kagera Member States through diplomatic channels and providing all environmental reports
Large dams										
Kagitumba-Mazimba Dam	A 20.5m high dam wall with crest length of 177m. Possible generation capacity of 10.7MW	Uganda	Impacts downstream have not been studied, but would be significant given the size of dam and MAR	Benefits downstream have not been quantified.	Agriculture, Water Supply	Energy	The total capital cost for this project is estimated to be USD 77 million. Average annual energy of 81 GWh/year. Irrigation potential to be 178 Ha and an amount of 46,728 people can be served with domestic water.	Uganda Ministry of Water, Energy and Agriculture	Uganda Ministry of Environment	Notification of other Kagera Member States through diplomatic channels and providing all environmental reports
Kakanja Dam	A 14.0m high dam with storage capacity of 72 million m^3 in Tanzania	Tanzania	Significant impact by inundation	Benefits still to be quantified.	Agriculture,	Water Supply		Tanzania Ministries of Water and Agriculture	Tanzania Ministry of Environment	Notification of other Kagera Member States through diplomatic channels and providing all environmental reports
Kanyaru Dam	A 52m high dam 333.9 million m^3 with 14.5 MW hydropower on the Rwanda/Burundi Border	Rwanda/Burundi	Limited social and environmental impacts but dam requires agreement between Rwanda and Burundi	Significant power, flood control and irrigation benefits to both countries	Agriculture and Energy	Water Resources, Agriculture	The total capital cost for this project is estimated to be USD 351 million. Average annual energy of 84 GWh/year. Irrigation potential to be 12,474 Ha and an amount of 614,202 people can be served with domestic water.	Ministries of Water for Rwanda and Burundi	Ministries of Agriculture, Energy from Rwanda and Burundi	An Agreement for the creation of a Special Purpose Vehicle (SPV) - an entity to implement the project between Rwanda and Burundi
Muvumba Dam	A 43m high dam with crest length of 1300m, and capacity of 108.7m^3. 2.9 MW hydropower.	Rwanda	Impacts still to be quantified. There are a number of potentially very significant and unknown environmental impacts that will require greater attention and mitigation before any	Very significant benefits for domestic water supply. Estimated 400 000 people to benefit from the scheme by 2022	Agriculture, Water Supply	Energy	The total capital cost for this project is estimated to be USD 131 million. Average annual energy of 17 GWh/year. Irrigation potential to be 2,198Ha and an amount of 29,788 people can be served	Rwanda Ministry of Water (Energy, Water and Sanitation Authority)	Rwanda Ministry of Agriculture, Energy and Environment	Notification of other Kagera Member States through diplomatic channels and providing all environmental reports

Name of Project or Programme	Project Description	Country where Project is located	Significance of impacts (Social and Environmental)	Significance of Benefits	Sectors involved in the project		Estimated project amount (size and complexity)	Recommended Institutional Arrangement for Implementation		Recommended Legal Arrangement for Implementation
					Primary	Secondary		Primary	Secondary	
			development				with domestic water.			
Upper Ruvubu	A 45.5m high dam wall with crest length of 480m. Possible estimated generation capacity of 3.6MW	Burundi	Limited impact downstream	The dam would provide irrigation and domestic water supply.	Agriculture, Water Supply	Energy	The total capital cost for this project is estimated to be USD 160 million. Average annual energy of 21 GWh/year. Irrigation potential to be 8,137 Ha and an amount of 154,613 people can be served with domestic water.	Burundi Ministry of Water and Agriculture	Burundi Ministries of Energy and Environment	Notification of other Kagera Member States through diplomatic channels and providing all environmental reports
Small dams										
Bigasha Dam	A 12m high dam with a crest length of 610.16m. Storage capacity would be 6.41 million m^3.	Uganda	The reservoir would have a significant impact on flows in the river below the dam but would have a negligible impact on flows in the Kagera River.	The dam would provide irrigation and domestic water supply.	Agriculture, Water Supply	None	The total capital cost for this project is estimated to be USD 56 million. Irrigation potential to be 257Ha and an amount of 136,893 people can be served with domestic water.	Uganda Ministries of Water and Agriculture	Uganda Ministry of Environment	Notification of other Kagera Member States through diplomatic channels and providing all environmental reports
Buyongwe Dam	Initially planned a s a dam but an alternative diversion weir and canal has been recommended	Burundi	Limited impact. Local river flows (the Buyongwe River) would be impacted, as would nearby wetlands.	The dam would provide irrigation and domestic water supply.	Irrigation	Water Supply	No costing has been done, nor funding sources identified.	Burundi Ministries and Water and Agriculture	Burundi Ministries of Energy and Environment	Notification of other Kagera Member States through diplomatic channels and provide all environmental reports
Gashayura Dam	A 19 m high dam with crest length of 601 m a storage capacity of 20.4 million m^3.	Burundi	No significant impacts downstream.	The dam would provide irrigation and domestic water supply.	Agriculture, Water Supply	Energy	The total capital cost for this project is estimated to be USD 67 million. Irrigation potential to be 1,212Ha and an amount of 170,720 people can be served with domestic water.	Burundi Ministries and Water and Agriculture	Burundi Ministries of Energy and Environment	Notification of other Kagera Member States through diplomatic channels and provide all environmental reports
Kabuyanda Dam	A 14.7m high dam, Wall crest length 350m, Storage capacity 6.6 million m^3	Uganda	Impacts still to be quantified.	The dam would provide irrigation and domestic water supply.	Agriculture, Water Supply	None	No costing has been done, nor funding sources identified.	Uganda Ministries and Water and Agriculture	Uganda ministry of Environment	Notification of other Kagera Member States through diplomatic channels and provide all environmental reports
Karazi Dam	A 9.5m high dam with crest length of 519 metres. Storage capacity estimated at 9.2 million m^3.	Tanzania	The reservoir would have a significant impact on flows in the river below the dam and particularly flooding. Given that this is a seasonal river this could be positive in that controlled releases could allow for extended low flows. The dam would not have an impact on the Kagera River.	The dam would provide irrigation and domestic water supply.	Agriculture, Water Supply	Fisheries	The total capital cost for this project is estimated to be USD 46 million. Irrigation potential to be 250Ha and an amount of 137,900 people can be served with domestic water.	Tanzania Ministries and Water and Agriculture	Tanzania Ministries of Fisheries and Environment	Notification of other Kagera Member States through diplomatic channels and provide all environmental reports

Name of Project or Programme	Project Description	Country where Project is located	Significance of impacts (Social and Environmental)	Significance of Benefits	Sectors involved in the project		Estimated project amount (size and complexity)	Recommended Institutional Arrangement for Implementation		Recommended Legal Arrangement for Implementation
					Primary	Secondary		Primary	Secondary	
Kavurugu Dam	A 19.5 m high dam with crest length of the wall 340 m. The capacity of the dam would be about 10.9 million m^3. Estimated possible generation capacity is 0.3MW	Burundi	Impacts on environmental flows in the Kavurungu River would have to be assessed.	The dam would provide irrigation and domestic water supply.	Agriculture, Water Supply	Energy	The total capital cost for this project is estimated to be USD 28 million. Average annual energy of 2 GWh/year. Irrigation potential to be 452Ha and an amount of 47,764 people can be served with domestic water.	Burundi Ministries and Water and Agriculture	Burundi Ministries of Energy and Environment	Notification of other Kagera Member States through diplomatic channels and provide all environmental reports
Mbarara Dam	A 19 m high dam with crest length of the wall 350 m. The dam has an expected capacity of 9.9 million m^3. Estimated possible generation capacity is 0.1MW	Burundi	Given the small size of the catchment, the impacts on the local hydrology may be severe. The overall impact on downstream flow in the Kagera River and on inflows into Lake Victoria would be negligible. Cumulative impact with Upper Ruvubu weakens this project	This Project is intended to supply local communities with water for domestic use, water for irrigation.	Agriculture, Water Supply	Energy	The total capital cost for this project is estimated to be USD 34 million. Average annual energy of 1 GWh/year. Irrigation potential to be 489Ha and an amount of 79,783 people can be served with domestic water.	Burundi Ministries and Water and Agriculture	Burundi Ministries of Energy and Environment	Notification of other Kagera Member States through diplomatic channels and provide all environmental reports
Munyange-Vumbe Dam	A 14.0m high dam with wall crest length 560 m and storage capacity 6.81 Mm^3	Burundi	Impacts still to be quantified.	The dam would provide water for irrigation, livestock and domestic use.	Agriculture, Water Supply	None	No costing have been done, nor funding sourced	Burundi Ministries and Water and Agriculture	Burundi Ministry of Environment	Notification of other Kagera Member States through diplomatic channels and provide all environmental reports
Taba-Gakomeye Dam	Originally planned as a dam but a diversion weir and canal has been proposed as more sustainable alternative	Rwanda	Local river flows will be impacted as will nearby wetlands.	The increased productivity that will be brought through additional secure water, will improve food security.	Irrigation	Water supply	No costing have been done, nor funding sourced	Rwanda Ministries and Water and Agriculture	Rwanda Ministries of Energy, Fisheries and Environment	Notification of other Kagera Member States through diplomatic channels and provide all environmental reports
Irrigation Schemes										
Bugasera irrigation Scheme	Multi-national irrigation and watershed management project	Rwanda	The main environmental impacts are erosion during the phases of implementation of facilities or development, possible disruptions to fisheries resources, natural and water quality of lakes, loss of biodiversity and loss of habitat of papyrus, pressure on water and woodland resources, and the pollution of surface waters through the increased use of agrochemicals.	Benefits are aimed firstly at local agricultural users but also at the wider environment and downstream water resources, through the protection of watersheds	Agriculture	None	Total project cost is estimated at USD 45.8 million.	Burundi and Rwanda Ministries and Water and Agriculture	Burundi and Rwanda Ministries of Energy and Environment	• Establishment of a Joint Irrigation and Water Management Authority between Burundi and Rwanda to implement and manage scheme. • Notification of other Kagera Member States through diplomatic channels and provide all environmental reports
Ngono Valley Scheme	Option 1: 5805 Ha Option 2: 13,630 Ha	Tanzania	No significant impact on the Kagera.	Irrigation should result in total production of	Water Resources and	Environment	Option1 Tshs 78 billion (USD 51 million) Option2 Tshs 380 billion	Tanzania Ministries and Water and Agriculture	Tanzania Ministries of Environment	Notification of other Kagera and Lake Victoria Member States through diplomatic channels and

Name of Project or Programme	Project Description	Country where Project is located	Significance of impacts (Social and Environmental)	Significance of Benefits	Sectors involved in the project		Estimated project amount (size and complexity)	Recommended Institutional Arrangement for Implementation		Recommended Legal Arrangement for Implementation
					Primary	Secondary		Primary	Secondary	
				106,000 tons of various crops	Agriculture		(USD 243 million)			provide all environmental reports
Nyanza Hillside Irrigation Scheme	Gross command area of 470 Ha of which net area of 390.5 Ha.	Rwanda	No information	No information	Water Resources and Agriculture	Environment	No costing have been done, nor funding sourced	Rwanda Ministries and Water and Agriculture	Rwanda Ministries of Energy and Environment	Notification of other Kagera Member States through diplomatic channels and provide all environmental reports
Ruramba Irrigation Scheme	Gross command area 76.6 Ha	Rwanda	No information	No information	Water Resources and Agriculture	Environment	Total project cost is estimated to be USD 4.9 million	Rwanda Ministries and Water and Agriculture	Burundi and Rwanda Ministries of Energy and Environment	Notification of other Kagera Member States through diplomatic channels and provide all environmental reports
Other Projects / Programmes										
Aquaculture - fingerponds	Fish farming	All four countries	No significant impact	Increased food production	Fisheries	Agriculture and Environment	Costing not yet quantified.	Member States Ministries of Water, Agriculture and Fisheries	Member States Ministries of Environment	Sharing of information with other Member States
Katuna water kiosks	Water supply from water kiosks.	All four countries	No significant impact	Increased water availability	Water Supply	None	Capital cost is the UGX 497 million	Member States Ministries of Water	None	Sharing of information with other Member States
Mining (water resource protection)	This proposal is aimed at the introduction and use of simple but specialized equipment to improve efficiencies and reduce wastewater production in small-scale mining.	All four countries	No Impact	Greater profitability, with benefits to miners, local community and the national fiscus.	Water Resources	Mining	Costing not yet quantified.	Member States Ministries of Water and Mining	Member States Ministries of Environment and Mining	Sharing of information with other Member States
Mutobo pipeline	This project aims to draw 100 000m^3/day from the Mutobo area, based in Musanze district in Northern Province and pipe this 100 km to Kigali.	Rwanda	Not yet quantified. Impacts still to be assessed	Urban use (water supply and sanitation) – City of Kigali	Water Supply	None	The Government intends to spend US$300 million	Rwanda Ministry of Water and Water Supply Authorities	Rwanda Ministry of Environment	Sharing of information with other Member States

Annexure C:
Implementation Plan Tables

Table 3.1: The Kagera River Basin Development Plan – Implementation Plan

Strategic Option 1: Creating an enabling environment								
Strategic Objective: ***To operationalize water governance in support of Basin-wide water resources development and management.***								
Strategy 1.1: Harmonised and improved water sector legislative and regulatory framework at regional and national levels to promote regional economic integration and increased trade								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
a) *Member States support the BDP through a harmonised governance framework*	• Evaluate the national legal frameworks of the member States. • Harmonise and, where necessary, update the legal frameworks where necessary, to promote the objectives of Basin Development, water resource management including watershed management and risk management.	• Updated legal frameworks of member States. • Tools and mechanisms established to implement the Basin Development Plan.	Short	• NELSAP to complete studies on policy harmonization for Kagera Member States to support Kagera BDP.	• Member States implement policy harmonization initiatives. • Member States to conduct legal review and update where necessary.	• National local water institutions to contribute and support policy harmonisation.	• NGO, Private Sector, water users, academic institutions, etc., to support and contribute to policy harmonization efforts and legal updating.	• Annual Budget • Donor funding • Private Sector • Service Fees
b) *Institutional structures for Basin water resources management are operationalized*	• Evaluate the institutional structures in member States in their ability and capacity to implement the BDP. • Re-structure institutions where necessary to enable implementation of the BDP and to regulate national legislative frameworks.	• Capacitated and operational institution structures in place. • Clear mandates, job descriptions and functions established for institution structures.	Short	• NELSAP to review and consolidate previous studies and make recommendations to Member States.	• All Member States to align institutional structures.	• Districts and local Watershed entities to participate and contribute to the national restructuring process.	• NGO, Private Sector, water users, academic institutions, etc., to participate in the institutional restructuring processes.	• Annual Budget • Donor funding • Private Sector • Service Fees
c) *Harmonised or Improved regulation of national legislative frameworks*	• Establish National Compliance and Enforcement Units to monitor water use, water quality, impact activities etc. • Harmonise or develop frameworks for water sector regulation.	• Compliance monitoring is in place and units report regularly. • Frameworks for water quality regulation, discharge regulation, permit regulation etc. developed and implemented.	Medium	• NELSAP to develop a compliance monitoring and enforcement mechanism for Member States.	• Member States to put in place governance structures for the implementation of Basin and National compliance and enforcement mechanisms.	• Districts and water entities to support compliance and enforcement mechanisms.	• NGO, Private Sector, water users, academic institutions, etc., to support National Compliance and enforcement initiatives.	• Annual Budget • Donor funding • Private Sector • Service Fees

Strategic Option 1: Creating an enabling environment								
Strategic Objective: ***To operationalize water governance in support of Basin-wide water resources development and management.***								
Strategy 1.2: Ensure qualified human resources and knowledge base within water management institutions for water planning, management and research								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
a) Training and capacity building	• Provide accredited training programmes in: - IWRM - Watershed management - Environmental management - Asset management - Natural Resource Legislation Compliance and enforcement - Natural Resource and Land management - Water quality monitoring - GIS - Risk management • Ensure capacity at institutions to implement protocol.	• Increased capability in the various fields	Short	• NELSAP to develop Training programmes to support BDP at Basin scale • Kagera Secretariat when established to develop programmes to support BDP at Basin Scale	• Ministries responsible for the BDP implementation (Energy, Water, Agriculture, etc.) to align Training programmes at National scale to support BDP • Tertiary institutions to get involved in future training.	• Districts and local river basin and other local water management institutions to participate in training and capacity building programmes	• NGOs, CBOs, WB, AfDB, SIDA, SIWI, FETwater to assist in developing training programmes	• Annual Budget • Donor funding • Private Sector • Service Fees
b) Practical and focused research and technology development	• Establish a funding grant system for research targeted at the Basin. • Compile list of research priorities each year.	• 2 research grants per year from RBO. • Research reports.	Implement within 2 years. Long-term function	• NELSAP and Kagera Secretariat (if established) to define the areas requiring research to support the BDP	• Member States to offer scholarship or research grants for research in the State in the Basin.	• Districts and local river basin institutions to support research initiatives by providing essential data	• NGO, Private Sector, water users, academic institutions, etc., to support research initiatives by identifying areas of research and provide data	• Annual Budget • Donor funding • Private Sector • Service Fees
c) Infrastructure Management staffing	• Improve or prepare register of all infrastructure (strategies 1.3, and 2.4) • Determine skills requirements, and level of staffing for categories of infrastructure. • Develop guidelines for institutions on staff requirements.	• Developed guidelines for all components of water services (reservoirs, per 100km pipeline, pump stations, WTWs, WWTWs, groundwater supply schemes, WC/WDM and aquatic specialists, etc.).	Short	• NELSAP and Kagera Secretariat (if established) to put in place programmes for infrastructure management	• Ministries responsible for infrastructure in the Member States to implement infrastructure management programmes	• District and local river basin institutions to implement infrastructure management programmes in their jurisdiction	• NGO, Private Sector, water users, academic institutions, etc., to support infrastructure management in their areas of operation	• Annual Budget • Donor funding • Private Sector • Service Fees
d) Learnerships in water resource management	• Provision for water-related learnerships and mentoring programmes in all spheres of Government.	• Number of officials who participated in the water-related learnerships and mentoring programmes • Number of officials successfully completing the water-related learnerships and mentoring programmes	Medium / Long	NELSAP and Kagera Secretariat (if established) to identify the types of learnership and support these by raising funds	• All relevant Departments provide learnerships and mentoring opportunities	• Districts/Watershed Institution staff to participate in learnerships and mentoring programmes	• NGO, Private Sector, water users, academic institutions, etc., to support and participate in learnership programmes in their area of operation	• Annual Budget • Donor funding • Private Sector • Service Fees

Strategic Option 1: Creating an enabling environment								
Strategic Objective: ***To operationalize water governance in support of Basin-wide water resources development and management.***								
Strategy 1.3: Strengthen knowledge base and establish IWRM information systems and tools								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
a) Integrate/upgrade/ develop/modernise an Information Management System (IMS)	• Integrate/upgrade/develop/ adjust a National Information System platform (server, webpage, user protocols, information format). • Determine standardisation of information approaches. • Identify existing data and information, and its accessibility.	• Centralized Environment & Water Information Portal (CEWIP) in place. • Clear IMS protocol being implemented. • Basin IMS requirements an annexure to Basin Agreement.	Short	• NELSAP and Kagera Secretariat (if established) to develop a basin wide information management system • Provide Basin information requirements • Determine Basin reporting format.	• Ministries and Departments in Members States to provide information needed for IMS and to contribute in its development and operation	• Districts and local river basin institutions including water boards and authorities to provide data and information necessary to populate the IMS	• NGO, Private Sector, water users, academic institutions, etc., to provide information required by the IMS	• Annual Budget • Donor funding • Private Sector • Service Fees
	• Integrate/upgrade/develop /adjust national databases for information on *inter alia*: o Risk assessment and management decision support tool/s o Assets (infrastructure). See also strategy 2.4. o Hydrology (surface and groundwater); o Water Quality; o Monitoring points (local, national, Basin); o Aquatic environments and biotopes; o Water user register; o Discharge permit register; o Social and economic indicators o Spatial data (aerial photography, maps); o Modelling systems (e.g. MIKE Basin) o Flooding information o CMMS (asset management) • Basin reporting format • Update with historic information	• Webpage, systems, databases and tools accessible and operational.	Short	• NELSAP and Kagera Secretariat (if established) to develop a basin wide database	• Ministries and Departments in Members States to provide information needed for database and to contribute in its development and operation	• Districts and local river basin institutions including water boards and authorities to provide data and information necessary to populate the database	• NGO, Private Sector, water users, academic institutions, etc., to provide information required by the database	• Annual Budget • Donor funding • Private Sector • Service Fees

Strategic Option 1: Creating an enabling environment								
Strategic Objective: ***To operationalize water governance in support of Basin-wide water resources development and management.***								
Strategy 1.4: Promote broad-based stakeholder representation and participation in water resources planning, development and management								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
a) Promote dialogue within and across the National water sectors.	• Integrate/develop a Basin and National Integrated Communication Strategy on sustainable water management (water scarcity, WC/WDM, IWRM, etc.). • Workshop the Strategy with relevant institutions / industry to promote their responsibility towards the environment and water. • Host joint initiatives with Sector Departments to educate the public, politicians, water users and District Officers on sustainable water management in the Watershed/District. • Link the Strategy to the National Water Departments' Communication Strategies.	• Communication strategy developed and implemented. • Minutes of regular meetings between sectors on sustainable water management available.	medium	• NELSAP and Kagera Secretariat to organise regular water dialogues where Member States organisations involved in the water sector can share ideas	• Ministries responsible for water, working in partnership with the Global Water Partnership to establish national water partnerships and forums for water sector institutions to share ideas and experiences	• Districts and local watershed institutions and water boards to participate in national dialogues	• Global Water Partnership can take a lead in establishing national water partnerships who would participate in national dialogues	• Annual Budget • Donor funding • Private Sector • Service Fees
b) Comprehensive public engagement and participation.	• Undertake a review of all existing water forums. • Consolidate water forums, where appropriate, into District/Watershed Liaison Committee on Water. • Identify the roles and responsibilities of Sector Departments on these Committees. • Sector Departments to nominate and appoint member(s) to participate on the Committee. • Sector Departments to ensure information transfer from the Committee to Basin IMS	• Register of Water Forums. • Consolidated water forums operational and meeting minutes available. • Formal process for information transfer in place. • Information from water forums transferred to the Basin IMS	Short	• NELSAP and Kagera Secretariat (if established) to develop a framework, road map and strategy for stakeholder participation in the basin	• Ministries responsible for water and other water sector Ministries to give effect to public participation processes and information portals	• Local watershed institutions including water boards to promote public participation in their areas of operation and contribute information to the portal	• NGO, Private Sector, water users, academic institutions, etc., to play a vital role in promoting public participation and act as a watch dog to ensure that Government delivers on its mandate on public participation as well as provide information to the portal	• Annual Budget • Donor funding • Private Sector • Service Fees
c) Awareness-raising on sustainable water management and ecological systems, WC/WDM options, water and health, etc., through various media.	• Use/improve/develop materials on water availability, water supply, water efficiency measures, water quality matters, etc. and distribute through various media (newspapers, radio, websites, weather reports, sign boards, rates accounts). • Review and further develop IWRM in school curricula. • Develop and promote campaign on IWRM, water resource protection, and climate change. • Campaign to link water quality with health and especially diarrhoea.	• Awareness raising information disseminated via various media forms. • IWRM included in school curricula. • Number of media events held to raise awareness on the value of water conservation and on climate change. • Campaigns successfully implemented	Short	• NELSAP and Kagera Secretariat (if established) should develop a communication and awareness strategy for the basin	• Ministries responsible for Water working with its partner ministries to establish national public awareness mechanism for water resources management including media awards for reporting on water resources	• Local watershed institutions, water board, etc., to support public awareness initiatives in their areas of operation	NGO, Private Sector, water users, academic institutions, etc., and in Media in particular to support awareness initiatives in water resources Management	• Annual Budget • Donor funding • Private Sector • Service Fees

Strategic Option 1: Creating an enabling environment								
Strategic Objective: ***To operationalize water governance in support of Basin-wide water resources development and management.***								
Strategy 1.4: Promote broad-based stakeholder representation and participation in water resources planning, development and management								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
d) Effective change management	• Established Change Management Task Teams to facilitate change management on lifestyle change projects. • Establish dialogue/forums with communities to explain the need for change and explain improved methodologies; provide support and guidance for change.	• Successful change of lifestyle and traditional practices to more sustainable practices of resource utilisation.	Short - medium	• NELSAP and Kagera Secretariat (if established) should develop a change management framework and strategy for the basin.	• Ministries responsible for lifestyle/traditional practices requiring change- type projects to establish national change management strategies and task teams.	• Local watershed institutions, water board, etc., to support the change management task teams.	NGO, Private Sector, water users, academic institutions, etc., and in Media in particular to support change management processes.	• Annual Budget • Donor funding • Private Sector • Service Fees

Strategic Option 1: Creating an enabling environment								
Strategic Objective: ***To operationalize water governance in support of Basin-wide water resources development and management.***								
Strategy 1.5: Ensure adequate funding for water resources management.								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
a) Water Tariffing	• Determine real costs of water for identified sectors (including capital costs, O&M, etc.). • Determine willingness to pay and ability to pay for water in identified sectors. • Draft tariff structure for all sectors, including basic water use, incentives and mechanisms of payment. • Engage users on tariff structure. • Adjust and implement tariff structure.	• Water tariff structure implemented • Level of financial sustainability of infrastructure achieved though tariffing.	Short / Medium	• NELSAP and Kagera Secretariat (if established) to develop framework and strategies and guidelines for setting tariffs for water services for all sectors	• Water Ministries in all governments to enact national legislation on tariffs for various water services.	• Districts, watershed institutions and water boards to promote payment of water services and ensure that these are affordable to local areas	• NGO, Private Sector, water users, academic institutions, etc., to support the payment of water services and to ensure that the tariffs charged are pro-poor	• Annual Budget • Donor funding • Private Sector • Service Fees
b) Efficient planning of donor aid	• Provide a register of Donor funded projects • Establish criteria for Donor funding projects so that these are in line with National and Basin development plans.	• Donor aid supports basin development projects • Integrated and publicly available reporting on projects, progress, and benefits derived from donor-funded projects.	Short	• NELSAP and Kagera Secretariat (if established) to carry out donor mapping and establish donor coordination mechanisms for the Basin and identify critical areas of need	• Member States to institute donor effectiveness mechanisms and prioritise donor funding for BDP	• Districts, watershed institutions and water boards to provide necessary impact information required by donors and contribute to the identification of areas of need.	• NGO, Private Sector, water users. Academic institutions, to promote donor effectiveness including playing the role of watchdog.	• Annual Budget • Donor funding • Private Sector • Service Fees
c) Public-Private Partnerships	• Use/improve/develop a national protocol for Public-Private Partnerships (PPP) (e.g. criteria, incentives, structuring, etc.). • Identify types of projects suitable for PPPs. • Advertise for PPPs.	• Number of applications received from businesses to establish PPPs. • Number of PPPs applications approved. • Number of PPPs established successfully.	Short/ Medium	• NELSAP and Kagera Secretariat (if established) to identify areas and programmes for PPP and develop framework for PPP involvement in the water sector.	• Member States to put in place necessary enabling environment for PPP including enabling legislation	• Districts, watershed institutions and water boards to support PPP involvement including providing information required.	• NGO, Private Sector, water users, academic institutions, etc., to support PPP initiatives.	• Annual Budget • Donor funding • Private Sector • Service Fees
d) Sustainable funding for water resources development (O&M and, as far as possible, capital cost)	• Seek government commitment to the funding of projects with favourable feasibility reports. • Implement mechanisms to ring-fence income from projects towards O&M	• Income from water supplied, relative to costs.	Medium	• NELSAP and Kagera Secretariat to carry out basin wide sustainable funding assessment for water development • To facilitate the development of basin wide strategies and guidelines for sustainable funding for water resources development	• Member States to carryout national assessment for water resources development • To develop strategies and guidelines water sustainable funding water resources development • To put in place structures for sustainable funding for water resources development • To budget for sustainable water resources development	• Watershed Authorities, Districts, to implement programmes and plans for sustainable funding for water resources development	NGO, Private Sector, water users. Donors, academic institutions, etc., to support and promote programmes for sustainable funding for water resources development, through information provision, research and funding	• Annual Budget • Donor funding • Private Sector • Service Fees
e) Sound financial management	• Undertake periodic cost: benefit assessments for projects. • Establish regular auditing procedures. • Develop and implement an International Financial Reporting	• Annual Financial Audits	Short	• NELSAP and Kagera Secretariat to develop basin wide strategies and guidelines for sound financial	• Member States to develop national strategies and guidelines for sound financial management	• Watershed Authorities, Districts, to implement sound financial management for	NGO, Private Sector, water users. Donors, academic institutions, etc., to support and promote sound	• Annual Budget • Donor funding • Private Sector • Service Fees

Strategic Option 1: Creating an enabling environment								
Strategic Objective: *To operationalize water governance in support of Basin-wide water resources development and management.*								
Strategy 1.5: Ensure adequate funding for water resources management.								
Target	Activities	Indicators (M&E)	Timeframe	Responsibility				Costing & Funding Sources
				Basin Scale	National Scale	Local Scale	Other Stakeholders	
	System (IFRS)			management • To put in place and implement sound financial management for their programmes	• Member States to put in place structure (policy, legal and institutional) for sound financial management • To implement sound financial management for their programmes	this programmes	financial management through information provision, research and funding	

Strategic Option 2: Basin Water Management

Strategic Objective: ***Effective management and control of Basin water resources and users.***

Strategy 2.1: Integrated and coordinated transboundary Basin water management

Target	Activities	Indicators (M&E)	Timeframe	Responsibility				Costing & Funding Sources
				Basin Scale	National Scale	Local Scale	Other Stakeholders	
a) Basin management Agreement	• Draft/finalise an Agreement. • Negotiate and amend. • Sign Agreement.	• Signed Kagera Basin Agreement for the non-navigational use and management of the Kagera River Basin.	Short/ medium	• NELSAP to facilitate the development of the Kagera Management Agreement	• Member States to contribute, negotiate and sign the Kagera Management Agreement and ensure its implementation and enforcement	• Watershed Authorities, Districts, to contribute information required for the development, negotiation and implementation of the Kagera Management Agreement especially its implementation at local level	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support Kagera Basin management Agreement development and implementation by providing information and funding	• Annual Budget • Donor funding • Private Sector • Service Fees
b) River Basin Organisation	• Appoint a task team to establish the RBO. • Establish the RBO Secretariat.	• Established competent Task Team • Kagera River Basin Organisation established. • KRBO implementing functions defined. • Kagera River accepted as a shared resource and responsibilities outlined.	Medium	• NELSAP and Kagera Secretariat to facilitate the establishment of the Kagera RBO	• Member States to negotiate, agree and legislate the establishment of the River Basin Organization and to support the RBO financially and managerially once it is established	• Watershed Authorities, Districts, to contribute to the development of the Kagera RBO and to contribute to the operations of the RBO once established	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support the process of the establishment of the RBO as well as support it during its operation once established.	• Annual Budget • Donor funding • Private Sector • Service Fees
c) Regional cooperation	• Establish discussion forums with EAC, NBI, SADC	• Discussion minutes • Regular regional engagement with Basin representation.	Medium	• NELSAP to facilitate the development of a framework for cooperation for the Kagera River Basin	• Member States to promote regional cooperation by creating an enabling environment (policy, legal and institutional) at national level • Each Member State to establish a coordination unit.	• Watershed Authorities, Districts, to promote regional cooperation by ensuring that their activities are in line with the regional framework for cooperation	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support regional cooperation through information sharing and aligning activities to it	• Annual Budget • Donor funding • Private Sector • Service Fees
d) Coordinated management	• Establish formal responsibilities in National Ministries for coordination and cooperation with other member States.	• Responsibilities are mainstreamed within Ministries	Medium	• NELSAP to facilitate the development of strategies and guidelines aimed at ensuring coordinated management for the basin	• Member States to put in place measures (policy, legal, institutional and other) at national level in line with the framework, strategies and guidelines for the basin	• Watershed Authorities, Districts, to support coordinated management of the river basin by ensuring that local operations are aligned with basin coordination frameworks.	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support coordinated management of the river basin through research information dissemination and funding	• Annual Budget • Donor funding • Private Sector • Service Fees
e) Control of transboundary impacts	• Agree on monitoring requirements and identify key points in Basin for monitoring. • Develop Basin response protocol for transboundary impact. This to include notification, joint response	• Key points monitoring schedule in place • Impact response protocol tested, developed, updated/maintained for implementation. • Institutions committed to monitoring	Short/ Medium	• NELSAP and Kagera Secretariat to coordinate the identification of transboundary impacts for the basin	• Member States identify impacts at national level that are of transboundary nature	• Watershed Authorities, Districts, to identify local impacts that are likely to contribute to	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support the control	• Annual Budget • Donor funding • Private Sector • Service Fees

Strategic Option 2: Basin Water Management								
Strategic Objective: ***Effective management and control of Basin water resources and users.***								
Strategy 2.1: Integrated and coordinated transboundary Basin water management								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
	mechanisms (prevention, control, and mitigation) and rehabilitation. • Regular maintenance/upgrade of early warning systems and response protocol framework and associated infrastructure.	and follow-up action are in place.		• To develop strategies, guidelines and action plans for the control of transboundary impacts in the basin	• Develop national strategies and guidelines for the control of national impacts that are of transboundary nature in line with the basin strategies and guidelines.	transboundary impacts • To implement the control of local impacts with transboundary dimensions	of transboundary impacts through information provision, research and funding	
f) Trade-offs facilitation and conflict prevention and resolution	• Improve/develop a clear trade-offs facilitation and conflict prevention and resolution protocol to address trade-offs and conflicts at national and Basin scale. • Ensure capacity of institutions to implement protocol. • Mainstream the conflict management protocol within current initiatives and plans to manage basin water	• Protocol for conflict resolution include in Basin Agreement. • Institutional mechanisms for conflict resolution established.	Short	• NELSAP and Kagera Secretariat to facilitate the development of a framework, protocol and guidelines for conflict resolution mechanisms for the basin	• Member States to contribute to the development of conflict resolution mechanism in the basin • Member States to put in place structure (policy, legal and intuitional) at national level to promote conflict resolution	• Watershed Authorities, Districts, develop conflict resolution mechanisms at local levels • To contribute and promote conflict resolution mechanism	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support the conflict resolution processes through information provision, research and funding	• Annual Budget • Donor funding • Private Sector • Service Fees
g) Management of transboundary bulk water infrastructure	• Establish Basin infrastructure management unit (capacity) in RBO. • Develop asset management system (refer strategy 2.4) • Develop protocol for member states of transboundary infrastructure for operation and maintenance including dam safety and operating rules.	• Transboundary Infrastructure Management Unit operational.	Medium	• NELSAP and Kagera Secretariat to facilitate the identification of significant transboundary bulk water infrastructure • NELSAP and Kagera Secretariat to develop strategies and guidelines for the management of significant transboundary bulk water infrastructure including dam synchronization programmes	• Member States to develop national strategies and guidelines for the management of significant transboundary bulk water infrastructure • Member States to put in place structure (policy, legal and institutional) for the management of transboundary water infrastructure including dam synchronization programmes	• Watershed Authorities, Districts, to put in place local structures for the management of significant transboundary bulk water infrastructure	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support and promote the management of significant transboundary bulk water infrastructure through information provision, research and funding	• Annual Budget • Donor funding • Private Sector • Service Fees
h) Resource sharing	• Agreement on seasonal and total acceptable Basin impacts (use of quantity and impact on quality of the total water resource) • Agree on levels of individual country impacts. • Agree and standardise on acceptable levels of environmental impact.	• Resource sharing agreements in place	Short	• NELSAP and Kagera Secretariat to develop basin wide strategies for resources sharing	• Member States to develop national strategies and guidelines for resources sharing • Member States to put in place structure (policy, legal and institutional) for resources sharing • To put in place and implement programmes for resources sharing	• Watershed Authorities, Districts, to put in place and implement local structures, plans and programmes for resource sharing	• NGO, Private Sector, water users. Donors, academic institutions, etc., to strategies, guidelines, programmes and plans for resources sharing, through information provision, research and funding	• Annual Budget • Donor funding • Private Sector • Service Fees

Strategic Option 2: Basin Water Management								
Strategic Objective: ***Effective management and control of Basin water resources and users.***								
Strategy 2.2: Watershed Management by Basin countries								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
a) Watershed management	• Confirm definition and delineation of Watersheds throughout the Basin States. • Create watershed management institutions for appropriate groupings of watersheds.	• Basin watersheds delineated. • Watershed Institutions operational (note that the number of institutions established will be constrained by staffing capacity)	Short	• NELSAP and Kagera to coordinate the development of strategies and guidelines for watershed management	• Member States to delineate watersheds and develop national laws, institutions, strategies and guidelines for water shed management	• Watershed Authorities, Districts, to develop and implement local watershed management programmes	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support watershed management programmes through the provision of research, information, indigenous knowledge and funding	• Annual Budget • Donor funding • Private Sector • Service Fees
b) Watershed strategies	• Draft Watershed-specific development strategies to support the overall Basin Vision.	• Watershed strategies operational and being implemented.	Medium	• NELSAP and Kagera Secretariat to develop framework for the development of basin wide watershed strategies	• Member States to develop guidelines for the development of watershed strategies • Member States to approve watershed management strategies in line with basin wide structures	• Watershed Authorities, Districts, to develop and implement local watershed strategies in line with national and basin wide strategies	• NGO, Private Sector, water users. Donors, academic institutions, etc., to contribute to the development and implementation watershed strategies through the provision of research, information, indigenous knowledge and funding	• Annual Budget • Donor funding • Private Sector • Service Fees
c) Watershed stakeholder coordination	• Define levels of stakeholder engagement and identify stakeholders and levels of stakeholders in each watershed (strategic, government, sector, community, NGO, etc.). • Establish stakeholder forums and communication structures for each watershed. • Establish basin catchment flood management councils/committees.	• Structure for stakeholder engagement defined. • Stakeholder forums operational and in communication with watershed institutions • Stakeholder analysis and profile • Stakeholder dialogue: minutes and proceedings	Short	• NELSAP and Kagera Secretariat to facilitate the development of a framework, road map and guidelines for basin wide stakeholder coordination	• Member States to develop national stakeholder coordination structures	• Watershed Authorities, Districts, to put in place local structures for the stakeholder coordination at local levels in line with national and basin structures	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support stakeholder coordination mechanisms and processes through the provision of research, information, indigenous knowledge and funding	• Annual Budget • Donor funding • Private Sector • Service Fees
d) Hydrology	• Regularly update the Mike Basin surface water hydrological model for the Basin and sub-Basins or the Nile Basin DSS as applicable • Update groundwater models as applicable • Improve understanding of groundwater abstraction and use	• Updated Kagera Mike Basin Model or Nile Basin DSS as applicable or groundwater models • Updated key hydrological information	Short/ Medium	• Custodianship of Basin model and information • NELSAP and Kagera Secretariat to facilitate the development of basin wide guidelines for hydrological	• Provide supporting information • Member States to develop national guidelines for hydrological assessment and to carry out hydrological	• Provide supporting information • Watershed Authorities, Districts, etc. to carry out hydrological assessments at local level	• NGO, Private Sector, water users. Donors, academic institutions, etc., to hydrological assessment through the provision of	• Annual Budget • Donor funding • Private Sector • Service Fees

Strategic Option 2: Basin Water Management								
Strategic Objective: ***Effective management and control of Basin water resources and users.***								
Strategy 2.2: Watershed Management by Basin countries								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
				assessment and to carry out basin wide hydrological assessments	assessments in their border		research, information, indigenous knowledge and funding	
e) Integrated Basin-level planning	• Prepare basin-level water resources assessment. • Prepare integrated water resources utilization and management plan for effective water supply. • Provide support and direction for implementation of the plan.	• Integrated basin-level water resources utilization and management plan developed.	Short	• Develop integrated basin-level plan • Provide support for nations for the implementation of the plan • Monitor the implementation of the plan • NELSAP and Kagera Secretariat to facilitate the development a monitoring mechanism for the implementation of the Kagera IWRM Plan	• Fine-tune national strategies, plans and programmes towards basin-levels strategies, plans and programmes • Provide support to basin authorities during planning • Implement basin-level plans and programmes • Provide feedback to basin authorities • Member States to implement the Kagera IWRM Plan	• Participate during implementation of basin-level plans • Watershed Authorities, Districts, to develop integrated catchment management plans in line with the Kagera IWRM Plan	• Multi-national and donor organizations to provide technical and economic support during basin-level planning and implementation • NGO, Private Sector, water users. Donors, academic institutions, etc., to support the implementation of the Kagera IWRM Plan through information	Initial cost of development integrated basin-level plan USD 4 million will be required. Funding sources include basin countries, multi-national development agencies, donor organization. • Annual Budget • Donor funding • Private Sector • Service Fees •
f) Sector water use planning	• For each country compile Basin specific sector targets, strategies and plans for water use, water demand, discharge, and WC/WDM. • Conduct situation and needs analyses of the sectors, to assess feasible options for each of the sectors, to recommend efficient options for each of the sectors. • Prepare a strategic master plan for implementation of the identified options above.	• Sectoral situation needs identified. • Sectoral strategic water master plans developed. • Sector planning strategies being implemented.	Short/ Medium	• NELSAP and Kagera Secretariat to facilitate the development of a framework and protocol s for determining sectoral water requirements and requirements of sectoral water master plans.	• Member States to develop and implement sector plans • Member States to develop national strategies ad guidelines for the determining sectoral water requirements and development sectoral waster master plans. • To put in place structure (policy, legal, institutional, etc.) for the regulation of the water master plans	• Watershed Authorities, Districts, to promote sector planning at local level • Watershed Authorities, Districts, etc., to contribute towards the determination of sectoral water requirements and development of sectoral water master plans. • To implement and regulate the sectors against the water master plans.	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support sector planning through the provision of research, information, indigenous knowledge and funding • NGO, Private Sector, water users. Donors, academic institutions, etc., to support the strategies and programmes for the containment of water contamination, through the provision of information, research, indigenous knowledge and	• Annual Budget • Donor funding • Private Sector • Service Fees

Strategic Option 2: Basin Water Management								
Strategic Objective: ***Effective management and control of Basin water resources and users.***								
Strategy 2.2: Watershed Management by Basin countries								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
							funds.	
g) Water allocation	• Water allocation schedule in place by sub-Basin and regularly updated • Harmonised process to process applications for water use	• Water allocation schedules • Processed water use applications	Short/ Medium	• NELSAP and Kagera Secretariat to facilitate the development of basin wide strategies and guidelines for water allocation	• Member States to develop national guidelines and strategies for water allocation • Implement national water allocation programmes • To put in place structure (policy, legal, institutional, etc.) for water allocation	• To implement catchment water allocation programmes	• NGO, Private Sector, water users. Donors, academic institutions, etc., to water allocation programmes through the provision of research, information, indigenous knowledge and funding	• Annual Budget • Donor funding • Private Sector • Service Fees
h) Water conservation / water demand management	• Develop WC/WDM targets for Watersheds • Develop sector guidelines to improve WC/WDM	• Targets set, monitored and reported on.	Medium	• NELSAP and Kagera Secretariat to facilitate the development of basin wide water conservation and water demand management strategies and guidelines	• Member states to develop national water conservation and demand management strategies, guidelines, and plans in line with basin wide guidelines and strategies	• Watershed Authorities, Districts, to develop and implement local water conservation and demand management plans, programmes and strategies	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support stakeholder coordination mechanisms and processes through the provision of research, information, indigenous knowledge and funding	• Annual Budget • Donor funding • Private Sector • Service Fees

Strategic Option 2: Basin Water Management								
Strategic Objective: ***Effective management and control of Basin water resources and users.***								
Strategy 2.3: Effective monitoring, assessment and information management for adequate management and allocation of water								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
a) Information requirements	• Prepare an Information and Communications Technology (ICT)-based protocol for data and information collection, archiving and updating. Link to strategy 1.3., which addresses the repository MIS.	• ICT-based data and information protocol • Database update mechanism	Medium	• Provide and collect data and information • Host ICT-based database • NELSAP to facilitate the identification of basin wide information formation requirement	• Provide and collect data and information • Member States to identify national information requirement that will contribute to basin wide information needs	• Provide and collect data and information • Watershed Authorities, Districts, to identify local information requirements that would contribute to basin wide information needs	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support the identification of basin wide information requirement through information provision, research and funding	• Annual Budget • Donor funding
b) Monitoring networks for climate, surface water and groundwater.	• Determine baseline monitoring needs for meteorological data, flow data and water storage • Determine annual and long-term changes in surface water flows and lakes and groundwater storage • Determine water quality (surface and groundwater) • Prepare and implement a water resource monitoring programme (surface water, groundwater for integrated) for the entire Basin but prioritising areas of high intensity use	• Data captured, stored and reported • Trends in meteorological data, flows, groundwater and lake levels, and water quality • An annual status report • Provisions for protecting against over-use and quality deterioration	Short/ Medium/ Long term	• Develop monitoring scheme	Develop monitoring scheme	• Watershed Authorities, Districts, to put in place, operate and maintain networks for climate, surface and groundwater	• NGO, Private Sector, water users. Donors, academic institutions, etc., to the establishment, operation and maintenance of monitoring networks for climate, surface and groundwater through information provision, research and funding	• Annual budget, • Donor funding for future monitoring networks upgrade • Private Sector • Service Fees

Strategic Option 2: Basin Water Management								
Strategic Objective: ***Effective management and control of Basin water resources and users.***								
Strategy 2.4: Asset management and operation of Basin water Infrastructure								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
a) Improvements to asset management practices	• Assess management practices according to industry standards • Develop asset management improvement plan	• Asset management maturity assessment completed • Asset management improvement plan compiled	Short	• NELSAP and Kagera to facilitate the development of basin wide guidelines for the improvement of asset management practices	• Member States to develop national guideline to improve national asset management practise • Member States to put in place and implement structures (legal, institutional, etc.) to improve asset management practices	• Watershed Authorities, Districts, to implement plans to improve asset management practices	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support plans to improve asset management practices, through information provision, research and funding	• Asset management maturity assessment and recommendations done for each country separately =USD$R40k x 4 = **USD$160 000** – 3 months • Annual Budget • Donor funding • Private Sector • Service Fees
b) Asset Management Plan and Maintenance Plan	• Compile asset management plan • Compile maintenance plans for all asset types including budget and skills requirements • Estimate costs • Ring-fence funding	• Asset management plans compiled. • Maintenance Plans implemented • Annual audit results	Medium/ Long	• NELSAP and Kagera to facilitate the development of a basin wide framework and guideline for operation and maintenance plan	• Member States to develop national operation and maintenance plans in line with the basin wide	• Watershed Authorities, Districts, to develop local operation and maintenance plans in line with national and basin wide plans	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support operation and maintenance plans through information provision, research and funding	• Asset management plan USD$180 000 – 6 months • Maintenance plans for all asset types USD$90 000 – 2 months • Annual Budget • Donor funding • Private Sector • Service Fees
c) Asset Inventory and status	• Compile asset inventory/register/database. • Verify asset status, replacement value, remaining life, condition	• Asset inventory complete	Short/ Medium	• NELSAP and Kagera Secretariat to facilitate the development of a framework for basin wide asset inventory • NELSAP and Kagera Secretariat to facilitate the development of guidelines for basin wide asset status assessment	• Determine National Protocol and prioritising criteria. • Develop inventory/database • Where no local capacity conduct activity • Member States to develop asset inventory structures and guidelines at national levels in line with framework for the basin • Member States to put in place and implement national structures for asset status	• Conduct activity • Watershed Authorities, Districts, to carry out asset inventories at local levels • Watershed Authorities, Districts, to carry out asset status at local levels	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support asset inventory activities through information provision, research and funding • NGO, Private Sector, water users. Donors, academic institutions, etc., to support asset status through information provision, research and funding	• Inventories of water infrastructure have been prepared in each country. The condition of all infrastructure would need to be re-assessed if 5 years beyond previous assessment. New scheme data will also need to be added to existing inventories. • Estimate of assessment USD$1.2million – 12 months • Annual Budget • Donor funding • Private Sector • Service Fees

Strategic Option 2: Basin Water Management								
Strategic Objective: ***Effective management and control of Basin water resources and users.***								
Strategy 2.4: Asset management and operation of Basin water Infrastructure								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
d) Refurbishment of assets on the basis of priority	• Identify and prioritise assets for refurbishment and maintenance • Raise funds and refurbish prioritised assets. • Write off assets that do not warrant refurbishment.	• Prioritisation list in place • Assets on refurbishment schedule	Medium	• NELSAP and Kagera to facilitate the development of guidelines for basin wide identification of priority assets	• Member States to put in place and implement structure guidelines and procedures for the identification of national priority assets	• Watershed Authorities, Districts, to carry out prioritization of key assets at local level using national and basin wide guidelines	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support identification of key priority asset through information provision, research and funding	• Budget USD$60 000 – 2 months (Engineer + supervisor + travel) • Annual Budget • Donor funding • Private Sector • Service Fees
e) A mechanism to ensure maintenance and efficient utilisation of water supply facilities and distribution networks established	• Undertake an audit of the status of water supply facilities (source supply systems, pumps and pipelines, reservoirs and water treatment works • Ensure that funding for maintenance is provided. • Prioritise, plan and implement repairs and refurbishment so that systems operate at optimal capacity.	• Funding for maintenance is ring-fenced as a priority by national governments • Increased coverage • Increased participation of community members in maintenance of water resources and facilities • Reduction of inoperative state of water supply facilities (at present at over 30% across most Basin countries)	Medium	• NELSAP and Kagera to facilitate the development of guidelines for basin wide maintenance and utilisation	• Member States to develop national guidelines for mechanisms for ensuring maintenance and efficient utilization of water supply facilities and distribution networks	• Watershed Authorities, Districts, to implement mechanisms to ensure maintenance and efficient utilization of water supply facilities and distribution networks	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support mechanisms to ensure maintenance and efficient utilization of water supply and facilities and distribution networks, through information provision, research and funding	• Annual Budget • Donor funding • Private Sector • Service Fees
f) Dam safety	• Register of dams considering ICOLD guidelines • Dam safety investigations • Introduce dam safety protocols (operation and maintenance)	• Dam safety register in place • Reports on dam safety investigations • Dam safety protocols in place, implemented and audited.	Medium/ Long	• NELSAP and Kagera Secretariat to develop basin wide Dam Safety programmes	• Member States to develop national dam safety programmes • Member States to put in place structures (legal, institutional, etc.) for dam safety	• Watershed Authorities, Districts, to implement dam safety programmes, with oversight from National Departments	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support dam safety programmes, through information provision, research and funding	• Annual Budget • Donor funding • Private Sector • Service Fees

Strategic Option 3: Water Supply and Sanitation								
Strategic Objective: ***To provide improved access for various water uses and sanitation facilities***								
Strategy 3.1: Rural domestic water supply								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
a) Water supply from surface and ground water sources	• Identify surface water and groundwater resources in the basin including rivers, streams, springs and lakes. Estimate safe yield of groundwater for different aquifers. • Investigate the technical, environmental and socio-economic feasibility of development of identified water sources. • Promote conjunctive use of surface and groundwater. • Develop self-help approaches to accessing water sources - boreholes, rainwater harvesting, local abstraction. • Prepare construction designs of feasible water supply systems. • Implementing projects and commissioning. • Operate and manage the water supply systems. • Expand the capacity of water treatment plants	<u>Overall Indicators</u> • Water supply coverage • Enhanced water supply service delivery especially in terms of per capita water supplied and water quality. • Functioning water supply facilities. <u>Specific Indicators</u> • Feasibility studies and design projects conducted. • Projects implemented. • Operations and maintenance plans implemented.	Short/ Medium/ Long	• Harmonize nations efforts towards surface water sources identification and utilization with basin-level visions and strategies • Provide support towards implementation of projects • NELSAP / Kagera Secretariat to conduct selected basin wide studies on potential water supply from sources	• Perform activities at a national scale • Provide technical and economic support for local authorities • Monitor progress • Evaluate effectiveness of plans and projects towards addressing the target • Member States to conduct and develop national studies on potential water supply from various sources	• Perform activities • Operate and manage water supply schemes • Watershed Authorities, Districts, to identify and develop potential water supply from various sources at local level	• NGOs, CBOs, donor organizations, etc. to provide technical and economic support for local authorities to implement plans and projects • Participate in all activities under the framework of the strategies and programmes developed • NGO, Private Sector, water users. Donors, academic institutions, etc., to support the identification and development of potential water supply from various sources through information provision, research and funding	<u>Medium Term</u> – **USD 120 million** <u>Long Term</u> – **USD 170 million** To compensate for the non-functionality of water systems additional 50% of the above cost (**USD 145 million**) is required. Funding sources include basin countries, multi-national development agencies, donor organization. • Annual Budget • Donor funding • Private Sector Service Fees
b) Rain Water Harvesting (RWH)	• Investigate opportunities for the implementation of rainwater harvesting. • Select appropriate roof tank designs and disseminate these to the public • Introduce a supply chain for appropriate material for rainwater harvesting – guttering, roof tank etc. Seek subsidies for materials. • Establishment of laws for rainwater harvesting tanks .	• Degree of self-sufficiency • Number of roof tanks in use.	Short/ Medium	• Provide support and direction towards implementation of projects • NELSAP and Kagera Secretariat to facilitate the development guidelines for water supply alternatives	• Provide technical and economic support for local authorities • Member States to develop guidelines for water supply alternatives at national level in line with basin guidelines	• Perform activities • Watershed Authorities, Districts, to develop local guidelines for water supply alternatives in line with national and basin wide guidelines. • Implement water supply alternatives at local level	• NGOs, CBOs, etc. to provide technical and economic support for local authorities to implement projects • NGO, Private Sector, water users. Donors, academic institutions, etc., to support the development of water supply alternatives through information provision, research and funding	<u>Medium Term</u> – **USD 5 million** <u>Long Term</u> – **USD 15 million** Funding sources include basin countries, multi-national development agencies, donor organization. • Annual Budget • Donor funding • Private Sector • Service Fees
c) Self-sufficiency in remote communities and households	• Introduce a household water treatment and storage programme	• Households attending satisfactorily to own needs through the programme	Short/ Medium	• NELSAP and Kagera Secretariat to facilitate the development guidelines for self-sufficiency in remote communities and households	• Member States to develop national strategies and guidelines for self-sufficiency for remote communities and households • Member States to	• Watershed Authorities, Districts, to implement programmes for self-sufficiency for remote communities and households	• NGO, Private Sector, water users. Donors, academic institutions, etc. To support and implement programmes for self-sufficiency for	• Annual Budget • Donor funding • Private Sector • Service Fees

Strategic Option 3: Water Supply and Sanitation								
Strategic Objective: ***To provide improved access for various water uses and sanitation facilities***								
Strategy 3.1: Rural domestic water supply								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
					develop and implement programmes for self-sufficiency for remote communities and households		remote communities and households	

Strategic Option 3: Water Supply and Sanitation								
Strategic Objective: ***To provide improved access for various water uses and sanitation facilities***								
Strategy 3.2: Urban water supply and treatment to potable standards								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
a) Water supply from surface water, groundwater or rainwater for identified cities, towns or urban areas	• Undertake a needs assessment to establish the levels of service within all cities, towns and larger settlements. • Determine water requirements - both current and for a 30-year time horizon. • Assess the role of planned new infrastructure and how this can be used to optimise benefits to people. • Evaluate, design and implement urban water supply systems for prioritised towns. • Operate and manage the water supply systems. • Monitor overall water quality of the water supply systems.	<u>Overall indicators</u> • Water supply coverage • Enhanced water supply service delivery especially in terms of per capita water supplied and water quality. • Functioning water facilities <u>Specific Indicators</u> • Water Resource and Water Services plans for all cities, towns, and formal villages • Urban water supply feasibility studies and design projects conducted. • Urban water supply projects implemented. • Increased access to potable water.	Short/ Medium/ Long	• Harmonize nations' efforts towards water sources identification and utilization with basin-level visions and strategies • Provide support towards implementation of projects	• Perform activities at a national scale • Provide technical and economic support for water utilities • Monitor progress • Evaluate effectiveness of plans and projects towards addressing the target	• Water supply utilities to perform activities • Operate and manage water utilities	• NGOs, CBOs, donor organizations, etc. to provide technical and economic support for water utilities to implement plans and projects	<u>Medium Term</u> – **USD 100 million** <u>Long Term</u> – **USD 125 million** To compensate for the non-functionality of water systems additional 50% of the above cost (**USD 112 million**) is required. Funding sources include basin countries, multi-national development agencies, donor organization. Further, the utilities can finance a portion of the cost from their revenue. • Annual Budget • Donor funding • Private Sector Service Fees
b) Kigali water supply and wastewater *Subset of Target a) based on priority. Other specific targets for cities/towns can be developed*	• Integrated long-term water supply planning for Kigali • Construct wastewater treatment facilities.	• <u>Water master plan</u> • <u>Water supply schemes implemented.</u> • <u>Wastewater treatment works constructed and operational in Kigali.</u>	Short	Not applicable	• Rwanda to ensure the construction of adequate Kigali wastewater treatment plants	• Watershed Authorities, Districts, to support the construction of the Kigali wastewater treatment plan	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support the construction of the Kigali wastewater treatment plant through information provision, research and funding	• <u>Annual Budget</u> • <u>Donor funding</u> • <u>Private Sector</u> • <u>Service Fees</u>
c) Treatment technology development	Plan and implement effective and efficient water treatment facilities.	• Number of urban water utilities with efficient treatment facilities.	Medium/ Long	• Provide support towards implementation of projects. • NELSAP and Kagera Secretariat to facilitate the development of basin wide guidelines for technology development.	• Provide technical and economic support for water utilities • Monitor progress • Evaluate effectiveness of plans and projects towards addressing the target • Member States to develop national guidelines for technology development in line with basin	• Water supply utilities to perform activities. • Watershed Authorities, Districts, to implement technology development.	• NGOs, CBOs, donor organizations, etc. to provide technical and economic support for water utilities to implement plans and projects • NGO, Private Sector, water users. Donors, academic institutions, etc., to support the technology	<u>Medium Term</u> – **USD 20 million** <u>Long Term</u> – **USD 20 million** Funding sources include basin countries, multi-national development agencies, donor organization. Further, the utilities can finance a portion of the cost from their revenue.

Strategic Option 3: Water Supply and Sanitation								
Strategic Objective: ***To provide improved access for various water uses and sanitation facilities***								
Strategy 3.2: Urban water supply and treatment to potable standards								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
					guidelines • To put in place structures (policy, legal, institutional, etc.) for technology development		development through information provision, research and funding	• Annual Budget • Donor funding • Private Sector Service Fees
d) *Prepare and implement Business Plans and O&M Plans for water utilities*	• Prepare business plans for utilities to realize self-sufficiency and sustainability. • Implement business plans that were developed. • Prepare and implement effective O&M plans for water utilities.	• Number of utilities with effective business plans implemented. • Number of utilities with operations and maintenance plans	Medium/ Long		• Provide technical and economic support to water supply utilities	• Water supply utilities to perform activities	• Provide technical and economic support to water supply utilities	The task will require initial investment of **USD 50 million** and additional yearly costs that can be financed by the water utilities. The initial O&M development cost can be included as part of project implementation while the running cost shall be covered by the utilities. • Annual Budget • Donor funding • Private Sector • Service Fees
e) *Regulation of effluent discharge*	• Develop discharge permit system, with the inclusion of a discharge tariffing system. • Ensure that new developments include wastewater treatment plans. • Issue discharge permits. • Monitor discharge according to permits and standards.	• Discharge permit system developed and implemented. Discharge permits issued and monitored. • Municipalities, water utilities, industries and mines with no wastewater/effluent quality problems.	Short/ Medium	• NELSAP and Kagera Secretariat to facilitate the development of basin wide guidelines and alignment of regulation.	• Member States to develop national regulation and discharge permit systems. • To put in place structures (policy, legal, institutional, etc.) for regulations. • Monitoring municipalities, water supply utilities, industries and mines in relation to the quality of effluent discharged. • Provide technical and economic support to municipals, water supply utilities, industries and mines to address effluent quality issues.	• Watershed Authorities, Districts, to implement regulations at local levels. • Municipals, water utilities, industries and mines to perform activities.	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support the development, implementation and enforcements of regulations through information provision, research and funding. • NGOs, CBOs, donor organizations, etc. to provide technical and economic support.	Wastewater quality monitoring will require a yearly cost of **USD 5 million** per year (**USD 100 million** during the project period). Municipals and water utilities can finance the cost from their revenue. • Annual Budget • Donor funding • Private Sector • Service Fees
f) *Good water planning practices entrenched*	• All Departments of Water to prioritise planning functions • Develop/integrate guidelines for good planning practices for water supply and treatment • Support the implementation of	• Good practice procedures followed in the planning, design, implementation, and O&M of water supply systems and treatment works	Medium	• NELSAP and Kagera Secretariat to facilitate the development of guidelines for good practice water	• Member States to put in place national guidelines for good water planning • To put in place	• Watershed Authorities, Districts, to implement good practice water planning	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support good	• Annual Budget • Donor funding • Private Sector • Service Fees

Strategic Option 3: Water Supply and Sanitation								
Strategic Objective: ***To provide improved access for various water uses and sanitation facilities***								
Strategy 3.2: Urban water supply and treatment to potable standards								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
	good planning practices for the provision of water supply and treatment services			planning at basin scale • To put in place monitoring mechanisms and plans for good practice water planning	structures (policy, legal, institutional, etc.) for good practice water planning		practice water planning through information provision, research and funding	

Strategic Option 3: Water Supply and Sanitation

Strategic Objective: ***To provide improved access for various water uses and sanitation facilities***

Strategy 3.3: Providing improved sanitation facilities

Target	Activities	Indicators (M&E)	Timeframe	Responsibility				Costing & Funding Sources
				Basin Scale	National Scale	Local Scale	Other Stakeholders	
a) *Improved sanitation facilities*	• Develop and implement "waterless" domestic effluent treatment. • Plan and implement improved sanitation facilities. • Plan, develop and implement domestic wastewater treatment options.	Overall Indicator • Coverage of improved sanitation (%) Specific Indicators • Improved sanitation facilities implemented and maintained. • Effective treatment of domestic wastewater. • Reduction % in water borne diseases. • Improved discharge water quality.	Medium/ Long	• Provide support and direction towards implementation of projects • NELSAP and Kagera Secretariat to facilitate the development of basin wide guidelines for improved sanitation facilities	• Provide technical and economic support for local authorities • Monitor progress • Evaluate effectiveness of plans and projects towards addressing the target • Member States to develop national guidelines for improves sanitation facilities in line with basin wide guidelines	• Perform activities • Watershed Authorities, Districts, to implement programmes for improves sanitation facilities at local level	• NGOs, CBOs, etc. to provide technical and economic support for local authorities to implement projects • NGO, Private Sector, water users. Donors, academic institutions, etc., to support the development of improved sanitation facilities through information provision, research and funding	Medium Term – **USD 100 million** Long Term – **USD 130 million** To compensate for the non-functionality of sanitary systems additional 25% of the above cost (**USD 58 million**) is required. • Annual Budget • Donor funding • Private Sector • Service Fees
b) *Support health and hygiene initiatives from a water perspective*	• Develop WASH programme. • Roll-out WASH programme to Watersheds and stakeholder engagements	• 5% Reduction in water-linked illnesses per year • Conduct periodic Knowledge, Attitude and Practice (KAP) surveys to assess the effectiveness of health and hygiene promotion delivered.	Medium/ Long	• Provide support and direction towards implementation of projects • NELSAP and Kagera Secretariat to facilitate the development of basin wide guidelines for the promotion of health and hygiene	• Provide technical and economic support for local authorities • Monitor progress Evaluate effectiveness of plans and projects towards addressing the target • Member States to develop national guidelines for the promotion of health and hygiene in line with basin wide guidelines To promote health and hygiene and national level	• Perform activities • Watershed Authorities, Districts, to promote health and hygiene at local levels	• NGOs, CBOs, etc. to provide technical and economic support for local authorities to implement projects • NGO, Private Sector, water users. Donors, academic institutions, etc., to support the promotion of health and hygiene through information provision, research and funding	A yearly cost of **USD 5 million** will be required • Annual Budget • Donor funding • Private Sector • Service Fees

Strategic Option 3: Water Supply and Sanitation

Strategic Objective: ***To provide improved access for various water uses and sanitation facilities***

Strategy 3.4: Urban, industrial and mining wastewater treatment.

Target	Activities	Indicators (M&E)	Timeframe	Responsibility				Costing & Funding Sources
				Basin Scale	National Scale	Local Scale	Other Stakeholders	
a) Setting wastewater quality standards *Refer Strategy 5.4 for overall water quality standards and guidelines*	• Prepare chemical and biological water quality standards, standardised for all Basin countries. • Develop treatment/ wastewater standards for waste streams (domestic effluent, industrial, mine, etc.), standardised for all Basin countries. • Monitor discharges.	• Wastewater/effluent quality standard and guideline prepared.	Short	• Perform activity in participation with nations • NELSAP and Kagera Secretariat to facilitate the development of basin wide standards for wastewater quality	• Perform activity in line with national and basin-level visions • Member States to develop national standards for wastewater quality • To put in place structure (policy, legal, institutional etc.) for enforcing standards for wastewater quality	• Municipals, water supply utilities, industries and mines to participate during quality standard and guidelines preparation • Watershed Authorities, Districts, to monitor the enforcement of standards at local levels	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support the development and enforcement of standard through information provision, research and funding	To prepare wastewater quality standards and guidelines a cost of **USD 350,000** is required. • Annual Budget • Donor funding • Private Sector Service Fees
b) Selection of technologies and providing of facilities	• Review situation with regard to existing facilities. • Plan and implement wastewater/effluent treatment facilities with adequate pre-planning so that WWTWs do not become overloaded. • Operate and maintain wastewater/effluent treatment facilities	• Number of municipalities, urban water utilities, industries and mines with efficient treatment facilities. • All wastewater generated is appropriately treated. • Water quality remains within guidelines.	Medium/ Long	• Provide support towards implementation of projects • NELSAP and Kagera Secretariat to facilitate the development of basin wide guidelines for technology development.	• Provide technical and economic support for municipals, water supply utilities, industries and mines • Monitor progress • Evaluate effectiveness of plans and projects towards addressing the target • Member States to develop national guidelines for technology development in line with basin guidelines. • To put in place structures (policy, legal, institutional, etc.) for technology development. • To develop facilities.	Municipals, water utilities, industries and mines to perform activities • Watershed Authorities, Districts, to implement technology development To develop facilities.	• NGOs, CBOs, donor organizations, etc. to provide technical and economic support • NGO, Private Sector, water users. Donors, academic institutions, etc., to support the technology and facility development through information provision, research and funding.	<u>Medium Term</u> – **USD 60 million** <u>Long Term</u> – **USD 80 million** Funding sources include basin countries, multi-national development agencies, donor organization. Further, municipals and water utilities can finance the cost from their revenue. • Annual Budget • Donor funding • Private Sector • Service Fees

Strategic Option 4: Livelihoods and Socio-economic development								
Strategic Objective: ***To develop and manage water resources to serve social and economic development in the Basin.***								
Strategy 4.1: Water demand of intensified, modernised agricultural and aquaculture developments								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
a) Rain-fed agriculture management	• Research indigenous approaches to rainwater management. • Provide a list of technologies (including rainwater management technologies) and practical handbook for teaching and dissemination of approaches. • Evaluate the basin's rainwater resource potential at catchment scale – including the future state. • Implementation of approaches to rainwater harvesting by community members. • Implementation of approaches to terrace farming • Prepare a strategic action plan for sustainable implementation of rainwater harvesting and treatment by community members and institutions within the Basin.	• Lowered vulnerability to climate change and improved productivity of farms due to improved water balance • Rainwater potential – current and future • Inventory of existing and potential rainwater management technologies • Protocol for managing rainwater • % of households and institutions engaged in rainwater harvesting • % of households and institutions depending on rainwater as one of their water sources • Terrace farming projects introduced • Increased demand for facilitation to harvest rainwater	Short/ medium	• NELSAP and Kagera Secretariat to develop strategies and guidelines for rainwater management	• Member States to identify develop national strategies guidelines and strategies for rainwater management	• Watershed Authorities, Districts, etc., to implement rainwater management at local level	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support rainwater management programmes through the provision of information, research, indigenous knowledge and funds	• Annual Budget • Donor funding • Private Sector • Service Fees
b) Runoff water harvesting (also see strategy 3.1 – Rainwater harvesting for rural domestic use)	• Evaluate existing and potential runoff farming practices – in terms of their ability to increase productivity and sustain the environmental integrity. • Design tank storage systems suited to (i) roof water harvesting for domestic use, and (ii) harvesting of surface runoff for homestead farming. • Evaluate economic viability, technological feasibility and social acceptability of alternative runoff harvesting technologies (e.g. spate irrigation, damming, surface and underground tanks etc.)	• Technology is proven and designs readily available for implementation. • Roof water tanks installed on 20% of homesteads. • Small businesses established to support construction and installation of rainwater tanks • Runoff harvesting potential • Inventory of runoff technologies for crop, livestock and fish farming • Runoff farming economics	Short/ medium	• NELSAP and Kagera Secretariat to develop strategies and guidelines for rainwater harvesting	• Member States to identify develop national strategies guidelines and strategies for rainwater harvesting	• Watershed Authorities, Districts, etc., to implement programmes for rainwater harvesting at local level	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support rainwater harvesting programmes through the provision of information, research, indigenous knowledge and funds	• Annual Budget • Donor funding • Private Sector • Service Fees
c) Irrigation and drainage	• Develop the Basin's irrigation master plan in which lands best suited to irrigation are defined and a long term irrigation development plan put forward for discussion with stakeholders. Opportunity to be linked to needs. • Existing irrigation schemes evaluated and indicated improvements implemented. • Plan for the expansion of irrigation within the limitations of Basin water use. • Seek optimal use of irrigation water through crop selection, improved irrigation methods and WC/WDM • Implement planned irrigation projects - as per the proposed development programme	• Irrigation development plan (Basin master plan) in place • Irrigation preparatory studies and feasibility studies completed. • Area under irrigation and drainage provided • Efficiency of water use • New irrigation projects implemented	Medium/ long-term	• NELSAP and Kagera Secretariat to develop strategies and guidelines for irrigation	• Member States to identify develop national strategies guidelines and strategies and schemes for irrigation • To put in place structures (policy, legal, institutional, etc.,) for irrigation	• Watershed Authorities, Districts, etc., to implement programmes	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support irrigation programmes and projects through the provision of information, research, indigenous knowledge and funds	• Annual Budget • Donor funding • Private Sector • Service Fees

Strategic Option 4: Livelihoods and Socio-economic development								
Strategic Objective: ***To develop and manage water resources to serve social and economic development in the Basin.***								
Strategy 4.1: Water demand of intensified, modernised agricultural and aquaculture developments								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
	(construction of dams and introduction of more diversion. • Refer to the list of proposed implementation projects.							
d) Water storage structures	• Prepare an inventory of the capacities of water storage structures in the Basin – both existing and planned. (See also strategies cataloguing and assessing infrastructure – strategy 2.4(c) • Implement dams recommended in the Basin Development Plan • Identify further opportunity and plan for dams in areas suited for irrigation and where there is proven demand and manageable impact. • Develop a handbook on small farm dams and small-scale water storage structures for use by local farmers. Refer to the list of proposed implementation projects.	• Dams constructed on basis of need and optimal use. • Handbook on small dams is available and distributed by agricultural extension officers • Capacity and yield of water storage structures accurately determined. • Inventory of water storage structures	Short/ Medium	• NELSAP and Kagera Secretariat to develop guidelines for water storage structures	• Member States to identify develop national guidelines for water storage structure	• Watershed Authorities, Districts, etc., to implement programmes for rainwater water storage structures	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support programmes for water storage structures through the provision of information, research, indigenous knowledge and funds	• Annual Budget • Donor funding • Private Sector • Service Fees
e) Marketing outlets and export	Support the following initiatives from a water perspective: • Develop market strategies, including export, for irrigated crops to increase the economic water productivity – hence address poverty and enhance investment capacity in the long run. • Promote market linkages for non-irrigated crops e.g. bananas, cassava. Promoting non-irrigated crops eases pressure on the water resource. • Promote agro-value chain development. • Improve market infrastructure including those related with market information.	• Crop marketing strategies developed. • Profitable market linkages identified. • Agro-value chains developed. • Market infrastructure implemented. • Export potential determined. • Export strategy developed. • Export barriers reduced.	Medium	• NELSAP and Kagera Secretariat to develop guidelines for marketing outlets.	• Member States to identify and develop national guidelines for marketing outlets • To put in place structures (policy, legal, institutional, etc.,) for marketing outlets.	• Watershed Authorities, Districts, etc., to implement marketing outlets programmes.	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support marketing outlets programmes and projects through the provision of information, research, indigenous knowledge and funds.	• Annual Budget • Donor funding • Private Sector • Service Fees
f) Providing water for livestock production	Support the following initiatives from a water perspective: • Ensure that livestock gets its due share of the water resource • Implement small dams and water points as a strategy to enhance livestock farming. • Implement spring protection though development of guidelines, monitoring and enforcement • Integrate livestock farming with irrigation and crop production	• Numbers of livestock • Levels of conflict between crop farmers and stockholders	Medium	• NELSAP and Kagera Secretariat to develop strategies and guidelines for livestock Support plans.	• Member States to develop national strategies and guidelines for livestock. • To put in place structures (policy, legal, institutional, etc.,) for livestock programmes.	• Watershed Authorities, Districts, etc., to put in place livestock programmes.	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support livestock programmes and projects through the provision of information, research, indigenous knowledge and funds.	• Annual Budget • Donor funding • Private Sector • Service Fees

Strategic Option 4: Livelihoods and Socio-economic development								
Strategic Objective: ***To develop and manage water resources to serve social and economic development in the Basin.***								
Strategy 4.1: Water demand of intensified, modernised agricultural and aquaculture developments								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
g) *Aquaculture and sustainable fisheries*	Support the following initiatives from an integrated water resources perspective: ▪ Promotion and training on appropriate aquaculture and fisheries practices ▪ Enhancing development and transfer of appropriate aquaculture and fisheries technologies ▪ Development of aquaculture and fish production value chains to enhance flow of inputs (seed, feed, technology, capital), products and information between the different actors	▪ Number of farmers trained. ▪ Number of technologies developed and transferred to farmers. ▪ Number of linkages created between different actors in the value chain.	Short/ Medium	• NELSAP and Kagera Secretariat to identify sustainable aquaculture programmes in the basin and a Fisheries Management Strategy ▪ To develop strategies and guidelines for sustainable aquaculture in the basin.	• Member States to identify sustainable aquaculture programmes and fisheries projects at national level. ▪ To develop national strategies guidelines and structures for aquaculture and fisheries at national level in line with basin strategies.	• Watershed Authorities, Districts, etc., to identify sustainable aquaculture programmes and projects at local level • To put in place local strategies, guidelines and structures for sustainable aquaculture in line with national and basin ones. ▪ To implement sustainable aquaculture programmes and projects.	▪ NGO, Private Sector, water users. Donors, academic institutions, etc., to support sustainable aquaculture strategies programmes and projects through the provision of information, research, indigenous knowledge and funds.	• Annual Budget • Donor funding • Private Sector ▪ Service Fees
h) *Fish-production habitat management*	Support the following initiatives from an integrated water resources perspective: ▪ Identify fish-production habitats. ▪ Develop strategy to protect fish-production habitats from impacts e.g. water quality, severe flow regime change. ▪ Develop mitigation plan to prevent impacts to fish production habitats and from fish production habitats.	▪ Fish-production habitats clearly identified and protected.	Medium / Long	• NELSAP and Kagera Secretariat to facilitate the identification of fish production habitats. • To facilitate the development of basin wide fish production habitat management strategies and guidelines.	• Member States to identify fish production habitats. • To develop national fish production habitat management strategies and guidelines and put in place structures for the implementation of these in line with basin wide strategies.	• Watershed Authorities, Districts, etc., to identify local fish production habitats. • To develop local strategies and guidelines for fish production habitat management in line with national and basin wide strategies. • To implement local fish production habitat management programmes and initiatives.	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support fish production habitat management programmes and strategies through the provision of information, research, indigenous knowledge and funds	• Annual Budget • Donor funding • Private Sector • Service Fees

Strategic Option 4: Livelihoods and Socio-economic development								
Strategic Objective: ***To develop and manage water resources to serve social and economic development in the Basin.***								
Strategy 4.2: Address the high demand for new water infrastructure to meet regional energy security.								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
a) Energy efficiency and conservation	• Contribute to the compilation of a detailed hydropower refurbishment programme to enhance existing capacity.	• Refurbishment programme developed and implemented. • Existing capacity enhanced.	Short	• NELSAP and Kagera Secretariat to facilitate the development of strategies and guidelines for energy efficiency and conservation at basin scale. • To put in place monitoring mechanisms and plans for energy efficiency and conservation.	• Member States to put in place national guidelines and strategies and guidelines for energy efficiency and conservation development. • To put in place structures (policy, legal, institutional, etc.) For energy efficiency and conservation.	• Watershed Authorities, Districts, etc., to put in place plans, programmes and projects for energy efficiency and conservation. •	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support energy efficiency and conservation plans, programmes and projects through the provision of information, research, indigenous knowledge and funds.	• Annual Budget • Donor funding • Private Sector • Service Fees
b) Integrated energy planning	• Establish need and the potential to meet energy needs. • Provide an energy plan based on sound decision-making criteria (Include options for smaller hydro development projects and other renewables such as geothermal)	• Decision-making Criteria developed. • Integrated Energy plan developed for the basin.	Short	• NELSAP and Kagera Secretariat to facilitate the development of an integrated energy plan at the basin scale.	• Member States to put in place national programmes, guidelines and strategies for integrated energy planning. • To develop national strategies guidelines and structures for integrated energy planning at national level in line with basin strategies.	• Watershed Authorities, Districts, etc., to implement programmes and projects for integrated energy planning.	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support strategies programmes and projects on integrated energy planning through the provision of information, research, indigenous knowledge and funds.	• Annual Budget • Donor funding • Private Sector • Service Fees
c) Contribute towards sound energy decision-making	From a water perspective, contribute towards: • Modern Regional Regulatory and Legal frameworks • Energy Policies supporting regional development Develop a good understanding of energy generation costs and benefits. Develop a good understanding of the implications of multipurpose objectives of providing both hydropower and irrigation water. Develop in-house expertise In this regard.	• In-house expertise in hydropower development • Legal and regulatory frameworks developed. • Energy policies for regional development developed. • Inter-regional trade policies refined.	Medium	• NELSAP and Kagera Secretariat to facilitate the development of guidelines for good sound decision making at basin scale. • To put in place monitoring mechanisms and plans for sound decision making.	• Member States to put in place national guidelines for sound decision making. • To put in place structures (policy, legal, institutional, etc.) • Sound decision making.	• Watershed Authorities, Districts, to implement sound decision making.	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support sound decision making through information provision, research and funding.	• Annual Budget • Donor funding • Private Sector • Service Fees
d) Energy resources developed	• Provide a guideline for the development of energy resources, notably focussing first on smaller-scale, local hydropower • Implement hydropower schemes as identified in the BDP • Refurbish small hydropower plants in disrepair (typically Maziba in Uganda)	• Local energy resources developed. • Hydropower schemes designed and implemented according to the BDP • Schemes refurbished • Diversified sources of energy available	Medium	• NELSAP and Kagera Secretariat to facilitate the development of strategies and guidelines for local energy resources development at basin scale. • To put in place	• Member States to put in place national guidelines and strategies and guidelines for local energy development. • To put in place structures (policy, legal, institutional,	• Watershed Authorities, Districts, etc., to implement local energy resources development.	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support local energy resources development through the provision of information,	• Annual Budget • Donor funding • Private Sector • Service Fees

Strategic Option 4: Livelihoods and Socio-economic development								
Strategic Objective: ***To develop and manage water resources to serve social and economic development in the Basin.***								
Strategy 4.2: Address the high demand for new water infrastructure to meet regional energy security.								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
	Refer to Development Plan for detailed programmes and projects.			monitoring mechanisms and plans for local energy resources development.	etc.) for local energy resources development.		research, indigenous knowledge and funds.	
e) Energy pricing, subsidy policies, and private sector participation	• From a water perspective, contribute towards the development of pricing strategies that will result in reasonable uptake of electric energy in rural areas • Incorporate mechanisms to allow for foreign investment in the energy sector.	• Pricing strategies developed and implemented. • Public Private Partnerships for the energy sector established.	Medium	• NELSAP and Kagera Secretariat to facilitate the development and alignment of energy pricing policies in the basin. • To put in place monitoring mechanisms for energy pricing, subsidy policies, and private sector participation.	• Member States to put in place national energy pricing and subsidy policies, and guidelines for private sector participation, in line with basin policies. • To enforce energy pricing and subsidy policies. • To put in place structures (policy, legal, institutional, etc.) for private sector participation.	• Watershed Authorities, Districts, etc., to implement energy pricing and subsidy policies. • Watershed Authorities, Districts, etc., to put in place plans, programmes and projects for private sector participation.	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support energy pricing and subsidy policies through the provision of information, research, indigenous knowledge and funds.	• Annual Budget • Donor funding • Annual budget • Private Sector • Service Fees

Strategic Option 4: Livelihoods and Socio-economic development								
Strategic Objective: ***To develop and manage water resources to serve social and economic development in the Basin.***								
Strategy 4.3: Address the demand for water in sustainable mining and industrial development								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
a) Water for diversification and growth	• Prepare a list of those development opportunities that will require water. This will entail a sectoral debate on priorities. Seek to ensure that good opportunities are not lost through poor choices in the allocation and use of water. • Link water for irrigation to the additional water required for agro-processing. • Support sustainable mining and industrial development initiatives that align with development and diversification priorities.	• Number of mines and industries supplied with water • Share of water allocated to industries and mines	Short	• NELSAP and Kagera Secretariat to facilitate the identification of diversification and growth initiatives in the basin. • To facilitate the development of basin wide strategies and guidelines for diversification and growth.	• Member States to identify national diversification and growth initiatives. • To develop national strategies and guidelines for diversifications and growth. • To put in place structures (policy, legal, institutional, etc.) to promote diversification and growth.	• Watershed Authorities, Districts, etc., to implement strategies for diversification and growth at local level.	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support initiatives for diversification and growth through the provision of information, research, indigenous knowledge and funds.	• Annual Budget • Donor funding • Private Sector • Service Fees
b) Sustainable mining	• Develop guidelines for sustainable development of mines and industries for the Kagera Basin • Evaluate water use applications for mining and industrial developments to ensure sustainable water use practices. • Undertake water quality monitoring (refer to strategy 5.4)	• Proof of sustainable practices at industries and mines • Approvals for new mining and industrial developments based on sustainability plans.	Medium/ Long	• NELSAP and Kagera to facilitate the development of sustainable mining strategies and guidelines in the basin.	• Member States to develop national sustainable mining strategies and guidelines in line with basin wide strategies. • To put in place structures (policy, legal, institutional, etc.) for sustainable mining. • Evaluate water use applications for mining and industry	• Watershed Authorities, Districts, etc., to develop local strategies and guidelines for the sustainable mining in line with national and basin ones.	• NGO, Private Sector, water users. Donors, academic institutions, etc., to sustainable mining strategies guidelines and programmes, through the provision of information, research, indigenous knowledge and funds.	• Annual Budget • Donor funding • Private Sector • Service Fees
c) Containment of water contamination	• Develop a Basin protocol for mine water management. • Set water quality objectives for mine water discharge incl. pH and sediment load. • Introduce equipment appropriate to artisanal mining operations for the separation and washing of mineral deposits. • Mines to develop environmental management plans and closure rehabilitation plans, including establishing rehabilitation funds.	• Mine water quality acceptable for discharge into rivers. • Water quality objectives set for discharge of mine water. • Protocols developed and regulated. • EMP, rehabilitation plans and proof of funding submitted for approval.	Medium/ Long	• NELSAP and Kagera to facilitate the development of protocols for determining water quality objectives and response plans at the basin scale.	• Member States to develop national strategies ad guidelines for the containment of water contamination in line with basin strategies and guidelines. • To put in place structure (policy, legal, institutional, etc.) for the regulation of containment of water contamination.	• Watershed Authorities, Districts, etc., to develop local strategies and guidelines for the containment of water contamination. • To implement water contamination containment strategies and programmes at local level in line with national and basin ones.	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support the strategies and programmes for the containment of water contamination, through the provision of information, research, indigenous knowledge and funds.	• Annual Budget • Donor funding • Private Sector • Service Fees
d) Water resources development and management strategies implemented	• Initiate development of a mechanism to ensure implementation of bylaws and regulations in place for controlling pollution and destruction of water resources to increase quality and availability	• Increased reported cases of illegal utilisation • Decreased pollution especially, by industries and decreased acts of water resources degradation, such as undertaking economic activities within restricted meters • Improved efficiency in water utilisation – as execution of bylaws will permit safe recycling of water e.g. from	Medium	• NELSAP and Kagera to facilitate the development of protocols for determining water quality objectives and response plans at the basin scale.	• Member States to develop national strategies ad guidelines for the containment of water contamination in line with basin strategies and guidelines.	• Watershed Authorities, Districts, etc., to develop local strategies and guidelines for the containment of water contamination. • To implement	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support the strategies and programmes for the containment of water contamination,	• Annual Budget • Donor funding • Private Sector • Service Fees

Strategic Option 4: Livelihoods and Socio-economic development								
Strategic Objective: *To develop and manage water resources to serve social and economic development in the Basin.*								
Strategy 4.3: Address the demand for water in sustainable mining and industrial development								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
		industries to aquaculture • Improved water flows			• To put in place structure (policy, legal, institutional, etc.) for the regulation of containment of water contamination.	water contamination containment strategies and programmes at local level in line with national and basin ones.	through the provision of information, research, indigenous knowledge and funds.	

Strategic Option 4: Livelihoods and Socio-economic development								
Strategic Objective: ***To develop and manage water resources to serve social and economic development in the Basin.***								
Strategy 4.4: Support sectoral conservation and development Basin initiatives from a water resource perspective								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
a) Sustainable farming practises, technologies, and development initiatives	• From a water perspective, collaboratively support and encourage sustainable farming practices, technologies, and development initiatives	• Close interaction and Basin-wide initiatives for the collaborative support of sustainable farming practices and technologies • Increased use of sustainable farming practices and technologies • Basin wide cooperation with regard to water-related development initiatives.	Short/ Medium/ Long	NELSAP and Kagera Secretariat to facilitate the identification of development initiatives in the basin.	• Member States to identify national development initiatives in line with the basin development initiatives.	• Watershed Authorities, Districts, etc., to identify local development initiatives in line with national and basin ones.	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support sus-tainable farming practices and technologies through the provision of information, research, indigenous knowledge and funds.	• Annual Budget • Donor funding • Private Sector • Service Fees
b) Water-related initiatives for tourism	• From a water perspective, engage with and collaboratively support Kagera tourism initiatives.	• Basin wide cooperation with regard to tourism initiatives that is related to Basin water resources.	Short/ Medium/ Long	• NELSAP and Kagera to facilitate the identification of basin wide tourism initiatives. • To develop basin wide strategies for basin wide tourism.	• Member States to identify national tourism initiatives. • To develop national tourism strategies in line with basin ones.	• Watershed Authorities, Districts, to identify local tourism initiatives. • To develop local tourism strategies, programmes and projects in line with national and basin strategies.	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support tourism initiatives through the provision of information, research, indigenous knowledge and funds.	• Annual Budget • Donor funding • Private Sector • Service Fees
c) Increased trade within Basin	• From a water perspectives, support initiatives that promotes increased trade within the Basin	• Basin-wide cooperation with regard to increased Basin trade.	Short/ Medium/ Long	• NELSAP and Kagera Secretariat to facilitate the development of a basin wide trade strategy and guidelines	• Member States to put develop trade strategies, protocols and structures	• Watershed institutions, Districts, etc., to support basin trade strategies	• NGOs, Private Sector, consumer, water users, etc. to support basin trade strategies and programmes through the provision of information, research, indigenous knowledge and funds	• Annual Budget • Donor funding • Private Sector • Service Fees
d) Feasible transport and navigation initiatives	• From a water perspective, support feasible initiatives for river and lake navigation that provides improved transport and supports increased opportunities for trade in the Basin.	• Basin-wide cooperation with regard to navigation and transport	Short/ Medium/ Long	• NELSAP and Kagera Secretariat to facilitate the development of basin wide transport and navigation strategies and guidelines.	• Member States to develop transport and navigation strategies and guidelines in line with basin wide strategies. • Put in place necessary structure (policy, legal, etc.,) for transport and navigation.	• Watershed institutions, Districts, etc., to implement transport and navigation strategies and programmes in line with national and basin ones.	• NGOs, Private Sector, consumer, water users, etc. to support basin transport and navigation strategies through the provision of information, research, indigenous knowledge and funds.	• Annual Budget • Donor funding • Private Sector • Service Fees

Strategic Option 5: Environment Protection, Land and Disaster Management								
Strategic Objective: ***To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices.***								
Strategy 5.1: Management and protection of natural resources								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
a) *Environmental Flows*	• Establish Basin-wide principles for Environmental Flows. • Develop Basin-wide process for determining Environmental Flow Requirements (EFR). • Calculate EFRs at identified points in Basin. • Develop Operating rules for Basin to ensure EFRs achieved • Monitor rivers for Environmental Flows and for changes to river structure and function	• EFR methodology approved and being used in the Basin. • EFRs are calculated at Basin monitoring Points • EFRs achieved at Basin monitoring points	Medium / Long	• RBO manage process for determining EFR process. • RBO develop operating rules • Implement • NELSAP and Kagera Secretariat to coordinate the development of basin wide environmental flow strategies and guidelines	• Member States to participate in development of process. • Implement • Member States to develop national environmental flow strategies, policies, legislation and programmes in line with basin wide strategies • Implement environmental flow programmes	• Watershed Authorities, Districts, etc., to implement environmental flows at local levels	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support the implementation of environmental flows through research, information , advocacy and funding	• Annual Budget • Donor funding • Private Sector • Service Fees
b) *Conservation and protection of rivers, lakes and marshlands*	• Determine and implement environmental flows to aid in the protection and sustainable management of rivers, lakes and wetlands. • Prioritise key rivers, lakes and wetlands. • Implement buffer zones around lakes, wetlands and rivers to inhibit erosion and water quality and habitat degradation. • Promotion of appropriate management of marshlands to optimize their ecological and economic functions. • Management of catchment area to reduce siltation and enhance buffering and filtering function. • Promotion of watershed management practices that focus on preventing negative environmental impacts of human activity.	• Basin-wide management plan addressing environmental, socio-economic and land use issues that affect water quality and availability. • Basin-wide Environmental Flow Assessment Study completed. • Prioritized water resources conserved. • Basin-wide wetland management strategy incorporating buffer zone guidelines developed and regulated. • Catchment areas managed appropriately. • Agreements of joint management of water resources in place and implemented. • Eco-economic management plans developed and regulated for marshlands. • Appropriate watershed management practices implemented in Basin countries.	Medium	• Basin-wide marshland / catchment area management strategy development. • Sector Departments to sensitize on use of appropriate watershed management practices. • NELSAP and Kagera Secretariat to coordinate the development of basin wide strategies and guidelines for the conservation of rivers, lakes and wetlands, guidelines for the ecological and economic management and utilisation of marshlands...	• National marshland / catchment management strategies. • Development of agreements on joint management of water resources. • Member States to development national strategies, laws and guidelines for the conservation of rivers, lakes and marshlands in line with basin strategies and guidelines and to optimize the ecological and economic functions of marshland management.	• Training in marshland / catchment management by national departments. • Capacity building on joint management of water resources. • Watershed Authorities, Districts, to development national strategies, laws and guidelines for the conservation and appropriate management of rivers, lakes and wetlands in line with national and basin wide strategies and guidelines.	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support the appropriate management, conservation and protection and protection of rivers, lakes and wetlands through research, information, indigenous knowledge and funding.	• Annual Budget • Donor funding • Private Sector • Service Fees
c) Protection of aquifers, springs and wells	• Mapping of key aquifers • Monitoring water use from aquifers and applying controls and restrictions if drawdown threatens other users or sustainability. • Establish wellhead protection zones and protocols. • Develop guidelines for well construction and management, including well siting, proper well construction. • Establish water users Associations. • Raise awareness on groundwater development and management. • Develop a database of wells and	• Clean and safe water supplied. • Aquifers sustainable managed and maintained. • Updated database available of wells and recharge.	Medium	• NELSAP and Kagera Secretariat to coordinate the development of basin wide strategies and guidelines for the conservation of groundwater • To develop basin wide monitoring programmes for the conservation and protection of groundwater	• Member States to develop national legislation, strategies and guidelines for the conservation and protection of groundwater in line with basin measures	• Watershed Authorities, Districts, etc., to develop and implement local programmes for conservation and protection of groundwater	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support the conservation and protection of groundwater measures through research, information, indigenous knowledge and funding	• Annual Budget • Donor funding • Private Sector • Service Fees

Strategic Option 5: Environment Protection, Land and Disaster Management								
Strategic Objective: ***To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices.***								
Strategy 5.1: Management and protection of natural resources								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
	recharge rates.							
d) Payment for ecosystem services with income used for ecosystem management	• Identification of ecosystem services. • Undertake costing of ecosystem services. • Establishment of mechanisms for payment for ecosystem services. • Sensitize stakeholders on payment for ecosystem services. • Develop an M&E system to monitor progress made on payment or ecosystem services.	• List of associated costs of ecosystem services developed and promoted. • Mechanisms or modalities for payment of ecosystem services established. • Stakeholders are aware of their responsibilities/roles on payment for ecosystem services. • M&E system on payment for ecosystem services in place.	Long	• NELSAP and Kagera Secretariat to coordinate the development of strategies and guidelines for the payment of ecosystems and services.	• Members States to develop national strategies and guidelines for the payment of ecosystems services in line with basin strategies and guidelines. • Basin countries mainstream payment for ecosystem services in their planning and budgeting process. • Administration – can consider moving responsibility to lower management levels when mature	• Watershed Authorities, Districts, etc., to support the payment of ecosystems and services at a local level.	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support payment of ecosystems and services through research, information and funding. • NGO Intermediaries can be contracted	• Annual Budget • Donor funding • Private Sector • Service Fees
e) SEA for the Basin	• Harmonised SEA guidelines kept updated and implemented. • Include SEA requirements into legislative processes.	• SEA guidelines harmonised and implemented.	Medium	• NELSAP and Kagera Secretariat to coordinate the development of SEA.	• Members States to coordinate harmonisation requirements. • Basin countries mainstream SEA processes.	• Watershed Authorities, Districts, etc., to support the SEA requirement	• NGO, Private Sector, water users, donors, academic institutions, etc., to support SEA requirement.	• Annual Budget • Donor funding • Private Sector • Service Fees

Strategic Option 5: Environment Protection, Land and Disaster Management								
Strategic Objective: ***To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices.***								
Strategy 5.2: Rehabilitation of degraded environments								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
a) Rehabilitation	• Identify and prioritise rivers/watersheds that are impacted by land-based pollution. • Develop a protocol to rehabilitate prioritised rivers/watersheds. • Develop an M&E system to monitor progress made in rivers/watersheds rehabilitated. • Implement protocol to rehabilitate prioritised rivers and watersheds. • Mining rehabilitation Refer to the development plan for initial identified projects.	• Number of rivers/watersheds prioritised for rehabilitation. • Number of rivers/watersheds successfully rehabilitated.	Medium / Long	• NELSAP and Kagera Secretariat to identify areas requiring rehabilitation in the basin. • To develop basin wide strategies and guidelines for the rehabilitation.	• Member States to identify national areas requiring rehabilitation. • Develop national strategies and guidelines for rehabilitation. • Implement rehabilitation programmes.	• Watersheds identify specific rehabilitation projects. • Watershed Authorities, Districts, etc., to develop local rehabilitation strategies and guidelines. • To identify rehabilitation areas, • To implement local rehabilitation programmes.	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support rehabilitation programmes through research, information and funding as well as participate in rehabilitation efforts.	• Annual Budget • Donor funding • Private Sector • Service Fees
b) Reforestation	Provide support from a water perspective for the following: • Identify areas of natural vulnerable to human pressure • Protection of all declared indigenous forest reserves • Develop basin wide guidelines for reforestation • Provide technology and tree seedlings to landholders for people-driven reforestation programme • Enforcement and monitoring • Integrate with forestry programme and with mining rehabilitation	• Area under natural forest that can be considered to provide goods and services (water, natural forest products including sustainable timber yields) • Area added to protection zones	Medium/ Long	• NELSAP and Kagera Secretariat to identify priorities and recommend approaches for reforestation in the basin	• Members States to identify areas and implement reforestation in the their countries	• Watershed Authorities, Districts, etc., to identify areas for reforestation in the their countries and to implement identifies reforestation programmes in the areas identified at national and basin levels	• Watershed Authorities, Districts, etc., to implement reforestation areas and to support reforestation programmes through information provision, research and funding	• Annual Budget • Donor funding • Private Sector • Service Fees
c) Mining	• Develop environmental standards of best practice for mining operations. • Include rehabilitation e.g. of denuded land, bank stability, acid mine drainage, etc. as part of the mine operations. • Require mines to establish a rehabilitation fund as part of operating costs, in order to finance the rehabilitation after closure. • Implementation of improved methods that increase the efficiencies of artisanal miners and reduce negative impacts on water quality (typically crushing, and washing of ore) • Integrate mining rehabilitation with forestry (plantation) development and with reforestation programmes.	• Best practice environmental standards are developed for the mining sector. • Mining operations are regulated against the best practice standards. • Rehabilitation of closed or abandoned mines takes place. • A rehabilitation fund for the environmental rehabilitation of mines is established and contributed to by the mines. • Improved water quality downstream of mining sites	Short/ Medium / Long	• NELSAP and Kagera Secretariat to coordinate the identification of mine rehabilitation projects at basin level	• Member States identify and implement mine rehabilitation projects in their countries	• Watershed Authorities, Districts, etc., identify and implement mine rehabilitation projects at a local level	• Watershed Authorities, Districts, etc., to support the identification and implementation of mine rehabilitation projects through research, information and funding.	• Annual Budget • Donor funding • Private Sector Service Fees

Strategic Option 5: Environment Protection, Land and Disaster Management								
Strategic Objective: ***To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices.***								
Strategy 5.3: Sustainable Land Management								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
a) Optimising water use through sustainable agriculture to avoid degradation and loss of productivity.	• Promote improved land care in rural areas • Develop land care programmes • Develop improved soil management techniques • Review crop types currently grown and advise farmers. • Identify areas more suitable to different crop types. • Encourage efficient irrigation practices to save water, reduce return flows, and reduce the leaching of fertilisers and pesticides.	• Land care programmes developed. • Provincial Crop matrix developed. • Number of farmers who were exposed to the Matrix. • Number of farmers who have successfully adapted their farming practices to grow more suitable and appropriate crops for their areas.	Short/ Medium	• NELSAP and Kagera Secretariat coordinate the development of basin wide strategies	• Member States to develop national strategies in line with basin strategies	• Watershed Authorities, Districts, etc., to develop local strategies in line with national and basin strategies.	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support the development of strategies through the provision of data, expert knowledge and funding	• Annual Budget • Donor funding • Private Sector • Service Fees
b) Extension officers	• Establish National units of extension officers. • Extension officers to inspect and promote improved land care practices.	• Units of extension officers established. • Number of Land care programmes rolled out per year.	Medium	• NELSAP and Kagera Secretariat to support the work of extension officers through training and coordination of information	• Member States to appoint, train and empower extension officers	• Watershed Authorities, Districts, etc., to appoint local extension offices and empower them through training	NGO, Private Sector, water users. Donors, academic institutions, etc., to cooperate with extension offices and support them through information gathering, training and funding	• Annual Budget • Donor funding • Private Sector • Service Fees
c) Improved forestry production and services	From a water perspective, engage with and collaboratively support the following initiatives for improved forestry production and services: • Programme for improved forest technologies (genetic material, species selection, and silviculture). • Degraded hill slopes and catchments are targeted for rehabilitation through protection forestry. • Programme encouraging homestead timber production - targeted to meet local needs with the aim of reducing pressure on indigenous woodlands. • Schools and community training and tree planting programmes. • Provision of forestry handbook for landholders. • Establishment of nurseries and provision of tree seedlings to	• Basin wide cooperation with regard to tree improvement technologies, • Landholders grow self-sufficiency in timber. • Recovery of remaining indigenous forest cover, with less destruction by wood-seekers. • Existing plantation forestry is maintained on a sustainable footing. • A village woodlot scheme is instituted in all countries. • Agroforestry is taught by agricultural extension officers and widely implemented. • A handbook on forestry practice is available to all landholders. • The role of forestry in catchment and water resource management is taught in schools. • Tree nurseries are established so that affordable seedlings are available to all farmers.	Short/ Medium	• NELSAP and Kagera Secretariat to facilitate the identification of forestry production areas and services. • To facilitate the development of strategies for forestry production and services at basin scale.	• Member States to identify forestry production areas and services. • To develop strategies and programmes for forestry production and services at national level in line with basin ones.	• Watershed Authorities, Districts, including village committees, local schools, to identify and implement forestry projects. • To implement and monitor forestry production and services strategies in line with national and basin ones.	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support forestry production and services strategies and programmes through the provision of information, research, indigenous knowledge and funds.	• Annual Budget • Donor funding • Private Sector Service Fees

Strategic Option 5: Environment Protection, Land and Disaster Management								
Strategic Objective: *To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices.*								
Strategy 5.3: Sustainable Land Management								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
	landholders. • Encouragement of agroforestry. • Research and publish information on the impact of trees in the water balance of the Kagera basin. • Research and publish information on the use of trees in the rehabilitation of catchments, prevention of soil erosion and improvements in infiltration.							

Strategic Option 5: Environment Protection, Land and Disaster Management								
Strategic Objective: ***To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices.***								
Strategy 5.4: Water Quality Management								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
a) Transboundary water quality objectives *Refer strategy 2.1* *Refer strategy 3.4*	• Identify transboundary monitoring points. • Determine the desired state of rivers at transboundary monitoring points. • Set water quality objectives that were derived from the desired state for transboundary monitoring points. • Design a monitoring programme to assess compliance to transboundary objectives (timeframe, methodology, responsibility, etc.).	• Formal bi-lateral agreements exist for transboundary rivers describing, inter alia, water quality objectives and standards • A basin-scale monitoring programme has been implemented to assess compliance to transboundary objectives • Availability of EIA reports for projects utilizing water resources	Short/ Medium	• Determine Basin standards. • NELSAP and Kagera Secretariat to coordinate the development of basin wide water quality objectives.	• Member States to develop national water quality objectives in line with basin wide objectives.	• Watershed Authorities, Districts, etc., to develop local water quality objectives in line with national and basin wide objectives.	• NGO, Private Sector, water users. Donors, academic institutions, etc., support the development of water quality objectives through research, information and funds.	• NGO, Private Sector, water users. Donors, academic institutions, etc.,
b) Water quality standards and guidelines	• Develop National Water Quality Guidelines for key water users (e.g. domestic, agricultural, industrial, recreation, aquatic ecosystems). • Design and implement routine water quality monitoring programmes to assess the state of rivers, lakes, and impoundments (monitoring objectives, sampling methodologies, frequencies, constituents, responsibility, etc.).	• Water quality standards/ guidelines in place. • Existence of guidelines on water quality standards and being used in water quality assessments.	Short	• Promote alignment of water quality guidelines in basin states. • NELSAP and Kagera Secretariat to coordinate the development of basin wide water quality standards.	• Member States to develop national water quality objectives in line with basin wide standards.	• Conduct monitoring. • Watershed Authorities, Districts, etc., to develop local water quality standards in line with national and basin wide objectives.	• NGO, Private Sector, water users. Donors, academic institutions, etc., support the development of water quality standards through research, information and funds.	• NGO, Private Sector, water users. Donors, academic institutions, etc.,
c) Point and Non-point source pollution	• Sensitize on appropriate land use management practices especially the application of fertilizers, irrigation, and pollution through return flows • Promote use of appropriate land use management practices to control erosion and sediment export (Refer Strategy 5.3) • Promote restoration of degraded watershed areas to reduce erosion and sediment export (Refer Strategy 5.3) • Develop cost effective pollution monitoring programmes (Refer Strategy 3.3) • Monitor compliance to effluent discharges standards and water quality objectives. • Provide adequate sanitation facilities (Refer Strategy 3.4)	• Mechanisms for pollution monitoring in place and practiced. • Levels of nutrients in rivers • Degraded watershed areas rehabilitated. • River sediment loads decreased. • River pathogen loads decreased. • Condition and capacity of waste water treatment works, and level of domestic pollution.	Short / medium	• NELSAP and Kagera Secretariat to develop basin wide strategies and guidelines for controlling non-point source pollution. • To develop a basin wide monitoring system for none point sources.	•Member States to develop and implement national strategies, guidelines and standards for controlling non-point source pollution.	• Watershed Authorities, Districts, etc., to develop and implement local non-point sources pollution in line with national and basin wide ones. • To monitor local non-point sources.	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support programmes for non-point source pollution through research, data provision and monitoring as well as advocate against non-point source pollution.	• NGO, Private Sector, water users. Donors, academic institutions, etc.,
d) Wastewater effluent quality monitoring for industries and mining	• Set up water quality laboratories. • Frequently conduct tests to investigate the quality of water produced. • Monitor overall water quality of the water discharge systems.	• Water utilities with no water quality problems. • Regular water quality test results available on database.	Medium/ Long	• Kagera Secretariat to ensure that water quality test results are included on the Basin database.	• Monitoring water supply utilities in relation to the quality of water supplied • Provide technical and economic	• Water supply utilities to perform activities	• NGOs, CBOs, donor organizations, etc. to provide technical and economic support for water utilities to	Water quality monitoring will require a yearly cost of USD 3 million per year (USD 60 million during the project period).

Strategic Option 5: Environment Protection, Land and Disaster Management								
Strategic Objective: ***To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices.***								
Strategy 5.4: Water Quality Management								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
					support to water supply utilities to address water quality issues		facilitate water quality monitoring	The water utilities can finance the cost from their revenue. • Annual Budget • Donor funding • Private Sector Service Fees
e) Water quality monitoring and water testing facilities	• Evaluate National water testing laboratory facilities and recommend upgrades required. • Develop programme for accreditation of National Water Testing Laboratories. • Identify priority monitoring points to be used for basin-scale water quality status assessments. • Implement water quality monitoring programmes and undertake regular assessments of the status of rivers, lakes and impoundments.	• National water testing laboratories meet national monitoring programme requirements. • Laboratories and monitoring programmes have documented quality control/quality assurance programmes. • Water testing laboratories are accredited by an accreditation authority. • Documented water quality motoring protocols exist and are being implemented. • Presence of water quality monitoring stations and data. • Annual basin-scale water quality status and trends assessments are conducted using monitoring data collected by basin countries.	Short / medium	• NELSAP and Kagera Secretariat to develop basin wide water quality monitoring networks and programmes. • NELSAP and Kagera Secretariat to develop basin wide strategies and guidelines for water quality monitoring.	• Member States to harmonise, where necessary develop, implement and finance national water quality monitoring networks and programmes in line with basin wide networks and programmes.	• Watershed Authorities, Districts, etc., to support national water quality monitoring networks and programmes through the provision of data. • Watershed Authorities, Districts, etc., should develop and implement local water quality monitoring programmes and networks in line with national and basin wide networks and programmes.	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support water quality monitoring networks and programmes through research, data provision and funding.	• Annual Budget • Donor funding • Private Sector • Service Fees
f) Compliance and regulation Refer strategy 1.1	• Develop compliance framework for water quality monitoring and regulation. • Monitor compliance of standards.	• Framework for water quality monitoring and regulation implemented.	Short	• NELSAP and Kagera Secretariat to develop basin wide strategies and guidelines for compliance and regulation.	• Member States to continue with or put in place finance and implement compliance and regulations in line strategies and guidelines develop for the basin.	• Watershed Authorities, Districts, etc., to support national compliance and regulation through the provision of relevant data.	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support compliance and regulation by acting as “watch dogs” that these are implemented. • Provide essential data for compliance monitoring • Provide research and studies on their effectiveness.	• Annual Budget • Donor funding • Private Sector • Service Fees

Strategic Option 5: Environment Protection, Land and Disaster Management								
Strategic Objective: ***To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices.***								
Strategy 5.5: Control alien invasive aquatic weeds and prevent new outbreaks								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
a) *Removal and prevention of aquatic invasive alien species such as hyacinth, papyrus, bamboo, water lettuce, etc.*	• Prepare a map of invasives with densities so that spread or reduction can be observed and planned for. • Set up a process of aerial surveys or other mechanisms of identifying and reporting. • Prioritise areas for removal of invasive alien vegetation. • Compile guideline of suitable techniques per species for removal and control of invasive alien plants. • Develop working groups in watersheds responsible for rapid identification and removal of alien invasive vegetation. • Research and implement biological controls.	• Water bodies are kept free of invasives. • Guideline on techniques for prevention of infestation and for the removal of alien Invasive species developed and implemented.	Short/ Medium	• NELSAP and Kagera Secretariat (if established) to coordinate the identification of affected areas and develop a strategies and guidelines for removal including research at basin scale. • NELSAP and Kagera Secretariat to develop basin wide monitoring mechanisms.	• Member States to identify affected areas at national level and develop and implement national strategies for removal alongside basin strategies and guidelines. • Member States to develop national monitoring mechanisms including funding.	• Watershed Authorities, Districts, etc., to identify affected areas at local level and enact programmes for removal using strategies and guidelines develop at national and regional levels. • Watershed Authorities, Districts, etc., to provide information to national level.	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support aquatic weeds eradication efforts through the provision of relevant information, indigenous knowledge and funds.	• Annual Budget • Donor funding • Private Sector • Service Fees

Strategic Option 5: Environment Protection, Land and Disaster Management								
Strategic Objective: ***To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices.***								
Strategy 5.6: Climate change adaptation and preparedness								
Target	**Activities**	**Indicators (M&E)**	**Timeframe**	**Responsibility**				**Costing & Funding Sources**
				Basin Scale	**National Scale**	**Local Scale**	**Other Stakeholders**	
a) Ensure that Disaster Risk Reduction is a priority with an institutional basis for implementation	• Adapt legislation to support risk reduction. • Support the creation of integrated risk reduction mechanisms to facilitate coordination and integrate risk reduction into development policies • Assess existing resources at all levels and allocate resources.	• Integrated risk reduction plans developed. • Sufficient resources/coping capacity (staff) established. • Integrated policies to endorse risk reduction and adaptation.	Medium / long	• Functional at Basin scale. • NELSAP and Kagera Secretariat (if established) to identify capacity needs for the disaster management for the basin.	• Implement and support at National level. • Member States to put in place mechanisms to address capacity needs at national level in line with basin requirements.	• Watershed Authorities, Districts, etc. to address national capacity needs in line with the basin wide requirements.	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support capacity needs through the provision of indigenous knowledge and funds.	• Annual Budget • Donor funding • Private Sector • Service Fees
b) Identify, assess and monitor disaster risk and enhance early warning	• Develop and update risk maps. • Develop systems of indicators of risk and vulnerability. • Develop early warning systems that are people centred, i.e. timely and understandable.	• An updated risk profile for the basin is developed. • Monitoring of indicators takes place. • Annual reports developed.	Short - Medium	• Own and update Risk assessment on annual basis. • NELSAP, NBI, LVBC and Kagera Secretariat (if established) to put in plan disaster risk management systems.	• National Disaster Management Structures in Member States to put in place disaster risk management structures (legislation and institutions). • National Governments to implement disaster risk management systems.	• Participate in assessments, include local knowledge. • Watershed Authorities, Districts, etc. to support and contribute to disaster risk management including provision on facilities and information.	• NGO, Private Sector, water users. Donors, etc., to support disaster risk management systems including provision of funds, facilities and information.	• Annual Budget • Donor funding • Private Sector • Service Fees
c) Use knowledge and education to build a culture of safety and resilience	• Provide easily-understandable information on disaster risk to high-risk communities. • Develop inter-regional and inter-sectoral networks among experts, managers and planners on risk preparedness and mitigation.	• Informed, resilient communities, training programs. • Established forums.	Short	Develop training standards and materials Establish forums	Endorse forums	Training	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support the awareness and establish risk resilience through information provision, research and funding.	Donor funding
d) Flood management	• Determine flood lines for residential, urban and industrial areas. • Provide floodplain development protocols (i.e. suitability of land uses in floodplains). • Review role of infrastructure in flood management and the expected role of currently proposed infrastructure. • Develop flood management plan for each watershed. •	• Flood lines defined. • Floodplain development protocol developed, implemented and regulated. • Flood management plans (flood mitigation and adaptation strategy) developed. • Basin catchment flood management councils/committees established.	Short/ Medium	• NELSAP and Kagera Secretariat to facilitate the identification of flood prone areas in the basin. • To facilitate the development of strategies and guidelines for flood management at basin scale.	• Member States to map out flood prone areas at national level. • To develop national flood management strategies and guidelines.	• Watershed Authorities, Districts, to map out local flood prone areas. • To develop and implement flood management strategies at local levels.	• NGO, Private Sector, water users. Donors, academic institutions, etc., to support the identification and development of flood management strategies through information provision, research and funding.	• Annual Budget • Donor funding • Private Sector • Service Fees
e) Drought management plans	• Develop National Drought Management Plans. • Develop Basin-wide drought management Plan.	• National requirements for UN Convention to combat desertification are met.	Short	• NELSAP and Kagera Secretariat to coordinate the development of Basin-wide drought preparedness plans.	Member States to develop and implement national drought management plans in line with the basin wide plan	• Watershed Authorities, Districts, etc. to develop and implement local drought management	• NGO, Private Sector, water users. Donors, etc., to support local, national and basin wide drought management	• Annual Budget • Donor funding • Private Sector • Service Fees

Strategic Option 5: Environment Protection, Land and Disaster Management								
Strategic Objective: *To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices.*								
Strategy 5.6: Climate change adaptation and preparedness								
Target	Activities	Indicators (M&E)	Timeframe	Responsibility				Costing & Funding Sources
				Basin Scale	National Scale	Local Scale	Other Stakeholders	
						plans in line with national and basin wide plans.	plans including provision of information.	

Annexure D:
Environmental Flows:
EF Tool and Scheme Assessment

DEVELOPMENT OF A BASIN-WIDE IWRM-BASED DEVELOPMENT PLAN FOR THE KAGERA BASIN

Burundi, Rwanda, Uganda and Tanzania

Environmental Flow Task

EF TASK PART I: EF TOOL

Contract No.: Kagera/2011/S/BDP-01
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Prepared by:

Southern Waters Ecological Research and Consulting cc

with input from Fluvius Consultants

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Contact: Cate Brown
Southern Waters Ecological Research and Consulting cc.
56 Roeland Square
Drury Lane
CAPE TOWN
8001

Tel: (021) 465 3135
Fax: (021) 465 3901
E-mail: cate@southernwaters.co.za

Contents

List of Tables

List of Figures

1. Introduction

a. Project Background

Proposals for the Development of a Basin-wide IWRM-based Development Plan for the Kagera Basin were submitted during November 2011, in response to the Request for Proposals by the Nile Equatorial Lakes Subsidiary Action Plan (NELSAP) of the Nile Basin Initiative (NBI). Aurecon AMEI was subsequently appointed, with the project commencing on 1 April 2012. The expected completion date is end October 2012.

Southern Waters Ecological Research and Consulting was appointed as a sub-consultant to Aurecon AMEI on 15 May 2012, to undertake the Environmental Flows (EF) task, with a target date for completion of this task of 1 June 2012.

b. Objective of the EF Task

The objectives of the EF task are to use existing information to[3]:

- identify concerns and threats to the protection of the riverine ecosystem;
- highlight the opportunities and constraints relating to preservation of the water resources of the basin;
- provide scenario information on the extent of resource protection that would be associated with proposed developments in the Kagera Basin, which could be used to identify an acceptable balance between resource development and resource protection.

c. Terms of Reference

The EF study will comprise:

1. A basin-level delineation of the river systems into river reaches that are expected to respond in a homogeneous manner to flow and related changes associated with proposed water-resource developments;
2. A catchment-level qualitative assessment of the flow and other implications, such as sediment-trapping and barriers to migration, for the riverine ecosystem represented by existing and proposed water-resource developments;
3. An assessment of options for resource-protection related to the location and operation of existing and proposed water-resource developments.

d. The approach adopted for the EF task

The scheduling of the EF Task is such that it precedes some of the other tasks from which information is required, in particular:

- Diagnostic/Situation Assessment Task;
- Strategic Planning Process.

Thus, the EF task has been divided into two parts. The first, this report, involves the development of a tool to predict the level of threat to the river ecosystem as a result of changes in the flow and sediment regime of the river. The second, which will coincide with the completion of the above

[3] The EF task will be undertaken within the limitations of the existing data.

tasks, is to use the tool to make predictions linked to specific water-resource developments to assist with decisions with respect to their location and operation.

Accordingly approach adopted for the EF task is as follows:

1. Delineate the Kagera Basin into relatively homogeneous longitudinal zones in terms of biophysical characteristics (reach analysis; Section 0).
2. Identify existing and previously-proposed water-resource developments in the Kagera Basin (Section 4).
3. Select representative sites for all the EF to follow (Section 5.a).
4. Select a short-list of ecologically-relevant flow statistics that can be used to characterise flow changes downstream of water-resource developments in the basin (Section 5.b).
5. Develop a simple decision support system (tool) to predict the potential threat to ecosystem function, and by inference biodiversity, at each EF site associated with different levels of flow change as a result of existing and previously-proposed water-resource developments (Section 6).
6. Provide an example of the sorts of results that would be generated (Section 7).
7. Generate results for specific water-resource developments to assist with decisions with respect to their location and operation (to follow in the Strategic Planning Process).

e. Study team

EFs and riverine ecology:	Dr Cate Brown – Southern Waters
Geomorphology and wetlands:	Mr Mark Rountree – Fluvius Consulting
MCDA/DSS construction:	Dr Alison Joubert – Southern Waters.

f. Limitations of study[4]

The following limitations apply:

- The study area was not visited by the study team.
- No new data were collected.
- No daily flow records were made available for EF sites for the initial work; these will be available for later work.
- Hydrology used was limited to that in BRL Ingénierie (2008).
- The relationships between river condition and flow change were derived from expert opinion using environmental flow studies in other parts of Africa as a guide.
- Socio-economic considerations where not included.
- Water quality was not included.
- The results highlight qualitative threat to ecosystem integrity and should not be misconstrued as quantitative environmental flow requirements.

[4] Some of these shortcomings will be addressed in forthcoming project tasks.

2. Environmental flows and the roles of different kinds of flow in river maintenance

a. Impacts on downstream riverine ecosystems associated with different types of water-resource development

Of all the environmental changes caused by dam construction and operation, the alteration of the flow regime downstream of dams has been the most pervasive, and damaging (World Bank, 2007). The more the flow changes, the less the ecosystem can provide the goods and services that people value it for. The impacts of such water-resource developments can stretch downstream for hundreds of kilometres, even affecting marine ecosystems (EF Window Brochure, 2003).

Bunn and Arthington (2002) highlighted four primary impacts related to flow change:

- change in channel shape and in the physical habitats such as riffles, pools, islands, and bars in rivers and floodplains, which support aquatic communities.
- disruption of biological functions by changing the volume and timing of flows.
- disruption of biological functions through the loss of longitudinal and lateral connectivity.
- the invasion of, often exotic, species that benefit from the flow changes, and thus out-compete the other species.

While the impacts of storage dams are mainly those associated with reduced water supply to the downstream environment, both they and hydropower plants (HPPs) affect the timing and distribution of flows, and increase the rate of change between high and low flows in the downstream river. The result is mismatched flows and abnormal flow fluctuations, which can impact on both the habitat and life-cycle stages of many animals and plants (Brown and King, 2006).

As storage capacity increases so too does the potential effect of the dam on the downstream environment. As a typical rule-of-thumb, a dam that creates a reservoir with a storage capacity less than the mean annual runoff (MAR) of the river on which it is situated will have considerably less influence on the downstream flow regime than one that results a reservoir will a storage capacity greater than the MAR, particularly with respect to dampening of the seasonal variability, attenuation of flood peaks and delays in the onset of seasons. However, the hydrology of the river and the manner in which a reservoir is operated will also affect the extent of the influence on the downstream flow regime.

A HPP will be least disruptive to a river's flow regime when it operates as a "run-of-river" facility, with outflows essentially matching the natural regime of inflows. A run-of-river operation in its truest form would release water hour by hour at the same rate as inflows; such operations are typical of small hydropower dams with little to no storage available to modify inflows. The operation of a storage dam or a HPP will have a significant influence on the downstream flow regime. For instance, a HPP with peak-power generation will generally have a far greater impact than base-load power generation (Renofalt *et al.*, 2010).

Reservoirs also disrupt the natural sediment regime of rivers by trapping bedload, and coarser portions of the suspended load. Sediment supply and sediment transport capacity interact such that:

- where sediment supply is less than the sediment transport capacity, there is an excess of erosive energy, resulting in net erosion, causing the river channel to erode its bed/banks and incise;
- where sediment supply is greater than sediment transport capacity, there is an excess of sediment, resulting in net deposition and the development of an aggrading river/floodplain environment.

Downstream of large reservoirs, water releases are largely sediment free. Sediment is replaced in the water column through erosion of the beds, banks, bars and islands, and with no opportunity for sediment replenishment from upstream, the reaches downstream of dams experience vastly enhanced erosive action relative to the pre-dam situation. In general, sediment-supply related changes downstream of dams include:

- coarsening of the bed material;
- incision of the active channel/s;
- net erosion of the beds and banks of rivers due to clean water releases from dams; and
- abandonment of secondary channels and associated loss of islands, and;
- a progressive loss of habitat diversity.

b. Roles of different kinds of flow in river maintenance (Brown and King, 2000)

The flow regime of a river consists of several different kinds of flow, each of which contributes to the river's overall maintenance (**Table 0.1**). Naturally, a river exists in a state of dynamic equilibrium, able to respond to seasonal and annual fluctuations in climate because its species have different tolerance ranges and so differ in their abundances as conditions change. Thus, at any time there is a mix of species that can cope efficiently with prevailing conditions, while other species may be present in lower numbers or surviving as, for instance, eggs, seeds or spores, until more suitable conditions occur. The mix of species and numbers of individuals present usually result, in the natural situation, in assemblages where no one species proliferates to "pest" proportions.

Manipulations of flow regimes represent unnatural disturbances to rivers, with these disturbances increasing in severity the further the flow regime is altered from what lies within the realm of "normal" for that system. Responses of rivers to flow manipulation can take many forms. For instance, hydrological cues that trigger fish spawning or seed germination may occur at the wrong time of the year or not at all, resulting in affected species perhaps failing to reproduce. Seasonal reversal of wet and dry season lowflows could mean that hydraulic and thermal conditions become mismatched with life-cycle requirements, again causing species to decrease in numbers and abundance. Other species, many seen as pests, are often able to take advantage of such environmental conditions, or the weakening of competition from the affected species, and increase in abundance. Large sub-daily fluctuations in discharge may erode river habitats and wash animals and plants downstream, or leave animals stranded on river margins.

Table 0.1 Roles of different kinds of flow in river maintenance (Brown and King, 2000)

Type of flow	Explanation
Lowflows	Lowflows are the flows in the river outside of floods. They maintain the basic ephemeral, seasonal or perennial nature of the river, thereby determining which animals and plants can survive there. The different magnitudes of lowflow in the dry and wet seasons create more or less wetted habitat and different hydraulic and chemical conditions, which directly influence the balance of species. For instance, species that need to spend several months in water to complete their life-cycles are rare in temporary rivers, though specific riparian tree species may be able to live on such a river's banks if the groundwater conditions are favourable.
Large floods or flood pluses	Large floods or flood pulses typically occur only once a year, or less often depending on the river. They dictate the general geomorphological character, shape and size of a river channel. Floods mobilise sediments and deposit silt, nutrients and seeds on floodplains. They inundate backwater areas, and trigger the emergence of adults of aquatic insects, which provide food for fish, frogs and birds. They maintain moisture levels in the banks that support the trees and shrubs, and prevent the riparian vegetation from being dominated by any one species. Floods also scour estuaries, ensuring, amongst other things, accessibility to marine fish dependent on them as nursery areas, and the maintenance of habitat diversity.
Small floods	Small floods stimulate spawning in fish, flush out poor quality water, mobilise sandy sediments, and contribute to flow variability. They re-set a wide spectrum of conditions in the river, triggering and synchronising activities as varied as upstream migration of fish and germination of riparian seedlings.
Flow variability	Flow variability, on a daily, seasonal or annual basis, acts as a form of natural disturbance. This maintains biological diversity through increased heterogeneity of physical habitats. For instance, lack of variability through the absence of small floods may favour fish species adapted to breed under conditions of more constant discharge, with resulting alterations in the relative numbers of fish species and/or loss of native species. Variability in lowflows dictates the width of the vegetation belt along the water line, which protects the banks against erosion. A loss of variability results in a narrowing of this band because the lower portion is no longer regularly exposed or the upper portion regularly inundated.

c. Environmental flows: definition

Water that is purposefully left in a river system or released from an impoundment to maintain a river system or parts thereof in a desired condition, is referred to as the Environmental Flow (EF). The closer to natural the desired condition, the greater the volume of the original flow regime that will be required as an EF and the closer to natural will be the distribution of that water.

EFs are based on an understanding of how flow changes can cause changes in river condition. This understanding can be used to describe the pattern of flows (including floodplain inundation and periods of low or even no flow) for the river that will (Brown and King, 2006):

- reduce the downstream impacts of a water-resource development;
- rehabilitate systems impacted by past developments;
- allow calculation of the costs of compensating people downstream for such impacts.

The provision of EFs is not intended to mimic a pristine river. A regulated river system cannot reproduce all aspects of natural flow, while at the same time providing for competing uses (Dyson et al., 2003). Thus, the concept of 'trade-offs' or compromises between competing uses of water and the river are central to the concept of EFs. Setting an EF means striking the right balance between allocating water directly for people (for power generation, industry, agriculture and public supply) and indirectly for people (by providing ecosystem goods and services; EF Window Brochure, 2003).

Even the most successful EFR will only partially mitigate against the effects of a water-resource development. For instance, the physical presence of a dam will, in itself, inevitably result in impacts on the downstream river related to, *inter alia*, trapping of sediment, reduction in flow variability, and changes in the temperature and chemical composition of the water, with knock-on social and economic impacts. Nothing is gained at no cost – if flow regimes are manipulated, the targeted rivers will change. Society decides, pro-actively or through inaction, the extent of that change (Brown and King, 2006).

3. Delineation of the study area

a. Introduction

The Kagera Basin is the largest sub-basin (60,500 km²) in the Lake Victoria basin, and contributes roughly 34% of the total river inflow to the lake. It covers portions of four countries: Burundi, Rwanda, Tanzania and Uganda.

Figure 0.1 The Lake Victoria basin, showing the Kagera River in the west.

The Kagera River is fed by three main tributaries: the Nyabarongo River, the Akanyaru River, and the Ruvubu River. All three rise on the Congo-Nile Divide and flow through hills and mountain foothills into a swamp and lakes area, where they form the Kagera River.

The area supports a population of *c*. 15 million people, with an economy that is based heavily on subsistence agriculture.

b. Physical delineation of the study area

Note: This section will be expanded in a later study task.

The monthly hydrographs provided in **Figure 0.2** give an indication of broad seasonal patterns in the mainstem Kagera River, but little or no indication of the daily fluctuations in flow that may occur. In the absence of daily hydrological data for much of the catchment, these were derived from an

analysis of the geomorphological character of the rivers and wetlands in an area. From an environmental flow perspective then, there appear to be four main flow regime types within the basin: flood-pulse; flashy with high baseflow, flashy and transitional (Figure 0.3). For the EF assessment though, the two flashy regimes will be combined as their responses to flow change are unlikely to differ significantly from one another at the level of detail of this study.

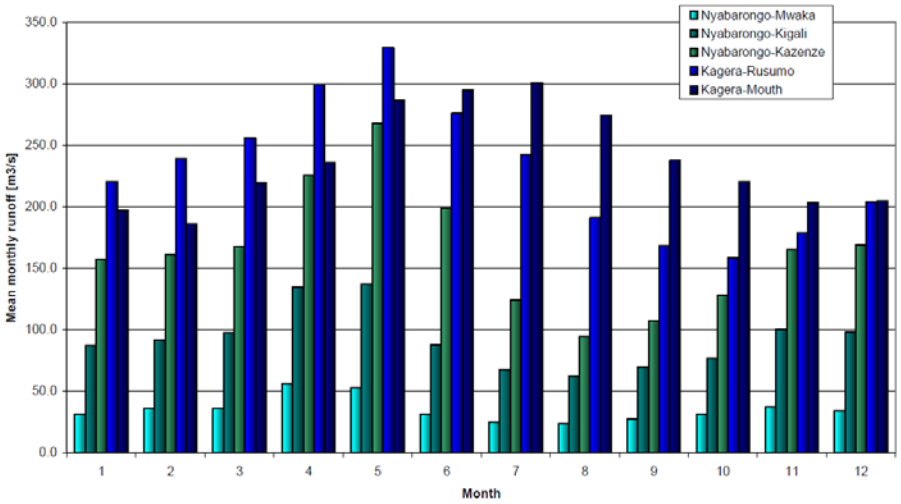

Figure 0.2 **Monthly hydrographs from five key sites on the main stem of the Kagera River, listed from most upstream to most downstream (BRL Ingénierie, 2008).**

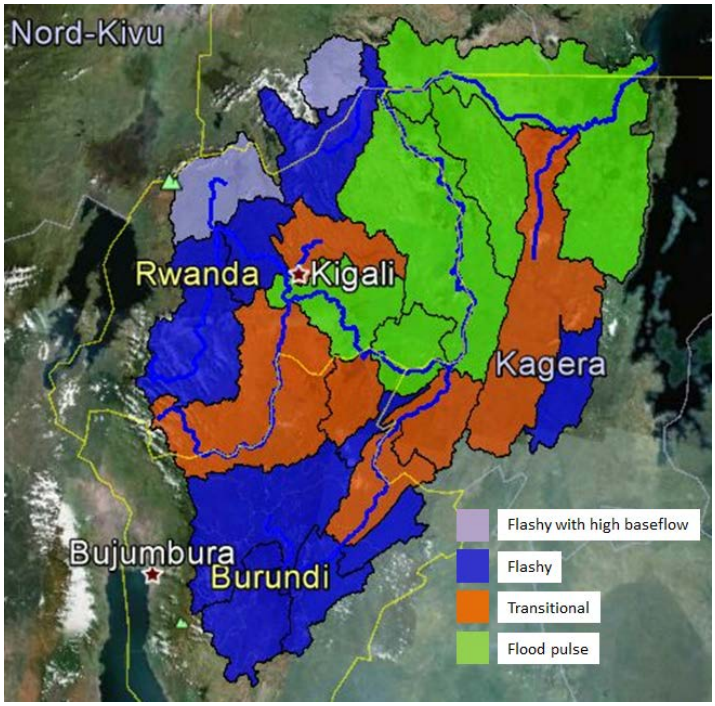

Figure 0.3 **Delineation of Kagera Basin on the basis of expected hydrographs**

Table 0.2 General descriptions of the hydromorphic zones

Name (main river system/s)	Description	Hydromorphic zone
Cizanye River	Intensely cultivated valley floor floodplain Small catchment, high population density.	Short tributaries; probably flashy systems
Kayongozi River	Near natural valley floor floodplain in the lowest sections of the subcatchment, but intensively cultivated valley floor in the middle and upper subcatchment. Small catchment, moderate to low population density.	Short tributaries; probably flashy systems
Lake Rweru, Lake Kanzigiri and Kanyamanza River	Foothills upper catchment with narrow valleys opens up to wider, but confined, valleys that are intensively cultivated. These flow in to large lakes on the edge of Kagera swamps. Small catchment and moderate to low population densities.	Short tributaries (flashy) but lake probably driven by flood pulse of Kagera River.
Unchannelled Valley Bottom wetlands[5]	Extensive unchannelled and weakly channeled valley bottom wetlands draining mountains. Main stem and main tributaries are unchannelled to weakly channeled wetlands. No cultivation on the valley bottom (i.e. inside these wetlands), although heavily utilized on slopes. Moderate to low population densities	Flashy with high baseflow
Kasongenye	Upper catchment with narrow valleys has forested streams that, in the lower catchment, open to a wide valley with a valley lake at the end of the sub-catchment. Sub-catchment is largely protected area (the Burigi Game Reserve) and therefore very low population densities.	Short steep tributaries; probably flashy system
Nyabugogo	Mountainous headwater sub-catchment consisting of a large valley lake in the upper catchment that flows down through intensively cultivated floodplains. High population densities and intensively utilized floodplains.	Flashy flows but possibly with strong baseflows regulated by the upper catchment lake.
Ruvyironza	Small headwater catchment flows in to the Ruvubu River. Extensive floodplain reaches throughout the catchment, and these are intensively farmed. Some of the wettest floodplain reaches in the upper catchment remain intact (i.e. not drained or cultivated). High population density.	Flashy
Rumanyika	Small catchment that flows in to the lower Kagera. Ruminyaka Orungundu Game Reserve is located in the lower sub-catchment and protects a large forested area of the catchment. The grass-dominated (weakly channelled) floodplain suggests a seasonally saturated (flood pulse) valley bottom system flowing through savanna/forested uplands. Low population densities (Tanzania).	Flood pulse
Mukungwa	Mountainous headwaters. Upper western section of the catchment is protected as part of the Volcans National Park, and upper eastern section has very large wetlands (Rugezi swamp) and lakes (Bulera, Luhondo) that attenuate runoff and release to the lower catchment. Cultivation is rapidly encroaching on to the valley bottoms. Lowest section of the sub-catchment is a steep gorge. Population density is moderate, but clearing of forests is extensive.	Likely to experience flashy floods, due to inputs from mountainous tributaries, but strong seasonal baseflow differences due to the moderating effect of swamps and lake from the upper eastern section of the catchment may underlie this.
Mwogo/ Nyabarongo headwaters	Mountainous headwaters. Uppermost section of this sub-catchment is well forested; being protected within the Nyungwe Forest Reserve. Steep, narrow valleys with large, steep rivers.	Flashy
Kagitumba	Mountain headwaters. Upper catchment of steep mountain valleys. The wetlands within these narrow valleys have been intensively cultivated. The rivers in the mid and lower catchment are less confined and meandering floodplains have	Expect flash flows. There are few natural sections of the river remaining in this catchment.

[5] Catchment is far larger than shown in the sub-basin catchment shape file.

Name (main river system/s)	Description	Hydromorphic zone
	developed (cropping and livestock uses).	
Ruvubu headwaters	Headwater catchment of the Ruvubu River. Extensive floodplain reaches throughout the catchment, which are intensively farmed. High population density.	Flashy
Akanyaru	Extensive wetlands across the catchment, with large wide valley bottom wetlands (and swamps and lakes) in the mid and lower sub-catchment. Valley bottoms and wetlands are intensively cultivated. High population density.	Flashy flows in upper catchment; possibly flood pulse in and below wetlands and lakes (amelioration from the wetlands/lakes is likely).
Lower Nyabarongo	Upper foothills zone. Upper eastern sections of the catchment are characterized by large valley bottom wetlands that are intensively cultivated. Moderate population density.	Flashy
Ruvubu upper foothills	Upper foothills zone of the Ruvubu system. Narrow valley, short tributaries and steep slopes. Expect flashy system Moderate population density.	Flashy
Mwisa	Lowlands dominated system with large lake and unchannelled valley bottom wetland system in the mainstem river. River flows from lake downstream to wetland and then through foothills zone to the Victoria Lake coastal zone. The Burigi Game Reserve protects a large part of this sub-catchment. Low/moderate population density.	Transitional Flashy/Pulse
Lower Ruvubu - A	Lowlands system of floodplain, swamps and lakes on the main stem. Large sections of the river are within protected areas. Low population density.	Transitional Flashy/Pulse
Lower Ruvubu - B	Lowlands system of floodplain, swamps and lakes on the main stem. Low/moderate population density.	Transitional Flashy/Pulse
Kagera swamps - A	Flat zones of swamps, large lakes and wide floodplains. Agriculture on higher lying areas (levees and drier floodplain areas), with large areas of swamps intact. Low population density.	Flood pulse
Kagera swamps - B	Similar patches of swamps and floodplains, but generally the floodplain and swamps are narrower (the valley is more confined, especially in the western section of this sub-catchment). Agriculture on higher lying areas (levees and drier floodplain areas), with areas of swamps intact. Low/moderate population density.	Flood pulse
Kagera Swamps (Akagera)	The Kimisi Game Reserve (upper catchment) and the Akagera National Park (middle and lower catchment) protects most of this sub-catchment. This large sub-catchment comprises the main swamps and lakes associated with the Kagera River. Low population density.	Flood pulse
Lake Victoria coastal plain	This lowest section of the Kagera flows across a flat coastal plain to Lake Victoria. Overbank flooding associated with the flood pulse recharges lakes and swamps along the lower reaches of this subcatchment. The Ibanda Game Reserve protects this sub-catchment. Low population density.	Flood pulse

c. Biodiversity hotspots

BRL Ingénierie (2008) identified the following biodiversity hotspots[6] in the study area (Figure 0.4):

- The Rugezi Wetlands on the Rusumo and Rubagambavu River.
- Lake Ihema

[6] These cover a wide variety of areas some of which contain endangered or unique species listed under Convention on International Trade on Endangered Species (CITES) and the World Conservation Union-IUCN (MINITERE, 2004).

- Lake Hago
- Lake Rwanyikizinga
- The Akagera National Park, which contains Lakes Rwanyikizinga, Mihindi, Hago, Kiyumbo and most parts of Lake Ihema.
- The Mugesera/Rweru Complex
- The Mgahinga National Park (not shown on FIG)
- The Ruvubu National Park.

The distribution of important wetland areas in the Kagera Basin is also shown in Figure 0.4. These areas are also important habitats for the protection of biodiversity in the basin (FAO, 2000) and include the Mugesera, Akagera, Nyabarongo, Rugezi and Akanyaru Wetlands.

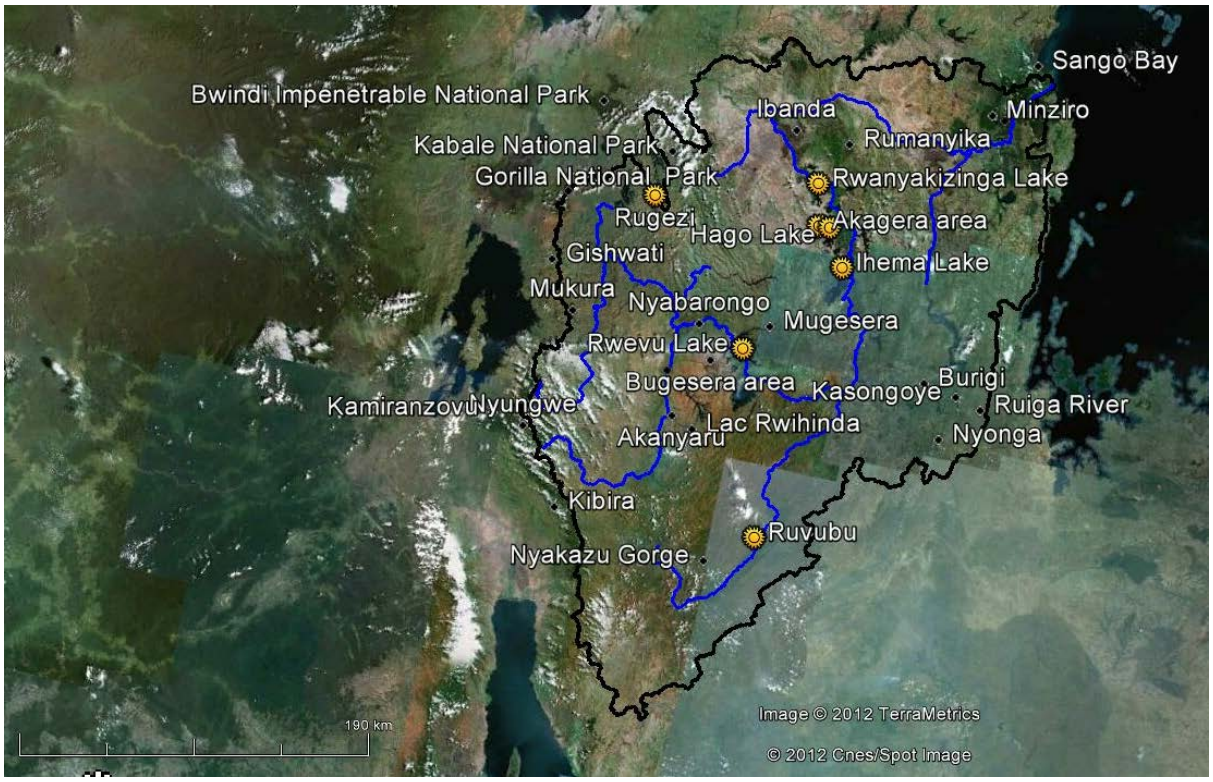

Figure 0.4 **Kagera River Basin: Showing wetlands and Biodiversity Hot Spots provided in BRL Ingénierie (2008) and project imagery. = hotspots depicted in BRL Ingénierie (2008).**

The protected areas in the Kagera River basin include four National Parks, three Game Reserves, one Game Controlled Area, three Nature Reserves and 21 Forest Reserves (BRL Ingénierie 2008).

4. Existing and proposed water-resource developments

a. Hydropower

The identified hydropower potential of the Kagera Basin is about 490 MW of which about 216 MW is considered feasible, and only about 44 MW of which has been developed to date (BRL Ingénierie 2008).

Existing hydropower projects include (BRL Ingénierie 2008):

- Mukungwa Hydropower Project (12.5 MW) in Rwanda
- Ntaruka Hydropower Project (11.2 MW) in Rwanda
- Rwegura Hydropower Project (18 MW) in Burundi
- Ruvyronza Hydropower Project (1.3 MW) in Burundi
- Kayenzi Hydropower Project (0.8 MW) in Burundi.

There is presently no hydropower generation within the Tanzanian or Ugandan portions of the Kagera Basin.

Potential hydropower projects (BRL Ingénierie 2008) include[7] (estimated generation capacity shown in brackets; **Figure 0.5**):

1. Rusumo Falls Hydropower Project (61.5 MW) on the Kagera River on the border between Rwanda and Tanzania.
2. Kakono Dam Hydropower Project (53 MW) located on the Kagera River in Tanzania near the Uganda border.
3. Kishanda Hydropower Project (180 to 207 MW) with a diversion from the Kagera River downstream of Lake Rushwa to a dam located on the Kishanda River in Tanzania.
4. Nyaborongo Hydropower Project (28 MW) located on the Nyaborongo River in Rwanda near Kigali.
5. Maziba Hydropower Project located on the Kiruruma River in Uganda (upgrade of existing HPP).
6. Kikagati Hydropower Project (10 MW) located on the Kagera River in Uganda near the Tanzanian border.
7. Nshungyezi Hydropower Project (54 MW) located on the Kagera River in Uganda near the Tanzanian border.
8. Kisiizi Hydropower Project located on the Kisiizi River in Uganda.
9. Kasongenye (on the Kasongenye River near Biharamulo) and Kaonjuba (on the Kamwana River near Muleba) Small Hydropower Projects (totalling 1.2 MW) in Tanzania.
10. Sixteen small and mini hydropower developments (totalling about 36 MW) in:
    - Rwanda (23 MW);
    - Burundi (9 MW);
    - Tanzania (1 MW – Kasongenye and Kaonjuba, see above);
    - Uganda (3 MW).

Additional detail on the two most likely of the proposed developments is given in Section i and ii.

[7] Note: The information provided here is taken from BRL Ingénierie (2008) and may change based on the outcome of the Diagnostic/Situation Assessment Task and the Strategic Planning Process in this study.

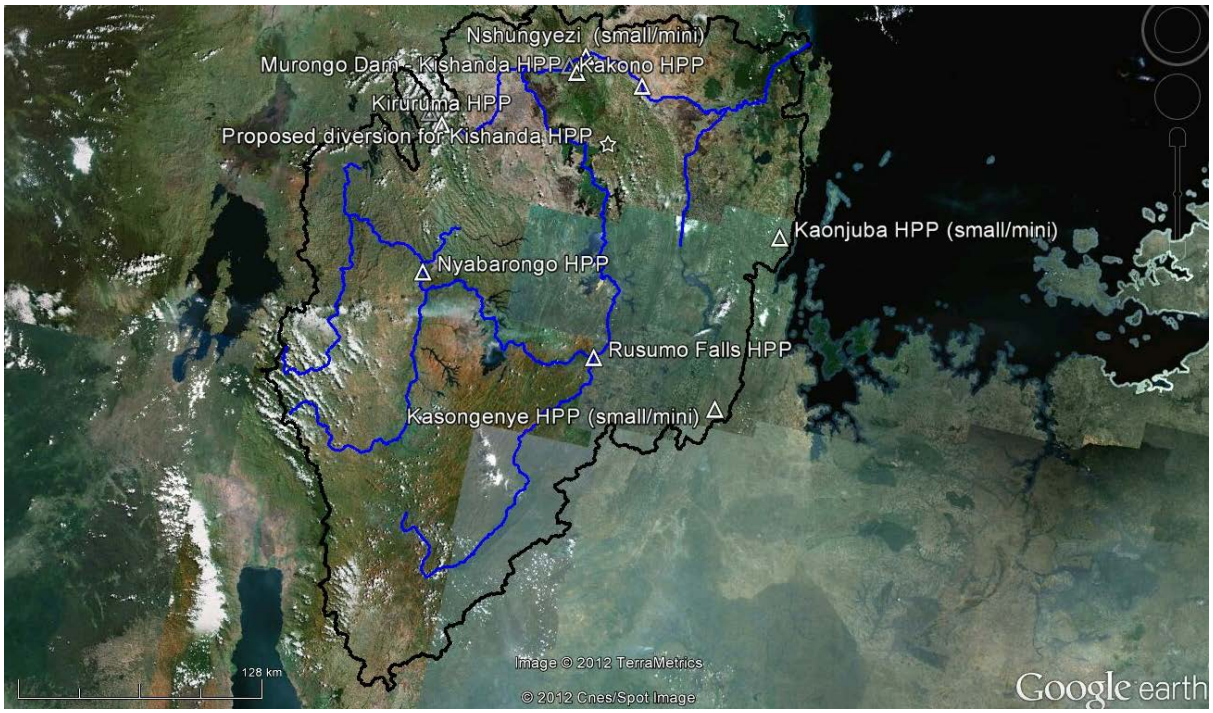

Figure 0.5 Locations of potential hydropower developments in the Kagera Basin

i. Rusumo Falls Hydropower Project

The 61.5-MW Rusumo Falls HPP would be built on the Kagera River on the border between Rwanda and Tanzania. The project would comprise a conventional gravity dam in the main channel with a full supply level of 1325 m – approximately 5 m about normal river levels, which would flood upstream in the Ruvubu River, and would affect levels in Lake Rweru, some 70 km upstream on the Nyabarongo River. The dam would be 12 m high and include spillway gates. Power facilitates would include intake above the dam, a 460-m power tunnel and three unit powerhouse with an installed capacity of 61.5 MW under a head of 35 m.

The project would affect downstream flows and sediments as follows:

- increased dry season lowflows;
- decreased wet season lowflows;
- delayed on-set of wet season flows;
- reduced duration of wet season flows;
- reduced number of within-year floods;
- reduced volume/magnitude of the wet season flood (in flood-pulse systems);
- reduced sediments;
- extreme within-day fluctuations associated with peak power production.

ii. Kakono Dam Hydropower Project

The 53-MW Kakono HPP would be located in Tanzania, on the Kagera River near the Uganda border, approximately 90 km from the mouth of the Kagera River and about the same distance from the city of Bukoba and Lake Victoria. Kakono is the furthest downstream potential hydropower site on the

Kagera River. The project would comprise a 35-m high concrete gravity dam and spillway, and earth-fill dam with a full supply level of 1182 m. The dam would create a reservoir with live storage equal to 30 h of plant output. Power facilitates would include intake in the dam, and a two unit powerhouse at the toe of the dam with an installed capacity of 53 MW under a head of 26 m. The project was identified for both power and downstream irrigation (about 70 000 ha).

The project would flood part of the Minziro Forest Reserve. It would also affect downstream flows and sediments as follows:

- increased dry season lowflows;
- decreased wet season lowflows;
- delayed on-set of wet season flows;
- reduced duration of wet season flows;
- reduced number of within-year floods;
- reduced volume/magnitude of the wet season flood (in flood-pulse systems)
- reduced sediments
- extreme within-day fluctuations associated with peak power production.

b. Other developments affecting river flow

To be completed in the Strategic Planning Process.

5. EF site selection and identification of ecologically-relevant summary flow statistics

a. EF site selection

An estimated 11 EF sites are required to ensure adequate coverage of the basin in terms of the main biodiversity hotspots. These are:

1 Nyaborongo River near Mukura
2 Nyaborongo River near Kigali
3 Kagera River near Rwevu
4 Kagera River near Akagera
5 Kagera River near Kiansechi
6 Kagera River near Minziro
7 Kiruruma River
8 Akanyaru River
9 Ruvubu River
10 Kishanda River
11 Kasongenye River.

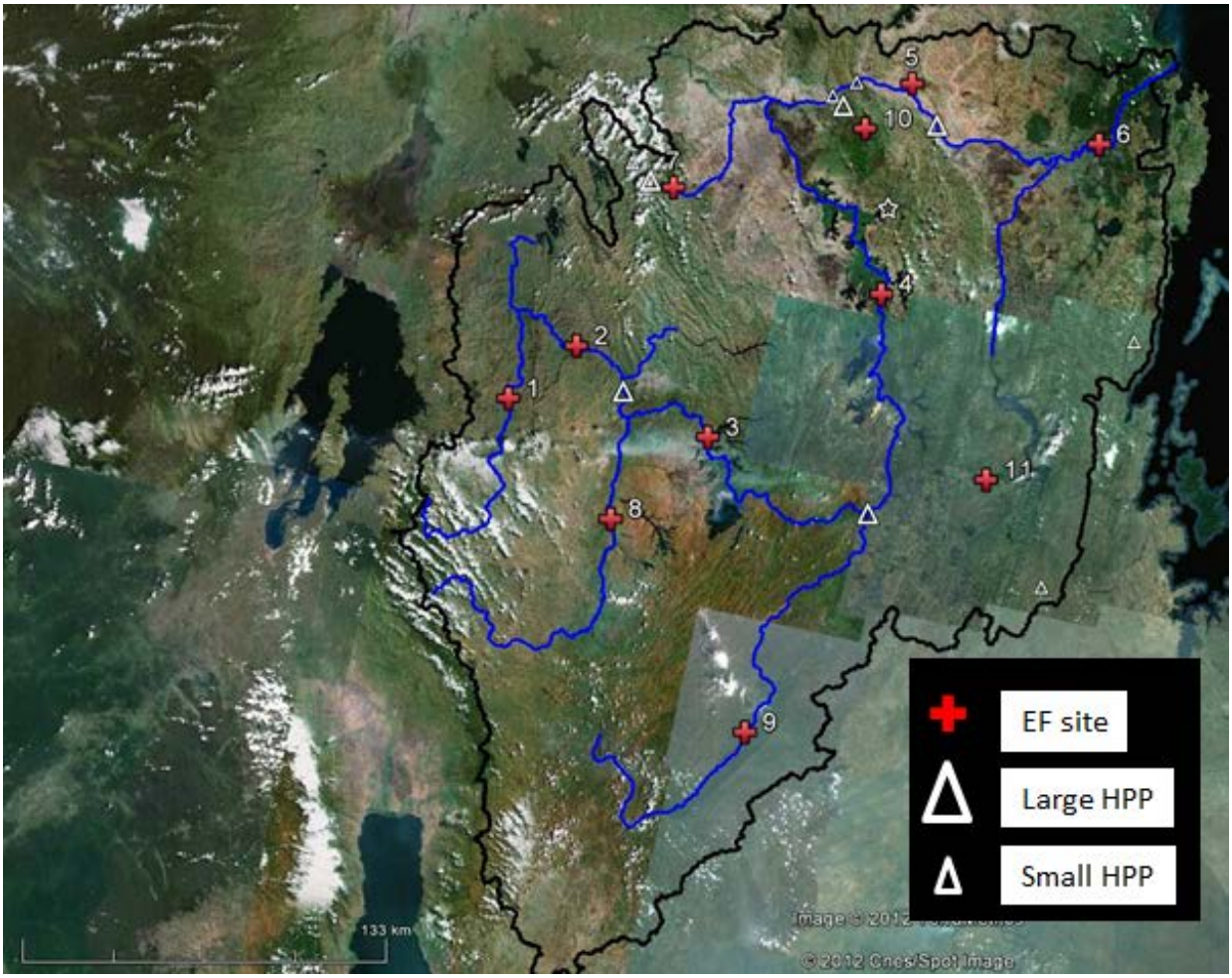

Figure 0.6 Kagera Basin showing locations of potential EF sites.

The actual site used will depend on the water-resources to be assessed. In terms of the ToR for the EF task between one and five EF sites will be analysed. It may be that additional sites will also be required in areas immediately downstream of the proposed developments.

Examples of the assessments are provided for Rusumo Falls HPP in Section 7.

b. Ecologically-relevant summaries of changes in flow

To gain an understanding of the possible impact of proposed water-resource developments on the downstream flow regimes, a series of nine questions were derived with respect to the possible change in ecologically-relevant aspects of the flow regime as a result of the presence and operation of a dam. These ecologically-relevant aspects of the flow regime include the onset of important seasons, which may affect breeding cycles, and the magnitude of the annual flood, which may inundate a floodplain. Knowing how these may change makes it easier to for ecologists to predict how changes in the hydrology could affect the ecosystem. The questions, together with an explanation of why each is relevant, are listed in **Table 0.3**.

Table 0.3 Description of the reasoning behind the questions about each of the ecologically-relevant aspects of the flow regime

No.		Question	Reasoning
1	Question related to overall volume	% natural MAR	This is the estimated percentage of the natural Mean Annual Runoff (MAR) that will arrive at each of the EF sites. The annual volume of water reaching an EF site is particularly important for ecosystems dependent on volume (such as the inflows to Lake Victoria) rather than on specific discharges (such as an annual channel maintenance flood). A relationship between percentage MAR and overall river condition has also emerged from the Reserve studies in South Africa (Hughes and Munster 1999) that accepts that up to 50% of the MAR can be removed from flashy river systems before the threat to integrity becomes serious, provided the water is removed in an ecologically-friendly manner.
2	Questions related to effects of peaking power releases	Peak power (Y/N)	Extreme within-day fluctuations in discharge can have a negative effect on the downstream environment, even if no water is abstracted from the system.
2a		Within day minimum (percentage of the natural dry season flow)	This describes the lowest flow expected during the daily fluctuations of peak power generation in the dry season.
2b		Within day maximum (percentage of natural dry season flow)	This describes the highest instantaneous flow expected during the fluctuating flows associated with peak power generation during the dry season. Rapidly fluctuating daily flows can cause rapid erosion of floodplains and river-channel banks. These impacts are more extreme when the difference between peaks and troughs are large.
2c		Hours of peak (out of 24)	This describes the number of hours of peak power generation per day. Where peaking power occurs, the duration of peaking power influences the degree of extreme flow variability and rate of change between the peak and trough of the daily flow variations. Large, rapid daily stage (water level) fluctuations cause very rapid erosion of floodplains and river channel banks. Conversely long periods of no release can result in fragmentation of the downstream rivers as riffles and rapids dry out and only pools remain as refuges for aquatic life.

No.		Question	Reasoning
3	Questions related to lowflows	Percentage of dry season low flows (daily average)	The different magnitudes of lowflow in the dry and wet seasons create more or less wetted habitat and different hydraulic and chemical conditions, which directly influence the balance of species.
4		Percentage of wet season low flows (daily average)	
5	Questions related to flood number and magnitude	Percentage of mid-level floods	Mid-level (intra-annual) floods provide critical cues to initiate migration or spawning of fish and other instream biota. Small floods can also play an important role in sorting and maintaining in-channel habitat.
6		Percentage of wet season magnitude/volume of peak flows	Many large rivers are low gradient (e.g. Amazon River, Okavango), flood-pulse driven environments, meaning that a prolonged annual wet season flood is required to activate and maintain much of the ecosystem. The wetlands and swamps of the central and lower Kagera Basin function in this manner.
7	Questions related to timing	Delay in onset of wet season (weeks)	An increase in flow together with an increase in ambient (and thus water) temperature are important lifecycle cues for many riverine species. Disconnection between these two factors can have negative effects on breeding cycles of animals and phenological (fruiting, flowering and seeding) cycles of plants.
8		Percentage of wet season duration	The length of the wet season is important for many species (e.g. fish) that leave the river channel to breed in the seasonally-flooded wetlands. In most cases these require a minimum period to ensure successful breeding and development of the young.
9	Questions related to sediment supply	Percentage of sediments retained	Sediment movement down a river is interrupted by dams which trap the bedload and the coarser fractions of suspended load. The impact of sediment free water being released downstream includes bed and bank erosion, undermining of bridges, channel straightening, abandonment of secondary channels and floodplains, channel narrowing, loss of bars and islands. Loss of sediment thus has important consequences for the geomorphology and thus general river habitat.

6. The Kagera mini-DRIFT DSS

The DSS used in this project was derived from the larger, more comprehensive DRIFT DSS (King and Brown 2003; King and Brown 2010). It uses the predicted relationship between ecosystem integrity and changes in ecologically-relevant aspects of the flow regime (Section 5.b), which are in the form of response curves (Section a), to predict the likely threat to ecosystem integrity associated with major flow changes related to water resource developments in the Kagera Basin.

a. Calibration of the response curves

The response curves that were calibrated for this project, describe the relationship between change in the ecologically-relevant summary statistics (described in Section 5.b) and overall ecosystem integrity. Thus, they integrate numerous, sometimes conflicting, ecosystem responses to change in a particular type of flow. The outcomes of the various EF studies were used to guide the calibration of the curves, the most relevant of which are:

- Baynes Hydropower Environmental Flow Assessment (Southern Waters 2010) on the Cunene River, Namibia and Angola
- Kafue Hydropower EF assessment and follow-up study to measure the effects of simulated peaking power on bank erosion and floodplain loss (Kafue River, Zambia).
- Sabaloka Hydropower Project, Mograt Hydropower Project and the Dagash Hydropower Project (Southern Waters 2006) on the Nile River, Sudan.
- Zambezi (Cahorra Bassa)
- Okavango Technical Diagnostic Analysis/EF component (FAO 2009), Botswana, Namibia, Angola.
- Pangani River Basin Environmental Flow Assessment (IUCN/PBWO 2005), Tanzania.
- Zambezi Delta Options Assessment (Bielfuss and Brown 2006), Mozambique.

The overall output of the combined response curves for a particular flow regime is presented as a predicted threat (associated with that flow regime) to overall ecosystem integrity and, by inference, to biodiversity.

Three sets of response curves were constructed based on perceived difference between the sensitivity of river reaches with different types of hydrographs to changes in the timing and magnitude of flows (**Table 0.4**). Each set of response curves is relevant for use in one of the three identified hydromorphic regions in the basin (see Section 3.b), *viz.* flood-pulse; flashy or transitional. In addition, because DSS relevant for different sites, of as yet unknown present day condition, the response curves take the natural condition as their starting point. This approach discounts possible non-flow related impacts, which may have altered the sensitivity of a particular system to flow changes.

Note: The evaluation of the extent of influence of a water resource development on a river ecosystem requires consideration of both temporal and spatial scale, as some effects may be extreme at a local scale but negligible at a gross scale. For the purposes of this basin level assessment, the extent of influence was evaluated on a broad spatial scale, with the focus on known biodiversity hotspots, over a c. twenty year horizon.

Table 0.4 The reasoning behind the difference in the shape of the response curves for the three hydromorphic zones

		Flood-pulse	Flashy	Transitional
Description of hydromorphic zone		Very shallow gradient, large wetland systems of lakes, swamps and floodplains. Occasionally interrupted by major slope breaks (e.g. Rusumo Falls).	Confined valleys with steep rivers and occasional unchannelled wetlands in the uppermost sections of the catchment; changing to meandering, confined floodplains in the lower sections.	Meandering, confined floodplains opening up to wider valleys and large wetlands.
		River flows are strongly moderated by large lakes and wetlands and do not respond to flows in the immediate catchment (flood-pulse is dominant).	River flows respond rapidly to rainfall in the catchment (relatively "flashy" flows).	River flows respond relatively fast to rainfall in the catchment (some intra-annual floods and flashiness).
Overall volume	% natural MAR	Driven by annual flood pulse – highly sensitive to volumetric changes in flood peak and in wet season lowflows, as these flood floodplains and fill lakes, and cue the seasonal lifecycles of the biota. Small changes in inflow can affect a large area of wetlands.	Not particularly sensitive to MAR reductions (provided these are done sensitively) until about 40% reduction (60% remaining in the channel). Thereafter integrity decreases with decreasing MAR.	Moderately sensitive to reductions in MAR.
Peaking power releases	Within day minimum	Highly sensitive to peaking locally at the site of peaking, with high levels of erosion expected. With distance downstream attenuation will be excellent because the systems are very flat, and so the peaking will have less effect on integrity with distance than would be the case for steeper flashy systems.	Very sensitive to peaking due to risks of erosion and slumping locally and for a considerable distance downstream as attenuation small in these steeper, narrower systems. Washing away and/or stranding of animals and plants can also be a problem.	Extremely sensitive to peaking due to high risk of bank slumping and erosion in floodplains and relatively steep wetlands of this transitional zone.
	Within day maximum			
	Hours of peak (out of 24)			
Questions related to lowflows	Percentage of dry season low flows (daily average)	Moderately sensitive to changes in dry season lowflows, provided these do not drop excessively low, as these will only affect a relatively small portion of the river ecosystem.	Highly sensitive to reductions in dry season low flows as these affects habitat connectivity and quality. E.g., longer dry seasons with lower discharge will mean less dilution of poor water quality, and less buffering of ambient temperature.	Intermediate sensitivity given the transitional nature of the hydromorphic zone, which incorporates both flashy and flood-pulse ecosystem types.
	Percentage of wet season low flows (daily average)	Highly sensitive to reductions in wet season low flows, since a small change in discharge will affect a very large area of wetland/lake.	Moderate sensitivity to reduction in wet season lowflows, provided these do not fall below the dry season flows, i.e., seasonal patterns retained.	

		Flood-pulse	Flashy	Transitional
Questions related to flood number and magnitude	Percentage of mid-level floods	Especially sensitive to mid-size floods, since many species in this zone are likely to be highly dependent on these as cues for breeding and/or migration. These floods also play an important role in sorting sediments and maintaining habitat condition and contribute to flow variability, which reduces inter-species competition.	Not sensitive to reduction of midsize floods as these probably attenuated naturally in the flood pulse zones.	
	Percentage of wet season magnitude/volume of peak flows	Moderately sensitive to a reduction in large floods. The 1:1 year floods scour pools, maintaining depth, but those with a greater return period tend to reset the system.	Highly sensitive to reductions in peak flows. The activation and maintenance of secondary (flood) channels and floodplain wetlands is dependent on large peak floods that overtop the banks and bars to inundate, scour and recharge these features. If these are reduced, then the associated habitats cannot be maintained.	
Questions related to timing	Delay in onset of wet season (weeks)	Very sensitive to delay in onset and reduced wet season duration, as changes can result in insufficient time for breeding and development of young to occur.	Moderately sensitive to delay in onset and duration, as these tend to be more varied than in flood-pulse systems.	Very sensitive to delay in onset and reduced wet season duration, as changes can result in insufficient time for breeding and development of young to occur.
	Percentage of wet season duration			
Questions related to sediment supply	Percentage of sediments retained	Moderately sensitive to reduced sediment delivery. Naturally much would have been trapped in upstream wetlands, but the wetlands are dependent on net sediment deposition for their underlying processes and physical morphology.	Very sensitive to sediment reductions, since a reversion to a net erosional zone would reduce flooding on the floodplains.	Very sensitive to sediment reductions, since a reversion to a net erosional zone would reduce flooding on the floodplains and activation of the lakes.

b. The response curves

The response curves used in the DSS for ecologically-relevant aspects of the flow regime for flood-pulse and flashy systems are provided in **Figure 0.7** and **Figure 0.8**.

Figure 0.7 **Response curves for ecologically-relevant aspects of the flow regime for flood-pulse and flashy systems (Part I).**

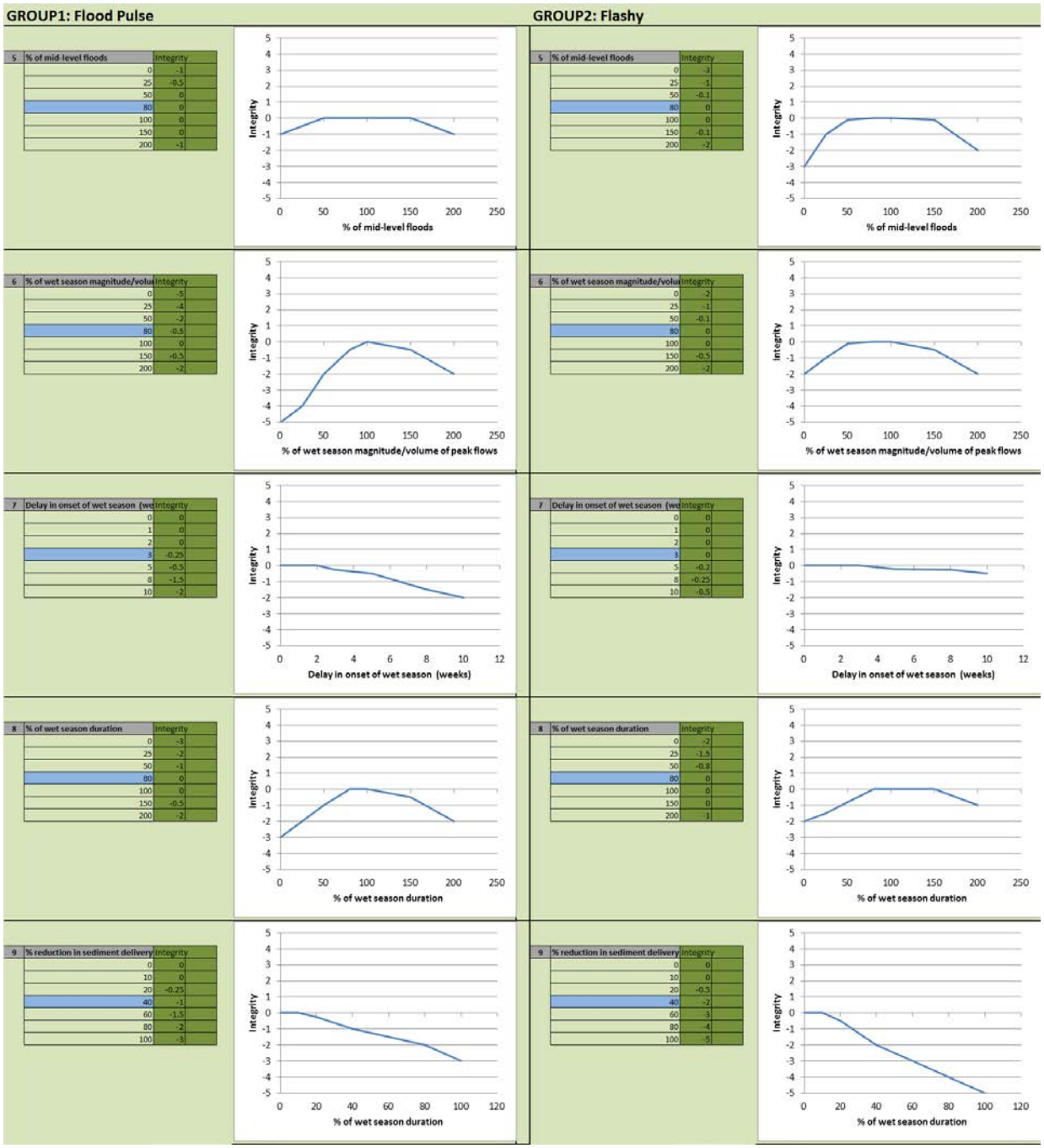

Figure 0.8 Response curves for ecologically-relevant aspects of the flow regime for flood-pulse and flashy systems (Part II).

7. Example of outputs - Rusumo Falls Hydropower Project

The preliminary results presented in this section are based on a set of assumptions about the operation of Rusumo Falls Hydropower Project, which are detailed in the relevant sections. These assumptions have been made in order to provide examples of the format of the results that will be forthcoming for these and other developments in the catchment once Diagnostic/Situation Assessment Task and Strategic Planning Process are completed, and will be refined and updated based on discussion with the engineers responsible for evaluating and refining possible water-resource developments for the basin.

a. Location and EF sites used in the assessment

The location of the EF site(s) used in the assessment, relative to the Rusumo Falls HPP, is shown in Figure 0.9 and some relevant detail is provided in Table 0.5.

The areas of main concern downstream of the Rusumo Falls HPP are:

- Akagera region – represented by EF Site 4.
- Kagera River between the confluence with the Kiruruma River and Kasongenye Rivers – represented by EF Site 5.
- Kagera River on the plains near Minziro – represented by EF Site 6.

All of these sites are within the flood-pulse hydromorphic regions of the catchment (Section 3.b).

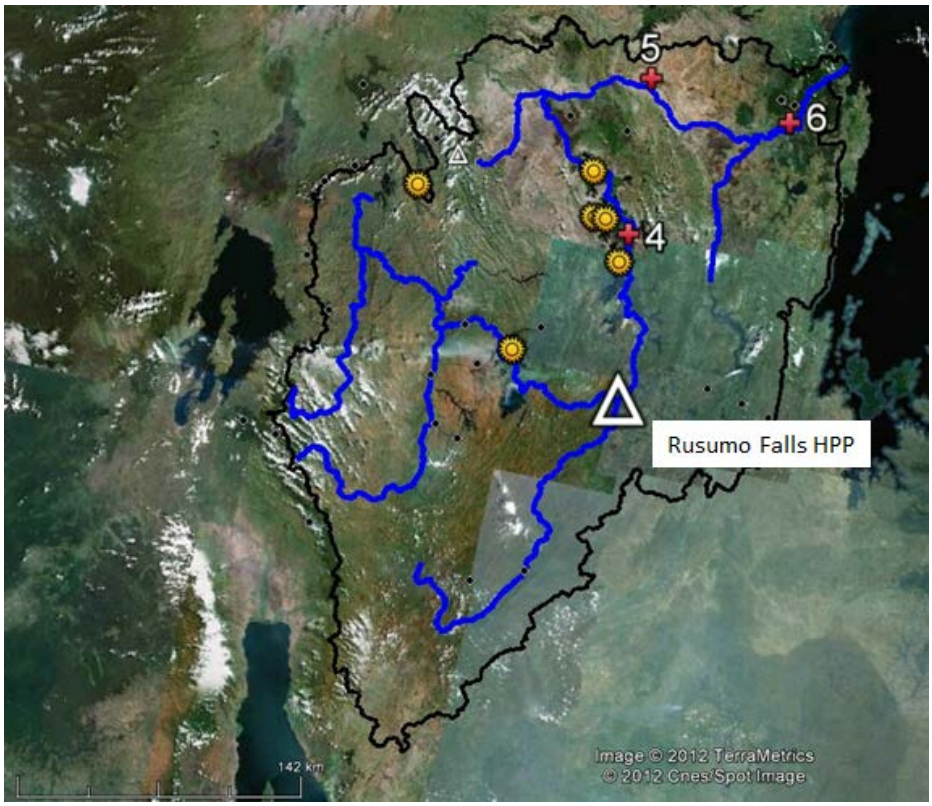

Figure 0.9 EF sites used to assess potential threat to ecosystem integrity posed by Rusumo Falls HPP. = hotspots depicted in BRL Ingénierie (2008).

Table 0.5 EF sites used to assess potential threat to ecosystem integrity posed by Rusumo Falls HPP

EF Site		Coordinates	Distance downstream of Rusumo HPP[8]	Hydromorphic zone
No.	Name			
4	Kagera River near Akagera	1.735° S, 30.823° E	*c.* 110 km	Flood pulse
5	Kagera River near Kiansechi	1.057° S, 30.922° E	*c.* 230 km	Flood pulse
6	Kagera River near Minziro	1.252° S, 31.522° E	*c.* 350 km	Flood pulse

b. Operational scenarios considered

The operational scenarios considered for Rusumo Falls HPP were:

1. Genuine run-of-river operation, i.e., hourly inflows equal hourly outflows. No sediment flushing.
2. Base-load power generation. Wet season flows overtop dam. No sediment flushing.
3. Peak-power generation, two peak periods: 2 hours morning and 2 hours evening, seven days a week. Wet season flows overtop dam. No balancing dam. No sediment flushing.
4. Peak-power generation, two peak periods: 2 hours morning and 2 hours evening, seven days a week. Wet season flows overtop dam. Balancing dam capable of storing full volume of dry season peak releases. No sediment flushing.

Table 0.6 describes the assumed impact of operational scenarios on downstream flow regime, and Table 0.7 provides the assumed influence of operational scenarios considered for Rusumo Falls HPP on downstream flow regime at the relevant EF sites.

Table 0.6 Description of the assumed influence of operational scenarios considered for Rusumo Falls HPP on downstream flow regime at the relevant EF sites (EF Sites 4, 5 and 6).

Flow statistic	Description for EF sites 4, 5 and 6 under Operational Scenarios 1, 2, 3 and 4
% natural MAR	The estimated percentage of the natural MAR that will arrive at each EF site. Scenario 1 assumes little storage, with little or change in MAR. Scenarios 2, 3 and 4 assume some evaporation losses from the reservoirs. These losses are ameliorated downstream due to the inflows from tributaries.
Peaking Power	Only scenarios 3 and 4 propose peak-power generation.
Peak power: Hours of peaking generation per day	Four hours of peaking power generation and 20 hours of no release have been assumed.

[8] Approximation based on BRL Ingénierie (2008).

Flow statistic	Description for EF sites 4, 5 and 6 under Operational Scenarios 1, 2, 3 and 4
Peak power: Within day minimum (% of the natural dry season flow)	We assumed 4 hours of power generation and 20 hours of no releases. Peaking at 900% of the natural daily average dry season flow will equate, over a 24 hour period, to the same volume as 24 hours of 150% of the natural daily dry season flow. This is the expected *% of dry season low flows* for the peak power flow scenarios. Attenuation within a balancing dam (Scenario 4) and within downstream wetlands (Scenarios 3 and 4) will reduce the daily fluctuations, with daily minimums probably above 100% of natural dry season flow due to the overall increased daily volumes in the dry season.
Peak power: Within day maximum (% of natural dry season flow)	Using the assumptions of dam operation described for the daily minimum above: The peak releases are assumed at 900% of the daily average, but these will decline strongly downstream of the release site due to attenuation in the lakes and wetlands. Maximum values thus decline from EF 4 to 6, but the effects of peaking (erosion and bank slumping) will more pronounced closer to the dam site.
% of dry season low flows (% of daily average)	Scenario 1 assumes little storage and therefore no opportunity to influence seasonality. Scenarios 2, 3, and 4 assume large reservoirs that could affect seasonality, such as storing the peaks of the wet season and later releasing these to increase the dry season flows. A 50% increase of the dry season flows was assumed. These increases will be most marked closer to the proposed HPPs and decline to some extent downstream due to evapotranspiration losses and the moderating influences of downstream tributaries.
% of wet season low flows (daily average)	A 40-60% decrease of the wet season low flows at the dam site is assumed. This would be ameliorated downstream due to the moderating influences of tributaries.
% of mid-level floods	Small intra-annual floods would be trapped by a large reservoir (Scenario 2, 3 and 4). The loss of these small floods will critical close to the HPP, but will be strongly ameliorated by floods introduced from unimpacted tributaries downstream as it is likely that many of these smaller floods are generated downstream of the Rusumo Falls HPP in any event.
% of wet season magnitude/volume of peak flows	A 40-60% decrease of the wet season peak flows at the dam site is assumed. This would be ameliorated downstream due to the moderating influences of tributaries.
Delay in onset of wet season (weeks)	Filling of the large reservoir (Scenarios 2, 3 and 4) at the end of the dry season will cause a delay the onset of wet season flows in the downstream river system. This delay will be longest close to the HPP, but progressively reduce downstream due to the inflows from tributaries.
% reduction of wet season duration	Storing of the wet season flows in the large reservoir (Scenarios 2, 3 and 4) will reduce the duration of wet season flows. This reduction will be largest close to the HPP, but progressively reduce downstream due to the inflows from tributaries.
% reduction in sediment delivery	Both large and small reservoirs will trap bedload and the coarser elements of suspended load sediment. The reduction in sediment delivered to the channel will be highest at the release site, but decrease downstream due to the increased erosion of the bed and banks of the channel and due to inflows of sediment from tributaries. In this catchment there are large sediment sinks (floodplains, wetlands and lakes) that naturally trap sediment, so the downstream impacts of sediment held in a reservoir will not be large. Impacts (bed and bank erosion, undermining bridges, channel straightening and narrowing) close to the release site could however be severe.

Table 0.7 The assumed influence of operational scenarios considered for Rusumo Falls HPP on downstream flow regime at the relevant EF sites.

Ecologically relevant flow statistics	EF site	Scenario 1	Scenario 2	Scenario 3	Scenario 4
		Run-of-river	Base-load power generation	Peak-power generation – no balancing dam	Peak-power generation – balancing dam
% natural MAR	4	100	95	95	95
	5	100	98	98	98
	6	100	99	99	99
Peak power	4	No	No	Yes	Yes
	5	No	No	Yes	Yes
	6	No	No	Yes	Yes
Within day minimum (% of the natural dry season flow)	4	N/A	N/A	70-90	100
	5	N/A	N/A	100	100
	6	N/A	N/A	100	100
Within day maximum (% of natural dry season flow)	4	N/A	N/A	140-160	100
	5	N/A	N/A	100	100
	6	N/A	N/A	100	100
% of dry season low flows (% of daily average)	4	100	140-160	140-160	140-160
	5	100	100-120	100-120	100-120
	6	100	100-120	100-120	100-120
% of wet season low flows (daily average)	4	100	40-60	40-60	40-60
	5	100	50-70	50-70	50-70
	6	100	60-80	60-80	60-80
% of mid-level floods	4	100	20-40	20-40	20-40
	5	100	70-90[9]	70-90	70-90
	6	100	80-100[10]	80-100	80-100
% of wet season magnitude/volume of peak flows	4	100	40-60	40-60	40-60
	5	100	60-80	60-80	60-80
	6	100	70-90	70-90	70-90
Delay in onset of wet season (weeks)	4	0	4-6	4-6	4-6
	5	0	2-4	2-4	2-4
	6	0	2-4	2-4	2-4
% of wet season duration	4	0	40-60	40-60	40-60
	5	0	20-40	20-40	20-40
	6	0	10-30	10-30	10-30
% reduction in sediment delivery	4	20-30	20-30	20-30	20-30
	5	5-10	5-10	5-10	5-10
	6	1-5	1-5	1-5	1-5

[9] .

[10] Unlikely that these floods are generated upstream of the Rusumo HPP.

c. Results and discussion

The DSS output for EF Sites 4, 5 and 6 downstream of the proposed Rusumo Falls HPP for four operational scenarios is provided in **Figure 0.10**. Essentially the first scenario, a true run-of-river scheme, would pose very little threat to the ecosystems at any of the selected EF sites, although there may be some localised impacts not captured here because the closest site, EF Site 4, is *c.* 110 km downstream of the HPP.

The other three scenarios all pose a low to moderate threat at EF Site 4 mainly related of delays in the timing of the wet season and reductions in the peak/volume of the seasonal flood. The ecosystems at EF Site 4 are not expected to be severely affected by peaking power releases because it is anticipated that these will be significantly attenuated given the distance and the flat nature of the river system between the HPP and the site. For similar reasons, plus the ameliorating effects of inflows from the incremental catchment, the threat at or near EF Sites 5 and 6 is expected to be low. However, the localised threat to the integrity of a site situated immediately downstream of a HPP with peaking releases would be high.

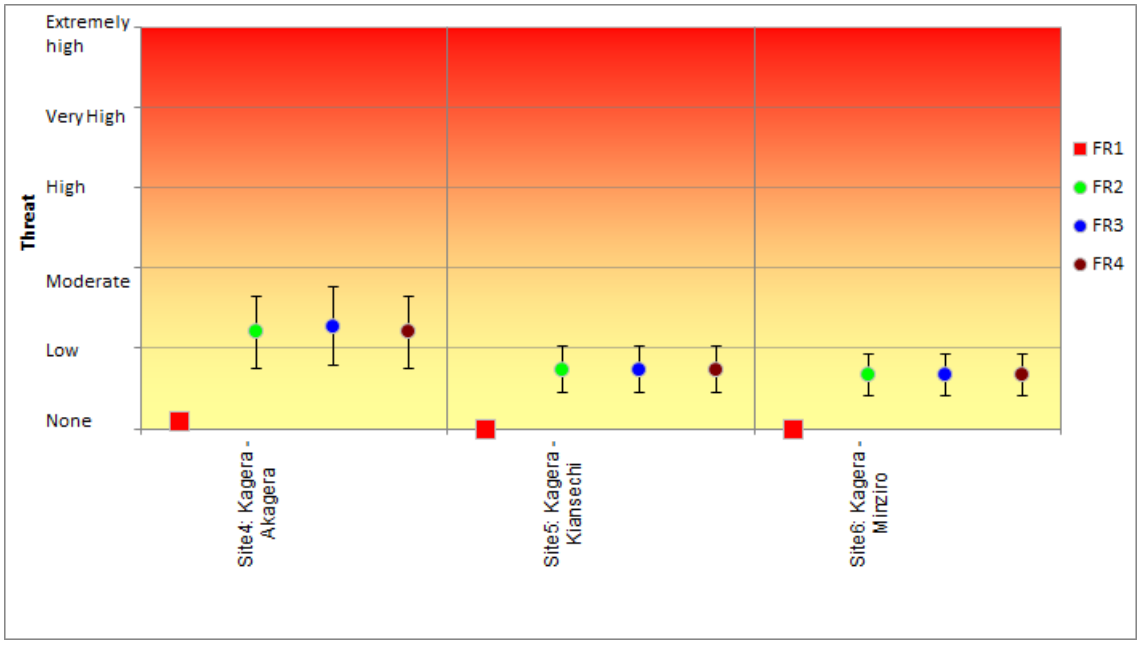

Figure 0.10 Predicted threat to the integrity of the ecosystems represented by EF Sites 4, 5, and 6 downstream of the proposed Rusumo Falls HPP.

DEVELOPMENT OF A BASIN-WIDE IWRM-BASED DEVELOPMENT PLAN FOR THE KAGERA BASIN

Burundi, Rwanda, Uganda and Tanzania

Environmental Flow Task

EF TASK PART II: SCHEME ASSESSMENT

Contract No.: Kagera/2011/S/BDP-01
Sida ref: 73001016

Prepared by:

Southern Waters Ecological Research and Consulting cc

with input from Fluvius Consultants

October 2012

Contact: Cate Brown
Southern Waters Ecological Research and Consulting cc.
56 Roeland Square
Drury Lane
CAPE TOWN
8001

Tel: (021) 465 3135
Fax: (021) 465 3901
E-mail: cate@southernwaters.co.za

Contents

List of Tables

List of Figures

1. Introduction

1.1 Project Background

Proposals for the Development of a Basin-wide IWRM-based Development Plan for the Kagera Basin were submitted during November 2011, in response to the Request for Proposals by the Nile Equatorial Lakes Subsidiary Action Plan (NELSAP) of the Nile Basin Initiative (NBI). Aurecon AMEI was subsequently appointed, with the project commencing on 1 April 2012. The expected completion date is end October 2012.

Southern Waters Ecological Research and Consulting was appointed as a sub-consultant to Aurecon AMEI on 15 May 2012, to undertake the Environmental Flows (EF) task, with a target date for completion of this task of 1 June 2012.

1.2 Objective of the EF Task

The objectives of the EF task are to use existing information to[11]:

- identify concerns and threats to the protection of the riverine ecosystem;
- highlight the opportunities and constraints relating to preservation of the water resources of the basin;
- provide scenario information on the extent of resource protection that would be associated with proposed developments in the Kagera Basin, which could be used to identify an acceptable balance between resource development and resource protection.

1.3 Terms of Reference

The EF study will comprise:

1. A basin-level delineation of the river systems into river reaches that are expected to respond in a homogeneous manner to flow and related changes associated with proposed water-resource developments;
2. A catchment-level qualitative assessment of the flow and other implications, such as sediment-trapping and barriers to migration, for the riverine ecosystem represented by existing and proposed water-resource developments;
3. An assessment of options for resource-protection related to the location and operation of existing and proposed water-resource developments.

1.4 The approach adopted for the EF task

The scheduling of the EF Task is such that it precedes some of the other tasks from which information is required, in particular:

- Diagnostic/Situation Assessment Task;
- Strategic Planning Process.

[11] The EF task will be undertaken within the limitations of the existing data.

Thus, the EF task has been divided into two parts. The first, this report, involves the development of a tool to predict the level of threat to the river ecosystem as a result of changes in the flow and sediment regime of the river. The second, which will coincide with the completion of the above tasks, is to use the tool to make predictions linked to specific water-resource developments to assist with decisions with respect to their location and operation.

Accordingly approach adopted for the EF task is as follows:

1. Delineate the Kagera Basin into relatively homogeneous longitudinal zones in terms of biophysical characteristics (reach analysis; PART I).
2. Identify existing and previously-proposed water-resource developments in the Kagera Basin (PART I).
3. Select representative sites for all the EF to follow (PART I).
4. Select a short-list of ecologically-relevant flow statistics that can be used to characterise flow changes downstream of water-resource developments in the basin (PART I).
5. Develop a simple decision support system (tool) to predict the potential threat to ecosystem function, and by inference biodiversity, at each EF site associated with different levels of flow change as a result of existing and previously-proposed water-resource developments (PART I).
6. Provide an example of the sorts of results that would be generated (PART I).
7. Generate results for specific water-resource developments to assist with decisions with respect to their location and operation ((PART II).

1.5 This report

This report is PART II of the EF assessment, *viz*. use the tool to make predictions linked to specific water-resource developments.

1.6 Study team

EFs and riverine ecology:	Dr Cate Brown – Southern Waters
Geomorphology and wetlands:	Mr Mark Rountree – Fluvius Consulting
MCDA/DSS construction:	Dr Alison Joubert – Southern Waters.

1.7 Limitations of study

The following limitations apply:

- The study area was not visited by the study team.
- No new data were collected.
- No daily flow records were made available for EF sites for the initial work; these will be available for later work.
- The relationships between river condition and flow change were derived from expert opinion using environmental flow studies in other parts of Africa as a guide.
- Socio-economic considerations where not included.
- Water quality was not included.
- The results highlight qualitative threat to ecosystem integrity and should not be misconstrued as quantitative environmental flow requirements.

2. The proposed water-resource developments assessed

Three basic types of water-resource developments have been proposed in the catchment (Table 10.1), *viz*.:

- Hydropower schemes (mainly run-or-river)
- Large dams
- Small dams.

Additional details about the schemes are available in the Strategic Planning Report, Volume 1.

Table 10.1 List of water-resource developments that were assessed

Scheme	Type	Coordinates		Hydrozone	Dam capacity[12]	MAR
		N	E			
Bigasha Dam	Small Dam	-0.9473	30.8933	Flashy	46.30%	17
Buyongwe Dam	Small Dam	-2.8153	29.9575	Flashy	39.75%	91
Cyanuzi-Kagogo Dam	Larger Dam	-2.2490	30.5910	Flashy	65.66%	64
Gashayura Dam	Small Dam	0.9040	30.6010	Flashy	41.60%	61
Kabuyanda Dam	Small Dam			Flashy	44.25%	9
Kagitumba-Mazimba Dam	Larger Dam	-1.3150	30.0890	Flashy	58.15%	163
Kakanja Dam	Larger Dam			Flashy	96.05%	75
Kakono Hydropower Project	Hydropower			Flood Pulse	0.36%	7400
Kanyaru Dam	Larger Dam	-2.7760	29.8200	Transitional	48.70%	739
Karazi Dam	Small Dam	-1.8219	31.01260	Flashy	46.31%	27
Kavurungu Dam	Small Dam	-2.9260	30.3700	Flashy	33.72%	56
Kishanda Valley	Hydropower			Flood Pulse	3.24%	7400
Mbarara Dam	Small Dam	-2.9590	29.7150	Flashy	47.07%	17
Munyange-Vumbe Dam	Small Dam			Flashy	40.76%	39
Muvumba Dam	Larger Dam			Flashy	73.46%	260
Nsongyezi HPP	Hydropower			Flood Pulse	0.64%	7400
Nyaboronga Dam	Hydropower	-1.8590	29.8910	Flashy	10.16%	2176
Rusumo Falls HPP	Hydropower	1.6169	30.7822	Flood pulse	0.00%	7400
Ruvironza Dam	Hydropower	-3.3394	29.9780	Flashy	50.00%	704
Taba-Gakomeye Dam	Small Dam	-2.5976	29.6032	Flashy	19.23%	43
Upper Ruvubu Dam	Larger Dam	-3.0540	29.7170	Flashy	50.00%	239

The hydrozone designations given in Table 10.1 refer to the zones identified in EF Part I (see Part I report; Figure 1.1).

[12] As a percentage of MAR

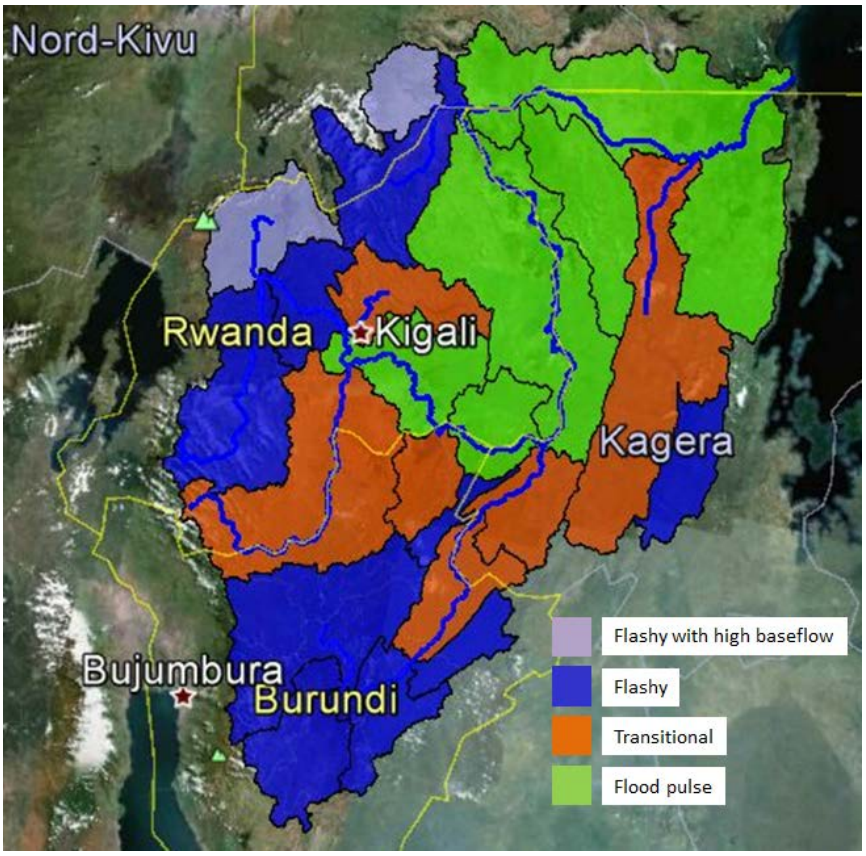

Figure 1.1 Delineation of the Kagera Basin on the basis of expected hydrographs

3. Identification of ecologically-relevant summary flow statistics

The DSS used in this project was derived from the larger, more comprehensive DRIFT DSS (King et al. 2003; King and Brown 2009). It uses the predicted relationship between ecosystem integrity and changes in ecologically-relevant aspects of the flow regime (Section 0), which are in the form of response curves (See Part I Report), to predict the likely threat to ecosystem integrity associated with major flow changes related to water-resource developments in the Kagera Basin.

3.1 Main assumptions

All of the assessments provide the following:

- an assessment of ecological threat to the downstream riverine ecosystem based on:
  - possible impacts at a site 5 km downstream of the scheme;
  - usage as envisaged in Strategic Planning Report, Volume 1;
- usage is based on a range, for instance, if the dam capacity in the Strategic Planning Report is 46.2% MAR, the values used in the DSS would be 40-50% MAR. This gives rise to the 'confidence bands' shown in the results graphs;
- small schemes situated on tributaries are most likely to be subject to a flashy flow regime (see EF Part I Report);
- the wet season in the Kagera Basin is c. eight months long;
- a minimum environmental flow release of 20% MAR (mean annual runoff) was been allowed for in the engineering calculations, it is assumed that this would equate to a minimum environmental flow release of 20% of daily discharge, i.e., dry season flows will never drop below 20% of natural;
- water for irrigation will be released through pipelines or canal systems, and not down the river;
- construction impacts and knock-on impacts as a result of the presence of the schemes are not considered.

It is worth noting that the (engineering) distinction between large and small dams is based on absolute storage capacity, and not on the percentage of the MAR stored in the dam, nor on the expected consumptive use of the water in the dam. In many cases the percentage of the MAR stored in the dam is similar for large and small dams, and in some cases it is higher in the small dams. For instance, Bigasha Dam, which is designated a small dam, has a storage capacity of 112% MAR and consumptive use of 43% MAR; whereas Kanyaru Dam, a large dam, has a storage capacity of 49% MAR and consumptive use of 4% MAR. For the most part, consumptive use has been used to assess percentage MAR that will remain in the downstream river.

3.2 Ecologically-relevant summary flow statistics

3.2.1 Hydropower schemes

The assumed influence of the hydropower schemes on the downstream flow regime is summarised in Table 1.2.

Table 1.2 Description of the assumed influence of hydropower schemes on the downstream flow regime

Flow statistic	Assumed influence of hydropower schemes
% natural MAR	The hydropower schemes all have very little storage, and no consumptive use is planned, so the % of the natural MAR downstream of each of them is expected to be c. 100%.
Peaking Power	The hydropower schemes are mostly run-of-river schemes aimed at base load power generation, so there will be no peaking power, except for Ruvyironza HPP.
% of dry season low flows (% of daily average)	The hydropower schemes all have very little storage and therefore little or no opportunity to influence seasonality. Wet and dry season flows are expected to be near natural.
% of wet season low flows (daily average)	
% of mid-level floods	The hydropower schemes all have very little storage and therefore little or no opportunity to capture flood flows. Mid-level floods, and peak wet season flows, are expected to be near natural.
% of wet season magnitude/volume of peak flows	
Delay in onset of wet season (weeks)	The hydropower schemes all have very little storage and therefore little or no opportunity to influence seasonality. Wet season onset and duration are expected to be near natural.
% reduction of wet season duration	
% reduction in sediment delivery	The hydropower schemes all have very little storage, but they may trap some bed load and the coarser elements of suspended load sediment.

The ecologically-relevant summary flow statistics for the six hydropower schemes are given in Table 1.3.

Table 1.3 Ecologically-relevant summary flow statistics for the six hydropower schemes

Scheme	Kakono HPP	Kishanda Valley HPP	Nsongyezi HPP	Nyabarongo HPP	Rusumo Falls HPP	Ruvyironza Dam
Hydrozone	Flood Pulse	Flood Pulse	Flood Pulse	Flashy	Flood pulse	Flashy
Dam capacity	0.36%	3.24%	0.64%	10.16%	0.00%	50.00%
Consumptive use	0	0	0	0	0	0
MAR	7400	7400	7400	2176	7400	704
% natural MAR[13]	99.64%	96.76%	99.36%	89.84%	100.00%	50.00%
Peak power	Y	Y	Y	Y	Y	Y
Within day minimum (% of the natural dry season flow)	20	20	20	20	20	20
Within day maximum (% of natural dry season	500-900	500-900	500-900	500-900	500-900	500-900

[13] In the downstream river

Scheme	Kakono HPP	Kishanda Valley HPP	Nsongyezi HPP	Nyabarongo HPP	Rusumo Falls HPP	Ruvyironza Dam
flow)						
% of dry season low flows (% of daily average)	100-110	100-110	100-110	100-110	100-110	130-150
% of wet season low flows (daily average)	90-100	90-100	90-100	90-100	90-100	60-70
% of mid-level floods	90-100	90-100	90-100	70-90	90-100	0-10
% of wet season magnitude/volume of peak flows	100	100	100	90-100	100	50-80
Delay in onset of wet season (weeks)	0	0	0	1	0	21
% of wet season duration	100	100	100	90	100	30
% reduction in sediment delivery	0-10	0-10	0-10	0-10	0-10	100

3.2.2 Large dams

The assumed influence of the large dams on the downstream flow regime is summarised in Table 1.4.

Table 1.4 Description of the assumed influence of large dams on the downstream flow regime

Flow statistic	Assumed influence of large dams
% natural MAR	The large dams have storage capacities between 50 and 96% of MAR.
Peaking Power	Most of the large dams have some peaking power generation.
Peak power: Hours of peaking generation per day	Four hours of peaking power generation and 20 hours of no release have been assumed.
Peak power: Within day minimum (% of the natural dry season flow)	The schemes all include a 20% MAR environmental flow release. Thus the minimum flow downstream of the dams, i.e., when no power is being generated, is expected to be c. 20% of the natural dry season flow.
Peak power: Within day maximum (% of natural dry season flow)	Using the assumptions of dam operation described for the daily minimum above: The peak releases are assumed at 500-900% of the daily average.
% of dry season low flows (% of daily average)	The large dams have storage capacities between 50 and 96% of MAR, and thus will influence seasonality. Dry season flows are expected to be 130-150% natural.
% of wet season low flows (daily average)	The large dams have storage capacities between 50 and 96% of MAR, and thus will influence seasonality. Wet season flows are expected to be 50-80% natural.
% of mid-level floods	The large dams will trap all the mid-level floods.
% of wet season magnitude/volume of peak flows	Although the very large floods are expected to pass through the dams, some attenuation of wet season magnitude/volume of peak flows is expected.

Flow statistic	Assumed influence of large dams
Delay in onset of wet season (weeks)	Filling of the large reservoirs at the end of the dry season will cause a considerable delay of the onset of wet season flows in the downstream river system.
% reduction of wet season duration	Storing of the wet season flows in a large reservoir will reduce the duration of wet season flows downstream.
% reduction in sediment delivery	Both large and small reservoirs will trap bed load and the coarser elements of suspended load sediment.

The ecologically-relevant summary flow statistics for the six large dams are given in Table 1.5.

Table 1.5 Ecologically-relevant summary flow statistics for the six large dams

Scheme	Cyanuzi-Kagogo Dam	Kagitumba-Mazimba Dam	Kakanja Dam	Kanyaru Dam	Muvumba Dam	Upper Ruvubu Dam
Hydrozone	Flashy	Flashy	Flashy	Transitional	Flashy	Flashy
Dam capacity	65.66%	58.15%	96.05%	48.70%	73.46%	50.00%
Consumptive use	19.92%	9.32%	40.42%	3.57%	44.22%	7.34%
MAR	64	163	75	739	260	239
% natural MAR[14]	34.34%	41.85%	3.95%	51.30%	26.54%	50.00%
Peak power	Y	Y	Y	Y	Y	Y
Within day minimum (% of the natural dry season flow)	20	20	20	20	20	20
Within day maximum (% of natural dry season flow)	500-900	500-900	500-900	500-900	500-900	500-900
% of dry season low flows (% of daily average)	130-150	130-150	130-150	130-150	130-150	130-150
% of wet season low flows (daily average)	60-70	60-70	60-70	60-70	60-70	60-70
% of mid-level floods	0-10	0-10	0-10	0-10	0-10	0-10
% of wet season magnitude/volume of peak flows	50-80	50-80	40-70	50-80	40-70	50-80
Delay in onset of wet season (weeks)	21	21	26	21	21	21
% of wet season duration	30	30	10	30	30	30
% reduction in sediment delivery	100	100	100	100	100	100

3.2.3 Small dams

[14] In the downstream river

The assumed influence of the small dams on the downstream flow regime is summarised in Table 1.6.

Table 1.6 Description of the assumed influence of small dams on the downstream flow regime

Flow statistic	Assumed influence of large dams
% natural MAR	The small dams have storage capacities between 40 and 60% of MAR.
Peaking Power	Most of the large dams do not have peaking power generation.
% of dry season low flows (% of daily average)	The small dams have storage capacities between 40 and 60% of MAR, and thus will influence seasonality. Dry season flows are expected to be 130-150% natural.
% of wet season low flows (daily average)	The small dams have storage capacities between 40 and 60% of MAR, and thus will influence seasonality. Wet season flows are expected to be 50-80% natural.
% of mid-level floods	The small dams will trap all the mid-level floods because they are situated on small rivers.
% of wet season magnitude/volume of peak flows	Although the very large floods are expected to pass through the dams, some attenuation of wet season magnitude/volume of peak flows is expected.
Delay in onset of wet season (weeks)	Filling of the large reservoirs at the end of the dry season will cause a considerable delay the onset of wet season flows in the downstream river system.
% reduction of wet season duration	Storing of the wet season flows in a large reservoir will reduce the duration of wet season flows downstream.
% reduction in sediment delivery	Both large and small reservoirs will trap bed load and the coarser elements of suspended load sediment.

The ecologically-relevant summary flow statistics for the nine small dams are given in Table 1.7.

Table 1.7 Ecologically-relevant summary flow statistics for the nine small dams

Scheme	Bigasha Dam	Buyongwe Dam	Gashayura Dam	Kabuyanda Dam	Karazi Dam	Kavuruga Dam	Mbarara Dam	Munyange-Vumbe Dam	Taba-Gakomeye Dam
Hydrozone	Flashy	Flashy	Flashy	Flashy	Flashy	Flashy	Flashy	Flashy	Flashy
Dam capacity	111.76%	20.88%	32.57%	70.22%	110.62%	26.98%	56.55%	17.44%	18.89
Consumptive use	46.30%	39.75%	41.60%	44.25%	46.31%	33.72%	47.07%	40.76%	19.23%
MAR	17	91	61	9	27	56	17	39	43
% natural MAR[15]	53.70%	60.25%	58.40%	55.75%	53.69%	66.28%	52.93%	59.24%	80.77%
Peak power	N	Y	Y	N	N	Y	N	Y	Y
Within day minimum (% of the natural dry season flow)	N/A	20	20	N/A	N/A	20	N/A	20	20
Within day maximum (% of natural dry season flow)	N/A	500-900	500-900	N/A	N/A	500-900	N/A	500-900	500-900
% of dry season low flows (% of daily average)	130-150	130-150	130-150	130-150	130-150	130-150	130-150	130-150	110-310
% of wet season low flows (daily average)	60-70	60-70	60-70	60-70	60-70	60-70	60-70	60-70	70-90
% of mid-level floods	0-10	0-10	0-10	0-10	0-10	0-10	0-10	0-10	70-90
% of wet season magnitude	50-80	60-90	50-80	50-80	50-80	50-80	50-80	50-80	90-100
Delay in onset of wet season (weeks)	21	21	21	21	21	21	21	21	1
% of wet season duration	30	30	30	30	30	30	30	30	90
% reduction in sediment delivery	100	100	100	100	100	100	100	100	0-10

[15] In the downstream river

4. Threat to the downstream riverine ecosystem posed by each of the proposed water-resource developments

The DSS outputs for the different schemes, hydropower, large dams and small dams, are provided in Figure 1.2, Figure 1.3 and Figure 1.4, respectively, and is summarised in Table 1.8

Table 1.8 Summary of the threat to the downstream riverine ecosystem posed by each of the proposed water-resource developments evaluated

Scheme	Type	Threat to downstream riverine ecosystem	
		Operation	Remove peaking power releases
Bigasha Dam	Small Dam	Low-moderate	-[16]
Buyongwe Dam	Small Dam	Moderate-high	Low-moderate
Cyanuzi-Kagogo Dam	Larger Dam	Moderate-high	Low-moderate
Gashayura Dam	Small Dam	Moderate-high	Low-moderate
Kabuyanda Dam	Small Dam	Low-moderate	-
Kagitumba-Mazimba Dam	Larger Dam	Moderate-high	Low-moderate
Kakanja Dam	Larger Dam	High-very high	Low-moderate
Kakono Hydropower Project	Hydropower	Low	Very low
Kanyaru Dam	Larger Dam	Low-moderate	Low-moderate
Karazi Dam	Small Dam	Low-moderate	-
Kavuruga Dam	Small Dam	Moderate-high	Low-moderate
Kishanda Valley	Hydropower	Low	Very low
Mbarara Dam	Small Dam	Moderate-high	Low-moderate
Munyange-Vumbe Dam	Small Dam	Low-moderate	-
Muvumba Dam	Larger Dam	Moderate-high	Low-moderate
Nsongyezi HPP	Hydropower	Low	Very low
Nyabarongo Dam	Hydropower	Low	Very low
Rusumo Falls HPP	Hydropower	Low	Very low
Ruvyironza Dam	Hydropower	Moderate-high	Low-moderate
Taba-Gakomeye Dam	Small Dam	Low	Very low
Upper Ruvubu Dam	Larger Dam	Moderate-high	Low-moderate

Essentially the run-of-river[17] hydropower schemes represent the lowest threat to the downstream riverine ecosystem and the dams with the highest storage and/or consumptive use relative to the MAR of the river on which they are situated, with peak power generation, represent the highest threat to the downstream riverine ecosystem. In all cases the threat to the ecosystem is reduced:

- incorporation of a 20% EF release;
- by not utilising the peaking-power option

[16] Did not have peaking power in original scenario
[17] A run-of-river operation in its truest form would release water hour by hour at the same rate as inflows; such operations are typical of hydropower dams with little to no storage available to modify inflows.

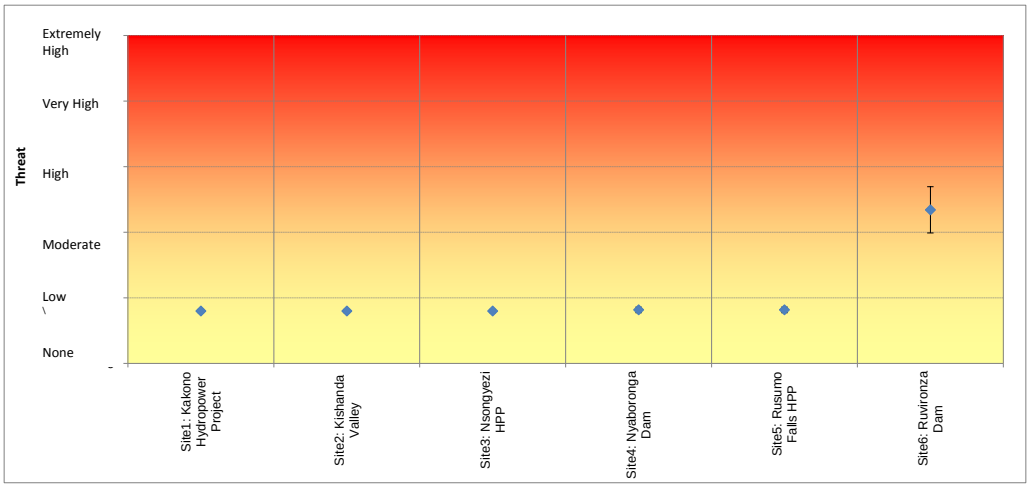

Figure 1.2 Predicted threat to the integrity of the ecosystems represented the proposed hydropower schemes

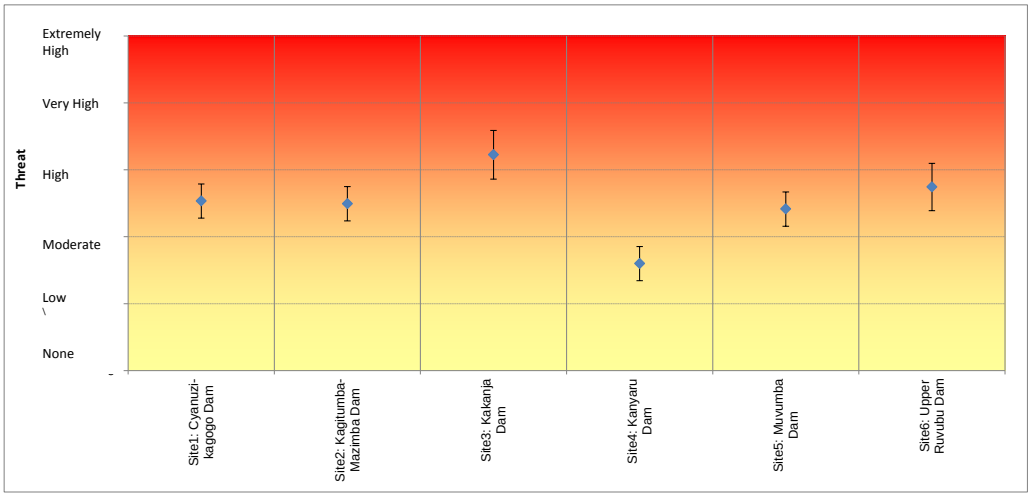

Figure 1.3 Predicted threat to the integrity of the ecosystems represented the proposed large dams

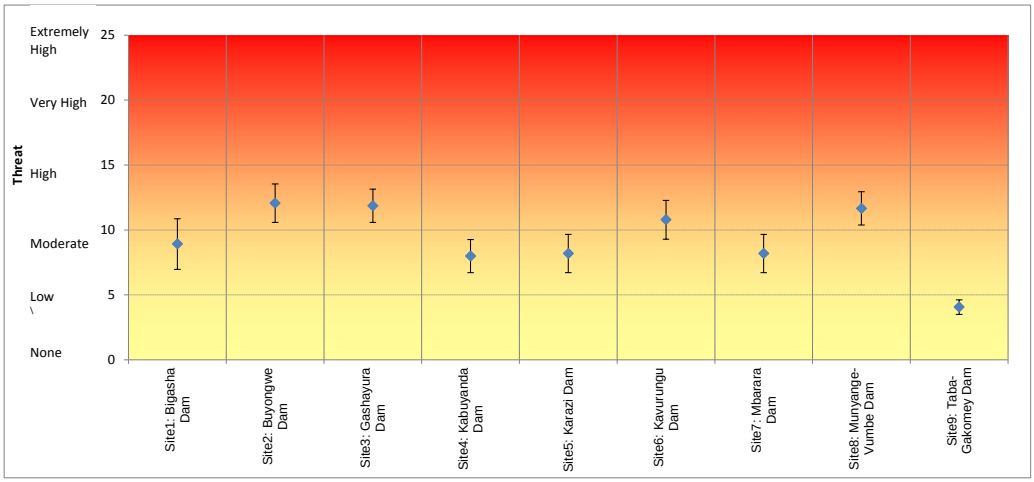

Figure 1.4 Predicted threat to the integrity of the ecosystems represented the proposed small dams

Also, all else being equal, dams on the steeper, smaller rivers in the catchment tend to pose a higher threat to the immediate downstream sections of river, as these systems tend to be steep, with a

more variable flow regime (flashy hydrozone). They also offer little or no attenuation of peaking releases and are prone to erosion.

5. Comments on threats to the wider riverine ecosystem

Most of the main river schemes are run-of-river hydropower schemes that are expected to pose a low threat to the downstream ecosystems. However, even the threats posed by other schemes are expected to be ameliorated considerably with distance downstream of the scheme. This is because:

- of the enhancing effects of inflows from the incremental catchment;
- river flows in the main river are strongly moderated by large lakes and wetlands and do not respond to flows in the immediate catchment (flood-pulse is dominant).
- with distance downstream attenuation will be excellent because the systems are very flat and so even peaking will have less effect on integrity with distance than would be the case for steeper flashy systems.

The main rivers are however expected to be highly sensitive to reductions in wet season low flows, since a small change in discharge will affect a very large area of wetland/lake.

These points are illustrated in the assessment of the perceived threats to the downstream ecosystem from the proposed Rusumo Falls HPP, including assessment of different operating scenarios, provided in the EF PART I Report.

It is difficult to make a detailed assessment of the impact of tributary schemes on the main river, but individually these are likely to be insignificant because of the nature of the main rivers, as discussed above, and also because the incremental contribution of each tributary is relatively small.

6. References

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Annexure E:
Risk Assessment

Annexure E: Risk Assessment

Kagera BDP Consultancy

Total Activities	Very High	High	Medium	Low	Very Low	Total Assessments	Raw Risk	Activity Ratio (incl. Mitigation)
93	0	0	29	39	25	93	1	0.06

RISK ANALYSIS

Strategic Option	Strategy	Strategic Option Objective	Strategy No.	Targets (Sub-Strategies)	Risk Description / Effect	Category	Probability	Severity	Impact Value	Initial Impact Classification	Mitigation	Probability	Severity	Impact Value	Risk Classification
Option 1	Creating an enabling environment	To operationalize water governance in support of Basin-wide water resources development and management	1.1	Improve water sector legislative and regulatory framework at regional and national levels.	All countries may not sign the Nile Cooperative Framework Agreement-CFA signed by only 6 countries	P,L	8	8	64	Medium	No envisaged mitigatory measures	8	8	64	Medium
Option 1	Creating an enabling environment	To operationalize water governance in support of Basin-wide water resources development and management	1.1	Improve water sector legislative and regulatory framework at regional and national levels.	Potential conflict of interest because Kenya is part of the Lake Victoria agreement but not part of Kagera agreement	P,L	3	16	48	Medium	Implement BDP under NBI not EAC	3	4	12	Low
Option 1	Creating an enabling environment	To operationalize water governance in support of Basin-wide water resources development and management	1.1	Improve water sector legislative and regulatory framework at regional and national levels.	Potential conflict of interest because Tanzania forms part of SADC and the EAC	P,L	3	16	48	Medium	Initiative under way to merge the communities under one umbrella - SADC, EAC, COMESA	3	4	12	Low
Option 1	Creating an enabling environment	To operationalize water governance in support of Basin-wide water resources development and management	1.1	Improve water sector legislative and regulatory framework at regional and national levels.	Ineffective harmonisation of Basin states water sector legislative and regulatory frameworks	L	5	16	80	Medium	Implement project to harmonise Basin legislation and standards	2	2	4	Very Low
Option 1	Creating an enabling environment	To operationalize water governance in support of Basin-wide water resources development and management	1.1	Improve water sector legislative and regulatory framework at regional and national levels.	Current or potential future legislation in conflict with the BDP	L	3	16	48	Medium	Implement Kagera Project to harmonist Basin legislation and standards	3	4	12	Low
Option 1	Creating an enabling environment	To operationalize water governance in support of Basin-wide water resources development and management	1.2	Ensure qualified human resources for water planning, management and research.	Insufficient capacity and capability	I	5	16	80	Medium	Timeously source appropriate staff, develop and implement applicable training courses at various levels and target audiences	3	4	12	Low
Option 1	Creating an enabling environment	To operationalize water governance in support of Basin-wide water resources development and management	1.2	Ensure qualified human resources for water planning, management and research.	Lack of adequate water resources education/tertiary training and institutions	I	3	16	48	Medium	Develop educational support plans.	2	4	8	Very Low
Option 1	Creating an enabling environment	To operationalize water governance in support of Basin-wide water resources development and management	1.3	Establish IWRM Information Management System and Tools.	Inadequate access to internet and software	T	8	16	128	High	Invest in sustainable communication networks e.g. radio-based communication	3	4	12	Low
Option 1	Creating an enabling environment	To operationalize water governance in support of Basin-wide water resources development and management	1.3	Establish IWRM Information Management System and Tools.	Harmonisation of models and tools between countries not successful	L	5	16	80	Medium	Implement project to harmonist basin legislation and standards	3	4	12	Low
Option 1	Creating an enabling environment	To operationalize water governance in support of Basin-wide water resources	1.3	Establish IWRM Information Management System and Tools.	Ineffective implementation of the IMS	T, I	8	16	128	High	Implement detailed training programmes on	5	8	40	Medium

		development and management									IMS utilisation. Prioritize IMS management in National Departments.				
Option 1	Creating an enabling environment	To operationalize water governance in support of Basin-wide water resources development and management	1.4	Promote broad-based stakeholder participation and representation.	Disparity in inter-country relationships	P	8	8	64	Medium	Ensure comprehensive stakeholder engagement in project planning and design, and effective conflict resolution	5	8	40	Medium
Option 1	Creating an enabling environment	To operationalize water governance in support of Basin-wide water resources development and management	1.4	Promote broad-based stakeholder participation and representation.	Dominance of pressure groups/politics	P	5	16	80	Medium	Ensure comprehensive stakeholder engagement in project planning and design	3	4	12	Low
Option 1	Creating an enabling environment	To operationalize water governance in support of Basin-wide water resources development and management	1.4	Promote broad-based stakeholder participation and representation.	Language and cultural barriers	S	5	8	40	Medium	Ensure comprehensive stakeholder engagement in project planning and design	3	2	6	Very Low
Option 1	Creating an enabling environment	To operationalize water governance in support of Basin-wide water resources development and management	1.5	Ensure adequate funding for water resources management.	Declining donor climate	E	8	8	64	Medium	Ensure project sustainability is a criteria of project planning; reduce dependence on external funding mechanisms	5	8	40	Medium
Option 1	Creating an enabling environment	To operationalize water governance in support of Basin-wide water resources development and management	1.5	Ensure adequate funding for water resources management.	Risk profiles of countries deterring donors	E	8	16	128	High	Ensure project sustainability is a criteria of project planning; reduce dependence on external funding mechanisms	5	8	40	Medium
Option 1	Creating an enabling environment	To operationalize water governance in support of Basin-wide water resources development and management	1.5	Ensure adequate funding for water resources management.	Ineffective finance mechanisms for schemes and basin activities	E	8	16	128	High	Ensure that project sustainability is a criteria of project planning; reduce dependence on external funding mechanisms - allowance in Basin countries' budgets	5	8	40	Medium
Option 1	Creating an enabling environment	To operationalize water governance in support of Basin-wide water resources development and management	1.5	Ensure adequate funding for water resources management.	Fraud and corruption	E	8	8	64	Medium	Implement strict financial management mechanisms double-checking.	5	4	20	Low
Option 2	Basin Water Management	To effectively manage and control basin water resources and users	2.1	Integrated and coordinated transboundary Basin water management.	Potential objections by Nile Basin countries to planned development	P	8	16	128	High	NBI to notify Nile Basin states of Plan and implementation programme	5	16	80	Medium
Option 2	Basin Water Management	To effectively manage and control basin water resources and users	2.1	Integrated and coordinated transboundary Basin water management.	One or more member states, development sectors, interest groups are not supportive of the BDP	S	5	8	40	Medium	Change management mechanisms included into project designs for projects requiring lifestyle changes.	3	8	24	Low
Option 2	Basin Water Management	To effectively manage and control basin water resources and users	2.1	Integrated and coordinated transboundary Basin water management.	Transboundary activities/project being implemented in an un-synchronised and ineffective fashion	P, I	5	16	80	Medium	Basin Secretariat to develop clear implementation programme for member states	3	4	12	Low
Option 2	Basin Water Management	To effectively manage and control basin water resources and users	2.2	Watershed management by Basin countries.	Ineffective implementation of Basin strategies and plans	I	8	8	64	Medium	Identify clear mandates and responsibilities between institutions and ensure buy-in and support	3	4	12	Low
Option 2	Basin Water Management	To effectively manage and control basin water resources and users	2.2	Watershed management by Basin countries.	Lack of appropriate capacity and capability of Basin countries	I	8	16	128	High	Ensure on-going recruitment and training; Implement succession plans	5	4	20	Low
Option 2	Basin Water Management	To effectively manage and control basin water resources and users	2.3	Ensure effective monitoring, assessment and information management.	Lack of appropriate capacity and capability of Basin countries	I	8	16	128	High	Ensure on-going recruitment and training; Implement succession plans	5	8	40	Medium
Option 2	Basin Water Management	To effectively manage and control basin water resources and users	2.4	Asset management and operation of Basin water infrastructure.	Lack of appropriate capacity and capability of Basin countries	I	8	16	128	High	Ensure on-going recruitment and training; Implement succession plans	5	8	40	Medium
Option 3	Water Supply and Sanitation	To provide improved access for various water uses and sanitation facilities	3.1	Domestic Rural water supply	Inability to pay for services	E	8	16	128	High	Ensure comprehensive stakeholder engagement	5	8	40	Medium

											in project planning and design				
Option 3	Water Supply and Sanitation	To provide improved access for various water uses and sanitation facilities	3.1	Domestic Rural water supply	Delays to implementation of schemes or derailment of implementation schemes	I	8	8	64	Medium	Ensure on-going recruitment and training; Implement succession plans; Ensure comprehensive stakeholder engagement in project planning and design.	5	4	20	Low
Option 3	Water Supply and Sanitation	To provide improved access for various water uses and sanitation facilities	3.1	Domestic Rural water supply	Ineffective sharing of institutional responsibilities	I	8	8	64	Medium	Identify clear mandates and responsibilities between institutions.	3	2	6	Very Low
Option 3	Water Supply and Sanitation	To provide improved access for various water uses and sanitation facilities	3.1	Domestic Rural water supply	Inadequate capacity and capability	I	8	8	64	Medium	Ensure on-going recruitment and training; Implement succession plans;	5	4	20	Low
Option 3	Water Supply and Sanitation	To provide improved access for various water uses and sanitation facilities	3.1	Domestic Rural water supply	Insufficient financing mechanisms	E	8	8	64	Medium	Ensure project sustainability is a criteria of project planning; reduce dependence on external funding mechanisms	3	4	12	Low
Option 3	Water Supply and Sanitation	To provide improved access for various water uses and sanitation facilities	3.2	Urban water supply and treatment to potable standards.	Inability to pay for services or poor payment	E	8	16	128	High	Ensure comprehensive stakeholder engagement in project planning and design.	8	4	32	Medium
Option 3	Water Supply and Sanitation	To provide improved access for various water uses and sanitation facilities	3.2	Urban water supply and treatment to potable standards.	Delays to implementation of schemes or derailment of implementation schemes	I	8	16	128	High	Ensure on-going recruitment and training; Implement succession plans; Ensure comprehensive stakeholder engagement in project planning and design.	5	4	20	Low
Option 3	Water Supply and Sanitation	To provide improved access for various water uses and sanitation facilities	3.2	Urban water supply and treatment to potable standards.	Ineffective sharing of institutional responsibilities	I	8	16	128	High	Identify clear mandates and responsibilities between institutions.	3	2	6	Very Low
Option 3	Water Supply and Sanitation	To provide improved access for various water uses and sanitation facilities	3.2	Urban water supply and treatment to potable standards.	Inadequate capacity and capability	I	8	16	128	High	Ensure on-going recruitment and training; Implement succession plans;	5	4	20	Low
Option 3	Water Supply and Sanitation	To provide improved access for various water uses and sanitation facilities	3.2	Urban water supply and treatment to potable standards.	Insufficient financing mechanisms	E	8	16	128	High	Ensure project sustainability is a criteria of project planning; reduce dependence on external funding mechanisms; engagement with users and industry	3	4	12	Low
Option 3	Water Supply and Sanitation	To provide improved access for various water uses and sanitation facilities	3.3	Providing improved sanitation facilities.	Inability to pay for services	E	8	16	128	High	Ensure comprehensive stakeholder engagement in project planning, design and operation	8	8	64	Medium
Option 3	Water Supply and Sanitation	To provide improved access for various water uses and sanitation facilities	3.3	Providing improved sanitation facilities.	Delays to implementation of schemes or derailment of implementation schemes	I	8	16	128	High	Ensure on-going recruitment and training; Implement succession plans; Ensure comprehensive stakeholder engagement in project planning and design.	5	4	20	Low
Option 3	Water Supply and Sanitation	To provide improved access for various water uses and sanitation facilities	3.3	Providing improved sanitation facilities.	Ineffective sharing of institutional responsibilities	I	8	16	128	High	Identify clear mandates and responsibilities between institutions.	3	2	6	Very Low
Option 3	Water Supply and Sanitation	To provide improved access for various water uses and sanitation facilities	3.3	Providing improved sanitation facilities.	Inadequate capacity and capability	I	8	16	128	High	Ensure on-going recruitment and training; Implement succession	5	4	20	Low

											plans;				
Option 3	Water Supply and Sanitation	To provide improved access for various water uses and sanitation facilities	3.3	Providing improved sanitation facilities.	Insufficient financing mechanisms	E	8	16	128	High	Ensure project sustainability is a criteria of project planning; reduce dependence on external funding mechanisms	3	4	12	Low
Option 3	Water Supply and Sanitation	To provide improved access for various water uses and sanitation facilities	3.4	Urban, industrial and mining wastewater treatment.	Resistance by these water users to treatment requirements	S	8	16	128	High	Change management mechanisms included into project designs for projects requiring lifestyle changes.	5	8	40	Medium
Option 3	Water Supply and Sanitation	To provide improved access for various water uses and sanitation facilities	3.4	Urban, industrial and mining wastewater treatment.	Cost implications of treatment requirements	E, T	5	16	80	Medium	Implement phased approach to treatment requirement to ensure cost effectiveness.	3	8	24	Low
Option 4	Livelihoods and Socio-economic development	Manage and develop water resources to serve social and economic development in the Basin	4.1	Water demand of intensified, modernised agricultural and aquaculture developments.	Insufficient funding	E	8	16	128	High	Ensure project sustainability is a criteria of project planning; reduce dependence on external funding mechanisms; donor funding	5	8	40	Medium
Option 4	Livelihoods and Socio-economic development	Manage and develop water resources to serve social and economic development in the Basin	4.1	Water demand of intensified, modernised agricultural and aquaculture developments.	Insufficient capability and capacity	I	8	16	128	High	Ensure on-going recruitment and training; Implement succession plans;	5	4	20	Low
Option 4	Livelihoods and Socio-economic development	Manage and develop water resources to serve social and economic development in the Basin	4.1	Water demand of intensified, modernised agricultural and aquaculture developments.	Disparate priorities - one or more member states, development sectors, interest groups may not be supportive	P	3	4	12	Low	Implement project to harmonist basin legislation and standards	2	2	4	Very Low
Option 4	Livelihoods and Socio-economic development	Manage and develop water resources to serve social and economic development in the Basin	4.1	Water demand of intensified, modernised agricultural and aquaculture developments.	Deterring influence of current and future legislation – regional and national	L	5	8	40	Medium	Implement project to harmonist basin legislation and standards	2	2	4	Very Low
Option 4	Livelihoods and Socio-economic development	Manage and develop water resources to serve social and economic development in the Basin	4.1	Water demand of intensified, modernised agricultural and aquaculture developments.	Unsupportive trading policies	L	5	16	80	Medium	Sign trade agreements between neighbouring countries; Harmonise basin trading policies and standards.	3	8	24	Low
Option 4	Livelihoods and Socio-economic development	Manage and develop water resources to serve social and economic development in the Basin	4.1	Water demand of intensified, modernised agricultural and aquaculture developments.	Markets inaccessibility	E	5	8	40	Medium	Improve access to markets through regional economic integration and in-country extension support services	3	4	12	Low
Option 4	Livelihoods and Socio-economic development	Manage and develop water resources to serve social and economic development in the Basin	4.1	Water demand of intensified, modernised agricultural and aquaculture developments.	Insufficient transport to get produce to markets – local and international	T	5	8	40	Medium	Ensure transport, energy etc. is a criteria of project planning;	3	4	12	Low
Option 4	Livelihoods and Socio-economic development	Manage and develop water resources to serve social and economic development in the Basin	4.2	Address the high demand for new water infrastructure to meet regional energy security.	Ineffective funding and finance mechanisms or inability to pay	E	8	16	128	High	Ensure project sustainability is a criteria of project planning; reduce dependence on external funding mechanisms	5	8	40	Medium
Option 4	Livelihoods and Socio-economic development	Manage and develop water resources to serve social and economic development in the Basin	4.2	Address the high demand for new water infrastructure to meet regional energy security.	Insufficient capability and capacity	I	8	16	128	High	Ensure on-going recruitment and training; Implement succession plans;	5	8	40	Medium
Option 4	Livelihoods and Socio-economic development	Manage and develop water resources to serve social and economic development in the Basin	4.2	Address the high demand for new water infrastructure to meet regional energy security.	Disparate priorities - one or more member states, development sectors, interest groups may not be supportive	P	5	8	40	Medium	Implement project to harmonist basin legislation and standards	2	2	4	Very Low
Option 4	Livelihoods and Socio-economic development	Manage and develop water resources to serve social and economic development in the Basin	4.2	Address the high demand for new water infrastructure to meet regional energy security.	Deterring influence - time and cost impacts - of current and future legislation – regional and national	L	5	8	40	Medium	Implement project to harmonist basin legislation and standards	2	2	4	Very Low
Option 4	Livelihoods and Socio-economic development	Manage and develop water resources to serve social and economic development in the Basin	4.2	Address the high demand for new water infrastructure to meet regional energy security.	Unsupportive trading policies	L	5	16	80	Medium	Sign trade agreements between neighbouring countries; Harmonise basin trading policies and standards.	2	2	4	Very Low
Option 4	Livelihoods and Socio-economic development	Manage and develop water resources to serve social and economic development in the Basin	4.2	Address the high demand for new water infrastructure to meet regional energy security.	Markets inaccessibility due to unavailability of regional transmission lines	E	5	4	20	Low	Support initiatives for the implementation of a regional transmission network	2	4	8	Very Low
Option 4	Livelihoods and Socio-	Manage and develop water resources to	4.2	Address the high demand for new	Regional energy development	T	5	8	40	Medium	Regular monitoring, review	2	2	4	Very Low

	economic development	serve social and economic development in the Basin		water infrastructure to meet regional energy security.	initiatives making BDP redundant						and updating of plan.				
Option 4	Livelihoods and Socio-economic development	Manage and develop water resources to serve social and economic development in the Basin	4.3	Address the demand for water in sustainable mining and industrial development.	Lack of private sector incentives, preferences and support	E	5	8	40	Medium	Ensure project sustainability is a criteria of project planning; reduce dependence on external funding mechanisms	3	8	24	Low
Option 4	Livelihoods and Socio-economic development	Manage and develop water resources to serve social and economic development in the Basin	4.3	Address the demand for water in sustainable mining and industrial development.	Time and cost Impacts of current and future legislation – international, regional and national	L	3	8	24	Low	All legislative requirements to be identified and included in project planning and programme up front.	2	2	4	Very Low
Option 4	Livelihoods and Socio-economic development	Manage and develop water resources to serve social and economic development in the Basin	4.3	Address the demand for water in sustainable mining and industrial development.	Unsupportive trading policies	L	5	16	80	Medium	Sign trade agreements between neighbouring countries; Harmonise basin trading policies and standards.	2	4	8	Very Low
Option 4	Livelihoods and Socio-economic development	Manage and develop water resources to serve social and economic development in the Basin	4.3	Address the demand for water in sustainable mining and industrial development.	Markets inaccessibility	E	5	4	20	Low	Improve access to markets through regional economic integration and in-country extension support services	3	4	12	Low
Option 4	Livelihoods and Socio-economic development	Manage and develop water resources to serve social and economic development in the Basin	4.3	Address the demand for water in sustainable mining and industrial development.	Negative influence of market values in the industry or components thereof	E	8	16	128	High	Support diversification initiatives or access to alternative markets	5	16	80	Medium
Option 4	Livelihoods and Socio-economic development	Manage and develop water resources to serve social and economic development in the Basin	4.3	Address the demand for water in sustainable mining and industrial development.	Insufficient transport to get produce to markets – local and international	T	3	8	24	Low	Ensure transport, energy etc. is a criteria of project planning;	3	4	12	Low
Option 4	Livelihoods and Socio-economic development	Manage and develop water resources to serve social and economic development in the Basin	4.3	Address the demand for water in sustainable mining and industrial development.	Insufficient ESIAs leading to legal violations	L, E	5	16	80	Medium	All legislative requirements to be identified and included in project planning and programme up front.	3	8	24	Low
Option 4	Livelihoods and Socio-economic development	Manage and develop water resources to serve social and economic development in the Basin	4.4	Support sectoral conservation and development initiatives from a water resource perspective.	Insufficient funding	E	8	8	64	Medium	Ensure project sustainability is a criteria of project planning; reduce dependence on external funding mechanisms	3	4	12	Low
Option 4	Livelihoods and Socio-economic development	Manage and develop water resources to serve social and economic development in the Basin	4.4	Support sectoral conservation and development initiatives from a water resource perspective.	Insufficient capability and capacity	I	8	8	64	Medium	Ensure on-going recruitment and training; Implement succession plans;	5	4	20	Low
Option 4	Livelihoods and Socio-economic development	Manage and develop water resources to serve social and economic development in the Basin	4.4	Support sectoral conservation and development initiatives from a water resource perspective.	Inefficient cross-sector communication and collaboration/corroboration	P, I	5	8	40	Medium	Ensure comprehensive stakeholder engagement in project planning and design.	3	4	12	Low
Option 5	Environmental and Disaster Management	To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices	5.1	Management and protection of natural resources.	Insufficient capability and capacity	I	8	16	128	High	Ensure on-going recruitment and training; Implement succession plans;	5	8	40	Medium
Option 5	Environmental and Disaster Management	To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices	5.1	Management and protection of natural resources.	One or more member states, development sectors, interest groups are not supportive	P	5	16	80	Medium	Ensure comprehensive stakeholder engagement in project planning and design.	3	16	48	Medium
Option 5	Environmental and Disaster Management	To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices	5.1	Management and protection of natural resources.	Insufficient financing mechanisms	E	8	16	128	High	Ensure project sustainability is a criteria of project planning; reduce dependence on external funding mechanisms	3	8	24	Low
Option 5	Environmental and Disaster Management	To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices	5.1	Management and protection of natural resources.	Time and cost Impacts of current and future legislation – international, regional and national	L	3	8	24	Low	All legislative requirements to be identified and included in project planning and programme up front.	2	2	4	Very Low
Option 5	Environmental and Disaster Management	To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices	5.1	Management and protection of natural resources.	Resistance to necessary lifestyle changes	S	5	8	40	Medium	Change management mechanisms included into project designs for projects requiring lifestyle changes.	2	4	8	Very Low

Option 5	Environmental and Disaster Management	To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices	5.1	Management and protection of natural resources.	Disparity between transboundary legislation and standards	L	5	8	40	Medium	Implement project to harmonise basin legislation and standards	2	2	4	Very Low
Option 5	Environmental and Disaster Management	To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices	5.2	Rehabilitation of degraded environments.	Insufficient capability and capacity	I	8	16	128	High	Ensure on-going recruitment and training; Implement succession plans;	5	8	40	Medium
Option 5	Environmental and Disaster Management	To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices	5.2	Rehabilitation of degraded environments.	One or more member states, development sectors, interest groups are not supportive	P	8	16	128	High	Ensure comprehensive stakeholder engagement in project planning and design.	5	8	40	Medium
Option 5	Environmental and Disaster Management	To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices	5.2	Rehabilitation of degraded environments.	Insufficient financing mechanisms	E	8	16	128	High	Ensure project sustainability is a criteria of project planning; reduce dependence on external funding mechanisms	5	8	40	Medium
Option 5	Environmental and Disaster Management	To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices	5.2	Rehabilitation of degraded environments.	Time and cost Impacts of current and future legislation – international, regional and national	L	3	8	24	Low	All legislative requirements to be identified and included in project planning and programme up front.	2	2	4	Very Low
Option 5	Environmental and Disaster Management	To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices	5.3	Sustainable land management.	Insufficient capability and capacity	I	8	16	128	High	Ensure on-going recruitment and training; Implement succession plans;	5	8	40	Medium
Option 5	Environmental and Disaster Management	To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices	5.3	Sustainable land management.	One or more member states, development sectors, interest groups are not supportive	P	5	16	80	Medium	Ensure comprehensive stakeholder engagement in project planning and design.	3	8	24	Low
Option 5	Environmental and Disaster Management	To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices	5.3	Sustainable land management.	Insufficient financing mechanisms	E	8	16	128	High	Ensure project sustainability is a criteria of project planning; reduce dependence on external funding mechanisms	5	8	40	Medium
Option 5	Environmental and Disaster Management	To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices	5.3	Sustainable land management.	Time and cost Impacts of current and future legislation – international, regional and national	L	3	8	24	Low	All legislative requirements to be identified and included in project planning and programme up front.	2	2	4	Very Low
Option 5	Environmental and Disaster Management	To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices	5.3	Sustainable land management.	Resistance to necessary lifestyle changes	S	5	8	40	Medium	Change management mechanisms included into project designs for projects requiring lifestyle changes.	2	4	8	Very Low
Option 5	Environmental and Disaster Management	To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices	5.4	Water quality management.	Insufficient capability and capacity	I	8	16	128	High	Ensure on-going recruitment and training; Implement succession plans;	5	8	40	Medium
Option 5	Environmental and Disaster Management	To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices	5.4	Water quality management.	One or more member states, development sectors, interest groups are not supportive	P	3	16	48	Medium	Ensure comprehensive stakeholder engagement in project planning and design.	2	8	16	Low
Option 5	Environmental and Disaster Management	To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices	5.4	Water quality management.	Insufficient financing mechanisms	E	8	16	128	High	Ensure project sustainability is a criteria of project planning; reduce dependence on external funding mechanisms	5	8	40	Medium
Option 5	Environmental and Disaster Management	To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices	5.4	Water quality management.	Disparity between transboundary legislation and regulations/standards	L	5	8	40	Medium	Implement project to harmonist basin legislation and standards	2	2	4	Very Low
Option 5	Environmental and Disaster Management	To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices	5.5	Control of alien and invasive aquatic plants	Insufficient capability and capacity	I	8	16	128	High	Ensure on-going recruitment and training; Implement succession plans;	5	8	40	Medium
Option 5	Environmental and Disaster Management	To increase the resilience of the Basin and its people to natural and human	5.5	Control of alien and invasive aquatic plants	Insufficient financing mechanisms	E	8	16	128	High	Ensure project sustainability is a criteria of	5	8	40	Medium

		pressures through sound land and environmental management practices									project planning; reduce dependence on external funding mechanisms				
Option 5	Environmental and Disaster Management	To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices	5.5	Positive Potential	Potential for employment opportunities	E	8	8	64	Medium	n/a	8	8	64	Medium
Option 5	Environmental and Disaster Management	To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices	5.6	Climate change adaptation and preparedness	Insufficient capability and capacity	I	8	16	128	High	Ensure on-going recruitment and training; Implement succession plans;	5	5	25	Low
Option 5	Environmental and Disaster Management	To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices	5.6	Climate change adaptation and preparedness	One or more member states, development sectors, interest groups are not supportive	P	5	16	80	Medium	Ensure comprehensive stakeholder engagement in project planning and design.	3	4	12	Low
Option 5	Environmental and Disaster Management	To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices	5.6	Climate change adaptation and preparedness	Insufficient financing mechanisms	E	8	16	128	High	Ensure project sustainability is a criteria of project planning; reduce dependence on external funding mechanisms	3	8	24	Low
Option 5	Environmental and Disaster Management	To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices	5.6	Climate change adaptation and preparedness	Time and cost Impacts of current and future legislation – international, regional and national	L	3	8	24	Low	All legislative requirements to be identified and included in project planning and programme up front.	2	2	4	Very Low
Option 5	Environmental and Disaster Management	To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices	5.6	Climate change adaptation and preparedness	Plans irrelevant due to models and information not being updated	T	5	8	40	Medium	Regular monitoring, review and updating of plans.	2	2	4	Very Low
Option 5	Environmental and Disaster Management	To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices	5.6	Climate change adaptation and preparedness	Resistance to necessary lifestyle changes	S	5	8	40	Medium	Change management mechanisms included into project designs for projects requiring lifestyle changes.	2	4	8	Very Low

Annexure F:
Source of Data for Planning Atlas

No	Dataset Name	Data Type	Keywords	Description and Data source
1	Biodiversity Hotspots	Vector	Protected Areas, National, WDPA, Points	This dataset was derived from the World Database on Protected Areas (WDPA), which provides the most comprehensive dataset on protected areas worldwide. The WDPA contains over 120,000 sites and has two main components: an aspatial (attribute) database and an expanding spatial (GIS) dataset containing the boundary information. This feature dataset contains nationally designated protected areas with IUCN Categories I-VI with known locations (points). Note: This dataset contains designated protected areas only and therefore excludes sites with status Degazetted, Proposed, Recommended, Unset and Voluntary - recognized. The dataset used in the study was retrieved from the Monograph.
2	Burundi Provinces	Vector	Burundi, provinces, administration	This layer contains administrative boundaries (provincial level) of Burundi. The data used in the study was retrieved from Kagera Monograph GIS database, and the original dataset was obtained from ESRI World GIS database (National Geographic World Map) at: http://www.esri.com/software/arcgis/arcgis-online-map-and-geoservices/map-services.
3	Capital Cities	Vector	Capital cities, Rwanda, Burundi	This shapefile contains the capital cities of Rwanda and Burundi. Data obtained from the Kagera River Basin Monograph.
4	Countries	Vector	Member States, Kagera Basin, Rwanda, Burundi, Tanzania, Uganda, DRC	National boundaries of the Kagera River Basin riparian countries (Uganda, Tanzania, Rwanda, Burundi), plus DRC. The original data was obtained from ESRI World GIS database (National Geographic World Map) at: http://www.esri.com/software/arcgis/arcgis-online-map-and-geoservices/map-services
5	Cultivation Intensity	Vector	Kagera River Basin, cultivation intensity, agriculture, land use	This dataset shows the Kagera River Basin cultivation intensity. The map was created from a reclassification of land cover maps of the 4 basin countries into areas of high, medium and low agricultural intensity; an indication of susceptibility to erosion. The ID_AGRIC field is used to classify the cultivation intensity as follows: 1, 2: Intensively Cultivated, 3: Moderately Cultivated, 4: Tree cropping, and 5: Vegetated. Original data from the FAO Africover database (http://www.africover.org/system/africover_data.php)
6	Dam Sites	Vector	Dam, projects, basin	This layer contains the location of existing dams and proposed/potential sites for new dams in the framework of this development planning study. This dataset also include an estimated (based on manual measurements) average valley width downstream the dam site. The data is mainly derived from the Monograph and the Kagera dams feasibility reports. Google Earth was also used to correct/augment suspicious coordinates
7	Forest Reserves	Vector	Forest, plantations	This dataset was extracted from the World Database on Protected Areas (WDPA). The WDPA contains over 120,000 sites and has two main components: an aspatial (attribute) database and an expanding spatial (GIS) dataset containing the boundary information. This feature dataset contains nationally designated protected areas without IUCN category (UA and Unset) with known locations (points). Note: This dataset contains designated protected areas only and therefore excludes sites with status Degazetted, Proposed, Recommended, Unset and Voluntary - recognised. The dataset used was obtained from the Kagera Monograph Study
8	Game Reserves	Vector	Game reserve, protected areas	Layer contains boundaries of game reserves within the Kagera river Basin. This data was obtained from the Monograph

No	Dataset Name	Data Type	Keywords	Description and Data source
9	Gauge Stations	Vector	River flow, gauge station	This dataset indicates the location of river flow gauging stations in the Kagera River Basin. The original data is from Monograph and was updated with information gathered during this KBDP study
10	Irrigation Schemes	Vector	Irrigation, project, Kagera Basin	Location of potential basin-wide irrigation schemes. Data generated during this study
11	kagera_basin	Vector	Boundaries, Environment, Inland Waters	Kagera Basin boundary as delineated during the Kagera Monograph Study. This map was used as a mask for all basin analysis in this study.
12	Kagera Land cover Map	Vector	Land cover, Forest, Plantation, Kagera River Basin	This dataset is derived from a reclassification of the land use map of the basin countries and shows natural forests and plantations. The classification is based on the "Forest_Class" field, and includes the following classes: Natural Forest, Forest Plantation, Cultivated Land, Other Vegetation covers, Settlements and Water Bodies. The original dataset was obtained from the FAO Africover database (http://www.africover.org/system/africover_data.php), and collected during the Monograph.
13	Livestock_population	Vector	Livestock, Livestock Unit	This dataset presents the livestock population distribution over the Kagera River Basin. Data from the Monograph
14	Major Towns/Cities	Vector	Town, City, Kagera Basin	This file shows the location of major cities and towns within the Kagera River Basin. Data from Kagera River Basin Monograph, WEMA Consult (T) Ltd data archive and addition sources, including Google Earth.
15	Main Rivers	Vector	Rivers	Kagera River main rivers and drainage channels of the Kagera River Basin. These were derived from a DEM analysis and corrected using other sources, including available topographical maps, Google Earth, etc. Initial data from the Monograph
16	Major Cities in and around basin	Vector	City, town, Kagera Basin	This file contains the location of major cities and towns within and around the Kagera River Basin. Data from Kagera river Basin Monograph, WEMA Consult (T) Ltd data archive and addition sources, including Google Earth.
17	Major Towns/Cities	Vector	Town, City, Kagera Basin	This file contains the location of major cities and towns within the Kagera River Basin. Data from Kagera River Basin Monograph, WEMA Consult (T) Ltd data archive and addition sources, including Google Earth.
18	National Parks	Vector	National park, protected area	Location of national parks across the Kagera River Basin. Data from the Monograph
19	Kagera River Basin Population (2012-2032)	Vector	Population, Kagera River Basin, population density	Present (2012) and projected population density in every district (province for Burundi) across the Kagera River Basin. Original data obtained from population census data published by respective national statistics agencies as follows: 1. Rwanda: National Institute of Statistics of Rwanda (NISR) 2. Burundi: Institute for Statistics and Economic Studies of Burundi (ISTEEBU) 3. Uganda: Uganda Bureau of Statistics 4. Tanzania: Tanzania National Bureau of Statistics (NBS). Projections are done based on the published population growth rates and in consideration of other relevant economic factors. Projections were made for years 2017, 2022, 2027 and 2032.

No	Dataset Name	Data Type	Keywords	Description and Data source
20	Population by sub-catchment	Vector	Population, density, sub-catchment	Current and projected population by sub-catchment in the Kagera Basin. Map obtained from a spatial join and an intersection between the sub-catchment and population by district/region layers. The layer presents both the estimated average population density (field ave_dens_year) in persons/sqkm and total number of inhabitants (field Tot_p_year) for each sub-catchment. Refer to the population & sub-catchment GIS layers inside respective vector folders for the data used.
21	Kagera River Basin Population Density (2012-2032)	Vector	Population, Kagera River Basin, population density	Present (2012) and projected population density in every district (province for Burundi) across the Kagera river basin. Original data obtained from population census data published by respective national statistics agencies as follows: 1. Rwanda: National Institute of Statistics of Rwanda (NISR) 2. Burundi: Institute for Statistics and Economic Studies of Burundi (ISTEEBU) 3. Uganda: Uganda Bureau of Statistics 4. Tanzania: Tanzania National Bureau of Statistics (NBS) Projections are done based on the published population growth rates and in consideration of other relevant economic factors. Projections were made for years 2017, 2022, 2027 and 2032
22	Projects	Vector	Projects, Irrigation, Hydropower, Dam	Location of the proposed development projects in the Kagera River Basin. Projects include dams, irrigation schemes and hydropower projects. Data generated during this study
23	Regions+Districts	Vector	Region, district, administration	Administrative boundaries of the Kagera river basin riparian countries and other countries in the region (Uganda, Tanzania, Rwanda, Burundi, and DRC). Original data from the Kagera Basin Monograph. The original dataset is from ESRI World GIS database (National Geographic World Map) available at: http://www.esri.com/software/arcgis/arcgis-online-map-and-geoservices/map-services
24	Rwanda Provinces	Vector	Orientation, boundaries, administrative, limits, polygon, province	The national and administrative boundaries of Rwanda. Original data have been provided by the MINITRACO-CGIS/NUR, MINECOFIN/SNR and updated by the CGIS-NUR and were compiled during the Kagera Monograph
25	Rwanda Districts	Vector	Orientation, boundaries, administrative, limits, polygon, district	The national and administrative boundaries of Rwanda. Original data have been provided by the MINITRACO-CGIS/NUR, MINECOFIN/SNR and updated by the CGIS-NUR and were compiled during the Kagera Monograph
26	Weather Stations	Vector	Weather, Precipitation, Meteorological, Rainfall, Stations	Rainfall recording stations with long term annual average precipitation (mm/year) in the Kagera river Basin. The average precipitation resulted from analysis of time series of precipitation data gathered from various national weather services during the Kagera River Monograph study. This dataset was used to generate the precipitation distribution map of the Kagera river basin.
27	Sub-catchments	Vector	Kagera River Basin, sub-catchments	Kagera river Basin sub-catchments, used as planning units for this study. The delineation of the sub-catchments was done from the basin DEM using the ArcHydro Extension (http://resources.arcgis.com/content/hydro/surface-water/about). The choice of sub-catchment outlet was motivated, among others, by the availability of river flow data at that particular point. This layer contains most of the basin information summarised at sub-catchment level, including precipitation and the surface water potential. Data generated during this study
28	Tanzania Districts	Vector	Tanzania, administration, districts	The national and administrative boundaries of Tanzania retrieved from the Kagera Monograph GIS database

No	Dataset Name	Data Type	Keywords	Description and Data source
29	Town and 2012 population	Vector	Town, urban centre, city, population	This file contains the major town/urban centre within the Kagera river Basin as well as their estimated 2012 population. Population data from member states national statistical agencies and estimations/projections made during this KBDP study (for details, see the dataset Kagera River Basin Population (2012-2032))
30	Uganda Districts	Vector	Uganda, District, Administration	Uganda local administrative boundaries. Original data from the Kagera River monograph GIS database
31	wetlands	Vector	wetlands, biodiversity	Contains main Kagera River basin wetlands. Data from the Monograph
32	DEM	Raster	Digital Elevation Model, Topography	SRTM 90x90m Digital elevation model of the Kagera Basin. This dataset was used to derive all topographical parameters of the catchment, including slope, contours, sub-catchment areas, drainage channels, and valley width downstream dam points. The original dataset was downloaded from the Global Land Cover Facility (www.landcover.org) and processed accordingly with various ArcGIS extensions/tools
33	Depth to Groundwater table	Raster	Groundwater table, groundwater depth, Kagera River Basin, groundwater	This layer shows the spatial distribution of the maximum depth to groundwater table (meters below topography) across the Kagera River Basin. This map was created by a spatial interpolation of a 5kmx5km point dataset, obtained from the British Geological Survey (BGS) & Natural Environment Research Council (NERC) Digital groundwater database of Africa (http://www.bgs.ac.uk/research/groundwater/international/africangroundwater/mapsDownload.html).
34	Maximum groundwater storage depth (mm)	Raster	Groundwater storage, Kagera River Basin	This layer shows the spatial distribution of the maximum groundwater storage (mm depth) across the Kagera River Basin. This map was created by a spatial interpolation of 5kmx5km point dataset, obtained from the British Geological Survey (BGS) & Natural Environment Research Council (NERC) Digital groundwater of Africa database (http://www.bgs.ac.uk/research/groundwater/international/africangroundwater/mapsDownload.html).
35	SRTM Water Bodies	Raster	Water bodies, Lakes, Ponds	Water Bodies including lakes and ponds within and around the Kagera River Basin. The primary source for these water features was a Landsat 5-based land cover water layer supplemented with medium-scale maps and charts. The map was produced during the Kagera River Monograph study.
36	Slope Length factor	Raster	Slope, Slope length, USLE, erosion	Slope Length (SL) factor derived from the DEM to use as input in the USLE erosion model. The slope length is calculated as the flow accumulation in each cell. Data generated during this study
37	Precipitation Distribution	Raster	Precipitation, Rainfall, Kagera River Basin	Dataset contains the spatial distribution of average annual precipitation distribution over the basin. This map is a result of a geostatistical interpolation (co-kriging with topographical correction) of the long term annual precipitation recorded at the meteorological stations spread all over the basin. The original meteorological records were obtained from various national weather services and other archives such as the FAO Loc-CLim database. These data were collected during the Monograph study. The map is clipped to the Kagera River Basin boundary

No	Dataset Name	Data Type	Keywords	Description and Data source
38	Groundwater productivity	Raster	Productivity, Groundwater, Kagera River Basin	This layer shows the spatial distribution of the average groundwater productivity (litres/second) across the Kagera River Basin. This map was created by a spatial interpolation of 5kmx5km point dataset, obtained from the British Geological Survey (BGS) & Natural Environment Research Council (NERC) Digital groundwater of Africa database (http://www.bgs.ac.uk/research/groundwater/international/africangroundwater/mapsDownload.html).
39	Slope Map (Degrees)	Raster	Slope, Topography	Spatial distribution of the catchment slope in degrees derived from the SRTM 90x90m Digital elevation model of the Kagera Basin.

Annexure G:
Planning Atlas (Separate Document)