

**E-358**  
**VOL. 4**

Ministry of Works, Housing & Communications  
Entebbe  
Uganda

**SECTOR ENVIRONMENTAL POLICY AND MANAGEMENT  
ASSESSMENT OF FRSP**

**VOLUME IV: ENVIRONMENTAL MANAGEMENT RESOURCES**

**FINAL REPORT**

**March 1999**

**437.4520.1**

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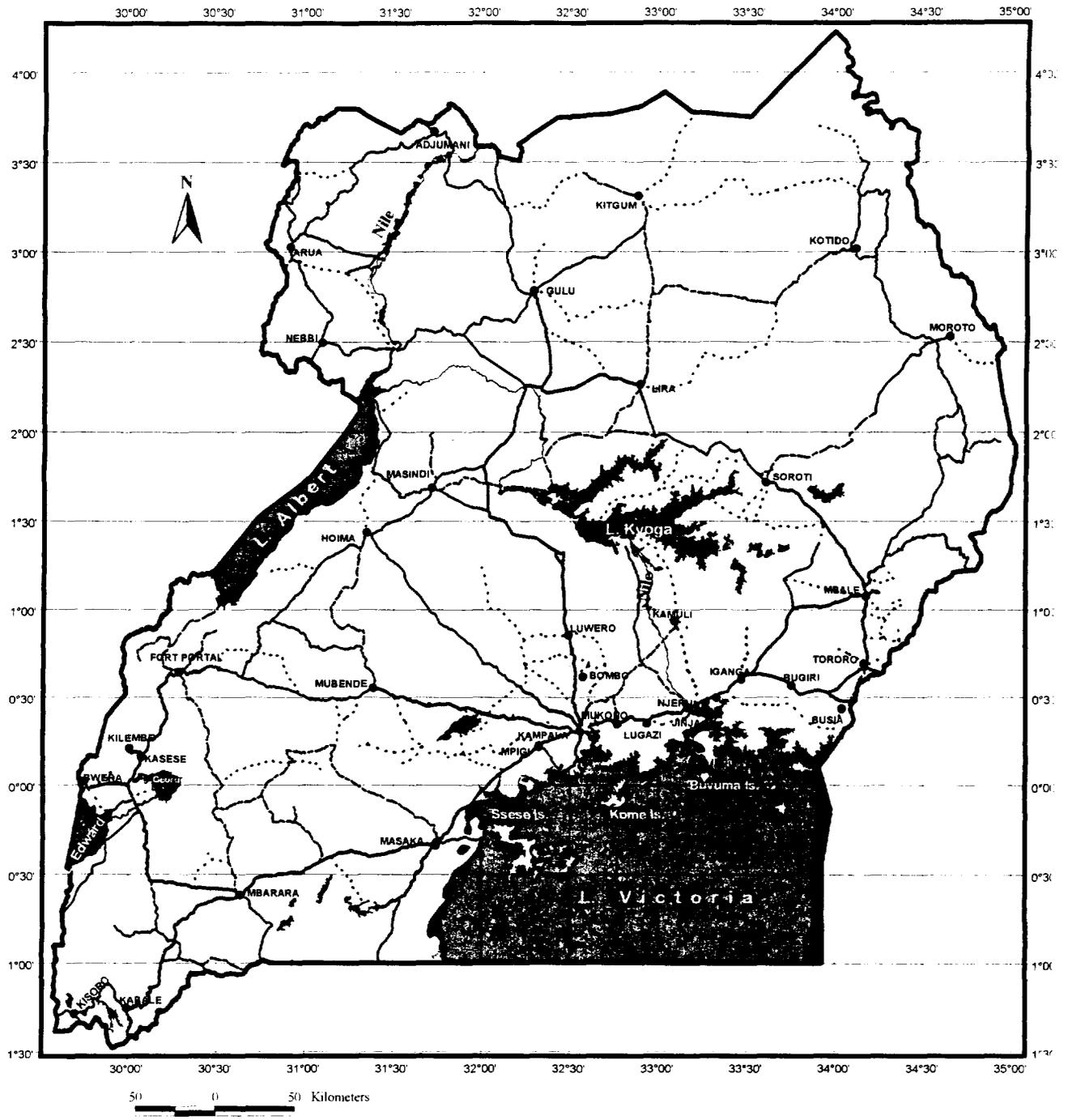
#### **OTHER VOLUMES**

Volume I	Executive Summary
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Volume III	Road Sector EIA Guidelines

## ACRONYMS AND ABBREVIATIONS

CFR	-	Central Forest Reserve
CHA	-	Controlled Hunting Area
CWA	-	Community Wildlife Area
DTWA	-	Department of Tourism, Wildlife and Antiquities
EIA(s)	-	environmental impact assessment(s)
ELU	-	Environmental Liaison Unit
FRSP	-	First Road Sector Project
ha	-	hectare
GEF	-	Global Environment Fund
GOU	-	Government of Uganda
kg	-	kilogramme
m	-	metre(s)
masl	-	metres above sea level
mm	-	millimetre(s)
MOWHC	-	Ministry of Works, Housing and Communications (formerly the Ministry of Works, Transport and Communications)
MUIENR	-	Makerere University Institute of Environment and Natural Resources
NBDB	-	National Biomass Data Bank
NBS	-	National Biomass Study
NEAP	-	National Environment Action Plan
NEMA	-	National Environment Management Authority
NGO	-	non government organisation(s)
NWCMP	-	National Wetlands Conservation and Management Programme
PA	-	Protected Area
RA	-	Road Agency
RAFU	-	Road Agency Formulation Unit
RSDP	-	Road Sector Development Programme
spp	-	species
UNP	-	Uganda National Parks
UWA	-	Uganda Wildlife Authority
WB	-	World Bank

# MAP 1. THE ROAD NETWORK IN UGANDA



## KEY

Road class



- Major town
- International Boundary
- Water

Class	Carriageway width (m)	Road reserve width (m)	Shoulder width (m)
I	7.0	40.0	2.0
II	6.0	30.0	2.0(1.5)
III	5.6	25.0	1.5(1.0)
A	6.0	30.0	2.0(1.5)
B	5.6	25.0	1.5(1.0)
C	4.0	15.0	1.2

Source of data: MORTH

Produced by RS & GIS Lab  
MUTENR-1999 for MORTH

## 1. INTRODUCTION

### 1.1 Background to the Study

In July 1998, the Ministry of Works, Housing and Communications (MOWHC) awarded the contract for conducting a study to assess the environmental policy and management of the First Road Sector Project (FRSP) to ARCADIS Euroconsult.

The study was initiated as a result of three major developments:

- i) the National Environment Statute of 1995 which made it mandatory for environmental impact assessments (EIAs) to be carried out for all new development projects;
- ii) the realisation by the MOWHC that the FRSP would include major road works requiring EIAs; and
- iii) increased funding for road sector activities by donors who stipulate environmental assessments as a condition of funding.

The FRSP's strategy for integrating environmental concerns into road sector activities is to:

- identify the sectoral environmental impacts of the road programme, and
- conduct site-specific impact assessments for each of the planned road sections

This study focuses on environmental policy and management as the basis of the Sectoral Environmental Assessment for the road sector in Uganda.

#### **1.1.1 Objectives of the FRSP Environmental Policy and Management Assessment Study**

The objectives of the study are:

- i) to assist the Government of Uganda to identify the status of the country's procedures for conducting EIAs of road sector projects by reviewing policies, regulations and the institutional framework for conducting EIAs;
- ii) to identify the most critical constraints to environmental management of the road sector in Uganda;
- iii) to develop sector specific environmental guidelines;
- iv) to streamline and standardise the EIA process for road works.

The study intends to achieve these objectives by:

- illustrating how environmental concerns can be integrated into road construction, rehabilitation, improvement or routine/periodic maintenance;
- establishing the modalities of setting up units within the MOWHC and RAFU/road agency that will be responsible for environmental management and related issues;
- indicating training needs to undertake environmental assessments;
- developing practical guidelines for environmental impact assessment applicable to the road sector in Uganda.

### **1.1.2 This Volume**

This document is Volume IV of the study report for the Sector Environmental Policy and Management Assessment of the FRSP. It is intended to complement the other volumes of this report, namely the Main Report (Volume II) and the Road Sector EIA Guidelines (Volume III).

This volume is intended as a reference document for road engineers within the MOWHC, RAFU (road agency), firms of consulting engineers, environmental practitioners and any individuals interested in environmental issues related to the road sector. It presents the environmental and social setting for the FRSP, and the Road Sector Development Programme as a whole. It is mainly descriptive because it aims at giving the reader an understanding of the mechanisms that are in place for environmental management, and environmental and social issues that affect, and/or are affected by, roads and road works.

The document begins with gives a description of the legal framework for environmental management of the road sector. The physical, natural and social environment of Uganda is then presented as applicable to the FRSP and the road sector. The report also presents, as a guide, an analysis of the types of impacts that may arise from road works activities, indicating possible mitigation measures and responsibility for monitoring. The importance of public participation in project planning and environmental assessment is addressed. Of particular use to road engineers and EIA practitioners is a comprehensive listing of environmental provisions that are included in existing MOWHC manuals and documentation.

### **1.2 Summary of the FRSP**

The First Road Sector Project represents the first five years of a ten-year US\$1.5 billion investment in the Ugandan road sector.

The main works proposed under the FRSP are:

- prioritising roads in the network for manual and mechanical routine maintenance and periodic maintenance;
- upgrading of 32 km of urban trunk roads in Kampala from 2-lane to 4-lane dual carriageway;
- strengthening of 357 km of existing paved roads;
- paving of 950 km of gravel roads;
- upgrading of 1700 km of feeder roads;
- construction of a 21 km new road - ie. the Kampala Bypass.

In addition, the FRSP includes a number of studies on road network improvement, and investments in road network administration and capacity building.

Similar investments are proposed under the second five years of the Road Sector Development Programme (RSDP).

## **2. LEGAL FRAMEWORK FOR ENVIRONMENTAL MANAGEMENT OF ROAD WORKS IN UGANDA**

### **2.1 Introduction**

Road development may have serious impacts on the environment from two perspectives: firstly, the effects of construction/improvement itself and the resulting disturbance of ecological and social systems especially their impacts on property rights; and secondly, after the road has been constructed/improved, the economic activities it creates may have both negative and positive impacts on the environment. These environmental and social effects must be managed within a legal framework.

Uganda has various laws governing the management of the environment and its resources. Below is a description of the basic legal instruments for the management of the environment and how it relates to road sector development.

### **2.2 Existing Laws Applicable to Road Sector Environmental Management**

#### **2.2.1 The Constitution of Uganda 1995**

The Constitution is the supreme law. It provides for environmental protection and conservation. In its national objectives and directive principles of state policy<sup>1</sup>, it provides that the state shall promote sustainable development and public awareness of the need to manage land, air and water resources in a balanced and sustainable manner for the present and future generations.

It further provides that the utilization of the natural resources of Uganda are to be managed in such a way as to meet the development and environment needs of present and future generations of Ugandans. In particular, the state is required to take all possible measures to prevent or minimise damage and destruction to land, air and water resources due to pollution or other causes.

The provisions of the Constitution protect property rights and other individual rights. Of key interest here is the requirement by the Constitution that property cannot be compulsorily acquired unless prompt, prior and adequate compensation has been paid to the property owner. This key requirement is discussed in Volume III of this report. Furthermore, the state is to promote and implement energy policies that will ensure that the people's basic needs and those of the environment are met. Above all, Article 39 of the Constitution provides for an individual's right to a clean and healthy environment. This provision is complemented by Article 50 which gives any person the right to take judicial action to redress the breach of a fundamental right, irrespective of whether the breach affects him or another person. These provisions are important for broadening the *locus standi* of citizens to redress environmental wrongs.

The state, including local governments, is required to create and develop parks, reserves and recreation areas and ensure conservation of natural resources and to promote the rational use of

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<sup>1</sup> Principle XXVII

natural resources so as to safeguard and protect the biodiversity of Uganda<sup>2</sup>. The management of rivers, lakes, wetlands, national parks, game reserves and forest reserves is vested in the state.

The Constitution also imposes a duty on the state to protect important natural resources, including land, water, minerals, oil, fauna and flora on behalf of the people of Uganda.

In Article 245, the Constitution states that parliament shall, by law, provide for measures intended to protect and preserve the environment from abuse, pollution and degradation, to manage the environment for sustainable development, and to promote environmental awareness. This has already been done through the National Environment Statute, the Water Statute, and the Wildlife Statute.

### **2.2.2 The Local Governments Act 1997<sup>3</sup>**

The Local Governments Act provides for the system of local governments which is based on the district. Under the district there are lower local governments and administrative units.<sup>4</sup> This system provides for elected councils. The executive committee of each council is nominated by the chairman. The functions of this committee include:

- i) Initiating and formulating policy for approval of council;
- ii) Overseeing the implementation of the government and councils' policies, and monitor and coordinate activities of non-government organisations in the district; and
- iii) Receiving and solving disputes forwarded to it from lower local governments.

The Act provides for a decentralized system of government in which certain services have been made the responsibility of the central government, while others have been made the responsibility of the local governments. With regard to road services, the mandate to construct or maintain roads is shared between the central and local governments especially the district.

### **2.2.3 The District Councils**

The District Council is the highest political authority in the district. It has both legislative and executive powers to be exercised in accordance with the Constitution and Local Governments Act 1997. The composition of the District Council is laid down in the Act.

The Second Schedule to the Act prescribes the functions of the Government that the District Council is responsible for. The following are functions relevant to natural resource management:

- i) land surveying
- ii) land administration
- iii) physical planning
- iv) forests and wetlands
- v) environment and sanitation
- vi) protection of streams, lakeshores, wetlands and forests
- vii) road services which are not the responsibility of the central government.

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<sup>2</sup> Article 237(2).

<sup>3</sup> No. 1 of 1997

<sup>4</sup> Section 4 of the Local Governments Act.

Under the district there are lower local government councils which consist of:

- a sub-county council (Section 24(1) of Local Governments Act).
- a City Division Council
- a Municipal Council
- a Municipal Division Council and
- a Town Council.

These councils have legislative powers. The District Councils have power to enact District Laws (Ordinances)<sup>5</sup> while urban, sub-county, division or village councils may in relation to its specified powers and functions make bye-laws not inconsistent with national statutes or the Constitution. Through this method, it is hoped that the district and other lower local councils will effectively control and manage their natural resources and environment.

The Act establishes administrative units and these are divided into two categories: rural and urban. In rural areas there are county level, parish level and village level units while in urban areas there are parish or ward level and village level units.

At each level of the administrative unit, there is a council and within the council is established an executive committee including the secretary for Production and Environment Protection. These committees have the responsibility of monitoring projects and other activities undertaken in the area by different actors including the government.<sup>6</sup>

The Second Schedule to the Local Governments Act, prescribes the functions for which the Urban Councils are responsible. The functions relevant to road construction and maintenance are laying out and adorning any streets or squares.

The District Councils may devolve the following services and functions to the Lower Local Councils:

- i) the control of soil erosion and protection of local wetlands,
- ii) the protection and maintenance of local water resources, and
- iii) any other functions the District may delegate.

#### **2.2.4 The Uganda Wildlife Statute 1996<sup>7</sup>**

This law specifically provides for who should control, manage and maintain national parks and other protected areas. It establishes novel concepts of planning, environmental impact assessment and monitoring as veritable instruments of managing wildlife resources.<sup>8</sup>

It also opens the arena of conservation to the private sector by making it possible for private individuals to manage wildlife through a system of use rights.

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<sup>5</sup> Section 3a(1)

<sup>6</sup> Section 50 of the Local Governments Act.

<sup>7</sup> Statute No. 4 of 1996.

<sup>8</sup> Ibid. Sections 16 and 17.

The Statute further provides for an environmental impact assessment for any activity to be carried out which has effect on any wildlife species in the manner provided for under National Environment Statute.<sup>9</sup>

The Statute, does not set up specific procedures for construction of roads in protected areas. Construction of roads, bridges, aerodromes, buildings and fences, that take place in these protected areas must follow the provisions of other laws, especially the National Environment Statute.

### **2.2.5 The National Environment Statute 1995<sup>10</sup>**

The National Environment Statute is contemplated as a coordinating Statute. Its provisions are to be carried out through cooperation between the National Environment Management Authority (NEMA) and other government agencies (lead agencies) through a system of consultation. Local authorities are considered lead agencies.

#### ***Institutional Frame Work Under the Environment Statute***

For the proper management of natural resources, the Environment Statute establishes NEMA as a corporate body and principal agency responsible for all issues concerning the environment.<sup>11</sup> At the apex of this Authority, is the Policy Committee on the Environment composed of ministers charged with various sectors of the environment. The Policy Committee is responsible for the formulation and implementation of policy guidelines, and coordinating environment policies of the various agencies of the Government<sup>12</sup>.

The statute establishes the Board, which is appointed by the minister with approval of the Policy Committee. The members of the board are appointed by virtue of their knowledge and experience in environment management. The principal role of the Board is to oversee the operation, policy and to review the performance of the secretariat as well as to establish procedures for the management of staff.

The Board is given the mandate to appoint technical committees including those on soil conservation and environmental impact assessment.

The Statute also enables local administrations to be involved in the management of the environment. The statute creates District Environment Committees charged with the management of environmental issues at the district level. Environment Committees are created at the lowest levels of local government structures to enable public participation in environmental decision making at those levels<sup>13</sup>.

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<sup>9</sup> Section 16.

<sup>10</sup> No. 4 of 1995

<sup>11</sup> Section 5 of the Environment Statute 1995.

<sup>12</sup> Section 8 (2) of the Environment Statute (1995).

<sup>13</sup> Sections 15, 16 and 17.

This kind of institutional framework ensures that natural resources are controlled and managed by communities for their own benefit on a sustainable basis.

### ***Management measures***

One of the key management tools provided by the Statute is the requirement of environmental impact assessment for projects likely to have a negative effect on the environment<sup>14</sup>. This year, regulations have been adopted detailing the measures to be taken in conducting an EIA and environmental audits<sup>15</sup>.

Management measures are required to take into account measures including incentives, fees and disincentives which may be prescribed by the minister of finance from time to time<sup>16</sup>.

The Statute requires that the central government collaborates with the local governments in the following areas<sup>17</sup>:

- a) management of lakes and rivers,
- b) management of lakeshores and riverbanks,
- c) management of wetlands
- d) management of hilltops, hill-sides, and mountainous areas,
- e) conservation of biological resources,
- f) management of forests,
- g) planting of woodlots,
- h) management of range lands,
- i) land use planning.

These issues are specifically selected because of their immediate relevance to community use and hence the need to involve local communities. The key emphasis is to permit the use of resources within their capacity to regenerate.

The Statute requires a developer where possible to reclaim lost ecosystems and degraded natural resources. It prohibits disturbance of river and lake beds, river banks and lakeshores; reclamation of wetlands and degradation of hilly and mountainous areas<sup>18</sup>. In case any of the prohibited activities must be carried out, the developer must first obtain a written authority issued by NEMA in consultation with the lead agencies concerned.

The provisions of the Statute require district environmental committees to identify areas to be targeted for afforestation and reforestation if such have been degraded. Local environment committees are urged to encourage voluntary self-help in the community to plant trees and other vegetation in any area which has lost its vegetation cover. NEMA is enjoined to issue guidelines

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<sup>14</sup> Sections 20 - 22 of the Statute.

<sup>15</sup> Environmental Impact Assessment Regulations, No.13 of 1998

<sup>16</sup> Section 34 and section 94.

<sup>17</sup> Part VII of the Statute.

<sup>18</sup> Sections 35 -39.

for sustainable use of wetlands, hillsides and mountain tops to ensure that they are not degraded by the activities of any developer<sup>19</sup>.

In case a developer does not comply with any of the provisions for sustainable use of the environment, NEMA may issue an environmental restoration order requiring him to restore the environment as near as possible to the state to which it was in before the commencement of the project. The restoration order issued may prevent the concerned person from taking any action which is likely to harm the environment, award compensation to be paid by that person to other persons whose environment has been harmed or levy a charge on him which is an estimate of the cost of any action required to restore the environment<sup>20</sup>.

An environmental restoration order has to clearly specify:

- the activity to which it relates;
- the person(s) to whom it is addressed;
- the time at which it comes into effect;
- the action which must be taken to remedy the harm;
- the penalties which may be imposed if the action specified is not undertaken; and
- the right of the person served with the order to appeal to the court against it.

Any person who has reason to believe that harm is being caused to the environment may apply to court for an environmental restoration order to issue against the person causing that harm<sup>21</sup>.

NEMA is also required in consultation with the lead agency to issue guidelines and prescribe measures for land use planning at the local, district and national levels and on the local land use plan, which shall be in conformity with the district and national land use plans prepared by the Local Environment Committee with the assistance of the District Environment officer or such other public officer as may be prescribed. NEMA and the District Environment Committees are responsible for monitoring the implementation of any land use plans prepared<sup>22</sup>. The EIA Regulations made under this Statute require all projects including road construction to carry out an EIA.

### ***Control of pollution***

In addition to these provisions relating to management of natural resources, the Statute contains important provisions on the control of pollution. Since pollution is a relative state of affairs, the Statute provides for mechanisms to establish environmental standards and criteria for what is considered environmentally acceptable behaviour and phenomena<sup>23</sup>. Where a person wishes to exceed the standards which have been set, such a person must apply for a pollution license under Part VIII of the Statute<sup>24</sup>. Standards for the control of pollution are now in the process of formulation.

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<sup>19</sup> Sections 40 - 41.

<sup>20</sup> Section 68.

<sup>21</sup> Section 72.

<sup>22</sup> Ibid. Section 49.

<sup>23</sup> Sections 25 - 32.

<sup>24</sup> Sections 58 - 66.

### *Enforcement of the law*

One of the key prerequisites of ensuring environmental quality is the ability to enforce the law. The Statute provides for a variety of mechanisms to ensure that the law will be enforced, which go beyond the traditional command and sanction approach of criminal law. The following are some of the mechanisms :

(a) *environmental easements*: Under the Statute, a person may apply for an easement to protect the environment. In view of the constitutional provision relating to rights to a clean and healthy environment and the capacity of any person to enforce that right notwithstanding that his specific rights have been affected, this easement differs from the common law easement. It may be enforced by any body who finds it necessary to protect a segment of the environment although he may not own property in the proximity of the property subject to the easement<sup>25</sup>.

(b) *environment restoration orders*: Where the person's activities affect the environment, the Authority or a court may issue a restoration order requiring the person to cease the activities or to restore the environment as much as possible to its original state. The order may be given pursuant to an action brought by an individual or upon the initiative of the Authority<sup>26</sup>.

(c) *awareness raising*: The need for popular awareness is a key requirement for enforcement of legislation. NEMA is given the mandate to carry out education and awareness campaigns to ensure that the public participates in environmental decision making and enforcement<sup>27</sup>.

(d) *the use of economic and social incentives*: The Statute clearly provides that management measures should be carried out in conjunction with the application of social and economic incentives including taxation measures<sup>28</sup>.

(e) *the use of criminal law*: Criminal law remains a veritable instrument for the control of behaviour because of the natural tendency of man to fear the infliction of pain, isolation or economic loss. Therefore, the Statute provides for serious penalties for infraction of its provisions. It is, however, recognized that criminal law cannot be the mainstay for the enforcement of law but is a necessary supplementary measure to the approaches outlined above<sup>29</sup>.

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<sup>25</sup> Sections 73 -77.

<sup>26</sup> Sections 68 - 72.

<sup>27</sup> Sections 86 - 88.

<sup>28</sup> Part VII.

<sup>29</sup> Part XIII .

### 2.2.6 The Land Act 1998<sup>30</sup>

The principal legislation on land tenure in Uganda is the Land Act. This gives power to an authorized undertaker to enter upon any land after an agreement with the occupier or owner of the land and carry out lawful acts thereon. In cases where there is no consensus between the landowner and the undertaker, the minister may compulsorily acquire that land subject to the provisions of the Constitution<sup>31</sup>.

The Act further provides that all land in Uganda whether alienated or not is subject to all existing public rights of way which are reserved and vested in government on behalf of the public; and all such rights of way are maintained by the public uninterrupted unless they are terminated or altered by the direction of the minister in writing.<sup>32</sup>

Under this Act, where an authorized undertaker executes public works upon or takes stone, murrum or similar materials from land, the authorized undertaker shall have over land such rights of access and other rights as may be reasonably necessary for the execution, construction, and maintenance of works. The taking of the material and land shall be deemed to be subject to those rights whether or not they have been registered under the Registration of Titles Act. An authorized undertaker executing public works on land under this Act shall promptly pay compensation to any person having an interest in the land for any damage caused to crops or buildings and for the land and materials taken or used for the works.

The Act does not cater for the after effects of these works on land and these may lead to environmental degradation. Like any other laws relating to the environment, the Land Act is subject to be read in line with the provisions of the Constitution and the National Environment Statute plus all regulations made thereunder especially the rules relating to the conservation of the natural environment.

### 2.2.7 The Water Statute 1995<sup>33</sup>

The statute empowers the Director of Water Development created under it to temporarily close all or any part of a road to traffic, if it is necessary to carry out works on the adjacent land to the road.<sup>34</sup>

Where it is necessary for the construction or operation of any works, the authority may break up the surface of any road and open or break up any works under the road.<sup>35</sup>

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<sup>30</sup> Act 16 of 1998.

<sup>31</sup> Section 43 of the Act.

<sup>32</sup> Section 72(1).

<sup>33</sup> No. 9 of 1995.

<sup>34</sup> Section 79(1).

<sup>35</sup> Section 80(1).

When these works are being carried out and the environment is affected, no regulation is put in place under the Statute to prohibit workers from leaving open ditches which may lead to soil erosion. This lacunae is, however, catered for by the Constitution and the National Environment Statute which have elaborated provisions relating to management of the environment.

### 2.2.8 The Roads Act 1964<sup>36</sup>

The Act defines a "Road" to mean any way open to the public for the circulation of vehicles which is maintained by the government or administration, "Road Authority" to mean:-

- a) in the case of a road maintained by the government, the minister; and
- b) in the case of a road maintained by an administration, such administration.

"Road Reserve" under this Act means an area declared to be a road reserve under the provisions of this Act. The Act further provides that the minister may by statutory instrument declare an area bounded by imaginary lines parallel to and distant not more than fifty feet from the centreline of any road to be a road reserve.

Subject to any order which may be made under this Act, no person shall, save with written permission of the road authority, erect any building or plant any tree or permanent crops within a road reserve.

The minister, or with the consent of the minister, a district commissioner, in relation to any road within or passing through any government town or an administration in respect of any area not being in a government town, may by order:

- a) prescribe the line in which buildings shall be erected in such town or area or
- b) prescribe the distance from the centre of the road within, which no building shall be erected in such town or area.

These orders are not to be repugnant to any provisions of the Public Health Act or any regulations or orders made thereunder or any scheme made under the Town and Country Planning Act. The order made may apply to any road or specific portion of any road and, in the case of a town, shall be published in the Gazette and, in the case of an area not being a town, shall be promulgated in such manner by putting the same in some conspicuous place or some place of public resort within that area or other wise as may seem proper to the administration issuing the same, and shall have the force of law as from the date of such publication or promulgation.

Planting or permitting to grow any tree or permanent crops or grazing of animals is prohibited if it interferes in any way with the proper function of any cutting, ditch or culvert constructed in connection with any road connecting with the road, any cattle path, bicycle track side road or entrance or means of access to a dwelling or to any other premises or place. These prohibitions are relevant where, in the opinion of the road authority it is likely to be dangerous to persons or vehicles using a road. The road authority is required to give written notice to the owner or occupier of the land on which such offence took place requiring him:

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<sup>36</sup> Cap 345.

- i) to pull down or remove the building or erection; or
- ii) to cut down or uproot the tree or crops; or
- iii) to alter or repair the cattle path, bicycle track side road or entrance or means of access or to close the same.

A road authority may dig and take away materials required for the construction and maintenance of roads in any part of a road reserve approved by the district commissioner without payment to any person.

### 2.2.9 The Access to Roads Act<sup>37</sup>

The Access to Roads Act seeks to ensure that a private land owner who has no reasonable means of access to public highway may apply for leave to construct a road of access to a public highway. This law also establishes a mechanism of applying for such a road. It also establishes a legal regime to ensure the safety of the neighbouring environment.

The Act permits the owner of any land who is unable through negotiations to obtain leave from adjoining land owners to construct a road of access to the public highway, to apply to a magistrate for leave to construct a road of access over any land lying between his land and the public highway<sup>38</sup>. This law also provides for means by which an order for the construction of an access road can be revoked<sup>39</sup>.

The Act further provides for maintenance of the access road in a good and efficient state of repair, and for payment of compensation in respect of the use of the land, the destruction of crops or trees and such other property<sup>40</sup>.

Although there is a provision for compensation for destruction of trees and crops under the Act, this provision is not enough to provide for environmental protection. The construction of such a road may be carried out in a steep area and this may lead to soil erosion and degradation of the landscape.

In terms of environmental issues relative to road construction, the Act lacks the component of Environmental Impact Assessment which should be carried out by a local authority knowledgeable in environmental management.

### 2.2.10 Forests Act<sup>41</sup>

The Act prohibits anyone from re-opening any road, track or bridge in a forest reserve. It further provides that construction or re-opening of any road track or bridge in a forest reserve requires written authority from the relevant authorities.

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<sup>37</sup> Cap 345 of the 1964 law of Uganda and Cap 346 Repealed by Act No. 2 of 1969.

<sup>38</sup> Section 1(i).

<sup>39</sup> Section 3 of the Access to Roads Act.

<sup>40</sup> Sections 8(1) and 3(3).

<sup>41</sup> Cap 246.

Reference to roads in this act relates to forest roads for the purposes of forest management, and not to public roads that traverse forest reserves.

### 2.2.11 The Mining Act<sup>42</sup>

This Act governs road construction in mining areas and regulates how mining should be carried out in relation to roads. It confers mining rights to prescribed persons. Mining rights are not to be conferred if the area to be mined is situated within 100 yards of any railway or situated within 50 yards from the centre of a road, street or highway except with the consent of the minister.

According to this Act, a mine means and includes any place, excavation or working upon, wherein or whereby any operation in connection with which mining is carried on. A mineral is defined to include:

- a) metalliferous ores and other substances in their natural state which are obtainable only by mining or in the course of prospecting operations;
- b) metalliferous ores and other substances in their natural state mined or obtained in the course of prospecting operations;
- c) the valuable parts of such ores or other substances when manufactured; and
- d) the product of treating or dressing such ores or other substances for marketing or exports;

The definition does not include mineral oils, clay, murrum, sand, or any stone except limestone, commonly used for building or similar purposes or such other common mineral substances as the minister may by statutory instrument declare them to be minerals.

The Act prohibits persons in the exercise of prospecting or mining rights under it to create passages or ways over, on or under any public land, other than that contained in their mining rights, except with the consent of the relevant authority.

Another legislation governing activities in mining is the Petroleum (Exploration and Protection) Act 1985. The Mining Act operates for all minerals other than petroleum. It concentrates on metallic minerals and limestone only. It leaves out other minerals such as gemstones, clay and murrum. However, the National Environment Statute and the EIA Regulations currently make it mandatory for all projects which are likely to have an impact on the environment to carry out or cause EIA to be carried out before such projects can be undertaken. Construction of roads in mining areas would, therefore, require an EIA to be carried out since such construction is likely to have an impact on the environment. EIA requirements are applicable to excavation of stones and murrum needed for road construction too.

The Mining Act does not provide for measures to be followed when a mine is no longer being operated. Miners should make sure that old mines are covered especially if they are near a road and all culverts and trenches which were used in the mine should be covered too. This loophole has now been taken care of the National Environment Statute, 1995 which requires restoration of sites to a state as near as possible to their original environment.

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<sup>42</sup> Cap 248.

### **2.2.12 Town and Country Planning Act<sup>43</sup>**

The 1995 Constitution provides that government may, pursuant to laws made by parliament and government policies, regulate the use of land. The principal statute on land use and land planning in urban and rural areas is the Town and Country Planning Act. The Act establishes the Town and Country Board which is charged with the duty of the planning and orderly development of towns and rural areas. The board advises the minister and local authorities in its duties.

Local Planning Committees may be formed, to which the board may delegate duties. The Act established guidelines for the making of planning schemes, acquisition of land and compensation for acquired lands. The Second Schedule to the Act contains an outline of a detailed scheme which includes a number of considerations designed to safeguard the natural environment.

Any land in the planning area required for road, open space gardens, schools, places of religious worship and reaction may be acquired on the advice of the board in relation to provisions of the law relating to compulsory acquisition.<sup>44</sup>

The Act further limits the number or prescribes the sites of new roads entering a road or the site of a proposed road.<sup>45</sup>

### **2.2.13 The Electricity Act<sup>46</sup>**

The Act provides for procedures to be followed by an authorized undertaker in relation to works which are to be carried out in relation of any land, building road, wall or bridge for purposes provided for under it. This mainly deals with how electricity can be distributed across any road, walls and how to use other public works to support the poles for support of any electric line. Clearing of vegetation and the whole process of constructing access roads may have significant impacts on the environment and hence requires the carrying out of environmental assessment as provided for under the National Environment Statute and EIA Regulations, 1998.

### **2.2.14 Local Laws Relating to Construction of Roads in Rural Trading Centres**

These are pieces of legislation previously made by the Kingdoms and districts in the form of bye-laws which regulate the construction of roads in the various rural trading centres. They seek to ensure that people build shops far from the centreline of the roads which pass through trading centres and regulate the mode of building which ensures safety of the public. The shops are supposed to be built 50 feet from the centreline of the road. These laws also prohibit throwing of debris on any road<sup>47</sup>.

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<sup>43</sup> Cap 30.

<sup>44</sup> Section 17 (1)(a).

<sup>45</sup> Section 19 (4)(k).

<sup>46</sup> Cap 135.

<sup>47</sup> For example the Madi Rural Trading Centre Law L.N no. 121/1963; Busoga Rural Trading Centre Law, L.N no.109/1962; Kigezi Rural Trading Centre Law, L.N no 92/1962. Most of the kingdoms and districts before 1967 had similar laws.

However, these laws do not provide for enough space for expansion in the case of a rural trading centre developing into a big town, or in case of repairs and construction to improve roads. The owners of these shops stand the risk of their shops being destroyed if there arises a need to expand the roads.

### **2.3 Property Rights and Compensation**

The law relating to compensation of property owners in Uganda stems from the Constitution of the Republic of Uganda, 1995. Article 237(1) of the Constitution vests all land in Uganda in the citizens of Uganda. However, under Article 237 (1) (a) the Government or Local Government may acquire land in the public interest. Such acquisition is subject to the provisions of Article 26 of the same Constitution, which gives every person in Uganda a right to own property.

Compulsory deprivation of one's property is prohibited by the Constitution except when the taking possession or acquisition is necessary for public use, among other things. If it is proved that the taking possession or acquisition is in public interest, for instance for the construction of a road, then the taking or acquisition shall be done subject to prompt payment of fair and adequate compensation, prior to the taking of possession or acquisition of the property.

Article 26 further gives a right of access to a court of law to any person who has an interest or right over the property. Court action is contemplated in cases where there may be delayed, inadequate or unfair compensation to the property owner or the owner of any right over the land in question.

Since the Constitution is the supreme law of Uganda and has binding force on all authorities and persons throughout Uganda,<sup>48</sup> it seems there cannot be any taking, acquisition or deprivation of any sort of any property or property right in Uganda without due compensation as envisaged under the Constitution.

Any other law which purports to permit any person or authority to acquire land without due compensation would accordingly be void to the level of its inconsistency with the constitutional provisions in that respect.<sup>49</sup>

Indeed, a number of laws permit compulsory taking of land for public use or in public interest. The salient ones which relate to the construction of roads are analysed hereunder.

#### **2.3.1 The Survey Act 1964<sup>50</sup>**

Before any attempts are made to construct any road or highway in any part of the country, a survey of the area has to be carried out. Survey operations in Uganda are governed by the Survey Act.

Under this Act, the Commissioner of Surveys can authorise the carrying out of a survey of any land if it is necessary.<sup>51</sup> However, where a general survey is necessary, notice of such specifying the limits of the area to be affected has to be published in the gazette.

<sup>48</sup> Article 2; Constitution of the Republic of Uganda, 1995.

<sup>49</sup> Ibid Article 273(1).

<sup>50</sup> Cap 209 of the 1964 Laws of Uganda.

<sup>51</sup> Ibid Section 2.

In case the survey is of a special nature, which could be outside the capacity and scope of the commissioner, then the minister may order for such a survey. In that case, the minister must specify the nature of the survey to be carried out and its purpose. He is compelled to comply with provisions of the Act when doing so.<sup>52</sup>

Only licensed surveyors or duly authorised officers with servants and workmen may enter upon any land and make all or any inquiries and do or cause to be done all things necessary for effecting such survey. The anticipated activities include, but are not limited to clearing of line boundaries.<sup>53</sup>

### **2.3.2 Compensation Under the Survey Act**

Compensation envisaged and actually provided for under the Act is only for trees, fences, and standing crops damaged or injured during the survey. The amount to be paid as compensation in that regard is assessed and determined by the surveyor. No compensation is to be paid to the owner of property under this Act if the surveyor is carrying out lawful acts authorised by law like the recovery of boundaries, marks and their repairs. If the survey is initiated by a private party, not the government, compensation is made by that private party if it has to be made. There is no compensation in respect of property damaged or injured for the purposes of constructing survey camps.

Obstructing a surveyor when he is carrying out lawful activities is an offence under this Act. However, in all cases, notice must always be given to the party to be affected by the survey.

Any grievances arising in this respect lie to either a Chief Magistrate or Magistrate Grade One.<sup>54</sup>

In terms of road construction, therefore, there must first be undertaken a survey, and due compensation made to the affected parties, if their property is damaged or injured. Thereafter, the surveyed area becomes property of the state or any government body. It seems that in cases of a road reserve, which is part of the road, there would be no compensation of any sort to the owners of property standing or lying on the area gazetted as a road reserve.

### **2.3.3 Compensation Under the Land Act<sup>55</sup>**

The Act authorizes an authorized undertaker of any project to construct access roads, extract and take materials from any land subject to compensation of the land owner for the use of land and damage caused to his developments on the land in issue.<sup>56</sup>

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<sup>52</sup> Ibid Section 3.

<sup>53</sup> Ibid Sections 11 and 19.

<sup>54</sup> Ibid Sections 23, 31 and 34.

<sup>55</sup> No. 16 of 1998.

<sup>56</sup> Ibid. S. 74 (3).

### **2.3.4 Compensation Under the Roads Act<sup>57</sup>**

The Roads Act prohibits:

- a) Construction or erection of any building in contravention of its provisions which interferes in any way with the proper function of any cutting, ditch or culvert constructed in connection with any road; or
- b) Planting or permitting to grow any trees, or permanent crops or grazing which interferes in any way with the proper function of any cutting, ditch or culvert constructed in connection with any road; or
- c) Connecting with any road any cattle path, bicycle track, side road or entrance or means of access to a dwelling or to any other premises or place which interferes in any way with the proper function of any cutting, ditch or culvert constructed in connection with a road or which in the opinion of the road authority is likely to be dangerous to persons or vehicles using a road.

If any of those prohibited acts occurs the road authority shall give written notice to the owner or occupier of the kind on which such offence took place requiring him;

- i) to pull down or remove the building or erection; or
- ii) to cut down or uproot the tree or crops; or
- iii) to alter or repair the cattle path, bicycle track, side road or entrance or means of access or to close the same.

Any person who fails to obey such a notice within a reasonable time shall be guilty of an offence and the court may order the same to comply with the requirements of the notice by a date to be named in the order. No compensation can be made in respect of any damage arising out of carrying out a lawful order prescribed either by the Act or Government.

A road authority may dig and take away materials required for the construction and maintenance of roads in any part of a road reserve approved by the district commissioner without payment to any person.

### **2.3.5 Compensation Under the Access to Roads Act**

The Access to Roads Act permits an owner of land who wishes to construct an access road through adjacent lands of other owners to do so through negotiations or by obtaining a court order granted by a magistrate for that purpose. If in the process of constructing an access road, there is damage to crops, trees or other property, the owner of such crops, trees or other property is entitled to compensation from the applicant.

The amount of compensation is assessed at the market value of the damaged property.

### **2.4 Compensation under the MOWHC General Conditions of Contract**

The MOWHC general conditions of contract permit the engineer to designate the areas to be cleared or grubbed. However, no clearing or grubbing is to be carried out without written instructions of the engineer, who shall designate in detail the exact areas to be cleared and/or grubbed and the time at which such shall be carried out.

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<sup>57</sup> Cap 345.

The clearing to be done under these conditions may be for areas which fall under the road reserve prism or any other areas designated by the engineer in writing.

The contractor undertaking the work is required to take necessary precautions to prevent damage to structures and other private or public property. The contractor may also borrow such areas as designated by the engineer for purposes of disposing of materials obtained during clearing or grubbing the area.

The MOWHC general conditions of contract render the tenderer and his personnel/agents liable for any personal injury, loss of or damage to property caused during site visits.

In the case of road or bridge works, it is a condition that the contractor will be liable for all damage (including consequential damage) to road, irrigation, ditches, main pipes, electric cables or wires or services of any kind caused by him or his sub-contractors in the execution of the works. The contractor is required to make good any damage without delay. One of the anticipated means of making good the damage caused would be compensation.

#### **2.4.1 General Principles Relating to Compensation in Uganda**

The position of the government of Uganda in relation to compensation to be paid if damage is caused to land are clear under the Constitution. The Water Statute<sup>58</sup> clearly transforms the constitutional provisions into detailed and enforceable legal requirements.

The Water Statute can be used as a model law in terms of compensation in the field of natural resources and land generally. According to this Statute, if damage is caused to land in the exercise of lawful activities, the parties whose interest in the land has been damaged are supposed to be compensated.<sup>59</sup> "Damage to land" under the Water Statute refers to loss suffered as a result of:

- deprivation of the possession of the surface of any land;
- damage to the surface of land and to any improvements, crops, or trees;
- damage to stock; and
- all consequential damage.

Compensation under this law can only be paid if a written claim for compensation has been logged with the responsible authority.

The claim for compensation must state:

- the claimant's name and address;
- a description of the land in respect of which the claim is made;
- the claimant's interest in the land;
- the nature and extent of the interest of any other person in the land;
- the damage caused to the land;
- the particulars of any other damage; and
- the total amount of the claim.

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<sup>58</sup> No. 9 of 1995.

<sup>59</sup> Section 91 of the Water Statutes, No. 9 of the 1995.

Award for compensation may take the form of a payment of money and any other type of award which the authority may consider appropriate.

There is a provision for the authority to notify the claimant of its decision on a claim as soon as practicable and if the claimant is aggrieved by that decision, he may appeal to the minister within the prescribed time. The minister is supposed to fix the appropriate compensation in the circumstances.

According to the Constitution of Uganda, 1995,<sup>60</sup> any person aggrieved by a decision of a court may appeal to an appropriate court. For purposes of compensation, both the authority and minister assume a quasi-judicial function, and, therefore, an aggrieved party, can appeal against the minister's decision to the high Court.

On the other hand, if it is the contractor's property or any property belonging to the government or its duly authorized agents which is damaged or injured, the offender shall be prosecuted in a criminal action and the court may in addition to the penal sanction, order such offender to compensate, the authority, government body or any person whose property is damaged.<sup>61</sup>

In conclusion, therefore, MOWHC should be prepared, together with the contractors, to pay compensation to anyone whose property is damaged or injured during the process of road construction. There are well founded legal provisions both constitutional and statutory which support the assertion that compensation in respect of damage caused to crops, buildings, fences and standing trees has to be made, if such developments are not in a road reserve prism. Compensation for developments within a road reserve prism can only be made if the gazetting of that area as a road reserve was done when such developments were already in place and no compensation has been made in that respect. This is because the provisions of the Roads Act, make it an offence to make any developments in a gazetted road reserve. The constitutional provisions relating to compensation would only be invoked if the land in question belonged to the owner of the developments damaged. A road reserve area is the property of the registered proprietor, the state. Any other person "sitting" on it would be a trespasser. One of the aspects which must be borne in mind with respect to the FRSP road projects is mitigation, which among other things considered includes compensation as one of the ways of ameliorating losses suffered by individuals and communities during the life of the project.

## **2.5 Commentary on Enforcement of these Laws**

The laws which were made before 1995 mostly impose fines which are now so low as to make the enforcement of these laws untenable. However, the laws made since 1995 have attempted to address this problem by providing for sufficient sanctions and alternative enforcement mechanisms as shown above in the discussion in the National Environment Statute.

The problem of enforcement must also be seen within an institutional context especially in relation to institutional capacity. To date, the institutions proposed under the new laws are yet to mature to handle the responsibilities they have been given. However, given the financial and manpower constraints that face these institutions, they are performing admirably. Much will depend on how these institutions cope with expanding responsibility in a fast changing world.

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<sup>60</sup> Article 50(3).

<sup>61</sup> Section 93 of the Water Statute.

### 3. THE PHYSICAL, NATURAL & SOCIAL ENVIRONMENT OF UGANDA

This chapter presents the environmental and social setting of Uganda, in order to provide an understanding of the background against which road development under the RSDP will take place. The descriptions of the physical, natural and social environments are enhanced with maps that have been created using digital data. This data will be presented on CD to the MOWHC on completion of this assignment. At the end of each section, the relevance of that particular environmental or social aspect to road projects is highlighted.

Uganda forms part of the East African region. It is located between latitudes 4° 12' N and 1° 29'S, and between longitudes 29° 34' and 35° 0' E. It occupies an area of about 241500 sq km. According to NEMA's 1996 State of the Environment Report, open water bodies cover 15.3%, permanent wetlands 3%, and seasonal wetlands 9.4% of the total area of Uganda. These cover 27.7% of Uganda while areas without water consist of 72.3% of Uganda. Uganda shares its border with Kenya to the east, Tanzania to the south, Rwanda south-west, Democratic Republic of Congo east, and Sudan to the north.

#### 3.1 Topography and Geology

The different geological characteristics of Uganda give rise to different land-forms and hence the topography of the country. Uganda is part of the African interior plateau, and the country can be divided into four altitudinal zones. The topography of the country is depicted in Map 2, while areas of steep terrain are shown in Map 3.

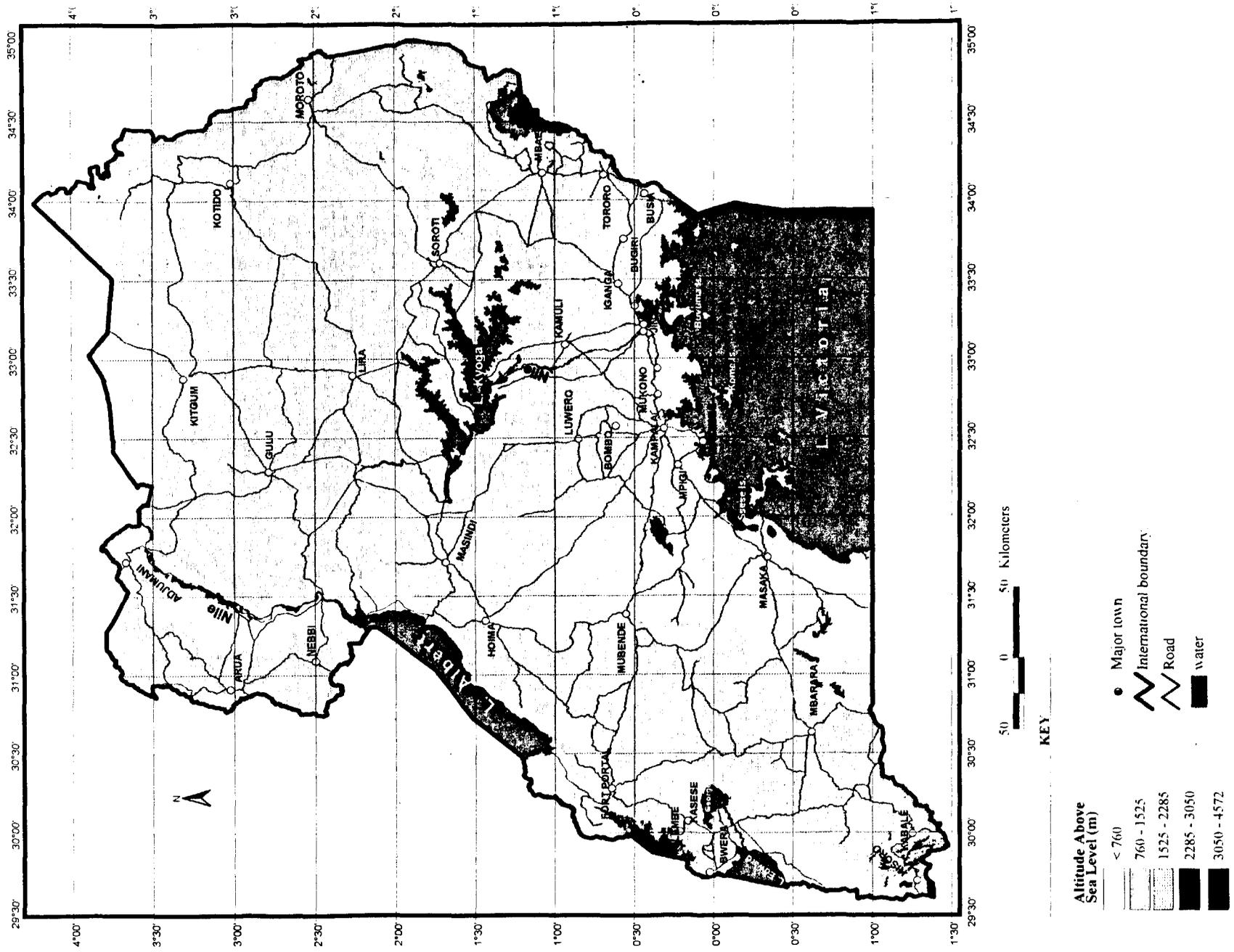
The first zone comprise land under 900 metres above sea level (masl). This zone is part of the Western Rift in which Lakes Albert, Edward and George are located, and has no prominent relief features except rivers and lakes.

The Pre-Cambium geological land-forms which cover most of central and mid-western Uganda make up the second zone. This zone has areas of altitude of 900 to 1200 masl, and spans 84% of Uganda. It stretches from Luwero, Kamuli, and Tororo Districts in the south, to Gulu, Kitgum, and Kotido Districts in the north. Lakes Kyoga and Bisina are at the centre of this zone. The zone is generally underlain by undifferentiated gneisses. The northern shores of Lake Kyoga are underlain by shales, arkoses and quartzites. The landscape is made up of hills that are flat topped and rising to almost the same height. Hill tops are covered with thick laterites that overly deeply weathered ancient rocks. Broad and open valleys which are covered by extensive papyrus and swamps separate these hills.

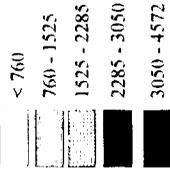
The next altitudinal zone comprises land between 1200 and 2000 masl. This occurs along the eastern border with Kenya, and the south-western region of Uganda. The Karagwe-Ankolean geology system gives rise to the hilly (1550 - 2500m above sea level) terrain of Kabale, and also some parts of Mbarara and Bushenyi. Such hilly terrain is also found in Karamoja and West Nile regions. Some of the prominent hills found in this zone are Tororo (1948 m), Naponono (1957 m), and Ogili (1992 m) on the north-western part of Uganda. The hilly areas cover about 3% of the total surface area of the country. The hilly areas are moderate to steep (30 - 50%).

The last altitudinal zone which consists of land above 2000 m consists mostly of mountainous regions found on the western, eastern, and northern parts of the country. This zone covers 2% of

# MAP 2. TOPOGRAPHY



## Altitude Above Sea Level (m)



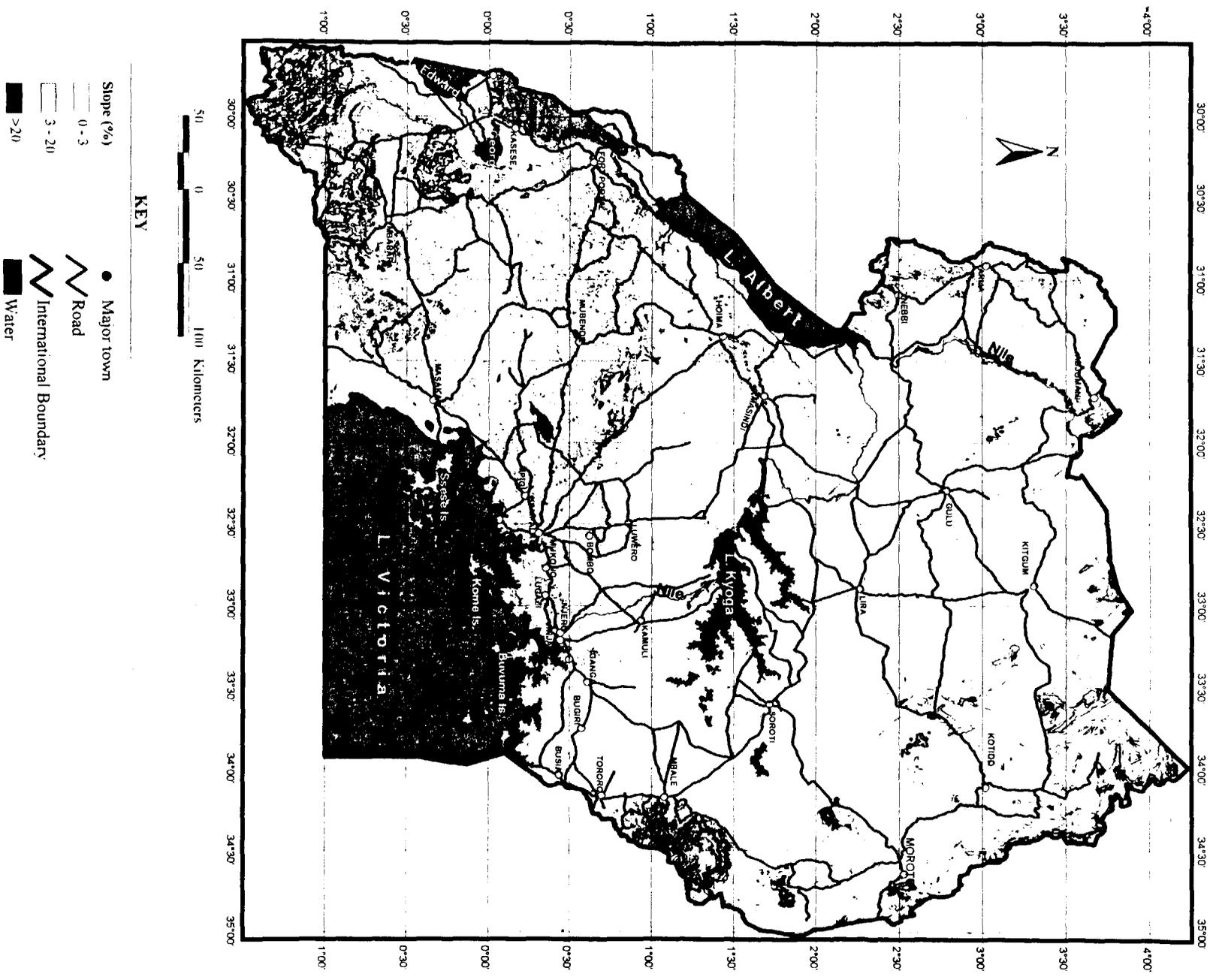
- Major town
- International boundary
- Road
- water

## KEY

Source of data: Topographic  
 Sheet of Uganda: 1:250,000

Produced by RS & GIS Lab  
 A/C/ENP, 1999, for A/OW/HC

# MAP 3. SLOPE STEEPNESS



Source of data Derived from  
1:500,000 contour 1:50,000

Produced by IIS & GIS Ltd.  
MILWAUKEE, WISCONSIN, U.S.A.

Uganda. The Rwenzori Mountains which occur on the western part were formed by uplifting of the host block. These mountains rise to 5100 m, and their summits are permanently covered by snow and ice. Muhavura and Mgahinga lie in the Ugandan side of the Virunga range in the south-western tip of the country. These mountains are volcanic in origin. Another mountainous region is found along the eastern border where Mt Elgon is the most prominent relief feature. This was formed by old and extinct volcanoes, and it has an altitude of 4320 m. In contrast to the steep slopes of the western highlands, Mt Elgon has generally gentle slopes. Several volcanic mountains also occur in Moroto and Kotido Districts.

### 3.1.1 Implications of Geological/Topographic Characteristics on Road Projects

Topographical information is important for the design of road projects, and in planning for their construction. Steep areas would affect design considerations, while hilly areas may affect efficiency of haulage. Although topography is studied in depth during the design stage, an initial indication of the conditions is useful, particularly for planning purposes. Some topographical considerations to be taken into account during the planning, design and construction stages are as follows:

#### Planning stage

- locations where rock is close to the surface should be avoided as this will usually require expensive excavation;
- the stability of cuts against landslides should be considered;
- the strength of the soil beneath the road (subgrade) is influenced by the ground formation.

#### Design stage

- the selection of design standards is related to the terrain;
- grades and curvatures should be kept to the minimum necessary to satisfy the service requirements of the road;
- to minimise drainage problems, locations on high grounds should be selected in contrast to ones in valleys;
- swamps/marshes and low-lying lands subject to flooding should be avoided;
- in hilly terrain, roads may need to go through passes in the hills or to cross ridges at their lowest points;
- the best location for a road is the one that results in the minimum total cost of earthworks, ie. quantities of excavation should balance as much as possible quantities of fill;
- the design speed of a road has a bearing on the terrain being traversed;
- the shape of the ground affects the hydrology and hydraulic designs of structures because:
  - it determines the limits of the catchment area and therefore the runoff
  - depressions in the ground hold back runoff water until they are filled
  - the length and steepness of slopes determines how much of the precipitation becomes part of the runoff.

#### Construction stage

- install erosion prevention measures in side ditches in steep grades;
- in hilly terrain, possibilities of landslides might exist.

### 3.2 Soils

Though there have been attempts to reclassify the 124 soil units in Uganda to FAO classification system, no FAO soil map of Uganda has been published. However, for the purposes of incorporating soil data in environmental analysis during road projects, the soils can be reclassified using information on textural classes. Map 4 shows a reclassification of the soil map of Uganda based on soil texture to giving only 9 soil types out of the 124 classes. Such a classification is useful for identifying sensitive soil types.

The types of soils are described on the basis of their productivity, and according to the classification illustrated in Map 4.

Soils of very high to high productivity usually ranging between sandy loam and sandy clay-loam and which occupy about 8% of the land in Uganda are to be found scattered in places like the footslopes of Mount Elgon, in Nebbi and Kabarole districts and in large parts of Buganda region. These areas with a rolling type of terrain whose slopes vary between 5 and 16 %, have rain forest and elephant grass as their typical vegetation cover and receive between 1000 and 1375 mm of rainfall on average per year.

Soils of moderate productivity are usually red clay-loams and cover approximately 14% of the land area of Uganda. They are mainly to be found in areas with rolling to undulating type of relief whose slopes range between 3 and 16 %, and which receive on average between 1000 and 1250 mm of rainfall per year. Such areas support a vegetative cover ranging from elephant grass to forest re-growth and are spread out in places like Kapchorwa, Namalu in Moroto, Kabale, Mabira in Mukono and Bushenyi.

Soils of fair productivity ranging between clay loam and sandy loam occupy the largest land area of Uganda, amounting to at least 43%. These soils are widespread in the central plateau of Uganda for example in Mubende, Kamuli, Jinja, Soroti, West Lira, Apac and Hoima. They generally occupy areas with a rolling to undulating hills type of relief with slopes ranging between 3 and 12 % and which receive between 1000 and 1250 mm of rain on average per year. These soils whose natural vegetative cover is characterised by medium grass savanna, are able to support both perennial and annual crops including cotton and tobacco but are unfavourable for tree crops and plantains.

Soils of low productivity that range between sandy loam and clay and which occupy about 30% of the Ugandan land surface are found scattered in association with other dominant soils in places like Kadam, Tororo, Kidepo and Ishasha. Their main locations are in northern Uganda and in the Western rift valley lowlands where they support a vegetative cover comprising short-grass savanna. Areas occupied by these soils have a gently rolling to undulating type of relief and receive annual rainfall averages of 1000 mm or less.

Soils of negligible productivity vary from those of sandy conditions e.g. sandy loam to plastic clays and occupy about 3% of the land area of Uganda and are generally to be found in flat valley bottoms in places like Mubende, Sango Bay and Kifu. They support a vegetation cover comprising mainly of swamp communities, papyrus etc. associated with alluvial conditions and the areas they occupy receive annual rainfall averages of about 1125 mm.

Soils of nil productivity are generally soils which would require draining and those which need to be irrigated to make them productive. They occur as skeletal soils or peat soils mainly on flat valley bottoms and flood plains and occupy a maximum of 2% of the surface area of Uganda.



Areas with these type of soils receive on average between 1000 and 1250 mm of rain per year and are mainly covered with short grass interspersed with shrubs and thickets.

### 3.2.1 Implications of Soil Types on Road Works

Using Map 4, it is possible to determine the extent and distribution of sensitive soil types such as poorly drained and sandy soils. Both poorly drained and sandy soils may be regarded as sensitive soils and they cover 13% of the Uganda surface area. The sensitive soils are located in low lying and flat areas mainly on the western shores of Lakes Victoria and Kyoga, the Western Rift Valley and most wetlands. This is not surprising because sandy soils are fluvial in nature and hence have to be formed in flat and low lying areas after deposition. On the other hand, poorly drained soils are also found in low lying areas such as wetlands.

Other soil types of importance to the road sector are clayey soils. Clayey soils, while they may be a nuisance to road usage especially during the wet season, they have low soil erosion potential. The clay soils are also widespread, accounting for about 11% of Uganda's surface. Sandy Loam, mostly found in northern Uganda, account for the largest percentage cover (27%).

In addition, the soil map assists in planning for construction, in order to establish possible sources of gravel and hardstone.

Other implications of soil types on the design and construction of roads are follows:

#### Design stage

- roads should be located on soils which require the least pavement thickness over them;
- knowledge of the properties of the soils enables a decision to be made as to whether treatment is needed or not, and if so, the type of chemical stabiliser should be used;
- to achieve the best balance in earthworks between cuts and fills requires that the road be located on soils that are suitable for road construction;
- the type and condition of the soil eg. granular and dry, affects how much of the initial part of the storm actually runs off to reach the drainage structures;
- the type of soil determines the need and extent of grassing to be done on cut/side slopes, the timing of its execution and duration of nurturing;
- determines the stability of cuttings and embankments;
- type of soil, amongst other factors, determines whether erosion protection structures are needed, and if so, influences the selection of their type ,design and locations.

#### Construction stage

- during construction of earthworks, water requirements and the types of equipment used for compaction depend on the properties of the soil being used.

### 3.3 Rainfall

The variation of rainfall in space and time in Uganda depends on:

- i. convergence of the north-east and south-east monsoons within the inter-tropical convergence zone,
- ii. the movement of the sun north and south of the Equator,
- iii. inflow of westerly winds from the Democratic Republic of Congo,

- iv. relief, and
- v. water bodies.

The mean annual rainfall varies from less than 500 mm in Karamoja to about 3000 mm over Lake Victoria (Map 5). Table 3.1 shows mean monthly rainfall figures for some centres in Uganda.

Uganda can be divided into five rainfall zones based upon both temporal and spatial variations of rainfall. These zones are described below.

### **3.3.1 Zone I Lake Victoria Region**

This zone extends for about 48 to 64 km around the shores of Lake Victoria. It has flat topped hills with a uniform height of about 1300 metres above sea level. The primary vegetation consists of short grass on hill tops, forests on valleys, and papyrus in swamps. The climate of the Lake Victoria region is characterised by small seasonal changes in temperature, humidity and wind due to the maritime influence of the lake. The limit of this region is where diurnal variations in temperatures are greater than 10°C. Rainfall occurs throughout the year with two maxima between March to May, and the other during October to December. The mean monthly rainfall varies from 150 to 250 mm between March and May. April receives the highest rainfall. Rainfall varies from 100 mm in October to 145 mm in November. The period from July to September receives low rainfall of about 75 mm per month. Low rainfall is also experienced between January and February which have an average of about 60 to 75 mm of rain per month. Rainfall decreases with distance from the lake. Entebbe, which falls within this zone, receives about 1500 mm of rain per year (Figure 3.1 and Table 3.1).

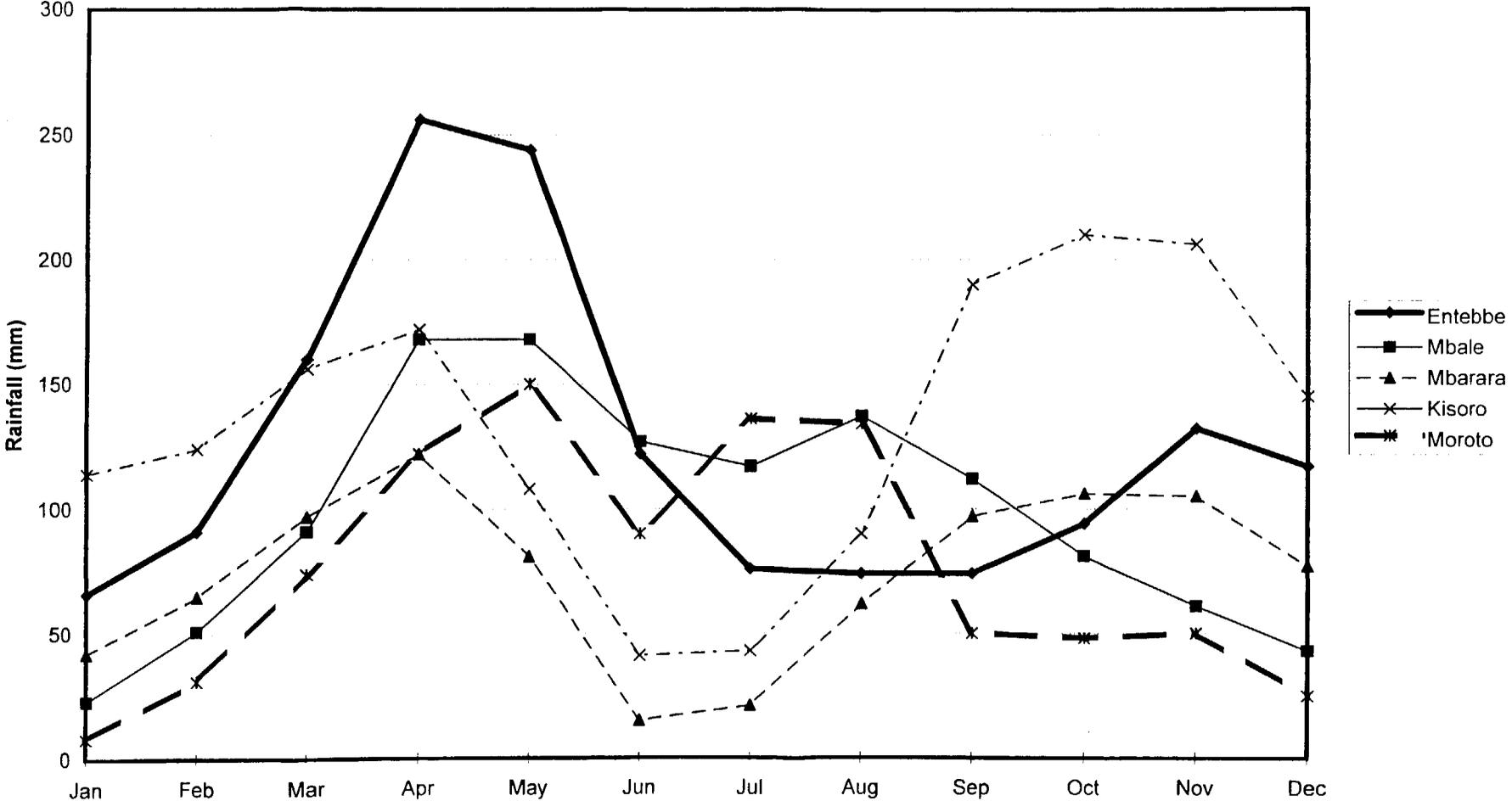
### **3.3.2 Zone II Karamoja**

The Karamoja region is made up of a flat plain with altitude between 900 and 1200 m, and peaks that are at 2400 to 3000 m high. This region is characterised by the occurrence of rainfall in one season only, April to August, as a result of the north-eastward movement of the inter-tropical convergence zone. The dry season is experienced between November to March. During this period the sky is cloudless and very high temperatures above 35°C occasionally occur. The average annual rainfall for this region varies from 325 to 620 mm. Areas with high ground such as Mt Moroto receives relatively high rainfall of about 890 mm (Figure 3.1 and Table 3.1).

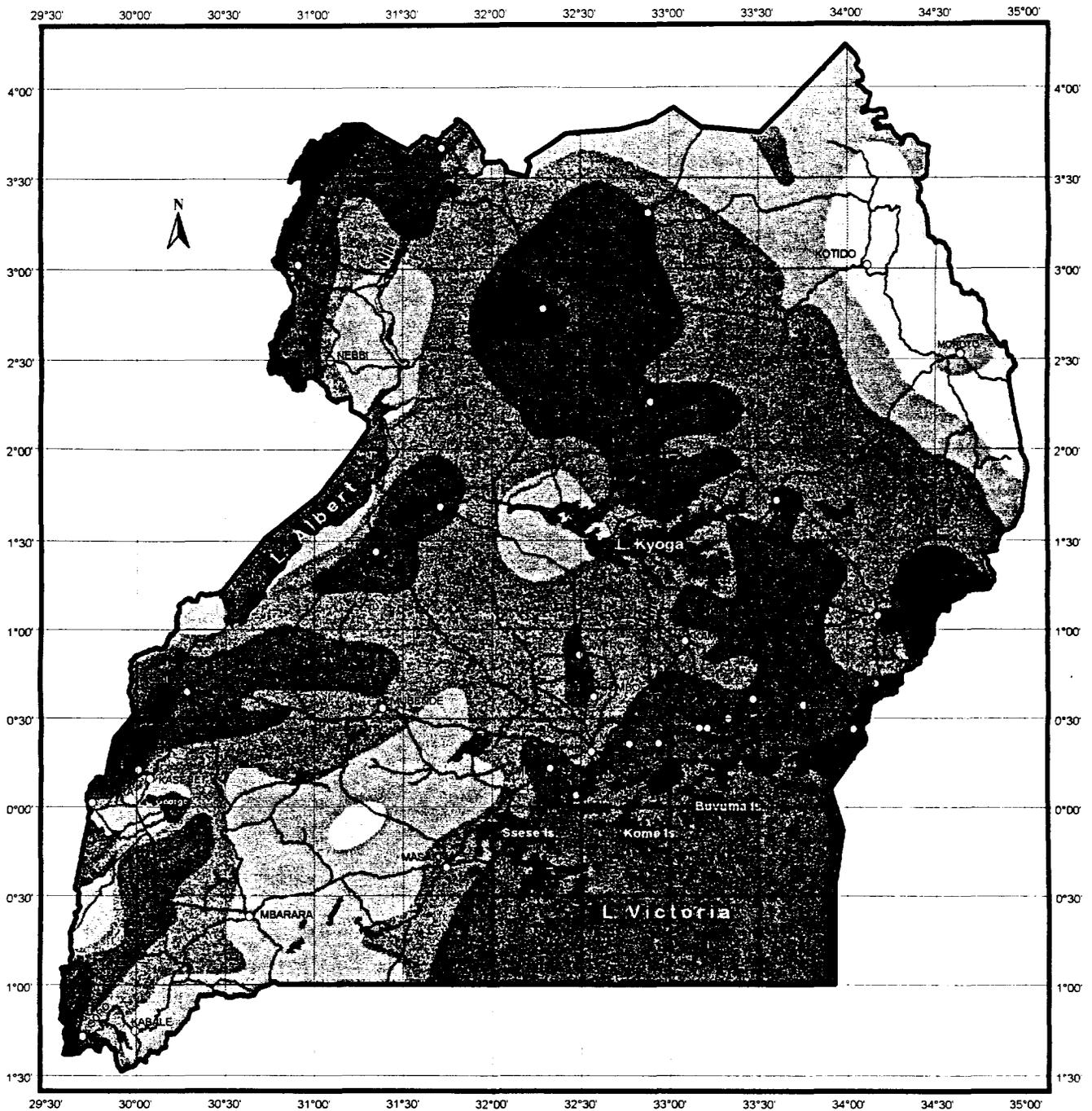
### **3.3.3 Zone III Western Uganda**

This region occurs in the form of a narrow strip along the western Ugandan border. It covers the high ground of the West Nile area, the escarpment along the eastern shores of Lake Albert, and in parts of Kabarole, Bundibugyo and Kasese. Most of this region occurs within the Rift Valley. Lake Albert which is at altitude of about 618 m is the lowest and hottest place in Uganda. This region experiences a hot and dry season during December and February. The average annual rainfall varies from about 750 to 1000 mm with 80 to 100 rainy days. Rainfall increases with altitude. The mountains surrounding the Rift Valley receive as much as 1250 mm per year.

FIG 3.1 MEAN MONTHLY RAINFALL AT SELECTED STATIONS



# MAP 5. RAINFALL DISTRIBUTION



50 0 50 Kilometers

### KEY

Rainfall (mm/year)	
	500 - 750
	750 - 1000
	1000 - 1250
	1250 - 1500
	1500 - 2000
	2000 - 2375
	Major town
	Road
	International Boundary
	Water

Source of data: Atlas of Uganda 1967

Produced by RS & GIS Lab  
MUSEAR (1999) for MOWHC

### 3.3.4 Zone IV Acholi-Kyoga

This zone covers West Nile, Kigezi Highlands, the area around Lake Kyoga, Bushenyi and part of Mbarara. Rainfall occurs throughout the year. The wet season extends from April to October. The period from April to May, and October receive the highest rainfall. Monthly rainfall can be as high as 150 to 200 mm. The occurrence of two periods of high rainfall is due to the passage of the Equatorial troughs. November to February receives the lowest rainfall which varies from 20 to 60 mm per month. June and July also experience relatively low rainfall (100 to 150 mm per month) in comparison with the wet months. The annual rainfall varies from 1000 to 1500 mm.

### 3.3.5 Zone V Ankole-Southern Uganda

Zone V is found in Ntungamo, Mbarara, Masaka, Mubende and Mpigi. It is hilly and has flat topped hills on the northern parts. The altitude of hill tops is about 1500 m. There are considerable swamps at an altitude of 900 m which are associated with Katonga River, and Lakes Wamala and Kachira. The seasonal variation of rainfall is characterized by two wet periods, April to May, and September to November, which are separated by relatively dry periods (Figure 3.1). This region receives about 1125 mm per year. A narrow stretch of land that extends from Ntungamo, through Mbarara, and up to Lake Wamala receives less than 875 mm of rain per year. In general there are about 90 to 130 rainy days in a year.

**Table 3.1: Mean Monthly Rainfall (mm) for Some Centres**

	Entebbe	Gulu	Kitgum	Masindi	Mbale	Soroti	Ft Portal	Bushenyi	Kabale	Mbarar	Kisoro	Arua	Moroto
Jan	66	10	8	28	23	18	37	71	61	42	114	19	8
Feb	91	51	25	55	51	64	74	99	92	65	124	49	31
Mar	160	89	76	102	91	81	132	123	108	97	156	85	74
Apr	256	170	132	157	168	183	186	154	136	122	172	140	122
May	244	211	175	150	168	206	144	97	96	81	108	147	150
Jun	122	145	150	102	127	125	84	41	26	15	41	128	90
Jul	76	155	178	112	117	117	59	36	20	21	43	152	136
Aug	74	216	180	137	137	173	117	87	58	62	90	192	134
Sep	74	170	140	140	112	137	190	116	98	97	190	166	50
Oct	94	160	112	119	81	112	219	151	95	106	210	182	48
Nov	132	96	145	117	61	76	165	150	106	105	206	108	50
Dec	117	43	36	43	43	25	76	114	92	77	145	43	25
Ann	1506	1516	1357	1262	1179	1317	1483	1239	988	890	1599	1411	918

### 3.3.6 Rainfall and Roads

During the design and construction stages of road projects it is necessary to consider the rainfall in the project area.

#### Design stage

- rainfall records within catchment areas are used in the estimation of the amount of runoff, which determines the design of drainage structures;

- carriageway and shoulders must provide adequate crossfalls to ensure that the precipitation falling on the road surface is removed as quickly as possible in order to minimise the danger to moving vehicles, and of water seeping into the pavement, causing its failure;
- the design of drainage and anti-erosion systems depends on rainfall;
- the choice of road marking materials is influenced by rainfall in the following manner:
  - in wet areas (mean annual rainfall greater than 500mm) use of plastic pavement materials is limited and bituminous surfacings have to be made as impervious as possible
  - in dry areas (mean annual rainfall less than 500mm) higher plasticities in pavement materials can be accepted;
- pavement thickness depends, amongst other factors, on the bearing capacity of the subgrade whose CBR strength criterion is assessed either in its unsoaked or soaked condition depending on whether the area is arid or not.

#### Construction stage

- for very arid areas, dry compaction of some materials during construction is sometimes recommended;
- rainfall records are used in the programming of the execution of roadworks.

### **3.4 Hydrology**

The drainage network in Uganda is characterised by the occurrence of several lakes, and permanent and seasonal wetlands. Table 3.2 below gives areas covered by these lakes.

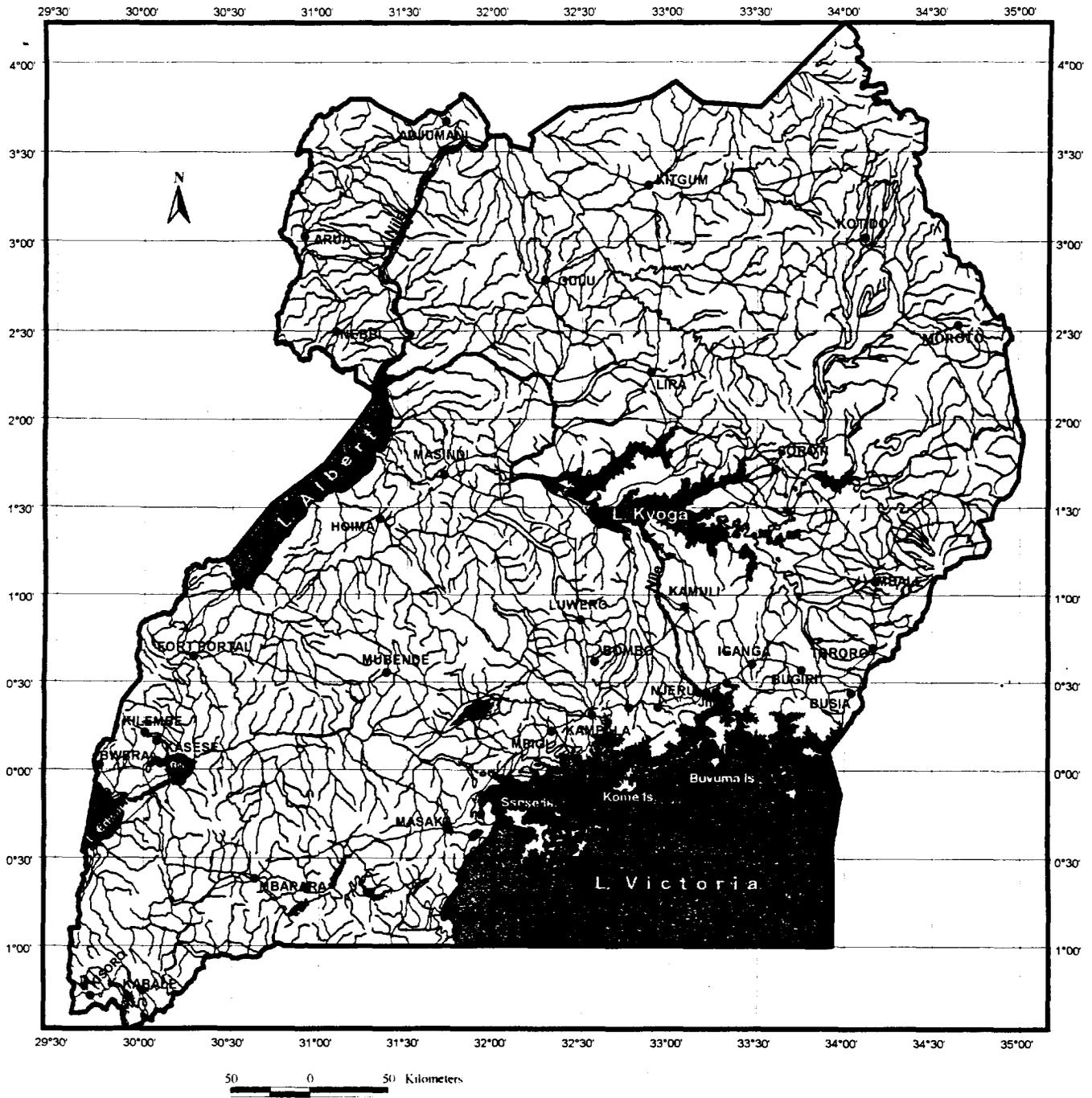
**Table 3.2: Ugandan Lakes**

Lake	Total Area (sq km)	% of Area in Uganda	Depth (m)
Victoria	68 457	42	82
Albert	5 335	55	51
Edward	2 203	29	117
Kyoga & Kwania	2 047	100	7
Bisina	308	100	-
George	246	100	3

Most rivers in Uganda used to flow during the pre-Pleistocene era, almost parallel to each other, towards the west where they joined the Congo River. Tectonic movements such as the down faulting which created the Western Rift, and uplifting severed the connection with the Congo River. This led to a change in flow direction towards the down warped zone which is the current Lake Victoria. The drainage network of Uganda can be divided into 8 basins which are described below and illustrated in Map 6.

Most rivers have 2 seasons of high flows and 2 seasons with low flows (see Table 3.3). High flows are experienced from April to July (0.240 to 0.320 litres/sec/sq km) with peak flows occurring in May. The other high flow period occurs during the December to January period (0.180 to 0.190 litres/sec/sq km). February and March have relatively low flow (0.150 litres/sec/sq km). The lowest flows occur from August to November. All months except April do experience zero flows in some years. Monthly flows have a moderate variability with all months having coefficients of variation of about 0.90.

# MAP 6. HYDROLOGY



**KEY**

- River
- Water
- Road
- Major town
- International Boundary

Source of data: Uganda grid data

Produced by RS & GIS Lab  
M-TERR for MOWHC

### 3.4.1 Lake Victoria Basin

This comprises the part of the East African plateau which drains into Lake Victoria. The major river occurring within this basin are Katonga and Kagera Rivers. Katonga River drains mostly the area occurring in Masaka, Mubende, and Mpigi Districts. Kagera River drains the north-western Tanzania, part of Rwanda, and then a very small area in Rakai District. The northern watershed of the Lake Victoria basin lies very close to its shores. Most of the rivers which occur within this basin are shallow and choked with papyrus, and have very sluggish flows. The Katonga River has a catchment area of 13930 sq km, and an average annual flow of 2.5 m<sup>3</sup>/sec at the Kampala-Masaka Road (Figure 3.2a). The river has a very small catchment yield of about 6 mm, which gives a runoff coefficient of about 1%. Thus most of the rainfall is lost through evapotranspiration from swamps.

### 3.4.2 Kyoga Basin

The Kyoga basin occurs on the central and eastern parts of Uganda and it is formed by rivers which drain into Lake Kyoga and Lake Kwana. This basin stretches from Kampala, Jinja, Tororo, Mbale, Kapchorwa, Moroto, and up to Kotido. It occupies about 25% of Uganda. Rivers which drain Mt Elgon have flash flows, and most have water falls. All other rivers are sluggish in their flows. Rivers such as Mpologoma (Pallisa and Tororo Districts), Ukutat (Moroto, Soroti Districts), and Okere (Soroti District) have wide papyrus covered valleys.

Rivers occurring in this basin have flow regimes of varying complexity depending on their locations. Rivers draining from the south-eastern Uganda such as Mpologoma have high flows during the May to June period (10 litres/sec/sq km) (Figure 3.2b). The July-October period has relatively low flows (4 to 5 litres/sec/sq km), which is followed by relatively high flows in November and December (7 litres/sec/sq km). Lowest flows occur from January-April (3.5 to 5.5 litres/sec/sq km). Monthly flows have a high variability during the November-May period with coefficients of variation ranging from 1.0 to 1.7. Catchment yields vary from 160 to 325 mm.

Rivers from the eastern part of this catchment, such as Namalu River in Moroto District, experience high flows during one period only, July to September, with the highest flows occurring in August (10 to 25 litres/sec/sq km) (Figure 3.2c). The December to April period is a low flow season (1.8 to 4 litres/sec/sq km). Zero flows can occur during June to November. The mean annual catchment yield is about 250 mm.

Rivers from northern part of Lake Kyoga have complex flow regimes (Figure 3.2d). The April to May period experience high flows compared. Flows decrease slightly in June, and thereafter gradually increase until peak flows in September. The mean annual catchment yield of rivers draining from the north is about 130 mm.

### 3.4.3 Aswa Basin

The Aswa River joins the Nile River in Sudan. The northern and western parts of this basin consists of lowlands. Rivers on this basin have a simple flow regime characterised by the occurrence of high flows in one clearly defined season, July to October (Figure 3.2e). During this period flows vary from 1.5 to 3.0 litres/sec/sq km. Low flows occur during the December to March period (0.035 to 1.000 litres/sec/sq km). Zero flows can occur during this period. Flows are highly variable during the low flow season (coefficient of variation = 1.0 to 2.7). Rivers occurring on the Aswa basin have small catchment yields of about 35 mm.

FIG 3.2a  
KATONGA RIVER AT KAMPALA-MASAKA ROAD

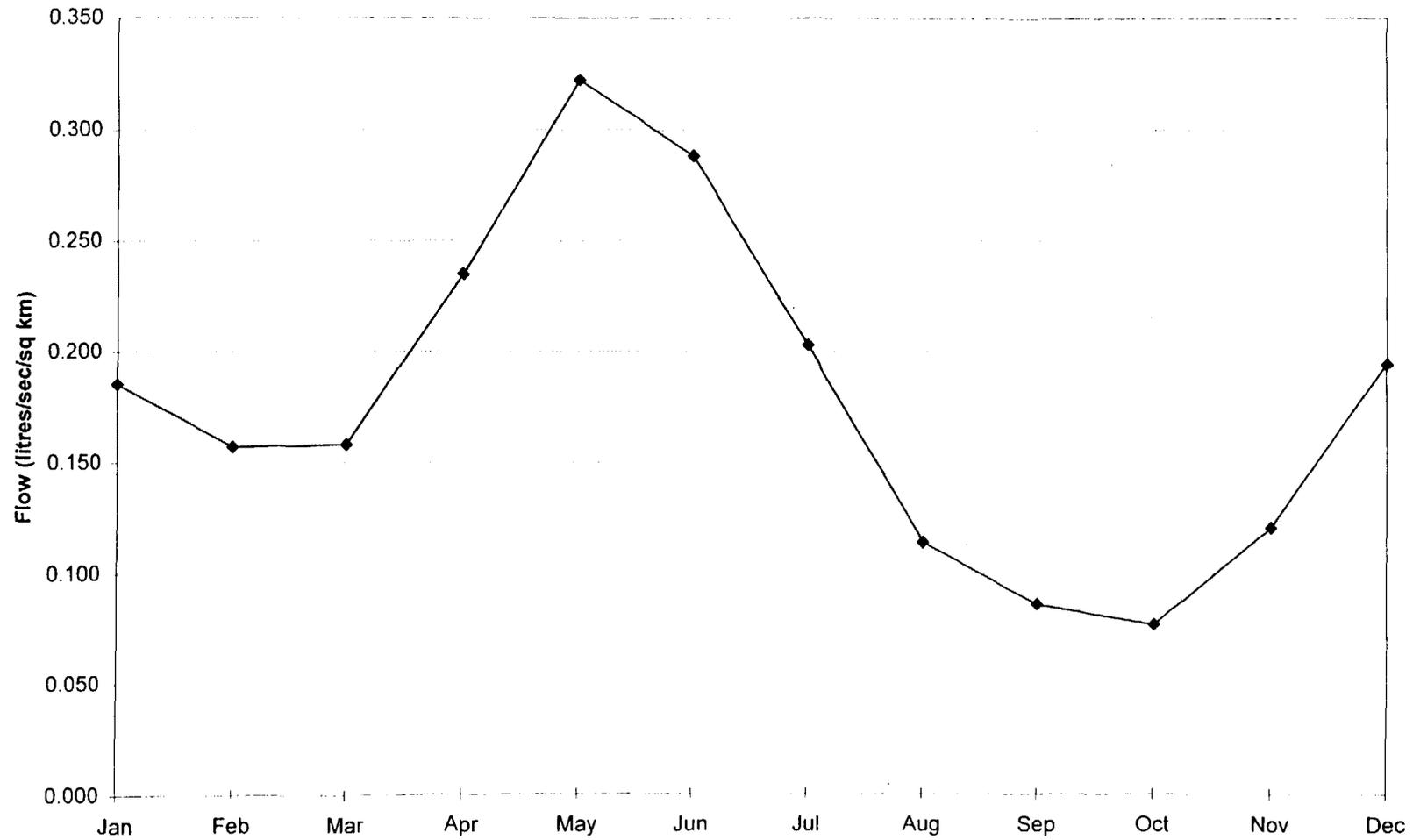


FIG 3.2b  
MPOLOGOMA RIVER AT BUDUMBA

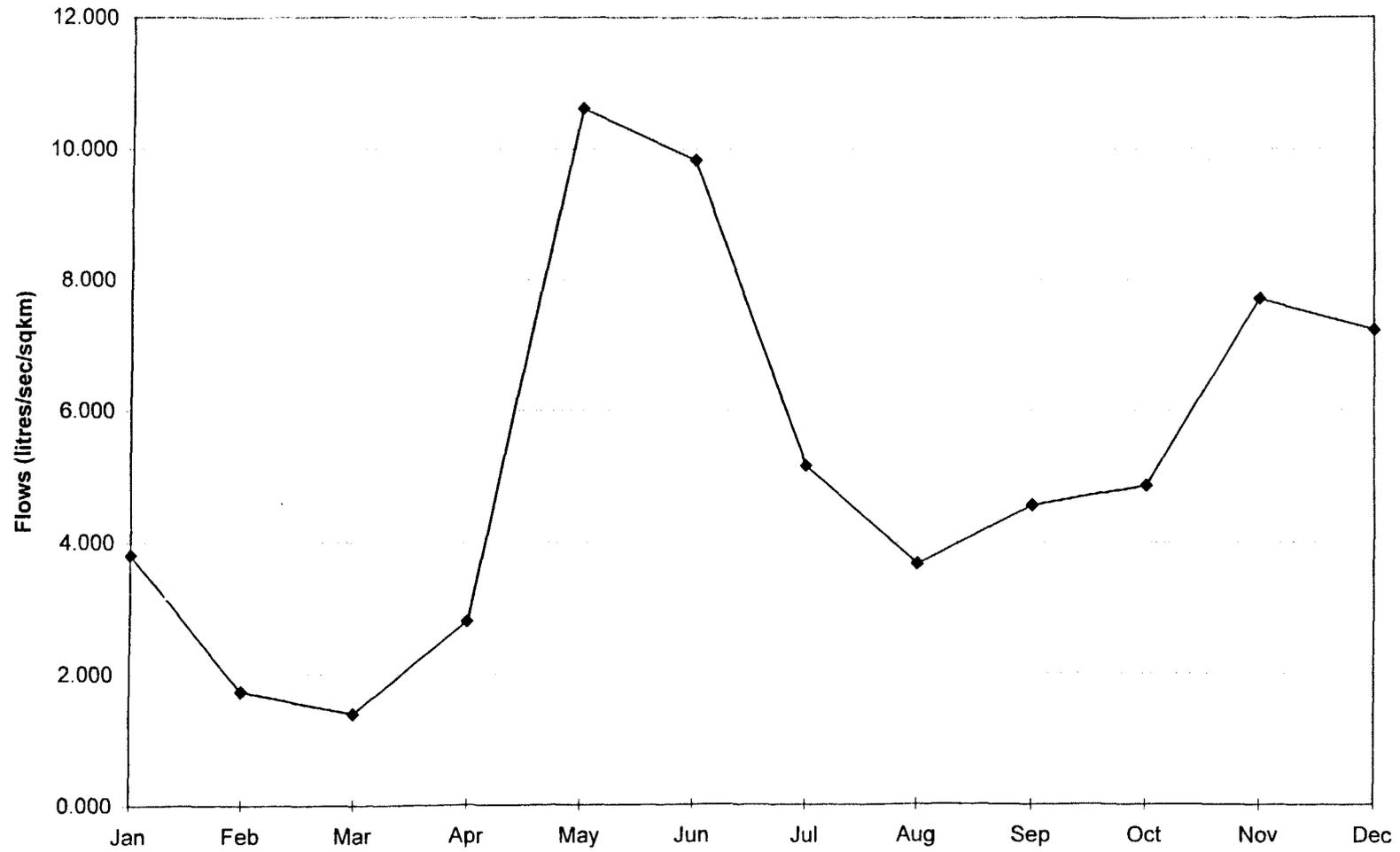


FIG 3.2c NAMALU RIVER AT MOROTO ROAD

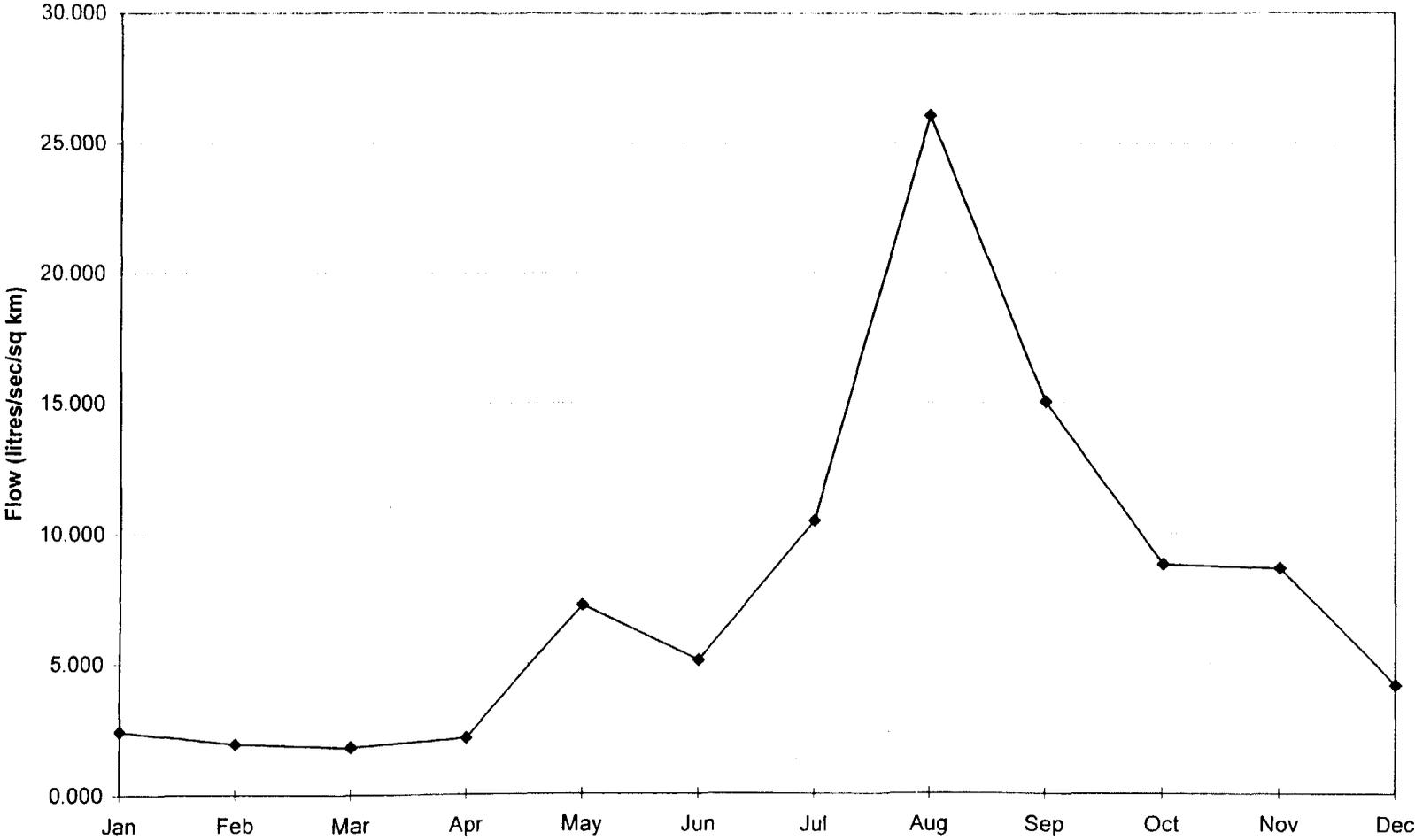


FIG 3.2d ENGET RIVER AT BATA-DOKOLO ROAD

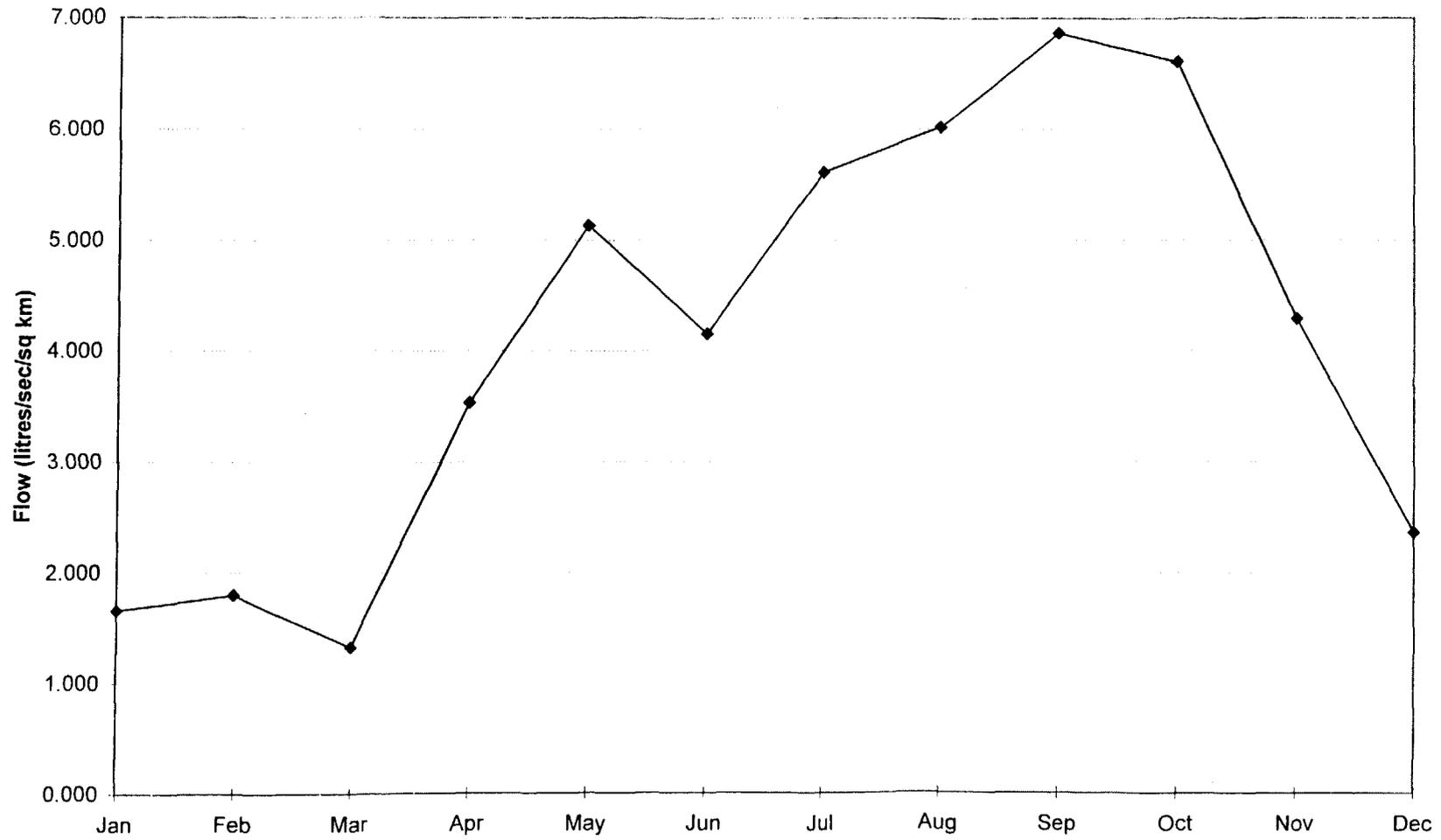
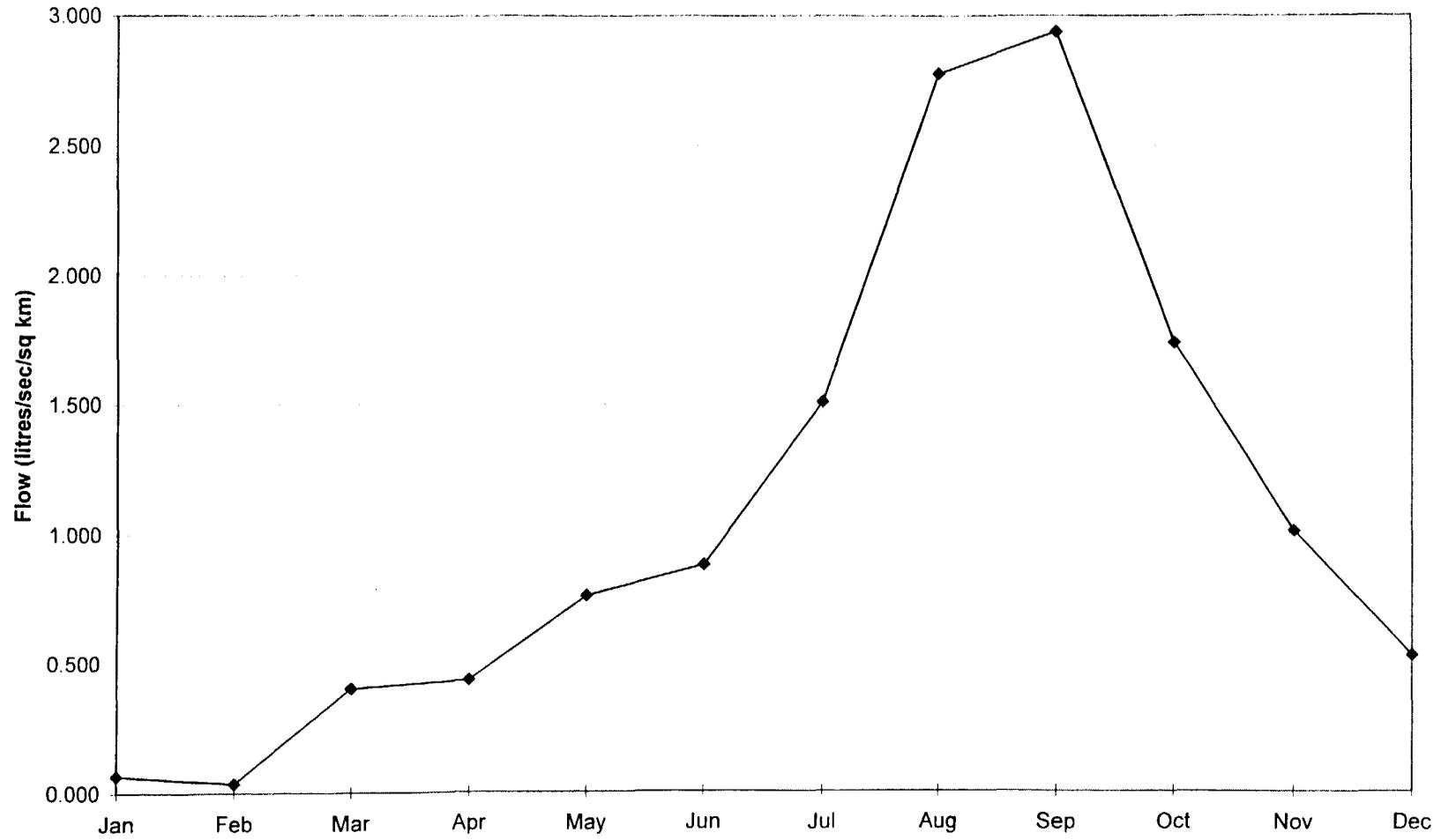


FIG 3.2e AGAGO RIVER AT KITGUM-LIRA ROAD



#### 3.4.4 Albert Nile Basin

This consists of rivers which drain into the Albert Nile from its outlet at Lake Albert up to the Sudan border. The channel of the Albert Nile is shallow and it flows slowly within a wide valley. Rivers from the west bank bring more water than those from the east. The tributaries of the Albert Nile experience a gradually increase in flows from March to May (5 to 7 litres/sec/sq km), and then a slight decrease in June (Figure 3.2f). High flows occur from July to November, with peak flows in August (9 to 12 litres/sec/sq km). Zero flows can occur in all the months. Rivers from the west such as Nyagak River have high mean annual catchment yields of about 245 mm. Monthly flows have moderate variability (coefficient of variation = 0.6 to 1.0).

#### 3.4.5 Albert System

The Albert System is made up of rivers which flow into the Western Rift and into Lake Albert. The northern and north-western slopes of the Rwenzori Mountains form part of this basin. The southern shores of Lake Albert is drained by Semliki River which connects Lakes Albert and Edward. This river which has several water falls descends some 300 metres from Lake Edward to Lake Albert. Rivers from the Rwenzori Mountains are fed by glaciers. Most of the rivers on this basin are fast flowing and have water falls at sections where they descend into the rift.

#### 3.4.6 Lake Edward System

This comprises rivers draining into Lakes Edward and George which are connected by the Kazinga Channel. Rivers from the southern slopes of Rwenzori Mountains (Nyamugasani and Mubuku Rivers), and those from Kigezi form part of this basin. Figure 3.2g shows the variation of flow within the year on one of the rivers. High flows occur during two seasons in a year, April to June, and August to November. During these seasons flows vary from 40 to 65 litres/sec/sq km. The January to March period has the lowest flows. July has low flows compared to June and August. This region has rivers with very high catchment yields. Rukoki River has a mean annual yield of 1280 mm, while that of Mitano River is 272 mm. Zero flows do not occur on most of the rivers. All the months have low variability (coefficient of variation = 0.4 to 0.8).

#### 3.4.7 Kafu Basin

The Kafu Basin consists of the area drained by the Kafu River which joins the Victoria Nile (Kyoga Nile) soon after it has left Lake Kyoga. It includes the area drained by the Victoria Nile between Lakes Kyoga and Albert. Kafu River has a flow regime similar to that of Katonga River, ie. two periods of high flows and two periods of low flows (see Figure 3.2h). High flows occur during the April to June period. This is followed by a low flow period up to November. December and January experience moderately high flows, which are followed by relatively low flows during February and March. The Kafu River has relatively a low catchment yield of 43 mm. This is due to numerous wetlands which have high evapotranspiration losses.

#### 3.4.8 Kidepo Basin

This occurs in the extreme north eastern part of Uganda occurring in Kotido and Kitgum Districts.

FIG 3.2f NYAGAK RIVER AT NYAPEA

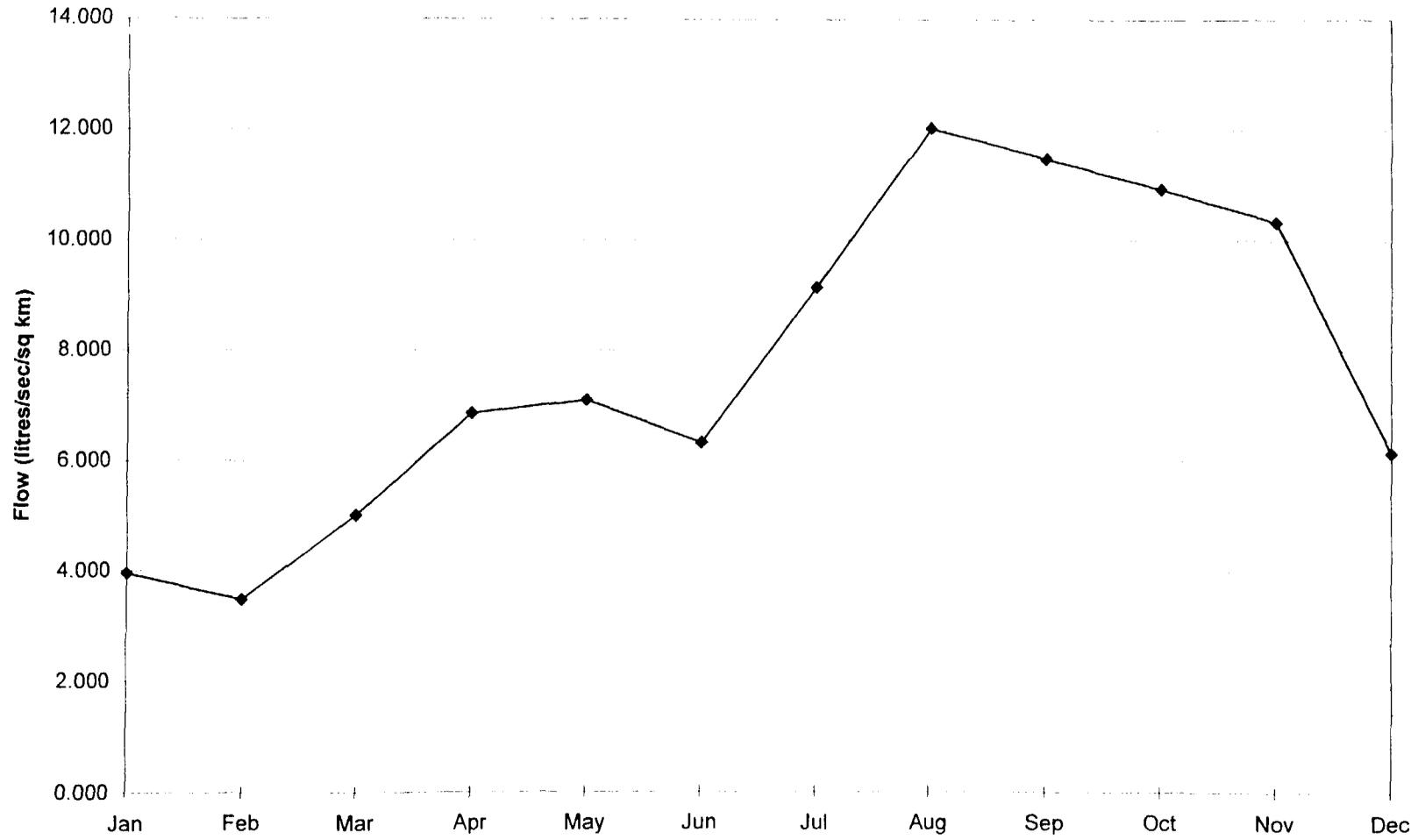


FIG 3.2g RUKOKI RIVER AT FORT PORTAL-KASESE ROAD

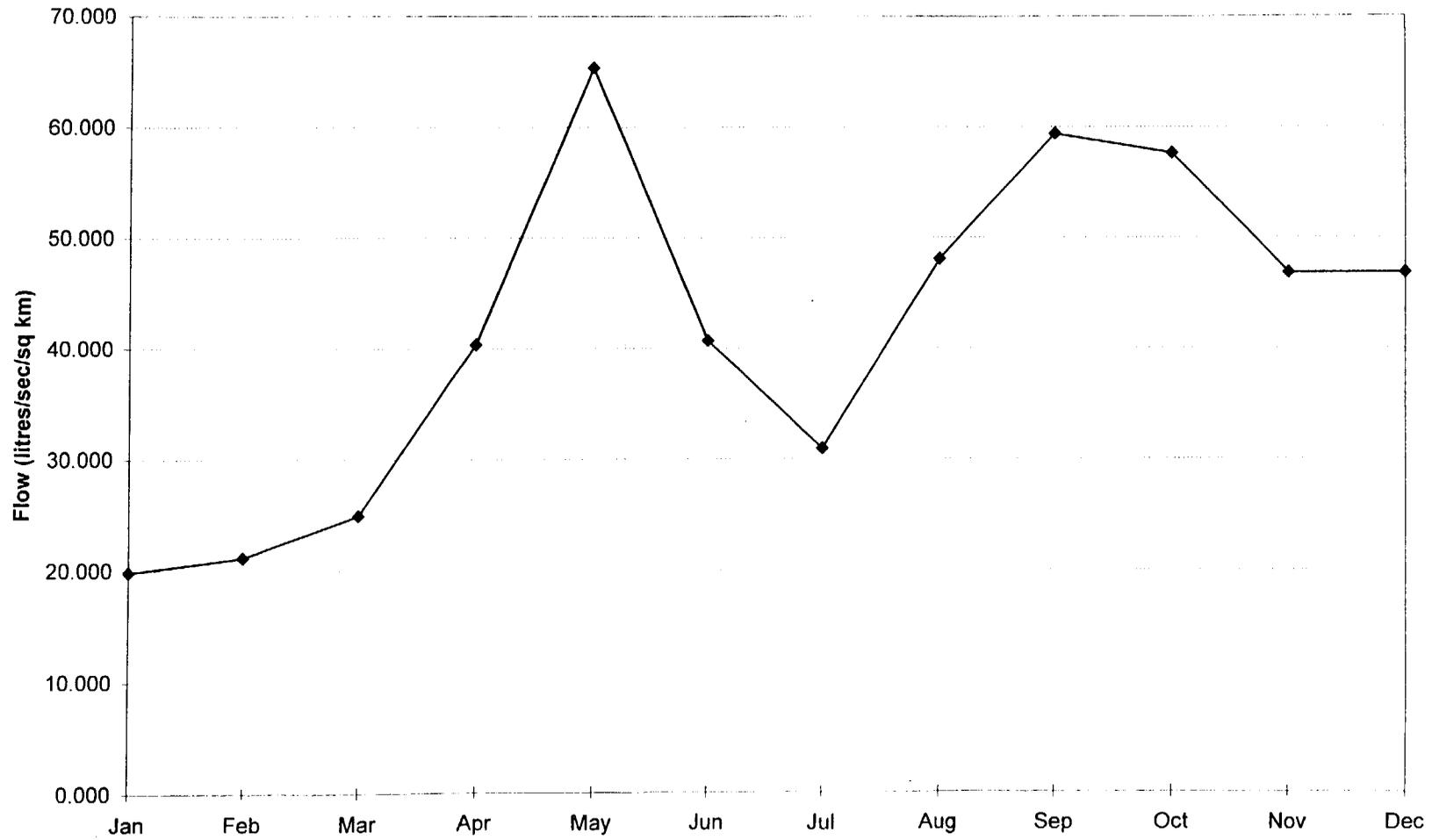


FIG 3.2h KAFU RIVER AT KAMPALA-GULU ROAD

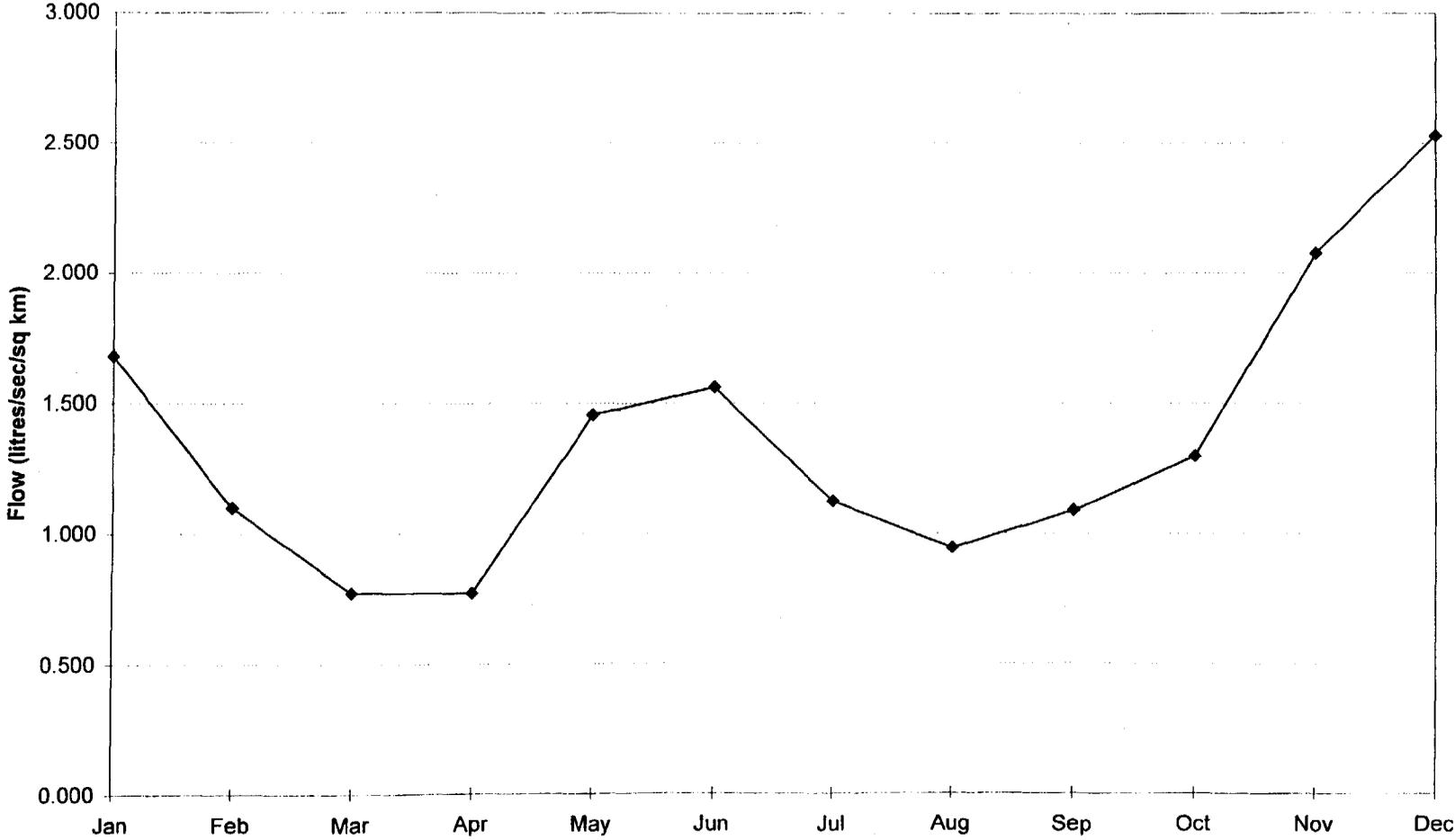


Table 3.3 gives mean monthly flows for the following rivers at given locations:

Katonga River at Kampala - Masaka Road  
 Mpologoma River at Bundumba  
 Namalu River at Mbale-Moroto Road  
 Enget River at Bata-Dokolo Road  
 Agago River at Kitgum-Lira Road  
 Nyagak River at Nyapea  
 Kafu River at Kampala-Gulu Road  
 Rukoki River at Fort Portal-Kasese Road

**Table 3.3: Mean Monthly Flows (Litres/Sec/Sq Km) For Selected Rivers**

	<b>Katonga</b>	<b>Mpologoma</b>	<b>Namalu</b>	<b>Enget</b>	<b>Agago</b>	<b>Nyagak</b>	<b>Kafu</b>	<b>Rukoki</b>
<b>Jan</b>	0.185	3.807	2.432	1.657	0.064	3.953	1.680	19.829
<b>Feb</b>	0.157	1.731	1.946	1.800	0.035	3.488	1.099	21.160
<b>Mar</b>	0.158	1.394	1.811	1.324	0.403	5.017	0.771	23.917
<b>Apr</b>	0.235	2.806	2.162	3.533	0.436	6.860	0.772	40.459
<b>May</b>	0.322	10.614	7.243	5.133	0.762	7.093	1.455	65.359
<b>Jun</b>	0.288	9.826	5.108	4.152	0.879	6.329	1.560	40.707
<b>Jul</b>	0.203	5.155	10.486	5.610	1.507	9.136	1.124	30.945
<b>Aug</b>	0.114	3.672	26.081	6.019	2.777	12.027	0.943	48.077
<b>Sep</b>	0.086	4.555	15.027	6.867	2.938	11.478	1.088	59.392
<b>Oct</b>	0.077	4.856	8.811	6.610	1.736	10.930	1.296	57.624
<b>Nov</b>	0.120	7.703	8.649	4.286	1.009	10.332	2.076	46.829
<b>Dec</b>	0.194	7.214	4.162	2.362	0.526	6.146	2.528	46.829
<b>Annual</b>	0.178	5.293	7.865	4.124	1.094	7.757	1.368	40.597

Source : Department of Water, Ministry of Water, Lands and Environment, 1998.

### 3.4.9 Hydrological Considerations during the FRSP

From the preceding text, it is apparent that Uganda has an extensive network of rivers and waterways. These have implications on road design, in terms of determining location and numbers of culverts and bridges, which would also affect the cost of the project. Other considerations are:

#### Planning stage

- roads should preferably be located along watersheds to minimise the need for culverts and bridges;
- swamps and marshes should be avoided;
- the size of catchments of streams/rivers crossed by the road will affect peak flows which determine the size of bridges in terms of waterways;
- it is difficult to construct roads in poorly drained areas.

#### Design stage

- a hydrological study of the area to be drained is an essential element in the design of the road drainage as it provides information on runoff and stream flow characteristics which is used as the basis for hydraulic design;

- favourable sites for river crossing are preferably selected where the road will be at right angles to the stream/river centreline to reduce the high cost of major structures or large culverts;
- swamps/marshes and other low-lying areas subject to flooding should be avoided;
- the choice of a ridge route will minimise the number of culverts needed and also lead to better foundation conditions.

#### Construction stage

- stockpiled materials are likely to be washed away in areas with high runoff rates;
- gullying is likely to occur in areas with high runoff.

#### Operation stage

Side drains are likely to be eroded in areas with high runoff;  
Flooding of roads crossing swamps/marshes is a possibility.

### **3.5 Land Use**

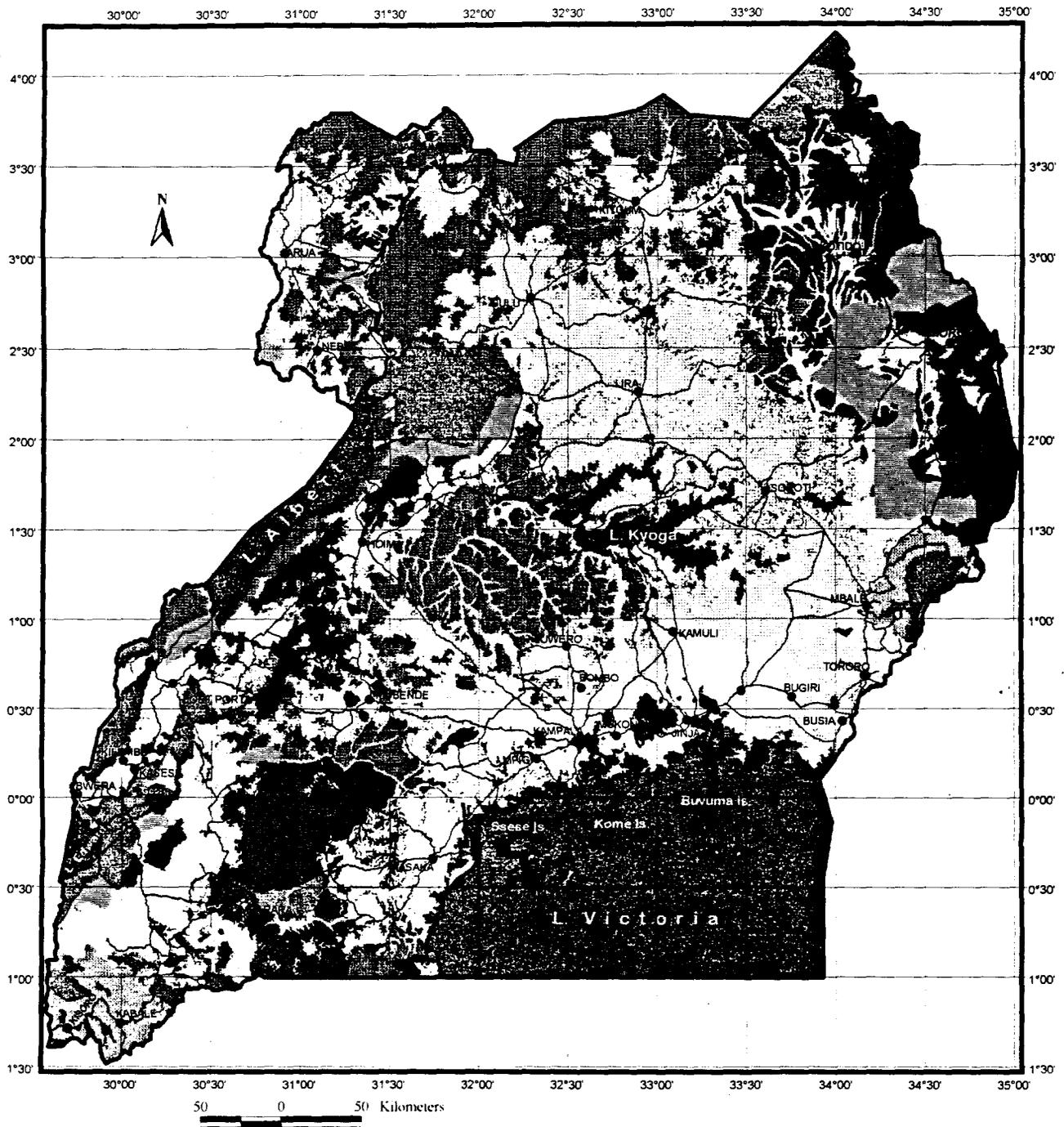
#### **3.5.1 General**

A land use map of Uganda (Map 7) has been produced for this study on the basis of a combination of the UWA Protected Areas map, Forest Department's Forest Reserve map, the National Biomass Study (1996) map of Land Cover Stratification (Vegetation), and the Agro-ecological Map of Uganda (refer Map 8). Total areas and percentage cover of each land use type is listed in Table 3.4. In terms of percentage cover, the main land use types are Protected Areas (20.5 %), Fishing<sup>62</sup> (15.7%), Small-scale farming in drier areas (15.5%), Grazing, with limited cultivation (15.4%) and Small-scale farming in wetter areas (10.4%). Note that this does not reflect the relative importance of each land use type in economic terms.

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<sup>62</sup> This land use has been assigned to open waters, which, of course, are also used for water transport. Fishing may also occur in other areas (eg. in designated parts of National Parks), but always as a land use type that is of secondary importance.

# MAP 7. LAND USE



**KEY**

Tropical Forest Reserve	Grazing and limited Cultivation
National Park	Limited dry season grazing
Wildlife Reserve	Fishing (Water)
Forest Plantation	Habitation (Cities and major towns)
Small Scale Farming in Pastoral Area	Major town
Small Scale Farming in wetter area	International Boundary
Small Scale Farming in drier area	Road
Pastoral Farming System	
High Altitude Crop	
Large Scale Farming	

Source of data: NBS Land Use, Agroecological, and Land-use-Brown (1986)

Produced by RS & GIS Lab, MUTENSI 1999, for MOWHC

**Table 3.4: Land Use in Uganda**

Land use type	Area (km <sup>2</sup> )	%	Remarks
Protected Areas (UWA)	48,374	20.5	Many of the Community Wildlife Areas (formerly Controlled Hunting Areas, and some (parts of) Wildlife Sanctuaries and Reserves, which together comprise 21,000 km <sup>2</sup> , are likely to be degazetted.
Fishing	37,894	15.7	Mainly in open waters.
Small-scale farming in drier areas	37,342	15.5	Cotton, millet and some grazing
Grazing, with limited cultivation	37,243	15.4	In areas of woodland, bushland and grassland.
Small-scale farming in wetter areas	25,115	10.4	Robusta coffee, bananas and maize, in combination with some grazing.
Pastoral farming systems	18,910	7.8	Dryland areas, generally without cultivation.
Wetland-based land use	13,830	5.8	Dry season grazing, fishing and harvesting of reeds and sedges.
Forest Reserves	12,100	4.9	Control of many of the smaller reserves, which make up about 1/3 of the network, may be handed over from Forest Department to local government or communities.
Small-scale farming in pastoral areas	5,544	2.3	Mainly maize, millet.
High altitude crops	3,520	1.4	Mainly Arabica coffee, wheat, potatoes.
Large-scale farming	224	0.1	Tea and sugarcane plantations
Forest plantations	326	0.1	Mainly pines, <i>Eucalyptus</i> and (some) Cypress: some are located within Forest Reserves, while others are located in newly gazetted National Parks, and will gradually be replaced by natural vegetation.
Habitation	n.a.*	0.1	Cities and major towns
<b>Total</b>	<b>240,700</b>	<b>100.0</b>	

\* n.a. = not available. This figure could not be accurately determined

### 3.5.2 Protected Areas

In Uganda, there are three broad categories of protected areas<sup>63</sup>, namely: conservation areas (in the PA system managed by the Uganda Wildlife Authority), forest reserves (managed by the Forest Department) and cultural, historical and archaeological sites (managed by the Antiquities and Museums Department). These protected areas altogether cover a total area of about 6.1 million ha, or 25.4 % of the country's total land area. These areas are described in detail in Section 3.8, and are depicted in Maps 7, 10 and 11.

UWA's PA system is primarily for the conservation of the country's biological resources, but also plays a role in attracting tourism, especially in a number of National Parks (eg. Queen Elizabeth, Murchison Falls, Rwenzori). Formerly, many areas were designated as Game Reserves or Controlled Hunting Areas (CHAs), but as much of the game in these areas is seriously depleted,

<sup>63</sup> Wetlands may be regarded as a fourth type of protected area, as all wetlands are protected by legislation. However, wetlands have generally not been included in officially gazetted protected areas (see Section 3.8.3).

the emphasis has moved to that of conservation. It is expected that the total area of the PA system will be down-sized considerably, as many of the current wildlife reserves and CHAs (together 3.6 million ha) are likely to be de-gazetted (see Section 3.8.1).

The Forest Reserves were formerly established for forest production and to a limited degree for watershed protection. As with UWA's PA system, the emphasis has shifted to that of protection of genetic resources and watershed protection, although forest production remains important.

### 3.5.3 Wetlands and Open Waters

Open waters - mainly lakes Victoria, Albert, George, Edward and Kyoga - extend over almost 38,000 km<sup>2</sup> or 15.7% of the country, while permanent wetlands cover a further 2.2 %. The area of seasonal wetlands (including swamp forest) is large, covering more than 14,169 km<sup>2</sup> or about 5.88 % of the country<sup>64</sup> (see Table 3.5). Some of these seasonal wetlands are used for cultivation (eg. rice farming around Lake Kyoga) or grazing, but most are not intensively used other than as a local resource for fish, wildlife, thatch and other plant products. In many cases, they are also of importance as a source of potable or irrigation water. The 600 ha Nakivubo swamp just southeast of Kampala plays an important role in purifying waste water leaving the (rather ineffective) Nakivubo sewage treatment plant.

Open waters are important for fisheries, and more than 4,000 landing sites are located along the Ugandan shores of Lake Victoria alone (NEMA, 1996). Over the period 1985-1995, the annual catch of fish in Uganda's waters peaked in 1993 at 276,200 metric tonnes, of which almost 25% was caught in Lake Victoria. This represents a productivity of about 74 kg/ha. year, which is reasonably productive for inland freshwater fisheries. The main species taken are Nile Perch *Lates niloticus*, and various species of Tilapia (*Oreochromis* spp.), which in 1995 accounted for about 42 % and 38 % of the total catch, respectively. However, fisheries production dropped to 103,000 metric tonnes per annum in 1994-95 (28 kg/ha year), and this has been largely attributed to the impact of Water hyacinth *Eichhornia crassipes*, which interferes with fish breeding grounds, lowers oxygen levels, and interferes with fishing gear.

### 3.5.4 Agriculture

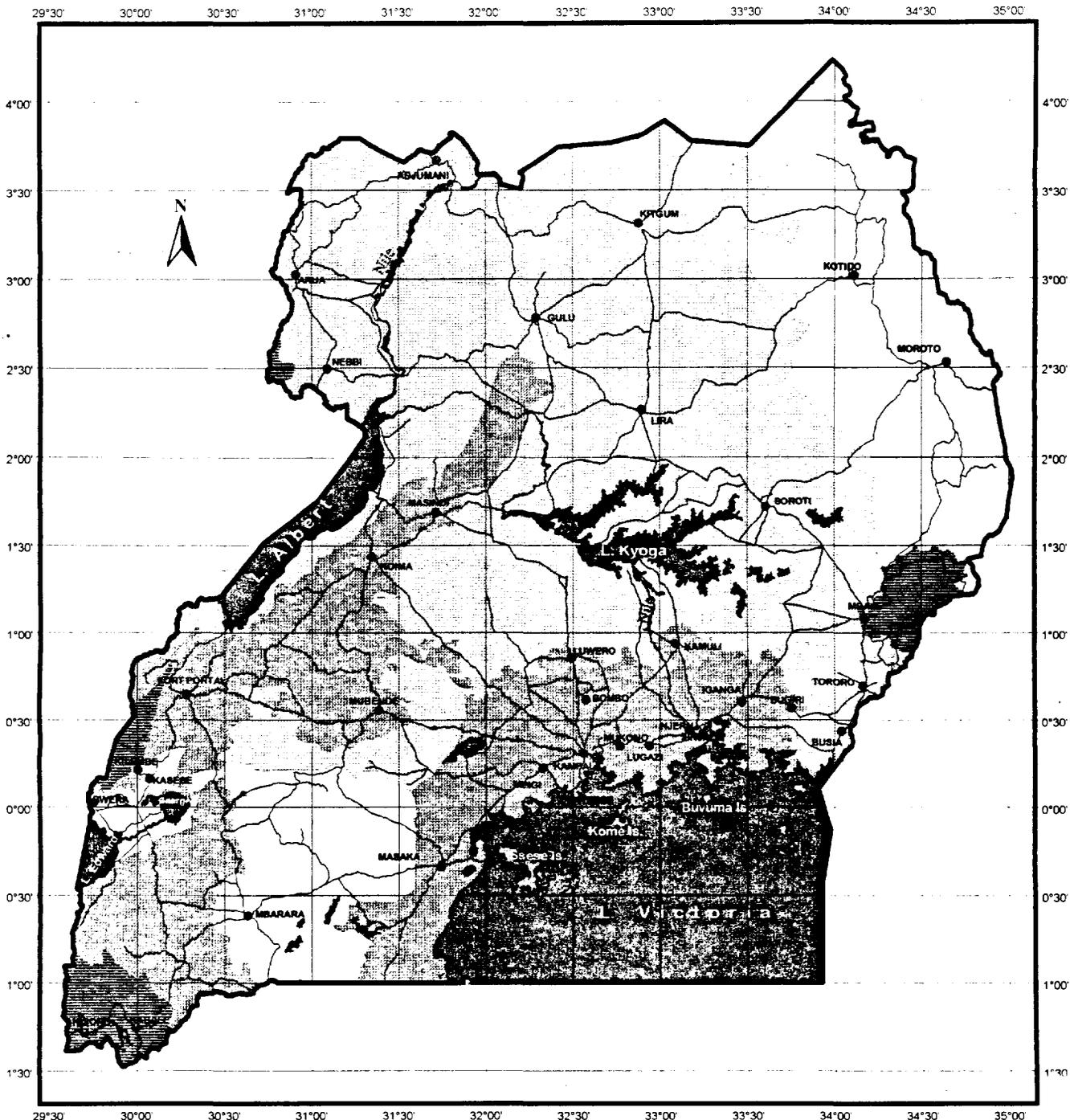
Outside the protected areas and wetlands, land use in Uganda is largely determined by a combination of topography, rainfall, and soil type. The highlands, which occupy about 7% of the country's total land area, are divided into south-western, eastern, western and north-eastern highlands. The first three highland areas have adequate rainfall, and are heavily populated; in these areas agricultural activity is intensive and includes coffee, bananas and tea, with temperate fruit, wheat, Arabica coffee and potatoes on higher ground. The latter are, for example, common on the lower slopes of the Rwenzori Mountains, and in the montane area between Kabale and Kisoro, in south-western Uganda.

In a broad zone around Lake Victoria, agricultural activity is also intensive, focusing on bananas, coffee, sweet potatoes, sugar and cocoa, along with some animal husbandry. Dairy production is important in these wetter pastoral areas. Other areas of intensive agriculture include small

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<sup>64</sup> Our figures differ from those of NEMA's (1996) State of the Environment Report for Uganda, which records that permanent wetlands extend over 3.0% of the country, while seasonal wetlands extend over 9.4%. Our figures are 2.2% and 5.88%, respectively. These discrepancies are discussed in Section 3.8.3.

# MAP 8. AGROECOLOGICAL ZONES



### KEY

- Zone 1 (High Altitude)
- Zone 2 (Pastoral Dry to Semi-Arid Rangeland)
- Zone 3 (Northern and Eastern Uganda)
- Zone 4 (Southern and Western Uganda)
- Major town
- Road
- International Boundary
- Water

Source of data: NRS

Produced by RS & GIS Lab  
30/12/98 - 1999 for MCHC

regions around the townships of Arua, Gulu, Kigezi, Lira, Mbarara and Soroti (Hickman, 1986; NEMA, 1996).

Large-scale farming is carried out in a number of large tea and sugarcane estates, which are mainly located in the western part of Uganda (between Masindi and Hoima), the southwestern part of the country (Kasese and Fort Portal), and between Kampala and Jinja. The area of these estates is relatively small, totalling at about 22,400 hectares.

### **3.5.5 Livestock**

Livestock farming is carried out under many different land use systems, usually in combination with some form of cultivation. In wetter areas the emphasis is more on cultivation, and in the wettest parts of the country, livestock supports a lively dairy industry. Livestock farming forms the main form of land use along a broad and somewhat drier zone that runs from the southwestern to the north-eastern part of the country, and includes Ntungamo, Mbarara, Masaka, Mubende, Kiboga, Luwero, Apac, Lira, Kitgum, Kotido and Karamoja districts. In all, livestock husbandry is an important land use type in about half of the country.

More than 90% of the livestock in Uganda is owned by traditional herders, and only a small percentage is owned by commercial ranchers. Cattle and goats are by far the most important, and in 1995 their numbers totalled 5.2 and 5.5 million, respectively. Poultry are kept in greater numbers, and the total number in 1995 was 21.8 million. Sheep and pigs are less common, with numbers totalling 1.7 and 1.3 million, respectively, in 1995 (NEMA, 1996).

### **3.5.6 Plantations**

Forest plantations occur both within Forest Department's Forest Reserves and as privately owned plantations. Two broad types of plantation exist: *Eucalyptus* hardwood plantations, of which 18,600 ha existed in 1995, and pine softwood plantations, which covered about 14,000 ha in 1995 (NEMA, 1996). Some of these are included in newly gazetted national parks, such as the 100 ha pine plantation at Kapkwata (east of Kapchorwa, along the Sironko-Suam Road) which is now located within Mt. Elgon National Park, and will gradually be replaced by indigenous vegetation once the pine trees have been felled (pers. comm., Mt. Elgon National Park Information Officer, Mbale).

### **3.5.7 Habitation**

Apart from Kampala, Jinja, Mbarara, Masaka and Entebbe, urban areas form only a minor element in land use, and are limited to the larger rural towns such as Arua, Busia, Fort Portal, Gulu, Kabale, Lira, Njeru, Soroti and Tororo. The total area of urban areas could not be accurately determined using remote sensing imagery, as such features are barely discernible, and are generally of a size that is at the limit of what can be distinguished on a large scale map.

### **3.5.8 Implications of Land Use on Roads**

The types of land use influence the traffic volumes and type of traffic using a road. This would determine the priority of a road in terms of national development. For example a good road network must service areas of high agricultural productivity so that produce can reach markets.

During the various stages of a road project the following land use considerations need to be taken into account:

#### Planning stage

- in urban areas, roads should be located along the edges of parklands and on undeveloped and therefore less populated and less expensive land;
- in urban areas, roads should be located as close as possible to principal parking terminals;
- in rural areas, as much as possible, any new road should be located on existing ones to minimise the use of farmland and to reduce total initial and maintenance costs;
- in rural areas, roads should be located along the edges of properties so as to cause the minimum interference to cultivation;
- roads should keep away from cemeteries, places of worship, hospitals and play grounds;
- the effect of a proposed road on existing or future utilities above or under the ground should be considered, in order to avoid expensive relocation of these utilities.

#### Feasibility stage

- knowledge of the agricultural activities as a measure of the economic growth is needed during the economic feasibility study of a road;
- in traffic forecasting, the type of traffic generated by agriculture or other land use activities of an area is taken into account;
- knowledge of activities associated with land use is useful for planning when to carry out traffic counts so to avoid this happening only when the traffic is at its peak eg during harvesting season;
- the economic analysis of the benefits from saving time in freight haulage in terms of getting the produce to the markets more quickly, the cost of delays in moving goods (consisting chiefly of costs due to interest on the capital which the goods represent) and the costs due to damage or spoilage of perishable goods.

#### Design stage

- the design speed of certain sections of the road depends on the use of the land adjoining those sections eg. reduced design speed in settled areas;
- during the design of structures, land use of the catchments areas is taken into account as it affects the runoff substantially (eg. areas with little vegetation have high runoff rates);
- land use is considered during design in determining locations for bus bays, accesses;
- effects of land clearance may increase runoff and sedimentation in stream channels, so flood peaks become higher and arrive more rapidly after rainfall. This may lead to flooding as the maximum flow the structure is designed to carry gets exceeded.

#### Construction stage

- roads may affect local drainage and interfere with crop irrigation;
- poaching by road construction crews
- destruction of sensitive habitats.

#### Operation stage

- increased access to wildlands and sensitive habitats;
- reduced transportation costs;
- improved agricultural productivity.

### 3.6 Vegetation & Natural Habitats

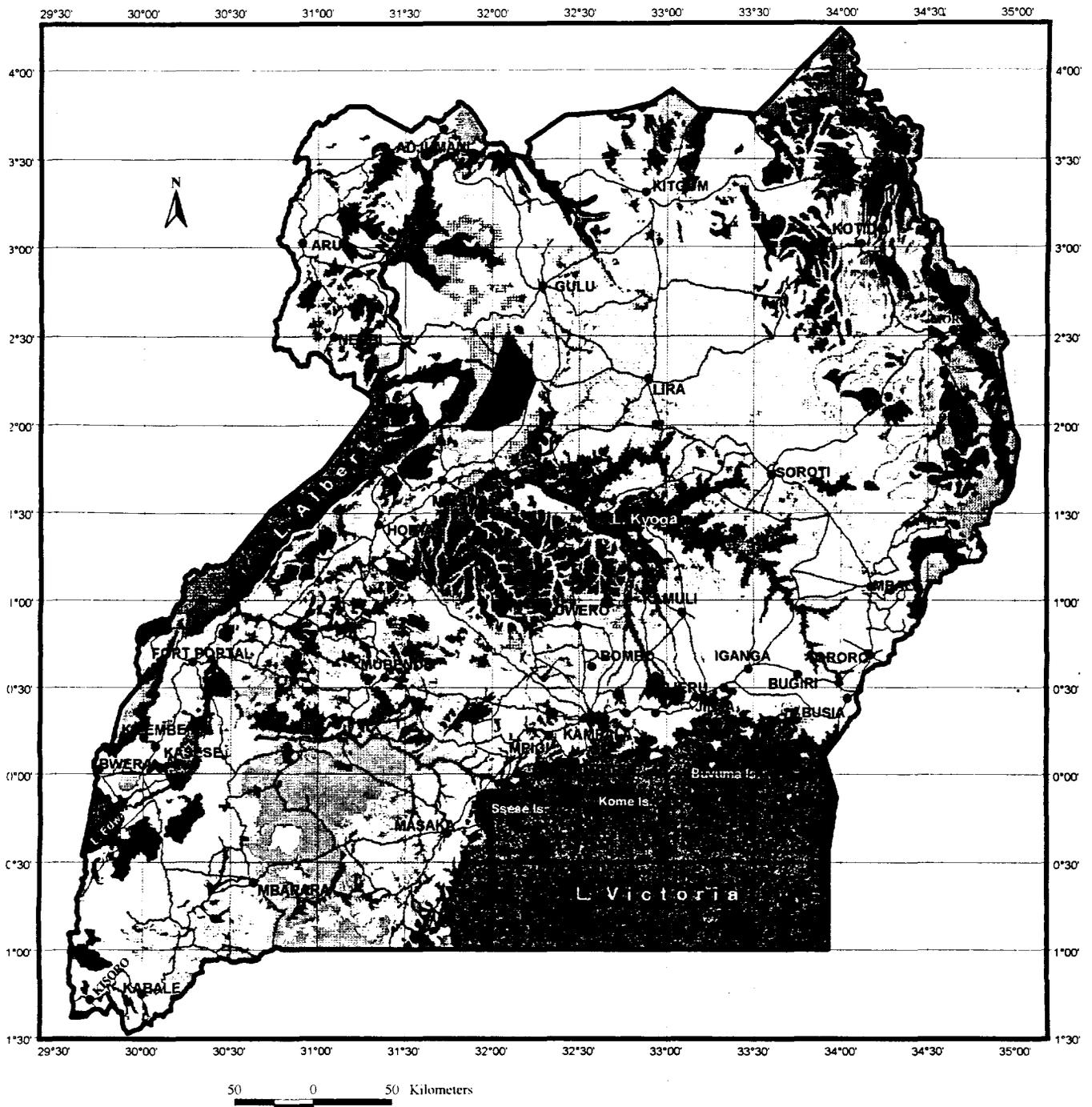
The composition and distribution of Uganda's vegetation has, during its recent geological history (Pleistocene), been largely determined by three environmental factors, temperature, moisture availability and human disturbance. According to Hamilton (1974), moisture changes have paralleled temperature changes in Uganda, with cold, relatively dry periods being alternated with warmer, relatively moister periods. During warmer periods, tree taxa are more common, while during drier periods grasses and other herbs such as *Chenopodiaceae* are more common. Human activities such as widespread burning began to take effect from about 50,000 years ago, and much of the vegetation found in Uganda's rangelands probably represents a fire climax, ie. a vegetation adapted to, and modified by regular burning. There is also evidence of large scale clearing of forest in Uganda for agricultural purposes, dating back to about 1,000 years B.C., for example in the lowlands around the Rwenzori Mountains, (Hamilton, 1974). The net result of human activities and climatic vagaries upon former forests, woodlands, shrublands and bushlands is largely what we see today: a mosaic of farmland, grasslands, shrublands, woodlands and scattered remnants of formerly large areas of forest.

In their map of Uganda's vegetation, Langdale-Brown *et al.*(1964) recognised a total of 86 vegetation types. For the FRSP study, this classification was simplified to the level of Langdale-Brown *et al.*'s main vegetation types, which consists of 22 broad types such as woodlands, grass steppe and high altitude forests, and largely follows the classification adopted by Lind and Morrison (1974) in their landmark study of East African vegetation.

It should be noted, however, that the Langdale-Brown *et al.* map depicts natural vegetation only. Since much of Uganda does not consist of natural vegetation, but of farmland and open water, these two land-cover types are also included in the vegetation map produced for the FRSP study (Map 9). In addition, built-up areas, which include settlements, towns and industrial areas, were also mapped as separate units. The latter data was obtained from the National Biomass Study (1996) Land Cover Stratification (Vegetation) map, which was digitally superimposed (in a GIS) upon the original vegetation map by Langdale-Brown *et al.* (1964). The net result of this combination is a classification consisting of Langdale-Brown *et al.*'s 22 main vegetation types, plus farmland, open water, and built-up areas.

Map 9 (Vegetation) depicts the result of the mapping procedure carried out for this study, and the net area and percentage cover of each vegetation type is indicated in Table 3.5.

# MAP 9. VEGETATION



## KEY

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>High Altitude Moorland and Heath</li> <li>High Altitude Forest</li> <li>Medium Altitude Moist Evergreen Forest</li> <li>High Altitude Moist Semi-deciduous Forest</li> <li>Forest/Savanna Mosaic</li> <li>Moist Thicket</li> <li>Woodland</li> <li>Open Water (with <i>Eichhornia crassipes</i>/Water hyacinth)</li> <li>Moist Acacia Savanna</li> <li>Butyrospermum Savanna</li> <li>Moist Combretum Savanna</li> <li>Palm Savanna</li> <li>Dry Combretum Savanna</li> <li>Dry Acacia Savanna</li> </ul> | <ul style="list-style-type: none"> <li>Grass Savanna</li> <li>Tree and Shrub Steppe</li> <li>Grass Steppe</li> <li>Bushland</li> <li>Dry Thicket</li> <li>Seasonal wetland</li> <li>Herbaceous Swamp (more-or-less permanent)</li> <li>Swamp Forest</li> <li>Farmland</li> <li>Built-up Area (settlements and industry)</li> <li>Major town</li> <li>Road</li> <li>International Boundary</li> </ul> |
|--|--|

Source of data: NBS and Langdale-Brown (1964).

Produced by RS & GIS Lab, MUTENR (1999), for MOW/HC.

Table 3.5: Vegetation Types

Vegetation type	Area (km <sup>2</sup> )	Percentage cover
Farmland (includes large sugar and tea plantations, and post cultivation communities)	91,135.7	37.84
Open water (with floating vegetation, especially Eichhornia crassipes/water hyacinth)	37,835.7	15.71
Dry <i>Combretum</i> savannas	25,893.6	10.75
Seasonal wetlands	13,924.7	5.78
<i>Butyrospermum</i> savannas	12,527.7	5.20
Dry <i>Acacia</i> savannas	10,222.4	4.24
Grass savannas	9,216.0	3.83
Herbaceous swamps (more-or-less permanent)	5,230.9	2.17
Moist <i>Combretum</i> savannas	4,583.3	1.90
Forest/savanna mosaics	4,109.0	1.71
Dry thickets	4,013.8	1.67
Bushland	3,822.7	1.59
High altitude moist semi-deciduous forests	3,596.1	1.49
High altitude forests	2,773.6	1.15
Woodlands	2,173.3	0.90
Medium altitude moist evergreen forest	1,795.6	0.75
Moist <i>Acacia</i> savannas	1,732.3	0.72
Moist thickets	1,676.5	0.70
Tree and shrub steppes	1,314.7	0.55
Palm savannas	1,264.7	0.53
Grass steppes	800.3	0.33
High altitude moorland and heath	677.5	0.28
Built-up areas (settlements and industry)	264.5	0.11
Swamp forests	244.3	0.10
<b>TOTAL</b>	<b>240,847.0</b>	<b>100.00</b>

**Note:** Table 3.5 includes anomalous vegetation types such as farmland, open water, built up areas, which are usually mapped as land cover types. Maps such as Langdale-Brown *et al.* (1964) do not distinguish between the latter types (except open water). Given the large area of farmland, this means that much is mapped as 'potential vegetation cover'.

Farmland and fallow farmland form by far the largest vegetation/land cover type, extending over a total area of 91,000 km<sup>2</sup> or almost 38% of Uganda's total area. The next in terms of size is formed by open water, which extends over almost 38,000 km<sup>2</sup> or almost 16% of the country's total area. The largest natural vegetation type is formed by dry *Combretum*-dominated savannas, of which Langdale-Brown *et al.* (1964) recognised 13 different types on the basis of co-dominant trees, shrubs or grasses. These savannas extend over almost 11% of Uganda. The next five largest natural broad vegetation types are seasonal wetlands (Langdale-Brown *et al.*'s "Communities on sites with impeded drainage"; which cover 5.78%), *Butyrospermum* savannas (5.2%), dry *Acacia* savannas (4.24%), grass savannas (3.83%) and herbaceous swamps (2.17%). The latter are dominated by either the sedge *Cyperus papyrus* or the grass *Miscanthidium violaceum*, while

grass savannas are generally dominated by either *Themeda triandra* or *Hyparrhenia* spp., generally in combination with one or more co-dominant grasses.

Tall forests occur mainly in four areas; in mountainous and hilly areas along the western and southwestern border with the Democratic Republic of Congo, scattered in a zone around Lake Victoria, on the islands in Lake Victoria, and on the slopes of Mount Elgon in eastern Uganda. Woodlands occur predominantly in two regions, namely in central Uganda (Kiboga, Luwero and Masindi districts), and north-northwestern Uganda (Arua, Gulu, Kitgum, Moyo). Bushlands occur primarily in southwestern Uganda (Mbarara, Rakai, Masaka), northwestern Uganda (Nebbi, Gulu) and in the northeastern and eastern part of the country, along the border with Kenya (Kotido, Kitgum, Moroto). Grasslands occur mainly in the same districts as the bushlands.

### 3.6.1 Sensitive Habitat Types

Certain habitats - ie. vegetation types - are sensitive to disturbance and are easily degraded in the course of development. Therefore, when development activities are carried out in such areas, extra attention is required with regard to conducting EIAs and proposing mitigation measures. In the case of construction of new roads, realignment to avoid such sensitive habitats may be the best option.

These sensitive habitats include all types of wetlands (seasonal wetlands, herbaceous wetlands, swamp forests, palm savannas, high altitude moorland), and semi-desert habitats (tree and shrub steppes, grass steppes), as shown in Table 3.6. They cover a total area of about 23,000 km<sup>2</sup>, or 9.7% of the country<sup>65</sup>. The roads targeted by FRSP do not pass through or close to semi-desert habitats, but they do pass through a number of wetlands, for example the roads around Pallisa (Pallisa-Kumi, Pallisa-Mbale, and Pallisa-Tirinyi). This is dealt with further in Section 3.8.3 on Wetlands.

**Table 3.6: Sensitive Habitats**

Vegetation type	Area (km <sup>2</sup> )	Percentage cover
Seasonal wetlands	13,924.7	5.78
Herbaceous swamps ( <i>more-or-less permanent</i> )	5,230.9	2.17
Palm savannas	1,264.7	0.53
High altitude moorland and heath	677.5	0.28
Swamp forests	244.3	0.10
subtotal for wetland habitats*	21,341.7	8.86
Tree and shrub steppes	1,314.7	0.55
Grass steppes	800.3	0.33
subtotal for desert habitats	2,115.0	0.88
<b>TOTAL</b>	<b>23,457.1</b>	<b>9.74</b>

\* Note that under the definition of wetlands under the Ramsar Convention, Uganda's open waters would also be recognised as wetlands, bringing the total area to 57,913 km<sup>2</sup> or 24% of Uganda.

<sup>65</sup> According to vegetation mapping carried out for the project, wetlands (excluding open waters) total about 8.33% of Uganda's area; a figure of 9.4% is usually quoted by the NWP and NEMA (1996).

### 3.6.2 Vegetation and its Implications on Road Projects

The type and amount of vegetation in the upper and lower catchments of roads, and also along them have a number of implications on road design and maintenance:

#### Planning stage

- avoid areas with unique/endangered plant species.

#### Design stage

- rate of overland flow( run-off) on catchment areas and therefore concentration time used during design of structures is considerably affected by the type of vegetation;
- a road should be sited where it does not affect unique plants that are of special value to the society, eg. those that have medicinal properties;
- knowledge of the existing types of vegetation in an area should be made use of in recommending the type of vegetation to be used for erosion control (including bio-engineering techniques), avenue tree planting, and in rehabilitation of borrow areas, as some types of vegetation are more effective than others in their uses.

#### Maintenance stage

- the height of the vegetation growing on the sides of the road has to be controlled by regular trimming in order to maintain sight distances and view of the road furniture eg. traffic signs;
- knowledge of the characteristics of the existing vegetation is therefore important in planning for its regular control.

#### Construction stage

new alignments may necessitate the clearing of forest or bush areas, some of which may harbour unique or endangered species;  
there will be an increased demand for fuelwood in the area, and provision for alternate fuels should therefore be considered.

#### Operation stage

- opening up new areas may encourage encroachment and tree felling in previously impassable areas.

## 3.7 Flora and fauna

### 3.7.1 Biodiversity

Because of its unique biogeographic location, Uganda harbours seven of Africa's 18 plant kingdoms - more than any other African country - and its biological diversity is one of the highest on the continent (Davenport & Matthews, 1995). It boasts more than half of all African bird species, and is second only to the Democratic Republic of Congo in terms of number of mammal species. In the latter, it is actually the 9<sup>th</sup> richest in the world, which is remarkable considering its size. Within Uganda, this unique position is well recognised, and biodiversity has received significant attention from GOU, especially during the 1990s, when:

- Uganda was one of the first nations to produce a nationwide biodiversity assessment (National Biodiversity Unit, 1992), which was presented at the United Nations Conference on Environment and Development (UNCED) at Rio de Janeiro in 1992;
- in 1993-95, the Forest Department carried out a nation-wide assessment of the biological diversity of all Forest Reserves larger than 5,000 ha (total of 66 areas), recording a wealth of data on the country's biological resources; this data is recorded in a series of 33 reports (eg. Davenport *et al.*, 1996) and summarised in the Forest Department (1998);
- in 1996-98, the Uganda Wildlife Authority (UWA) carried out surveys of biological diversity in all former Controlled Hunting Areas (CHAs), and many of the Wildlife Reserves, in order to create a rational basis for gazettelement and de-gazettelement of Protected Areas.

In addition, Uganda is a signatory to the:

- Convention on the Conservation of Nature and Natural Resources (1968);
- Convention on Wetlands of International Importance Especially as Waterfowl Habitat (1971) (commonly known as the Ramsar Convention)<sup>66</sup>;
- Convention on the International Trade in Endangered Species of Wild Fauna and Flora (1973) (commonly known by its acronym CITES); and
- in 1993 it ratified the Convention on Biological Diversity (CBD, 1992).

Unfortunately, due to years of unrest in the 1970s and 1980s, little wildlife remains outside the current network of protected areas, which consists of areas included in UWA's Protected Area System (National Parks, Wildlife Reserves, Wildlife Sanctuaries and Community Wildlife Reserves; see Section 3.8.1) and Forest Reserves managed by the Forest Department (see Section 3.8.). Wetlands form a separate category of protected area, as they are protected by a blanket law preventing disturbances in all wetlands nationwide and are not formally included in the PA network (see Section 3.8.3).

In a legal sense, the National Environment Management Authority (NEMA) is responsible for managing the country's biological diversity. Among others, NEMA is responsible for issuing guidelines and prescribing measures for the conservation of biodiversity, and is to prepare and maintain an inventory of the nation's biological diversity (see Box 1). As it is a co-ordinating rather than an implementing body, its primary role in this field is to direct lead agencies such as the Forest Department and UWA for the *in situ* protection of biodiversity.

Although mentioned in the National Environmental Statute (1995) as being a function of NEMA, this agency does not operate a database on Uganda's biodiversity. Such a database has, however, been developed since 1990 by MUIENR's National Biodiversity Data Bank (NBDB). Box 2 provides information about NBDB, including the volume of information stored, taxa covered, and the type of outputs that can be generated.

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<sup>66</sup> Although Uganda is a signatory to the Ramsar Convention, it has not ratified the Convention.

**Box 1: National Environmental Statute (1995) and Biodiversity**

The following sections in the Statute address biodiversity:

*Section 42: (1) The Authority <ie. NEMA>, shall in consultation with the Lead Agency, issue guidelines and prescribe measures for the conservation of biological diversity. (2) The Authority may, in issuing guidelines under subsection (1) - (a) specify national strategies, plans and programmes for the conservation and sustainable use of biological diversity; (b) integrate the conservation and sustainable utilisation ethic in relation to biological diversity in existing government activities and activities of private persons; (c) identify, prepare and maintain an inventory of biological diversity of Uganda; (d) determine which components of biological diversity are threatened with extinction; (e) identify potential threats to biological diversity and devise measures to remove or investigate their effects.*

*Section 43: (1) The Authority shall, in consultation with the Lead Agency - (a) prescribe measures to ensure the conservation of biological resources in-situ; (b) the Authority shall, in consultation with the Lead Agency, issue guidelines for - (i) land use methods that are compatible with the conservation of biological diversity; (ii) the selection and management of protected areas so as to promote the conservation of various terrestrial and aquatic ecosystems of Uganda; (iii) the selection and management of buffer zones near protected areas; (iv) special measures for protection of species, ecosystems, and habitats faced with extinction; (v) prohibiting or controlling the introduction of alien species; (vi) integrating traditional knowledge for the conservation of biological diversity with mainstream scientific knowledge.*

### Box 2: National Biodiversity Data Bank

The Makerere University Institute of Environment and Natural Resources (MUIENR) established a National Biodiversity Data Bank (NBDB) in 1990, in order to store and analyse data on Uganda's biodiversity. Initially, the NBDB was based on a simple filing system consisting of datasheets per species, but in 1993 - with GEF support - this evolved into a computerised system. The latter is still being developed, and is as yet by no means complete in its dealing of various taxa and spatial distribution records. Below, a summary is given of data availability in the NBDB per taxon. To date, a total of more than 25,000 observations of individual species have been entered into the data base.

#### NBDB coverage of various taxa

<i>Taxon</i>	<i>Checklist developed for NBDB</i>	<i>Observation records entered in NBDB</i>
fungi	planned	planned
lichens	planned	planned
mosses	planned	planned
ferns	planned	planned
flowering plants	checklist (incomplete)	planned
insects	checklist for dragonflies, moths & butterflies	planned
fish	checklist developed	planned
amphibians	checklist developed	planned
reptiles	checklist developed	planned
birds	checklist developed	observations entered
mammals	checklist developed	observations entered

NBDB can produce maps depicting the spatial distribution of recorded observations, and to date this has been carried out for individual species. This spatial data can also be combined with habitat data (eg. a vegetation map), and from this the occurrence of recorded species can be extrapolated to other areas. This GIS system also includes maps of existing forest reserves, National Parks and Wildlife Reserves, which can also be combined with spatial data on species distribution. NBDB also stores information on the status of each species, ie. Red Data Book status, IUCN status and CITES appendix listings. NBDB has been used to review the coverage and effectiveness of Uganda's Protected Areas (Pomeroy *et al.*, 1998), and can in principle also be used to assess the occurrence of threatened birds and mammals along a certain stretch of road targeted by MOWHC.

NBDB has a number of weaknesses that limit its applicability. Firstly, the coverage of various taxa is rather limited, and to date only observations on birds and mammals have been entered. These groups are useful as indicator species, but a full reliance on this may mean overlooking taxa with restricted range (eg. two tree/shrub species endemic to Tororo Rock). Secondly, the majority of observations have been made along roads, and assessments of populations and distribution of species relies heavily on extrapolation to other areas of similar habitat. Lastly, NBDB's assessment of habitats is based on the vegetation map of Uganda produced in 1964 by Langdale-Brown *et al.*, which in turn was based on aerial photographs dating from 1959. Changes in the natural environment have been profound in many areas, and comparison with the National Biomass Study (1996) shows that a large part (almost 35%) of the country now consists of small-scale farmland, rather than natural habitats.

### 3.7.2 Plant Resources

As mentioned earlier, Uganda is richly endowed with plant species. A total of 5,518 higher plants, Angiosperms, have been recorded to date (National Biodiversity Unit, 1992), and if algae, ferns, mosses and Gymnosperms are included this figure approaches 7,000 (Table 3.7).

Information about the spatial distribution of plant species in Uganda is far from complete, but it is reasonable to assume that if significant areas of all of the major vegetation types are safeguarded, then most plant species will also be adequately protected.

**Table 3.7: Plant Diversity in Uganda**

Group	Number of families	Number of genera	Number of species
Lichens*	?	51	296
Fungi*	?	184	420
Algae	20	49	115
Mosses	?	39	69
Ferns + allies	29	102	386
Gymnosperms	6	10	40
Angiosperms / Monocotyledons	35	267	1,458
Angiosperms / Dicotyledons	161	1,255	4,060
subtotal higher plants (angiosperms)	196	1,522	5,518
<b>Total</b>		<b>1,957</b>	<b>6,844</b>

Source: adapted from National Biodiversity Unit (1992)

\* Lichens represent a symbiosis between single-celled algae and fungi. Fungi are often placed separate from plants

While most vegetation types are included in either the UWA Protected Area System (see Table 3.8), or in the Forest Department's network of the Forest Reserves, a number of habitats appear to have been neglected (see Section 3.8.1). Habitats that are not (sufficiently) included in the existing PA System, which UWA aims to incorporate in the near future, include upland wetlands, montane wetlands, and seasonal wetlands. Other habitats that are inadequately incorporated include Grass Steppe and Swamp Forest, while Moist *Acacia* Savanna and Palm Savanna<sup>67</sup> appear to be threatened because of lack of protection in existing reserves (Pomeroy *et al.*, 1998). Once the hitherto neglected habitats have been included in the PA System and extra measures to ensure the survival of Moist *Acacia* Savanna and Palm Savanna have been taken, it is expected that most of Uganda's floral diversity will also be safeguarded.

Species that may end up not being protected, however, are restricted-range endemics (ie. endemic species known from only one or a few, small localities). A known example in Uganda are a number of tree and shrub species that occur only on Tororo Rock and no-where else; if the vegetation on Tororo Rock were to be cleared, these species would become extinct. An inventory of restricted-range endemic species has not been compiled, but it is highly important that this be carried out soon, as these very localised endemics are among the rarest species present in Uganda, and are highly vulnerable.

<sup>67</sup> These habitat types follow the Langdale-Brown *et al.* (1964) vegetation map of Uganda.

**Table 3.8: Vegetation Types in UWA's PA System**

Vegetation type	Area (km <sup>2</sup> )	Protected in PA System (km <sup>2</sup> )	Percentage in PA System
Freshwater swamp forest	272	46	16.9
Upper montane forest	3,303	1,971	59.7
Lower montane forest	361	0	0
Lowland evergreen broadleaf forest	24,932	1,245	5.0
Semi-evergreen, moist broadleaf forest	6,584	2,781	42.2
Deciduous/semi-deciduous broadleaf forest	7	0	0
Thorn forest	18,505	12,067	65.2
Sparse trees/parkland	1,340	32	2.4

Source: adapted from WCMC's Web Site

Outside the protected areas, only a few plants or plant groups are afforded legal protection. Firstly, trees included in the Forest Department's list of Reserved Tree Species, Class I Hardwood Trees (Table 3.9) are partly protected, as permission must be given by the Forest Department for felling these trees for timber. Ironically, due to a quirk of the legal system, if felling is intended for clearing an area for agricultural purposes, the Forest Department's permission is not required. Secondly, some plants are protected by the CITES Convention to which Uganda is a party (see Section 3.7.1). This convention prevents or restricts the international trade of certain species or groups of species, including *Cycads*, orchids and certain palms. However, this only applies to international trade, and does not apply to in-country collecting or habitat destruction which is probably responsible for the bulk of species loss in most countries.

**Table 3.9: Reserved Tree Species**

Species	Family	Common or trade name
<i>Azelia africana</i>	Leguminosae	Azelia, Beyo
<i>Azelia coriaria</i>	Leguminosae	Mugavu
<i>Araucaria</i> spp.	Araucariaceae	Araucaria
<i>Cedrella odorata</i>		Cedrella
<i>Chlorophora excelsa</i>		Mvule, Muvule Iroko
<i>Dalbergia melanoxylon</i>	Leguminosae	Africa Black Wood, Ebony
<i>Entandrophragma angolense</i>	Meliaceae	Mukusu, Budongo Mahogany, Gedu Nohor
<i>Entandrophragma cylindricum</i>	Meliaceae	Muyovu, Sapele
<i>Entandrophragma excelsa</i>	Meliaceae	Muyovu
<i>Entandrophragma utile</i>	Meliaceae	Mufumbi
<i>Eucalyptus grandis</i>	Myrtaceae	Kalitunsi
<i>Eucalyptus robusta</i>	Myrtaceae	Kalitunsi
<i>Eucalyptus tereticornis</i>	Myrtaceae	Kalitunsi
<i>Fagara macrophylla</i>	Rutaceae	East African Satinwood
<i>Guarea cedrata</i>	Meliaceae	Scented Guarea
<i>Hagenia abyssinica</i>	Rosaceae	Omujezi
<i>Holoptelea grandis</i>		Mumuli
<i>Juniperus procera</i>	Cupressaceae	African Pencil Cedar, Munyama, African Mahogany
<i>Khaya grandifolia</i>		Tido, Big-leaf Mahogany
<i>Khaya senegalensis</i>		Senegal Mahogany
<i>Lovoa</i> spp.		Uganda Walnut
<i>Mitragyna</i> spp.	Rubiaceae	Abur, Nzingu
<i>Ocotea usambarensis</i>	Lauraceae	East African Camphorwood
<i>Olea welwitschii</i>	Oleaceae	Elgon Olive
<i>Podocarpus</i> spp.	Podocarpaceae	Podo
<i>Tectona grandis</i>	Verbenaceae	Teak

**Note:** Forest Department Class I Hardwood Trees, for which permission from the Forest Department is required for felling, including areas outside Forest Reserves.

### 3.7.3 Animal Resources

Uganda's animal resources are one of the richest in Africa. The country harbours 1010 bird species, which is more than half (54%) of all bird species (1865) recorded in Africa. In addition, 335 mammal species have been recorded. The total number of genera and species per animal group is provided in Table 3.10.

According to IUCN (pers. comm. Muhweezi, 1998) the main threats to wildlife in Uganda are habitat conversion, pressure on land (due to poverty), rapid population increase and lack of development in non-agricultural sectors (ie. little development of industry). It may be added that the country's wildlife was badly depleted by widespread hunting during the unstable 1970s and 1980s, and that populations have not significantly recovered in many areas, including protected areas. The net result is that very little wildlife remains outside the existing protected areas network, and even within the network populations are depleted. Many of the former Controlled Hunting Areas and Wildlife Reserves have little in the way of wildlife remaining within their boundaries.

**Table 3.10: Wildlife Species Diversity**

Group	Number of genera	Number of species	References
Insects	3170	8999	National Biodiversity Unit (1992)
Molluscs	23	83	Mandahl-Barth (1954) Ormoding <i>et al.</i> (1996)
Fish	64	293	Greenwood (1966) National Biodiversity Unit (1992) Ormoding <i>et al.</i> (1996)
Amphibians	19	51	Loveridge (1957) National Biodiversity Unit (1992) Ormoding <i>et al.</i> (1996)
Reptiles	75	151	Loveridge (1957) Pitman (1974) National Biodiversity Unit (1992)
Birds	345	1000 1010	National Biodiversity Unit (1992) Pomeroy <i>et al.</i> (1998)
Mammals	153	321 335	National Biodiversity Unit (1992) Pomeroy <i>et al.</i> (1998)

However, in spite of heavy losses in population numbers, most wildlife species are not depleted to the point that recovery is unlikely, and many, if not most, species are afforded sufficient protection in the country's protected areas network, especially in UWA's National Parks and the Forest Department's Forest Reserves. For most species, this network would appear ample. Pomeroy *et al.* (1998) report that while 70 bird species (out of 1010 recorded in Uganda) do not occur in UWA's PA System, most of these probably do occur in the Forest Reserves. Also, while 58 % of 335 recorded wildlife species are amply protected by UWA's PA System, a significant number of the remaining 140 species are likely to be adequately protected in the Forest Reserves.

In legal terms, Uganda's wildlife is afforded protection under the Uganda Wildlife Statute (1996) (GOU, 1996), which states, among others, that the Minister may declare any species a protected species, and that species that are protected by international conventions to which Uganda is a party, are also afforded protection (Box 3). Unfortunately, in practice the situation is not very clear as the Uganda Wildlife Statute does not include schedules of protected species, and the Game (Preservation and Control) Act 1964 (GOU, 1964) regulates hunting and control, and does not list any fully protected species. Also, with devolution of responsibilities from central to local government, animals may be classified as protected or vermin, depending on the local situation.

**Box 3: Uganda Wildlife Statute (1996)**

Section 28: (1) The Minister may, on the recommendation of the Board, by statutory order, declare any species of wild plant or wild animal specified in the order to be classified as a protected species under this statute. (2) Species which migrate to or through Uganda which are protected under any international convention or treaty to which Uganda is party and to which section 91 applies shall be protected under this Statute. (3) Any order made under subsection (1) may apply to an individual species throughout Uganda, or to all or some species in a specified area, or to varieties of a species including sex and age groups. (4) An order made under subsection (1) shall state whether species of wild animals or plant shall be - (a) fully protected species which may not be subject to wildlife use rights; or (b) partially protected species to be utilised only subject to a grant of a wildlife use right.

Section 91: (1) Where Uganda is a party to any convention or treaty concerning wildlife, or in a case where such a convention or treaty is required by the Constitution to be ratified, after it has been ratified in accordance with the Constitution, the Minister may, by statutory order, and with the approval of Parliament signified by its resolution- (a) set out the provisions of the convention or treaty; (b) give the force of law in Uganda to the convention or treaty required to be given the force of laws in Uganda; (c) amend any enactment other than the Constitution for the purpose of giving effect to the convention or treaty; (d) make such other provision as may be necessary for giving effect to the convention or treaty in Uganda or for enabling Uganda to perform its obligations or exercise its rights under the convention or treaty.

In spite of this, certain species are protected from international trade because of Uganda's accession to the CITES convention. However, CITES does not apply to in-country hunting or destruction of wildlife. Another complication in the legal sphere is that various laws (Uganda Wildlife Statute 1996, the Game (Preservation and Control) Act, laws in magistrate courts) are far from being harmonised. Fines for killing of wildlife have not been updated for decades, and if for instance a person is caught being in possession of ivory, this may result in a very paltry UgSh 2,000 (US\$ 1.60) fine. It is not very surprising, therefore, that agencies such as UWA do not pursue such matters in court.

Bird and mammal species occurring in IUCN listings, or otherwise recorded as threatened, are listed in Tables 3.11 and 3.12.

Due to rising pressures on land, conflicts between humans and wildlife have been increasing in recent years. In response to this problem, UWA organised a workshop in July 1998 (Ratter, 1998), on "problem animals", which are defined as animals that cause:

- human injury or death,
- livestock injury or death,
- crop destruction,
- compete with livestock for grazing,
- destruction of infrastructure,
- social disruption, or
- lead to disease infection (notably of livestock).

Table 3.11: Status of Ugandan Birds

Species	Common English name	IUCN Status
<i>Alethe poliophrys</i>	Red-throated Alethe	K
<i>Apalis karamojae</i>	Karamoja Apalis	K
<i>Apalis rwenzorii</i>	Collared Apalis	K
<i>Balaeniceps rex</i>	Whale-headed Stork	V
<i>Balearica pavonina</i>	Sudan Crowned Crane	V
<i>Balearica regulorum</i>	Crowned Crane	V
<i>Batis diops</i>	Rwenzori Puff-back Flycatcher	K
<i>Bradypterus alfredi</i>	Bamboo Warbler	K
<i>Bradypterus carpalis</i>	White-winged Rush Warbler	K
<i>Bradypterus graueri</i>	Grauer's Rush Warbler	R
<i>Campephaga phoenicea</i>	Red-shouldered Cuckoo Shrike	K
<i>Caprimulgus batesi</i>	Bates' Forest Nightjar	R
<i>Cercotrichas leucostrigata</i>	Northern Bearded Scrub-robin	K
<i>Charadrius forbesi</i>	Forbes' Plover	K
<i>Chlorocichla laetissima</i>	Joyfull Greenbul	K
<i>Chloropeta (Acrocephalus) gracilirostris</i>	Lesser Swamp Warbler	K
<i>Ciconia ciconia</i>	European White Stork	K
<i>Cisticola carruthersi</i>	Carruther's Cisticola	K
<i>Columba albinucha</i>	White-naped Pigeon	R
<i>Cossypha roberti</i>	Robert's Chat	K
<i>Crex crex</i>	European Corn Crake	R
<i>Cryptospiza reichenovii</i>	Red-faced Crimsonwing	K
<i>Cryptospiza jacksoni</i>	Dusky Crimsonwing	K
<i>Cryptospiza shelleyi</i>	Shelley's Crimsonwing	K
<i>Dryotiorchis spectabilis</i>	Congo Serpent Eagle	R
<i>Ephippiorhynchus senegalensis</i>	Saddlebill Stork	V
<i>Eremomela turneri</i>	Turner's Eremomela	K
<i>Falco peregrinus</i>	Peregrine Falcon	V
<i>Francolinus jacksoni</i>	Jackson's Francolin	R
<i>Francolinus nahani</i>	Nahan's Forest Francolin	R
<i>Francolinus nobilis</i>	Handsome Francolin	R
<i>Glaucidium castaneum</i>	Chestnut Owlet	R
<i>Glaucidium tephronotum</i>	Red-chested Owlet	R
<i>Graueria vittata</i>	Grauer's Warbler	K
<i>Hemitesia neumanni</i>	Short-tailed Warbler	K
<i>Hieraaetus africanus</i>	Cassin's Hawk-eagle	R
<i>Hirundo atrocaerulea</i>	Blue Swallow	R
<i>Indicator narokensis</i>	Narok Honeyguide	R
<i>Indicator pumilio</i>	Chapin's Least Honeyguide	R
<i>Laniarius fulleborni</i>	Fulleborn's Black Boubou	K
<i>Laniarius mufumbiri</i>	Yellow-crowned Gonolek	K
<i>Lybius rubrifacies</i>	Red-faced Barbet	R
<i>Melaenornis ardesiacae</i>	Yellow-eyed Black Flycatcher	K
<i>Melignomon zenkeri</i>	Zenker's Honeyguide	K
<i>Muscicapa lendu</i>	Lendu Flycatcher	K
<i>Nectarinia alinae</i>	Blue-headed Sunbird	K
<i>Nectarinia purpureiventris</i>	Purple-breasted Sunbird	K
<i>Nectarinia regia</i>	Regal Sunbird	K
<i>Nesocharis ansorgei</i>	White-collared Oliveback	K



**Table 3.12: Status of Ugandan Mammals**

Species	Common English name	IUCN Status
<i>Actinonyx jubatus</i>	Cheetah	V
<i>Aepyceros melampus</i>	Impala	R
<i>Bideogale nigripes</i>	Black-legged Mongoose	K
<i>Cephalophus dorsalis</i>	Bay Duiker	Ex
<i>Cephalophus leucogaster</i>	Gabon Duiker	Ex
<i>Cephalophus nigrifrons</i>	Black-fronted Duiker	E
<i>Cephalophus rufilatus</i>	Red-flanked Duiker	V
<i>Cephalophus silvicultor</i>	Yellow-backed Duiker	E
<i>Ceratotherium simum cottoni</i>	White (Square-lipped) Rhino	Ex
<i>Cercocebus albigenia</i>	Grey-cheeked Mangabey	K
<i>Cercocebus galeritus</i>	Crested Mangabey	K
<i>Diceros bicornis</i>	Black (Hook-lipped) Rhino	Ex
<i>Galago thomasi</i>	Thomas's Galago	K
<i>Gazella grantii</i>	Grant's Gazelle	K
<i>Gorilla gorilla beringei</i>	Eastern (Mountain) Gorilla	E
<i>Hippotragus equinus</i>	Roan Antelope	R
<i>Idiurus zenkeri</i>	Pygmy Flying Squirrel	K
<i>Loxodonta africana</i>	African Elephant	V
<i>Lycaon pictus</i>	Wild Dog	Ex
<i>Madoqua guentheri</i>	Guenther's Long-snouted Dik-dik	K
<i>Neotragus batesi</i>	Bates's Pygmy Antelope	V
<i>Okapia johnstonii</i>	Okapi	Ex
<i>Oreotragus oreotragus</i>	Klipspringer	R
<i>Oryx gazella beisa</i>	Beisa Oryx	V
<i>Pan troglodytes</i>	Chimpanzee	V
<i>Panthera pardus</i>	Leopard	V
<i>Raphicerus campestris</i>	Steenbok	Ex
<i>Redunca fulvorufula</i>	Mountain Reedbuck	E
<i>Rhynchocyon cirnei</i>	Checkered Elephant Shrew	K
<i>Taurotragus (Tragelaphus) derbianus</i>	Giant Eland	Ex
<i>Boocercus (Tragelaphus) eurycerus</i>	Bongo	Ex
<i>Tragelaphus imberbis</i>	Lesser Kudu	R
<i>Tragelaphus spekeii</i>	Sitatunga	K
<i>Tragelaphus strepsiceros</i>	Greater Kudu	R

Source: Based on National Biodiversity Unit (1992) for status and Dorst & Dandelot (1972) for common names.

Note: Table 3.12 does not include most smaller mammals, such as rodents.

IUCN status: Ex = extinct  
V = vulnerable  
R = rare

E = endangered  
K = insufficiently known

The so-called problem animals (20 species in all) discussed at the UWA workshop in July 1998 are listed in Table 3.13, along with their conservation value. When species with a high conservation value (eg. elephant, gorilla and lion) cause problems in their interactions with humans, livestock or crops, UWA will under most circumstances attempt to find a remedy for the situation, for example by capturing the animals and translocating them to a nearby reserve. When species with a medium conservation value (eg. hippo, kob and warthog) are involved, UWA will take a case-by-case approach and intervene when appropriate. In the case of problems with species with a low conservation value (eg. bushpig, baboon and Vervet Monkey), UWA will not intervene, but allow local villagers to undertake actions, such as hunting or poison baiting.

**Table 3.13: Problem Animals**

High Conservation Value	Medium Conservation Value	Low Conservation Value
Chimpanzee Crocodile Elephant Gorilla Leopard Lion Sitatunga	Buffalo Bushbuck Hippo Hyaena Kob Porcupine Python Warthog	Baboon* Bushpig* Guineafowl Quelea Vervet Monkey*

Source: UWA, 1998.

\* Baboon, Bushpig and Vervet Monkey are listed as vermin (GOU, 1964), and according to Ratter (1998), the other species listed in Table 3.13 are protected by law, except the quelea and the porcupine.

### 3.7.4 Roads, Fauna and Flora

At planning stage, areas harbouring sensitive faunal and floral species need to be taken into account in order that alternative routes can be considered. During design, to reduce the impact of a road on the fauna and flora the following could be done:

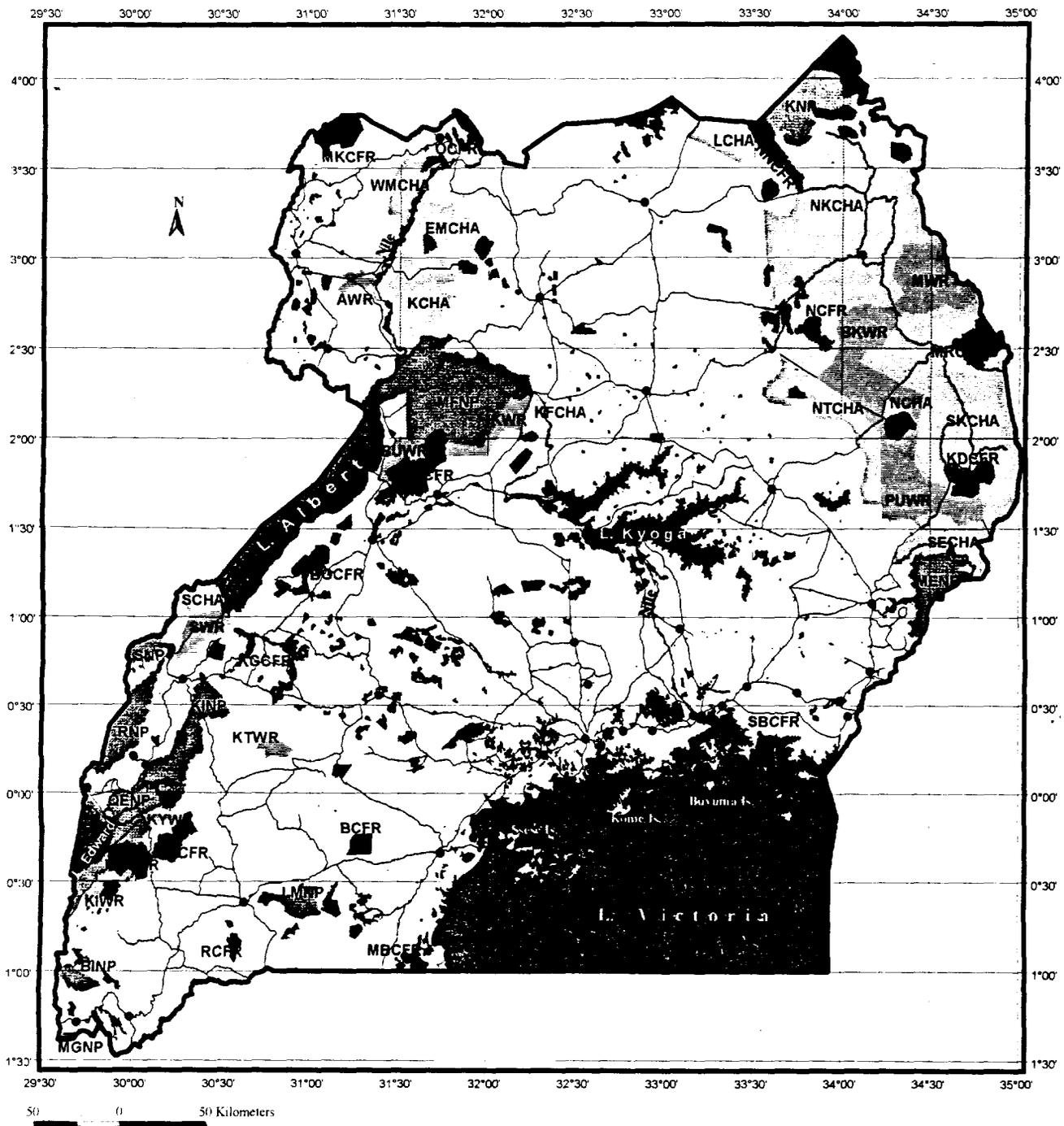
- reduce the road cross-sections;
- provide animal crossings;
- have speed reducing devices;
- allow for artificial fences.

### 3.8 Protected Areas

There are four main types of protected areas in Uganda, namely i) areas included in UWA's Protected Area System (UWA's PA system), ii) Forest Reserve managed by the Forest Department, iii) wetlands, and iv) cultural and historical sites. In Section 3.5.2 protected areas were discussed as a land use type; in this section the various types of protected area are dealt with separately and in greater detail.

The four main types of protected areas are afforded different degrees of protection. Forest Reserves and areas in the UWA PA system are officially gazetted, whereas wetlands are provided with a 'blanket' protection under the National Environmental Statute(1995). While more than 200 cultural and historical sites are considered protected areas, only seven are officially gazetted.

# MAP 10. PROTECTED AREAS



## KEY

- Central Forest Reserve
- Animal Sanctuary
- National Park
- Wildlife Reserve
- Controlled Hunting Area
- Major towns
- International boundary
- Roads
- Water

National Parks	Wildlife Reserves	Controlled Hunting Areas	Central Forest Reserves
BINP Bwindi Impenetrable	BKWR Bokora Corridor	EMCHA East Madi	BCFR Buyaga Dam
KINP Kibale	BUWR Bugungu	KFCHA Karuma Falls	BDCFR Budongo
KNP Kidepo	KYWR Chambura	KCHA Kiak	BGCFR Bugoma
LMNP Lake Mburo	KWR Karuma	LCHA Lipan	KCFR Kasyoha-Kitomi
MENP Mt Elgon	MWR Matheniko	NKCHA North Karamoja	KDCFR Kadam
MFNP Murchison Falls	SWR Toro/Semliki	SECHA Sebei	MBFR Malabigambo
MGNP Mgahanga	KIWR Kigezi	NCHA Napak	MKCFR Mt Kei
QENP Queen Elizabeth	AWR Ajas's	SCHA Semliki Flat	KGCFR Kagombe
RNP Mt Rwenzori	PUWR Pian-Upe	NTCHA North Teso	MRCFR Moroto
SNP Semuliki	KTWR Katonga	SKCHA South Karamoja	MCFR Mabira
		WMCHA West Madi	NCFR Napak
			NMCFR North Mazamagambo
			NNCFR Nyangasa-Napone
			OCFR Otzi (East)
			RCFR Rwoho
			SBCFR South Busoga

Source of Data: NBS

Produced by RS & GIS Lab, AICLENR, 1999, for MORNHC

Table 3.14 provides an overview of the various categories of protected areas. A few caveats need to be added here:

- six of the ten national parks have recently been gazetted, from a former status of Forest Reserve;
- only a negligible fraction of Uganda's wetlands (<2%) is included in either Forest Reserves or the PA system;
- of UWA's PA System, only the National Parks are core areas; other classes under the PA System are currently under review, and much is likely to be de-gazetted, especially of the Community Wildlife Areas, which comprise 57% of the total PA System;
- The Forest Department's Forest Reserves are also undergoing changes in status, and it is likely that only reserves >1,000 ha will remain under the Forest Department in the future, when its status is changed to that of National Forest Authority;
- the total area of wetlands is an issue of debate, as it depends on definitions; that of the Ramsar Convention would include open waters such as Lakes Victoria, Kyoga, Albert and Edward, while that used by the National Wetland Conservation and Management Programme and GOU (1995) is much narrower and excludes open waters; open waters comprise 66% of all wetlands (in the broader Ramsar definition); and
- Cultural and Historical sites extend over a negligible area, and this is therefore omitted from Table 3.14.

Whereas the total of all classes of protected areas extends over almost half of Uganda's total area, the core areas that are protected by law and are likely to remain gazetted total 4.2 million ha or about 17.6% of Uganda's total area.

**Table 3.14: Protected Areas in Uganda**

Category	Class	Area (ha)	Percentage cover
<b>UWA</b>	National Parks ***	1,115,500	4.63
	Wildlife Reserves	876,400	3.64
	Wildlife Sanctuaries	85,000	0.35
	Community Wildlife Areas	2,760,500	11.46
	Subtotal	4,837,400	20.08
<b>Forest Department</b>	Forest Reserves >5,000 ha ***	788,000	3.27
	Forest Reserves 1,000-5,000 ha ***	350,000	1.45
	Forest Reserves <1,000 ha	72,000	0.30
	Subtotal	1,210,000	5.02
<b>Wetlands</b>	Open water	3,783,570	15.7
	Seasonal wetlands ***	1,392,470	5.78
	Permanent herbaceous swamps ***	523,090	2.17
	High altitude moorland ***	50,000	0.21
	Swamp forests ***	24,430	0.10
	Subtotal	5,773,560	23.96
<b>Cultural &amp; historical sites</b>	more than 200 known sites	negligible	negligible
<b>Subtotal of core areas *</b>		4,243,490	17.6
<b>Total of all 'protected' areas</b>		11,820,960	49.1

\* Core areas, as defined here, are legally protected and are likely to remain so in future. Non-core areas are likely to be (partially) degazetted, or in the case of open waters, do not fall under the restricted definition of wetlands used by GOU.

Table 3.14 (cont): Protected Areas in Uganda

Protected Area	District(s)	Size (ha)	Year of gazettal
<b>National Parks</b>			
Murchison Falls	Gulu/Masindi/Apac	386,000	1952
Queen Elizabeth	Kasese/Bushenyi/ Rukungiri	197,800	1952
Kidepo Valley	Kotido	144,200	1962
Lake Mburo	Mbarara	36,500	1982
Bwindi Impenetrable	Kabale/Kisoro/Rukungiri	33,100	1991
Mgahinga Gorilla	Kisoro	2,500	1991
Rwenzori Mountains	Kasese	99,600	1991
Mount Elgon	Mbale	117,200	1993
Kibale	Kabarole	76,600	1993
Semiliki	Bundibugyo	22,000	1993
<i>Subtotal</i>		<i>1,115,500</i>	
<b>Wildlife Reserves</b>			
Kigezi	Rukungiri	32,800	1952
Toro	Bundibugyo	54,900	1959
Katonga	Kabarole	20,700	1964
Karuma	Masindi	71,300	1964
Pian-Upe	Moroto	228,700	1964
Bokora	Moroto	203,400	1964
Matheniko	Moroto/Kotido	158,700	1964
Ajai	Arua	15,600	1965
Kyambura	Bushenyi	15,500	1965
Bugungu	Masindi	74,800	1968
<i>Subtotal</i>		<i>876,400</i>	
<b>Wildlife Sanctuaries</b>			
Mountain Kei	Moyo	52,300	-
Otze	Moyo	20,400	-
Entebbe	Mpigi	5,100	1951
Jinja	Jinja	3,200	1953
Dufule	Moyo	1,000	1959
Kazinga	Kasese/Bushenyi	2,300	1959
Malawi	Tororo	700	1962
<i>Subtotal</i>		<i>85,000</i>	

**Table 3.14 (cont): Protected Areas in Uganda**

Community Wildlife Areas	District(s)	Size (ha)	Year of gazettal
Napak	Moroto	22,500	-
East Teso	Soroti	50,400	-
North Karamoja	Kotido/Moroto	1,079,300	1963
South Karamoja	Moroto	798,800	1963
Sebei	Kapchorwa	132,300	1963
West Madi	Moyo	82,100	1963
East Madi	Moyo	175,200	1963
Lipan	Kitgum	90,000	1963
Karuma Falls	Masindi	24,100	1963
Kaiso	Hoima	22,700	1963
Buhuka	Kibale/Hoima	1,800	1963
Semliki Flats	Bundibugyo	50,400	1963
Katonga	Kabarole	229,900	1963
<i>Subtotal</i>		<i>2,760,500</i>	
<b>TOTAL</b>		<b>4,837,400</b>	

Source: UWA, Forestry Department, NWCMP, 1998.

### 3.8.1 The UWA Protected Area System

#### Existing PA System

The Protected Area System<sup>68</sup> managed by the Uganda Wildlife Authority (UWA) includes a total of ten National Parks, ten Wildlife Reserves, seven Wildlife Sanctuaries and thirteen Community Wildlife Areas, which altogether extend over 4,837,400 ha or 20 % of the country's total area. Map 10 indicates the location of each of these Protected Areas, while Table 3.15 provides information about the regulations under each category of status. It must be pointed out, however, that this entire system is currently being reviewed by UWA, and that a major downsizing is likely to occur in the near future (see below). Only the National Parks, which form the PA System's crown jewels, are likely to pass this exercise unscathed.

The present PA System is highly diverse and scattered, situated predominantly in outlying parts of the country. Most of Uganda's biomes, or major habitats, are represented; for example, there is afro-montane forest in the Bwindi Impenetrable National Park, lowland forest in Semliki National Park, swamp in parts of Queen Elizabeth and Murchison Falls National Parks, savanna in several parks and game reserves, while drier, even arid, formations are found in abundance in the cluster of PAs in the north-east. Certain biomes such as wetlands are, however, under-represented and the inclusion of additional areas to complement the existing system is likely to occur as part of the ongoing review of the PA System.

<sup>68</sup> Other protected areas, such as Forest Reserves, wetlands and cultural/historical sites are not managed by UWA; these are dealt with in Sections 3.8.2 to 3.8.4.

**Table 3.15: Permitted Activities in Protected Areas**

<b>Protected Area</b>	<b>Objectives and Permitted Activities</b>
<b>National Parks</b>	<b>Objectives:</b> NPs are areas of national importance for nature and landscape conservation and natural heritage preservation. They should be ecologically viable units. <b>Permitted activities:</b> Viewing and scientific research. Hunting of wildlife and disturbance of vegetation prohibited. harvesting/removal of approved resources may be authorised in designated areas.
<b>Wildlife Reserves</b> (formerly Game Reserves)	<b>Objectives:</b> WRs are areas of importance for wildlife conservation, utilisation and management. They should also be of sufficient size for management of wildlife populations. They may also serve as buffer zones to a NP. <b>Permitted activities:</b> Wildlife conservation, recreation, scenic viewing, consumptive utilisation (including sport hunting), scientific research.
<b>Wildlife Sanctuaries</b> (formerly Animal Sanctuaries)	<b>Objectives:</b> Ws are areas of varying size, designated for specific biodiversity conservation purposes, including the preservation of a critical species. <b>Permitted activities:</b> Recreation, scenic viewing, scientific research. Hunting of animals and destruction of critical habitats are prohibited.
<b>Community Wildlife Areas</b> (formerly Controlled Hunting Areas)	<b>Objectives:</b> CWAs are wildlife conservation areas that are jointly managed with the communities in the area, which may directly benefit through tourism, sustainable utilisation of wildlife, etc. <b>Permitted activities:</b> Tourism, wildlife consumptive utilisation, commercial and sport hunting, and varied mixed land use practices, grazing and agricultural activities are allowed where appropriate.

Ongoing Changes

The Wildlife Act (1996) brought about significant changes to the PA System, both to the protected area nomenclature but also, in certain cases, to function. National Parks remained unchanged, but Game Reserves became Wildlife Reserves, Animal Sanctuaries became Wildlife Sanctuaries, and Controlled Hunting Areas are in the process of being converted (mainly) to Community Wildlife Areas. At the same time, the Uganda Wildlife Authority was formed by the amalgamation of two existing agencies, Uganda National Parks (UNP; formerly responsible for National Parks) and the Game Department (formerly responsible for Game Reserves and Controlled Hunting Areas). Its functions are described in Box 4. UWA resides under the Ministry of Trade, Tourism and Industry, and is headed by the Chairman of a Board of Trustees. Currently, there are about 1,100 staff (including field-based staff), but this will probably drop to about 950 after downsizing and restructuring exercises within the organisation are completed.

The Controlled Hunting Areas (CHAs) are likely to see the most profound changes to status and function. UWA's policy, and indeed the National Environmental Statute and Uganda Wildlife Statute, require it to sustain a process of survey and research aimed at the rationalisation of the protected area system. Surveys are largely the responsibility of UWA's Monitoring Section, who

have to date covered most (if not all) of Uganda's CHAs. This has resulted so far in a series of internal documents (eg. Muhimbura-Atukunda *et al.*, 1997), and their synthesis has led to the development of a strategic plan for biodiversity conservation in the CHAs (Lamprey *et al.*, 1998). A revised draft of the latter was due to appear by the end of September 1998.

#### **Box 4: The Functions of UWA**

The Uganda Wildlife Statute (GOU, 1996), Section 6, states that UWA's functions are:

- a) *to ensure sustainable management of wildlife conservation areas;*
- b) *to develop and recommend policies on wildlife management to Government;*
- c) *to co-ordinate the implementation of Government policies in the field of wildlife management;*
- d) *to identify and recommend areas for declaration as wildlife conservation areas and the revocation of such declaration;*
- e) *to develop, implement and monitor collaborative arrangements for the management of wildlife;*
- f) *to establish management plans for wildlife conservation areas and for wildlife populations outside wildlife conservation areas;*
- g) *to establish policies and procedures for the sustainable utilisation of wildlife by and for the benefit of the communities living in proximity to wildlife;*
- h) *to control and monitor industrial and mining developments in wildlife protected areas;*
- i) *to monitor and control problem animals, and provide technical advice on the control of vermin;*
- j) *to control internal and external trade in specimens of wildlife;*
- k) *in consultation with other lead agencies, to control, develop or license the development of tourist facilities in wildlife protected areas;*
- l) *to consider reports from district wildlife committees and make necessary comments and decisions;*
- m) *to promote the conservation of biological diversity ex-situ and to contribute to the establishment of standards and regulations for that purpose;*
- n) *to promote wildlife research and knowledge of wildlife and wildlife conservation areas;*
- o) *to disseminate information and promote public education and awareness of wildlife conservation and management;*
- p) *to prepare an annual report on the state of wildlife and such other reports as may be prescribed;*
- q) *to encourage training in wildlife management;*
- r) *to charge fees for such services as it provides and for such licenses, rights and other permission that it may grant;*
- s) *to perform such other functions as are specifically provided for in this Statute or as may be delegated to it by Government or by local government.*

Though diverse, the present system lacks certain representative habitats such as wetlands and certain montane habitats (see below), some of which may be found in the existing CHAs. Conversely, it is also becoming increasingly obvious that (parts of) CHAs are no longer of conservation value, and will therefore be (partly) de-gazetted. The survey work carried out over the past two years concentrated to a large extent on the CHAs, with a view to identifying areas suitable for upgrading, wildlife management centred on communities, and those that should be degazetted and allowed to revert to public land. All of the former CHAs will therefore change their name or status, and sometimes both, in the near future. Those that emerge from the review and survey process as Community Wildlife Areas will, as the new name implies, feature decentralised wildlife management systems. UWA will be just one of several agencies or bodies involved in decisions relating to land and resource use. In such cases, the intention is that district councils and communities will take the lead in land use decisions and the exercising of wildlife use rights conferred on them by UWA. Very much will depend on local initiative, and the mere recognition of a CWA will not guarantee success. The current view within UWA is that only a small number of CHAs will remain, for the simple reason that very little wildlife remains outside the current network of National Parks, Wildlife Reserve and Forest Reserves.

### Gazettal of New Areas

Few areas have been gazetted or degazetted during the past decades. All of the existing Wildlife Reserves, Wildlife Sanctuaries and Controlled Hunting Areas (CHAs) and three of the ten National Parks were all gazetted in the 1950s and 1960s, while six of the seven National Parks gazetted over the past two decades were former Forest Reserves, and gazettal simply meant a change of status from one protected area category to another (Table 3.15). Formerly, reasons for gazettal in the PA System were for watershed management, timber production, preservation of big game and controlling tsetse area access. Protection of wetlands and of the country's biological resources have only recently become important criteria for inclusion in the PA System, although both are now firmly embedded in the legislation (pers. comm. IUCN Uganda Country Office), and confirmed by Uganda's signing of both the Ramsar Convention and the Convention on Biological Diversity (see Section 3.7.1). Although the Uganda Wildlife Act 1996 states that gazettal of new areas is to be completed within two years, this has not yet occurred, and it is obvious that the issue of gazetting new areas is politically sensitive and a topic that is hotly debated.

As stated above, inventories of all districts are being conducted by UWA's Monitoring Team, while the Forest Department has carried out extensive surveys of biological resources in all of its reserves larger than 5,000 ha (see Section 3.8.2). These two sources of information will provide the basis for a final decision regarding gazettal of new areas, and the two key documents for this decision making will be the Forest Department (1998) and Lamprey *et al.* (1998), both of which are due to appear at the end of September 1998.

Habitats that are not (sufficiently) included in the existing PA System, which UWA aims to incorporate in the near future, include upland wetlands, montane wetlands, and seasonal wetlands. Areas specifically targeted by UWA are the wetlands around Lake Kyoga (especially the area around Lakes Bisina and Opeta), Kafu Basin in western Uganda, the Semliki Flats and wetlands in the area around Lake Victoria.

The Inventory of Wetland Biodiversity in Uganda (Omoding *et al.*, 1996) helped to prioritise wetlands sites that are of significant biodiversity and recommendations were made for Lake Nabugabo, Lake Bisina, Lake Munyanyange, Lake Katwe, Lake Mutanda, Lake Kachera, Lutembe Bay, Muchoya swamp, Kitange swamp and Ssezibwa River to be included in a network of protected areas.

### FRSP and UWA's PA System

The roads targeted by FRSP will affect seven of the ten national parks, as these roads run through or directly along through of these parks (Mount Elgon, Murchison Falls, Queen Elizabeth and Semliki), or at a short distance from the park (Bwindi Impenetrable, Mgahinga Gorilla, Rwenzori Mountains) (see Table 3.16).

Under the FRSP no new roads are anticipated, except for the Kampala Bypass, and therefore no major impacts are expected to go through the existing PAs. There are likely to be some adverse effects during the construction phase, due to direct human disturbance (noise, poaching, fuel collecting, etc). After completion of the roads under FRSP, the situation becomes more complex. The upgrading of existing roads leading to the Protected Areas is welcomed by some within UWA, as this will facilitate access, both for management purposes and for tourists. It will also provide better access to markets for local people and stimulate local economies, perhaps reducing dependency on the resources of the Protected Areas. Improved, widened roads are also more

effective fire-breaks, and may help prevent the spread of at least some fire damage during the dry season.

Others within UWA voice concern, as increased access simply makes poaching easier, and (greatly) increased traffic through a Protected Area will be more difficult to control. Improved roads also mean greater vehicle velocities, leading to a higher incidence of road kills. Also, improved, wide paved roads form a more formidable barrier for wildlife to cross, and can lead to fragmentation of populations within a park. Lastly, tourists may be tempted to by-pass the official entrance to a given National Park and simply follow the improved trunk road leading through the park, leading to a loss of revenue to UWA.

**Table 3.16: FRSP Roads Affecting National Parks**

National Park	FRSP road section	Remarks
Bwindi Impenetrable	Kabale-Kisoro	Road passes through Ikumba, from where another road (not targeted by FRSP) leads to Bwindi; (some) increased access & tourism expected.
Mgahinga Gorilla	Kabale-Kisoro	Road through Kisoro passes many km from the park's boundary; increased access and tourism to be expected.
Mount Elgon	Sironko-Suam	Part of the road SE of Kaburoron runs directly along the park boundary, while elsewhere it runs 1-3 km's from the park boundary; access and tourism will increase.
Murchison Falls	Karuma-Pakwach	The first section (Karuma-Aparanga) largely runs through the park, while the section Purongo-Pakwach runs directly along the parks northern boundary; access and amount of traffic will increase, as will tourism.
Queen Elizabeth	Katunguru-Kikorongo	Road passes through the middle of the park; FRSP will lead to better accessibility, heavier traffic use, more visitors to the park.
Rwenzori Mountains	Katunguru-Fort Portal Fort Portal-Bundibugyo	Improvement of both of these roads will increase access to this park; both roads lie at least several km's from park boundaries.
Semliki	Fort Portal-Bundibugyo	Road passes directly along half the length of the park, forming the park's SE boundary.

### 3.8.2 Forest Reserves

#### The Forest Reserve Network

##### *History up to 1990*

At the turn of the century, forests covered approximately 12.7% of Uganda's total area, but by 1990 this had dropped to about 3%, with very little remaining outside government forest reserves. In 1990 there were about 1.53 million ha of gazetted forests scattered in 733 reserves, covering approximately 6.5% of the country's area (Map 7).

A forestry policy was first adopted by the government in 1929 and by 1990 it had been revised three times. Initially, forestry policy emphasised the role of the Forest Department in the protection of the environment, but the emphasis shifted in the early 1970s towards short-term economic benefits from timber extraction. It was not until 1987 that this policy was altered, marking a return to the importance of protective forestry. Under the latter, emphasis was placed on the maintenance of enough forest land to ensure sufficient supplies of timber, to allow for amenity and recreation, and to ensure the conservation of plants and animals in natural ecosystems. This policy also specified that 20% of the total reserved forest area was to be conserved in strict nature reserves and that a further 30% be protected from intensive forms of forestry management in buffer zones (WCMC, 1992). From the late 1980s to the early 1990s, Forest Reserves were classified as Central Forest Reserves, Local Forest Reserves, Village Forests, Nature Reserves and Forest Parks (Box 5).

**Box 5: Classification of Forest Reserves Until Early 1990s**

**Forest reserve:** Prohibited activities include grazing, camping, fish farming, planting or cultivation of crops, erection of buildings or enclosures, construction of roads, the use of such areas for recreational, commercial, residential or industrial purposes, or the negligent lighting of fires; without written authority from a senior forest officer.

**Central forest reserve:** An area which may be declared by statutory order by the Minister. The Chief Conservator may issue licenses for the cutting, taking, working or removal of forest produce. Prohibited activities generally as for forest reserves.

**Local forest reserve:** An area which may be declared by statutory order by the Minister. The appropriate local authority is responsible for maintaining and controlling such areas. Local authority may issue licenses for the cutting, taking, working or removal of forest produce and may make rules applicable to any local forest reserve which it maintains and controls with the approval of the Minister. Prohibited activities generally as forest reserve.

**Village forest:** Any area within the jurisdiction of a local authority may be declared a village forest with approval of the Minister. The control, management and utilisation of such areas is the responsibility of the local authority. The local authority may issue licenses for the cutting, working, or removal of forest produce. The negligent lighting of fires is prohibited in such areas.

**Nature reserve:** Any forest area may be declared closed to all forms of consumptive resource use at the discretion of the senior forest officer and therein designated a nature reserve. Areas within forest reserves which are set aside to preserve representative examples of ecosystems and to afford a higher degree of protection to flora and fauna. Such areas receive minimal management interference and can be used for research, education and environmental monitoring.

**Forest park:** Such parks are to be established in areas with considerable conservation and/or landscape appeal and recreation value. A multi-use management area where 50% of the area would be protected against extractive resource use; mechanised exploitation is prohibited and manual harvesting of forest products licensed and strictly regulated within designated areas. Park guards responsible for enforcing regulations protecting plants and animals.

In 1990, Forest Department's reserves were distributed in such a way that 50% were located in savanna woodland and forest plantation, 40% in tropical high forest, and 10% in montane catchment areas. From the perspective of biodiversity and eco-tourism, the latter two categories represent a very significant resource. Tropical high forest - and the reserves containing it - is found chiefly in three geographical zones: (1) The eastern rim of the Rift Valley escarpment in western Uganda, (2) a broad zone round the north-western shores of Lake Victoria, and (3) on

scattered mountains in the north and east of Uganda. In addition to the Forest Department's reserves, there are about 2,000 km<sup>2</sup> of private forests and an unknown -albeit small - area of residual forest on public land. It has been estimated that only about half of the forestry land essentially remains undisturbed, ie. with a good forest cover (WCMC, 1992).

*Transitional Period 1990-98*

The Forest Department has, in recent years, increasingly focused its activities on sustainable management of forest resources and forest conservation.

Between 1991-93, the status of 14 of the larger forest reserves was altered to National Park or they were included in existing National Parks. With the change in status, management of these areas was handed over to Uganda National Parks (now UWA), and no less than six of the ten National Parks now in Uganda are former Forest Reserves. At present, 1.21 million ha remain under the Forest Department management, scattered over a total of 719 forest reserves (Table 3.17). The 46 reserves larger than 5,000 hectares cover a total area of about 788,000 ha or almost 2/3's of the Forest Department's forest reserve network. Of the remainder, 106 forest reserves are 10 ha or smaller, 163 are in the range of 101-1,000 ha, and 100 are in the 1,001-5,000 ha range (Table 3.18).

**Table 3.17: Forest Reserve Size and Numbers**

Size class (hectares)	<11	11-100	101-1000	1001-5000	>5000
Number of reserves per class	106	163	304	100	46

**Table 3.18: Forest Reserves Larger Than 5,000 Hectares**

Serial Forest Department	No.	Forest reserve	District	Area (ha)
AP33		Maruzi	Apac	6,118
AR26		Mt. Kei	Arua	40,689
BS06		North Maramagambo	Bushenyi	29,127
GL11		Kitak	Gulu	10,205
GL22		Wiceri	Gulu	6,470
IG18		South Busoga	Iganga	16,382
KA15		Kitechura	Kabarole	5,317
KG02		Achwa River	Kitgum	8,459
KG04		Agoro-agu	Kitgum	26,508
KG18		Nyangea-Napore	Kitgum	14,066
KG19		Ogili	Kitgum	5,348
KG28		Rom	Kitgum	10,904
KI03		Kagombe	Kibale	11,331
KO06		Kikonda	Kiboga	12,186
KO11		Taala	Kiboga	9,150
KT01		Akur	Kotido	6,434
KT02		Alerek	Kotido	7,433
KT05		Kano	Kotido	8,293
KT09		Lwala	Kotido	5,884
KT10		Morongole	Kotido	15,063
KT11		Nangolibwel	Kotido	20,210
KT13		Nyangea-Napore	Kotido	27,677
KT15		Timu	Kotido	11,751
KT16		Zulia	Kotido	102,893
LU03		Kabwika-Majwalanganda	Luwero	8,285
LU06		Kamusenene	Luwero	6,177
LU07		Kapimpini	Luwero	6,202
LU08		Kasagala	Luwero	10,298
MD08		Kasana-Kasambya	Mubende	5,141
MK03		Buyaga Dam	Masaka	14,192
MK07		Kazooba	Masaka	7,423
MK20		Mujuzi	Masaka	6,079
MN33		Mabira	Mukono	29,964
MP49		Nsowe	Mpigi	5,097
MR01		Kadam	Moroto	39,917
MR02		Moroto	Moroto	48,210
MR03		Napak	Moroto	20,316
MS01		Budongo (part)	Masindi	81,893
MS06		Kibeka	Masindi	9,570
MY04		Era	Moyo	7,389
MY08		Otzi (East)	Moyo	18,757
MY11		Zoka	Moyo	6,089
NT02		Rwoho (part)	Ntungamo	6,673
RA09		Kyalwamuka	Rakai	6,527
RA11		Malabigambo	Rakai	11,173
RU13		South Maramagambo	Rukungiri	15,175
<b>TOTAL</b>				<b>788,445</b>

In principle, NEMA plays a co-ordinating role in the management of Uganda's forest resources, as is described in the National Environment Statute (1995), Section 46:

*(1) The Authority <ie. NEMA> shall, in consultation with the Lead Agency <ie. the Forest Department> , issue guidelines and prescribe measures for the management of all forests in Uganda. (2) The guidelines and measures issued or prescribed under subsection (1) shall take into account- (a) forests in protected areas, including forest reserves, national parks and game reserves; (b) forests on lands subject to interests held by private persons. (3) All forests shall be managed in accordance with the principle of sustainable development. (4) The commercial exploitation of any forest shall be carried out in accordance with the principle of optimum sustainable yield as prescribed by paragraph (e) of subsection (1) of section (3). (5) Traditional uses of forests which are indispensable to the local communities and are compatible with the principle of sustainable development shall be protected. (6) Notwithstanding the provisions of subsections (3), (4) and (5), the Authority may, in consultation with the Lead Agency, expressly exclude human activities in any forest area by declaring a forest area a specially protected forest.*

In practice, however, management has largely been left up to the "Lead Agency", ie. the Forest Department, as NEMA does not have the capacity to be actively involved in formulation of guidelines and measures.

#### *Changes in 1998-99*

Until recently, Forest Reserves were classified as Central Forest Reserves, Local Forest Reserves, Village Forests, Nature Reserves and Forest Parks, and all 733 reserves were managed by the Forest Department. Shortcomings of this system were that there was overlap with UWA's mandate for the preservation of biological resources, resources were stretched in order to manage all 733 reserves, and local government had limited access to forest resources, which lead to friction.

The system of forest management is now being entirely overhauled and simplified: management of Nature Reserves and Forest Parks will be handed over to UWA, management of reserves 10 ha or smaller (mostly classified as Village Forests) will be devolved to local authorities and villages, and management of most reserves in the range of 11-100 ha (former Local Forest Reserves) will be handed over to local authorities (pers. comm., Forest Department, 1998). What remains within direct Forest Department jurisdiction are Central Forest Reserves, which will simply be known as Forest Reserves, and under the new system most of these will be subjected to a zoning plan. The changes are summarised in Box 6.

Three zone types are to be recognised under the new system: Core Zones, Buffer Zones and Production Zones. In the Core Zone, allowable activities will be much the same as in the original Nature reserves, but the Buffer Zone is a new category, as in these areas some limited extractive activities will be allowed. Activities in the Production Zone are to be much the same as in the original Central Forest Reserves (CFRs). Not all Forest Reserves will have all three types of zone, but it is expected that all of the larger reserves (ie. >5,000ha) will incorporate all three zones.

Following parallel developments in other ministries (eg. formulation of a Road Agency under the MOWHC), the formation of a semi-autonomous National Forest Authority is currently underway. This will take some time, however, and actual formation probably will not occur until 1999, after formalities and institutional hurdles have been cleared.

**Box 6: Revised Forest Management System**System in early 1990s

1. Central forest reserve
2. Local forest reserve
3. Village reserve
4. Nature reserve
5. Forest park

System as revised in 1998

1. Forest reserves, with zoning plans and 3 zone types:
  - Core Zone ( $\cong$  Nature reserve)
  - Buffer Zone
  - Production Zone
2. Devolved to local forest authorities.
3. Devolved to local authorities & villages.
4. Management handed over to UWA.
5. Management handed over to UWA.

Biodiversity and Forest Reserves

Over the past decade, the Forest Department has increasingly focused its activities on sustainable management of forest resources and forest conservation. Its Nature Conservation Section, supported by GEF/EU funding, carried out biodiversity surveys in 1993-95 in 65 major reserves, with the intention of upgrading some of the best reserves to Strict Nature Reserves (the plan was that 20% of Forest Reserves should be upgraded in this way over the next four years, and that at least 50% of tropical high forest in Forest Reserves should be conserved). The latter has since been overtaken by other events, including the establishment of UWA, restructuring of the Forest Department and the transfer of a number of reserves to UWA. The results of these "Biodiversity Studies in Forest Reserves" was published in 33 volumes in 1996, which are available at the Forest Department headquarters in Kampala (see Annex III). These reports focus almost entirely on biodiversity, dealing with major taxa that are readily identified and have a good indicator value: trees and shrubs, birds, small mammals, butterflies and large moths. These biodiversity reports do not deal with management issues, existing threats and habitat condition, nor do they provide adequate maps, and as such they provide little more information than that of the area's species diversity. An overview volume providing general conclusions is currently being produced by the Forest Department (1998).

The biodiversity of the Forest Department's larger reserves, as determined by the Forest Department (1998) is indicated in Table 3.19. Note that the total number of species recorded at a particular site is not the most important criterion for determining if a given area is of significance for the preservation of Uganda's biodiversity. Factors such as the occurrence of unique species or vegetation types are deemed to be of greater significance. Mt. Elgon, for instance, does not score very high in terms of overall biodiversity (ie. it has a moderately high total number of species), but it scores high in overall biodiversity because it harbours a large number of endemic and restricted-range species (Davenport *et al.*, 1996).

Table 3.19 lists eight Prime Areas (Budongo, Bwindi, Kibale, Mt. Elgon, Mt. Moroto, Otzi, Rwenzori, Semliki) which in 1993-5 (when the biodiversity studies were carried out) were Uganda's most important forest reserves in terms of biodiversity conservation (Forest Department, 1998). Each of these forest reserves contributes more than 2% of the national protected area species complement, and supports at least one (broadly) endemic species. In addition, most of these Prime Areas also have more than 1% of species within one taxon unique to that particular forest. Since these biodiversity studies were carried out, however, Bwindi,

Kibale, Mt. Elgon, Rwenzori and Semliki, have been handed over to UWA and are now part of UWA's Protected Area system.

Table 3.19 further lists a total of 11 Core Areas and 25 Secondary Areas, which are regarded as 'highly important' and 'important', respectively, for the conservation of species diversity in Uganda's forests. The remaining reserves are deemed to be of little significance in terms of biodiversity, although they may of course be important for other reasons.

Table 3.19: Biodiversity of the Forest Department's More Important Reserves

Forest Reserve	Area km <sup>2</sup>	Reserve suitability <sup>3</sup>	Biodiversity score <sup>2</sup>	Biodiversity criteria <sup>1</sup>						
				1	2	3	4	5	6	
<b>Prime areas</b>										
Budongo	825	**	15.4	+	+				+	
Bwindi #	321	**	high	+	+				+	
Kibale #	558	**	moderate	+					+	
Mt. Elgon #	1192	**	moderate	+	+				+	
Mt. Moroto	483	***	14.7	+	+				+	+
Otzi	188	***	14.1	+					+	
Rwenzori #	996	***	high	+	+				+	
Semliki #	219	***	high	+	+				+	
<b>Core areas</b>										
Bugoma	401	**	14.1			+				
Echuya	35	*	14.3			+			+	
Era	74	***	13.4		+	+			+	
Kalinzu M.	584	*	14.7		+	+			+	
Kasyoha-K	390	**	15.6		+	+			+	+
Labwor Hills	437	***	12.8			+			+	+
Mabira	300	*	13.0			+			+	+
Mt. Kei	384	**	13.2		+	+			+	+
Nyangea-N	417	***	13.4			+			+	
Sango Bay	151	**	13.9		+	+			+	+
Sesse Islands	43	**	11.5		+	+			+	+
<b>Secondary areas</b>										
Agoro-Agu	235	***	12.8					+	+	
Igwe-Luvunya	20	*	12.2						+	
Itwara	86	**	11.4						+	
Jubiya	36	**	12.4						+	
Kasagala	103	***	12.0						+	+
Kazooba	74	**	11.1							+
Kijanabolola	65	**	11.0						+	
Kitechura	53	**	11.9							+
Kyambogo	89	**	low							+
Lokung	13	**	10.6						+	
Lwala	59	***	12.1						+	
Mafuga	38	*	13.4						+	
Morongole	151	***	13.2					+	+	
Mpigi	261	*	13.5						+	
Mt. Kadam	399	***	14.1						+	+
Mt. Napak	203	***	13.2						+	+
Ogili	53	***	13.1							+
Rom	109	***	12.2						+	
Rwoho	90	**	12.0						+	
S. Busoga	163	***	12.5						+	+
Taala	92	*	10.6							+
Timu	118	***	12.1					+	+	
Wabisi-Wajala	87	**	10.8							+
West Bugwe	30	*	13.6						+	
Zulia	1026	***	moderate-low							+

Source: adapted from the Forest Department, 1998

# These reserves have now become part of UWA's PA system.

### Notes on Table 3.19

#### 1. Biodiversity criteria

- a) Site contributes >2% of national PA system species complement
- b) Within any taxon >1% of species unique to forest
- c) Site contributes 1-2% of national PA system complement
- d) Within any taxon 0.5-1% of species unique to forest
- e) Site supports at least one unique species of conservation significance (ie. broadly endemic)
- f) Site supports vegetation type not otherwise represented in PA system

2. **Biodiversity score: this is on a scale of 1-20.** This is based on total number of species.

3. **Reserve suitability.** This is determined by a combination of biodiversity importance, multiple-use, timber production and community use.

### EIA and Forest Reserves

It is a legal requirement that EIAs are to be conducted for any significant development occurring in or adjacent a gazetted Forest Reserve, but up to now sector-specific guidelines have not been developed. All projects targeted by the FRSP - including pavement strengthening and upgrading of roads from murrum to paved - that pass through or immediately adjacent Forest Reserves, will require full EIAs.

Road projects carried out on roads that pass through (or immediately adjacent) any of the prime, core or secondary forest reserves (listed in Table 3.20), will have to take into account the importance of the forest reserve for biodiversity, and invest significantly in mitigation measures. Table 3.20 summarises the nine reserves likely to be affected by FRSP. Note that the status of five of these nine reserves has in the meantime been altered to that of National Park.

EIA procedures within the Forest Department are such that, when EIA reports are submitted to the Forest Department Commissioner, copies are distributed to a number of senior officers, either in the Forest Management Section or the Forest Conservation Section. These officers, who have an MSc level education and are supervised by an Assistant Commissioner, are generally quite capable of handling and evaluating most of the submitted EIAs. A recommendation based on their findings is usually conclusive for determining the Forest Department's stance on a particular EIA.

**Table 3.20: Important Forest Reserves Possibly Affected by FRSP**

No.	Forest Reserve	Road Section	Reason
1	Mt. Elgon (now a National Park)	Sironko - Kapchorwa	passes close to NP
2	West Bugwe	Muwayo-Tororo	passes through FR
3	Igwe-Luvunya	Bugiri-Muwayo	runs along FR
4	Echuya	Kabale-Kisoro	runs though FR
5	Kalindu-Maramagambo (now part of National Park)	Bushenyi-Kasese	runs though NP
6	Kasyoha-Kitomi (now part of National Park)	Bushenyi-Kasese	runs close to this part of the NP
7	Rwenzori (now a National Park)	Fort Portal-Bundibugyo	runs through NP
8	Semliki (now a National Park)	Fort Portal-Bundibugyo	runs through NP
9	Kitechura	Kyenjojo-Mubende	runs though FR

### 3.8.3 Wetlands

#### Brief Description of Wetlands in Uganda

According to the Ugandan National Wetlands Conservation and Management Programme (NWCMP) wetlands are defined as "*an area that stays wet long enough for only certain plants and animals to grow, even when there is no rain*", and includes papyrus swamps, swamp forests, riverine wetlands, lake edge, floodplains, damboos and artificial wetlands. The Ramsar Convention on the other hand, uses a much broader definition of wetlands, which are defined as "*areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or saline, including areas of marine water, the depth of which at low tide does not exceed six metres*". Under the Ramsar definition, wetlands may include riparian and coastal zones adjacent to the wetlands, lakes, and certain small island ecosystems.

If the NWCMP definition is used, wetlands in Uganda extend over 21,000-31,000 km<sup>2</sup>, or somewhere in the range of 9-12 % of the country's total area, depending on the source of the information (Table 3.21). If the Ramsar definition is used, which includes open inland waters, Uganda's wetlands extend over 18-24 % of the country's total area.

**Table 3.21: Wetland Area**

Wetland definition	Total area (km <sup>2</sup> )	Percentage cover	Reference
NWCMP <sup>1</sup>	21,341	8.9	NWCMP
	23,000	9.6	Min. Natural Resources, in NEMA (1996)
	29,000	12.1	Omoding <i>et al.</i> (1996)
	29,589	12.3	Langdale-Brown <i>et al.</i> (1964)
	30,105	12.5	National Biomass Study (1996)
Ramsar <sup>2</sup>	43,000	17.9	Hughes & Hughes (1992)
	57,900	24.1	Ramsar Convention, 1971

#### Notes:

1. According to the National Wetlands Conservation and Management Programme (NWCMP) wetlands are defined as "*an area that stays wet long enough for only certain plants and animals to grow, even when there is no rain*", and includes papyrus swamps, swamp forests, riverine wetlands, lake edge, floodplains, damboos and artificial wetlands.
2. According to the Ramsar Convention, wetlands are defined as "*areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or saline, including areas of marine water, the depth of which at low tide does not exceed six metres*". Furthermore, wetlands may include riparian and coastal zones adjacent to the wetlands, lakes, and small island ecosystems.

As a contribution to the National Wetlands Conservation and Management Programme, a National Wetlands Inventory was carried out between October, 1993 and December 1995 (Omoding *et al.*, 1996). In all, 62 wetland sites were surveyed, but a number of wetlands assumed to be of conservation importance could not be visited because of insecurity or inaccessibility, and survey coverage is therefore assumed to be incomplete. The inventory led to the classification of twelve major wetland categories (ie. main types of wetlands; Table 3.22), and yielded important information on the distribution of rare and endangered species. It also resulted in the main indicator species for the twelve major wetland types.

The main wetlands in Uganda, based on Hughes and Hughes (1992) and Denny (1993) are:

- the Western Rift Valley lakes and the swamps along their margins: L. George, L. Edward and L. Albert;
- the very extensive papyrus and *Miscanthidium* swamps of Lake Kyoga and Lake Victoria;
- riverine swamps and floodplains of the Nile headwaters;
- the Kafu River swamps and floodplain;
- the Okere River swamps and floodplain;
- Lake Bisina and Lake Opeta with their associated papyrus and *Miscanthidium* dominated swamps;
- high altitude valley lakes and associated swamps (Lake Bunyonyi, L. Mutanda, L. Mullehe); and
- high altitude *Sphagnum* bogs and moors scattered throughout all montane regions of Uganda.

Table 3.22: Wetland Types in Uganda

A.	Freshwater emergent Reed swamps typically dominated by a single reed species: i) Papyrus swamps, associated with <i>Leersia hexandra</i> , <i>Ipomoea rubens</i> , <i>Polygonum</i> spp. etc. ii) <i>Miscanthidium</i> swamps iii) <i>Typha</i> swamps iv) <i>Vossia</i> , associated with <i>Cyperus mundii</i> , etc.. v) <i>Cladium</i> swamps, associated with <i>Hydrocotyle</i> , <i>Myrica</i> , <i>Rubus</i>
B.	Freshwater floating leafed but rooted vegetation communities dominated by: i) <i>Nymphaea</i> spp., with <i>Wisneria</i> , <i>Pistia</i> , <i>Lemna</i> , <i>Azolla</i> , <i>Trapa</i> ii) <i>Potamogeton</i> spp., with <i>Ceratophyllum</i> , <i>Lemna</i> iii) <i>Trapa natans</i>
C.	Freshwater submerged rooted macrophytes dominated by: i) <i>Ceratophyllum</i> in association with <i>Lagarosiphon</i> and/or <i>Hydrilla</i> with <i>Nitella</i> spp. ii) <i>Ottelia</i> in association with <i>Najas</i> spp. iii) <i>Najas</i> in association with <i>Potamogeton</i> spp.
D.	Freshwater submerged not rooted macrophyte communities may have <i>Ceratophyllum</i> and <i>Lemna trisulca</i> forming separate stand.
E.	The surface floating vegetation communities found associated with plants that grow at the open water swamp interface, since their distribution is dependent on wind and water movements.
F.	Flood plain herbaceous wetlands; very variable, but usually dominated by monocots: i) <i>Echinochloa</i> - <i>Panicum repens</i> - <i>Cynodon</i> swamps, with <i>Fimbristylis</i> and <i>Vossia</i> ii) <i>Loudetia</i> - <i>Cynodon</i> - <i>Setaria</i> swamps, with <i>Scleria</i> , <i>Fimbristylis</i> , <i>Cyperus</i> and <i>Fuirena</i> . iii) <i>Cynodon</i> - <i>Setaria</i> - <i>Hyparrhenia</i> - <i>Brachiaria</i> swamps, associated with <i>Panicum repens</i> iv) <i>Cyperus</i> spp. - <i>Leersia hexandra</i> swamps v) <i>Oryza</i> (wild rice) swamps, or man-made <i>Oryza sativa</i> swamps
G.	<i>Acacia</i> - <i>Hyparrhenia</i> dominated seasonally flooded wooded grasslands, associated with <i>Setaria</i> spp., <i>Pillio stigma thonningii</i> and <i>Zizyphus mauritiana</i>
H.	Palustrine swamp forests. Mixed species, usually with <i>Phoenix reclinata</i> and <i>Raphia</i> palms occurring in the wettest areas, and commonly with <i>Rauvolfia</i> , <i>Diospyros</i> and <i>Voacanga</i> .
I.	Characteristic flora of riverine forests.
J.	Montane wetlands, commonly associated with: i) <i>Sphagnum</i> spp., with other <i>Byophyta</i> such as <i>Brachythecium</i> , <i>Senecio</i> , <i>Helichrysum</i> , <i>Lobelia</i> , <i>Luzula</i> , and <i>Hypericum</i> ii) <i>Carex</i> sp., associated with <i>Alchemilla</i> , <i>Helichrysum</i> , <i>Luzula</i> , <i>Agrostis</i> and <i>Cyperus nigricans</i>
K.	Permanent saline wetlands, with <i>Cyperus laevigatus</i> pure stands and some <i>Sporobolus spicatus</i>
L.	Saline habitats over wide salinity range, with <i>Sporobolus spicatus</i> in the most saline areas, <i>S. robustus</i> in a moderately saline range, and <i>S. pyramidalis</i> in mildly saline areas.

Source: adapted from Ormoding *et al.* (1996)

### Wetland Protection

Wetlands in Uganda are provided with a 'blanket' protection under the National Environment Statute(1995), of which Section 37 reads:

*No person shall a) reclaim or drain any wetland; b) erect, construct, place, alter, extend, remove or demolish any structure that is fixed in, on, under or over any wetland; c) disturb any wetland by drilling or tunnelling in a manner that has or is likely to have an adverse effect on the wetland; d) deposit in, on or under any wetland any substance in a manner that has or is likely to have an adverse effect on the wetland; e) destroy, damage or disturb any wetland in a manner that has or is likely to have an adverse effect on any plant or animal or its habitat; f) introduce or plant any exotic or introduced plant or animal in a wetland, unless he has written approval from the Authority <ie. NEMA> given in consultation with the Lead Agency.*

This legislation on wetlands further states that any proposed development activity in wetlands larger than 0.25 ha require a full EIA.

In spite of recommendations made more than 10 years ago that wetlands should be better represented in the Protected Area System (MacKinnon & MacKinnon, 1987), only some 2% of the country's wetlands occur within UWAs PA System and the Forest Department's Forest Reserves. The view held by some conservationists in Uganda is that threats to wetlands are limited and that the current legislation affords ample protection. Formal inclusion of wetlands in the Protected Area is therefore not considered a high priority in some circles.

What may also have contributed to a lack of formal protection of wetlands is the ambiguous wording of the National Wetland Policy (Ministry of Natural Resources, 1995). This policy specifically states in article 7.4 on the Conservation of Wetlands that the "*Government will establish fully "Protected Wetlands Areas" of important biological diversity*". Part of the difficulty in achieving this is that "Protected Wetlands Areas" appear to be a new class of protected area, that does not occur in the existing UWA Protected Area System. The question then becomes: which governmental or semi-autonomous body is then qualified to manage formally protected wetlands ?

While the various debates are still ongoing, it is obvious that reclamation and encroachment of wetlands is occurring throughout the country. Data from the National Biomass Study (in NEMA, 1996) shows that on average 7.9% of Uganda's wetlands had been converted to other land uses. This figure does not seem alarming, but it must be pointed out that in many districts this percentage is much higher: in Jinja it is 76%, Kisoro 67%, Kabale 58%, Iganga 49%, Tororo 48%, Pallisa 36%, Rukungiri 31%, Kamuli 29%, Kampala 25% and Mbale 19%. In addition, not all wetlands are equally affected. In Pallisa District, for instance, while 36% of all wetlands had been converted (mainly for agricultural purposes such as rice cultivation), 68% of the seasonal wetlands had been reclaimed, compared to only 0.7% of the permanent wetlands (NEMA (1997). The main pressures behind conversion are increase in rice growing, ease of draining seasonal wetlands, dry season grazing, subsistence hunting and harvesting of vegetation (eg. papyrus used for mats and baskets). It must also be pointed out that the remote sensing imagery use by the National Biomass Study dated from 1989-1992, and some of the aforementioned wetland conversion percentages are therefore almost ten years old. Recent surveys by this study team in Pallisa District shows that conversion to rice fields is ongoing.

The lack of formal gazettal of important wetlands was also one of the criticisms reported in the recent external review of the Uganda National Wetlands Conservation and Management Programme, carried out in August 1998 (ARCADIS-Euroconsult, 1998).

### Proposed Wetland Protection

As mentioned under Section 3.8.1, Lake Nabugabo, Lake Bisina, Lake Munyanyange, Lake Katwe, Lake Mutanda, Lake Kachera, Lutembe Bay, Muchoya swamp, Kitange swamp and River Ssezibwa were prioritised to be included in a network of protected areas (Omoding *et al.*, 1996). These wetlands were selected based on their ecological characteristics, their biogeographical location, their location within the nation's eight drainage basins and their relative pristine conditions. Not all wetlands could be covered by the inventory due to problems of accessibility, insurgent activities and logistical constraints. In its current third phase, NWCMP has developed and operationalised criteria for selecting wetlands that should be gazetted. These criteria are currently being used by the various district inventory teams and could result in the identification of additional sites in need of protection.

Habitats that are not sufficiently included in the existing Protected Area System, which UWA aims to incorporate in the near future, include upland wetlands, montane wetlands, and seasonal wetlands. Areas specifically targeted by UWA include wetlands around Lake Kyoga (especially the area around lakes Bisina and Opeta), Kafu basin in western Uganda, the Semliki Flats, and wetlands in the area around Lake Victoria. IUCN has drafted criteria for the selection of at least three wetland sites for inclusion in the PA System, namely Nakivubo<sup>69</sup> (located four km southeast of Kampala), Lake Nabugabo (a lake on the western shores of Lake Victoria, separated from the latter by a narrow barrier) and Lake Bisina<sup>70</sup>.

### Ramsar Convention

In 1988, the GOU acceded to (but has not ratified) the Convention on Wetlands of International Importance especially as Waterfowl Habitat (commonly known as the Ramsar Convention, from its place of adoption by Contracting Parties in 1971). This convention is an intergovernmental treaty which provides for international co-operation for the conservation and wise use of wetlands. One of the obligations under the Ramsar Convention by member states is to designate wetlands of international importance for inclusion on the list of Ramsar sites. Uganda designated Lake George on the so-called "Ramsar list" on the basis of its international importance, in terms of ecological, botanical, limnological or hydrological values. Proposals are underway for three additional Ramsar sites, namely Lake Nabugabo, the Nakivubo swamps and possibly Lake Bisina.

Under the Convention, member states (Contracting Parties) are also obliged to develop a national wetland policy and to include wetland conservation and wise use considerations within their national land use planning. The Contracting Parties meet every three years to discuss national experiences and review the status of sites. Uganda developed a National Wetland Policy in 1995 (Ministry of Natural Resources, 1995), and wetland issues are incorporated in the National Environmental Action Plan (NEAP; Ministry of Natural Resources, 1994). In addition, a management plan has been drafted for Lake George, and GOU has recently hosted the Pan-African Regional Ramsar Meeting (July 1998).

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<sup>69</sup> Nakivubo wetland is a 600 ha swamp located 4 km south-east of Kampala city. It is of vital importance to the city, as effluents from the city's ineffective Bugolobi Sewage Treatment Plant are effectively cleansed by this wetland ecosystem. Loss of this wetland would lead to discharge of unacceptably polluted effluents into Lake Victoria, and may eventually percolate into the area's groundwater.

<sup>70</sup> These three sites are also likely to be nominated as Ramsar Sites, ie. Wetlands of International Importance, under the Ramsar Convention (see Section 3.8.3).

### FRSP and Wetlands

Under the existing environmental legislation, all road projects under FRSP will require full EIAs for elements that pass through wetlands larger in area than 0.25 ha. In practice this means that EIAs will have to be carried out on most road sections falling under the FRSP, as wetlands are common throughout the country. As no new roads are to be constructed under the FRSP except for the Kampala by-pass and perhaps a few realignments, impacts on wetlands are expected to be limited, if proper precautions and adequate mitigation measures are taken. Potential risks include enhanced erosion and siltation, oil and lubricant spillage, increased runoff, loss of vegetation, poaching and fuel gathering by construction teams, and changes of hydrology. It is possible that in some areas the hydrology might actually be restored to a condition that is closer to what it was formerly, before construction of the initial road. This is likely to be the case in areas where flooding of roads is currently a problem because of insufficient cross-drainage, for example on the Pallisa-Tirinyi Road, and the Pallisa-Mbale Road.

### **3.8.4 Cultural & Historical sites**

#### Antiquities & Museums Department's Network

The Department of Tourism, Wildlife and Antiquities (DTWA - formerly the Antiquities and Museums Department), which is responsible for nearly 200 cultural and historic sites scattered throughout the country, resides under the Ministry of Tourism, Trade and Industry (MOTTI)<sup>71</sup>. This will soon change, as a semi-autonomous body, the National Heritage Council, is currently being established. This council will be answerable to MOTTI, but presided over by a Board of Trustees and an Executive Director. DTWA has received two years of grant funds from the World Bank's Institutional Development Facility for this restructuring exercise. After this, provisions have been made to receive funds for further development out of the Protected Area Management and Sustainable Development project, Phase II (PAMSU II), which will also be used for further development of UWA's PA system. The proposal for a World Bank loan to fund PAMSU II has been submitted to Parliament for approval, but the outcome is likely to be positive.

The National Environment Statute (1995) specifies that NEMA has a co-ordinating role in identifying and managing Uganda's cultural heritage. Section 50 states:

*(1) The Authority <ie. NEMA> shall, with the assistance of Local Environment Committees, District Environment Committees and the Lead Agency <ie. DTWA> identify those elements, objects and sites in the natural environment which are of cultural importance to the various peoples of Uganda; (2) The Authority shall in such manner as may be prescribed, maintain a register of all elements, objects and sites identified under (1); (3) The Authority shall, in consultation with the Lead Agency, issue guidelines and prescribe measures for the management or protection of cultural elements, objects and sites registered under this subsection.*

In practice, however, NEMA has not been able to carry out this role, which has largely been left up to an under-funded DTWA.

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<sup>71</sup> Formerly DTWA was located within the Ministry of Tourism, Trade and Antiquities.

The location of some 100 of the almost 200 known archaeological and historic sites is indicated in Map 11, and about 141 sites are listed in Table 3.23. Because of the lack of systematic surveying and complete coverage, there can be little doubt that numerous other sites await discovery. The known sites comprise approximately:

- 5 Miocene fossil sites
- 6 Pleistocene fossil sites
- 12 Early Stone Age sites, c. 50,000 B.C.
- 18 Middle to Late Stone Age sites, c. 50,000 B.C. - A.D. 1,000.
- 11 Rock-art and rock-gong sites, c. A.D. 500-1750
- 13 Iron age sites, c. up to A.D. 1,000
- 50 Archaeological (post 1500 AD) sites (earthworks, Royal Tombs, Royal Enclosures)
- 8 historical sites
- 11 Forts prior to 1890
- 45 Forts dating from 1890 - 1905

The best known and most accessible of established sites are the Royal Tombs at Kasubi (administered by the National Museum on behalf of the Uganda Government), the Bigo mounds and trenches (on the Katonga River north-west of Masaka), the mound complex at Ntusi (close to Bigo) and the rock-art centred on Nyero (between Mbale and Soroti). Two of the most spectacular prehistoric sites are rock shelters on Lolui Island and at Semwema. There are numerous sites, notably the Royal Tombs, Stone Age and Iron Age and historical sites close to Kampala. There are several sites within or close to the Murchison Falls National Park, numerous Stone Age and early Iron Age sites within and close to the Rwenzori National Park (also open exposures of Pleistocene fossils) and a locus of Stone Age, Iron Age and pre-colonial earthworks (Royal Enclosures) close to the Lake Mburo National Park.

Provision exists in DTWA for Antiquities Assistants (ie. caretakers) to administer, protect and maintain the following sites - Nyero Rock paintings, Mursa earthworks, Nakaima's shrine (Mubende), Wamala, Mparo and Karambi Tombs, and Samuel Baker's Fort at Patiko. In practice, however, some of these sites have been neglected due to shortage of funds, or, in the case of Nyero, also because of the insurgency problem in the 1980s.

Only seven of these 200 sites have officially been gazetted for protection, namely the Nyero Rock Paintings, Patiko Fort, Mursa Archaeological site, Mwendu Hill Archaeological site, Bigo Archaeological site, Ntusi Archaeological site, and Bureyorere Traditional site (a palace). In addition, two sites have been recommended for gazettal, namely Napak Paleontological site (with Miocene fossils), and Moroto Paleontological site (also with Miocene fossils). A number of smaller sites have been de-gazetted in recent years, along with three major sites that have been returned to local government for management, namely the Kasubi Tombs at Kampala, Mbaro Tombs at Hoima, and Karambe Tombs at Fort Portal.





Table 3.23 (cont): Cultural and Historical Sites

#	Site	District	Types of cultural & historical site*												
			1	2	3	4	5	6	7	8	9	10	11	12	
89	20 km E Bullisa	Masindi			+										
90	Nabumali	Mbale													+
91	Walisi Hills	Mbale				+									
92	Bweyorere	Mbarara			+	+									
93	Kabingu	Mbarara			+										
94	Mbarara	Mbarara				+									
95	Oruchinga Valley	Mbarara		+	+	+									
96	Loteteleit	Moroto						+							
97	Magosi	Moroto				+									
98	Moroto	Moroto				+									
99	Nakiloro	Moroto	+												
100	Napak	Moroto	+												
101	Bora	Moyo													+
102	Dufile	Moyo													+
103	Faloro	Moyo										+			
104	Entebbe	Mpigi				+		+							
105	Kibibi	Mpigi										+			
106	numerous	Mpigi										+			
107	Fort Raymond	Mubende													+
108	Masaka Hill	Mubende								+					+
109	Mubende Hill	Mubende								+					
110	Tanda Pits	Mubende							+						
111	Bugoia Island	Mukono			+										
112	Bugungu	Mukono			+										
113	Buvuma Island	Mukono			+										
114	Galiraya	Mukono													+
115	Moniko	Mukono						+							
116	Nakawungu	Mukono				+									
117	Uronganyani	Mukono										+			
118	Pacego	Nebbi		+											
119	Wadelai	Nebbi												+	
120	Budaka	Pallisa													+
121	Gogonya	Pallisa													+
122	Kakoro	Pallisa						+							
123	Bijja	Rakai													+
124	Kabusameru	Rakai													+
125	Kakuuto	Rakai													+
126	Kasambia	Rakai													+
127	Sango Hills	Rakai				+									
128	Akisim	Soroti	+												
129	Asuret	Soroti						+							
130	Bululu	Soroti													+
131	Onyeri	Soroti						+							

\* Types of cultural & historical sites:

**Paleontological**

1. Principal Miocene fossil localities
2. Principal Pleistocene fossil localities

**Archaeological (prehistory)**

3. Early Stone Age site, c. 50,000 BC
4. Middle & Late Stone Age site, c. 50,000 BC - AD 1,000

**Certain cave sites at time transgressing into Iron Age**

5. Rock paintings, engravings & gongs, c. AD 500-1750
6. Early Iron Age sites, ? up to AD 1,000

**Archaeological (ethno-historic)**

7. Earthworks, etc..
8. Royal Tombs (Buganda & Bunyoro only)
9. Royal Enclosures

**Historical sites**

10. Historical sites
11. Forts prior to 1890
12. Forts from 1890-1905

Key to Map 11

Number	Name	Number	Name	Number	Name
1	Nakiloro	35	Ntusi	69	Mukongoro
2	Bukwa	36	Masaka Hill	70	Bululu
3	Akisim	37	Kibengo	71	St. Stanley
4	Napak	38	Munsa za Kateboha	72	Kagaa
5	Nyabusosi	39	Kigezi	73	Bijje
6	Pacego	40	Kasongo	74	Budaka
7	Magungo	41	Kampala	75	Nabumali
8	Sango Hills	42	Kakumiro	76	Ft. Briggs
9	Bugungu	43	Magungo	77	Ft. Thruston
10	Karugutu	44	Fajuli	78	Katuba
11	Butare	45	Uronganyani	79	Buinja
12	Kasese	46	Faloro	80	Ft. Barranwa
13	Katunguru	47	Faguli	81	Galiraya
14	Nakawungu	48	Luba's	82	Gogonyo
15	Bweyore	49	Wakoli's	83	Fajao
16	No name	50	Baker's View	84	Kasambia
17	Walasi hills	51	Masaka	85	Kakuuto
18	Kagadi	52	Masaka	86	E. Wadelai
19	Akokoro	53	Kisindizi	87	Burusana
20	Magosi	54	Kisindizi	88	Ft. Wavertree
21	Loteteleit	55	Dufile	89	Ft. Gerry
22	Onyeri	56	Farajok	90	Ft. Edward
23	Moniko	57	Bora	91	Ft. George
24	Kibiro	58	Wadelai	92	Ft. Grant
25	Kakoro	59	Fadibek	93	Karambi
26	Lwentale	60	Fabbo	94	Kabagambe
27	Asuret	61	Fatiko	95	Ft. Raymond
28	Nyero	62	FT. Lugard	96	Oruchinga Valley
29	Toror Hills	63	FT. Kaduma	97	Kiwara peats
30	Luzira	64	Ft. Kivari	98	Entebbe
31	Tanda Pits	65	Ft. Grant	99	Londu
32	Mubende Hill	66	Koki	100	Ibuje
33	Kibale	67	Kisalizi	101	Foda
34	Ensa-za Katebwoha	68	Kitanwa		



### Effect of the FRSP on Cultural and Historical Sites

In general, DTWA does not expect the FRSP to have negative repercussions on Uganda's archaeological and historical sites, as (apart from the Kampala Bypass) no new roads are expected to be constructed. Also, none of the roads targeted by the FRSP pass precariously close to any of the known sites.

Feeder roads are currently being constructed in Murchison Falls NP and Queen Elizabeth NP, and DTWA have been consulted to provide information and expertise. In Murchison Fall NP, a DTWA team located several archaeological sites near the proposed alignment, which illustrates the need for DTWA involvement. In the past DTWA was not always consulted, which lead to the loss of important artefacts and remains in at least several sites. In general, the Commissioner of DTWA expects FRSP to contribute in a positive way, by making archaeological and historical sites more accessible for both domestic and foreign tourists, which will eventually translate into more revenue for the organisation.

### **3.8.5 Protected Areas and Roads: General Considerations**

In Sections 3.8.1 to 3.8.4, the implications of UWA's protected areas, forests, wetlands and cultural and historic sites have been discussed. In this section some general considerations to be taken into account during the planning and design stages are put forward.

#### Planning stage

- new roads or realignments should not be made to pass through protected areas.

#### Design stage

- provision should be made for behaviour modifiers to regulate speed;
- provision should be made for traffic signs forbidding vehicles to stop in these areas, and warning of the likely presence of animals on the road;
- barriers and parking bays should be located at the beginning and end of these areas to enable inspection of vehicle contents.

## **3.9 Demography and Ethnic Distribution**

Road Sector development is a multi-dimensional concept that encompasses not only the economic and social aspects of national activity, but also those related to population and the use and management of environmental resources (SOER, 1996). The challenge for the FRSP is to ensure that communities avoid situations where severe stress is put on them and the environment due to road sector development activities.

### **3.9.1 Demography**

#### Population

By 1996, Uganda's population was estimated at 19.8 million having increased from 16.7 million in 1991. The growth rate by 1991 was estimated at 2.5% per annum. The percentage of women is higher (50.9%) throughout the country with a few districts where men are in the majority (eg.



Kalangala). Of the 19.8 million people, 89% of them are rural while only 11% live in the urban areas. Despite the smaller urban population, most motor vehicles are found in urban areas with the capital city of Kampala accounting for over 50% of the total motor vehicle fleet (Magezi, 1997).

### Population Density

The population density varies from the lowest of 12 people per square kilometre in Moroto (Kotido = 15, Kitgum = 22) to 301 people per square kilometre in Kisoro (Mbale = 284, Kabale = 246). In high population density areas, land value tends to be high making compensation very expensive.

### Urban Population

By definition the 1991 Housing and Population Census defines an urban centre as "any gazetted centre with 1,000 persons or more". The urban population growth rate is quite high with a number of urban centres (eg. Busia, Lira) recording a growth rate of more than 10% per annum. At this rate, it is projected that by 2015, over 26% of the population will live in urban areas. In all urban centres the percentage of women is higher than that of men. The high urban population growth rate means that the design Average Daily Traffic (ADT) for the roads could easily be exceeded in a short period.

### Family Characteristics

Uganda is a patrilineal society whereby over 75% of all households are male headed. There are about 4.8 person per household in the rural areas which drops to 4.2 in the urban areas. Most of the population are young and by 1995, the dependency ratio which is the number of people (young and old) as a percentage of those between 15 and 64 was 122.

Table 3.24 shows selected demographic characteristics, while population densities are depicted in Map 12.

**Table 3.24: Selected Demographic Characteristics**

Indicator	Census Year	
	1980	1991
Population (Millions)	12.64	16.67
Growth rate (% per annum)	2.7	2.5
Sex ratio (males per 100 females)	98.2	96.5
Total fertility rate (per 1000 persons)	7.2	7.1
Urban Population (%)	8.7	11.3
Population Density (p/sq.km)	64.4	85.0
Dependence ratio	100	102

Source: Uganda Demographic and Health Survey, 1995.

### Life Expectancy

Although the global life expectancy is about 65 years, in Uganda it has dropped to about 40.7 years. This is mainly due to high mortality rate among young children as well as the impact of AIDS.

### Major Causes of Diseases and Death

Malaria is responsible for the largest number of under-five in-patient deaths (21.4%), followed by measles (9.9%), diarrhoea (8.2%), pneumonia (7.5%) and AIDS (5.1%). Other diseases include Guinea Worm affecting up to 20% of the population in the North and North East of Uganda, and Acute Respiratory Infections (ARI).

### Per Capita Income

The Human Development Index (UNDP 1997), shows also that the Northern region had the lowest per capita Income at US \$ 185, while Central region (mostly Bantu) had the highest at US \$ 494. This is followed by Western Uganda at US \$ 231 per capita.

### **3.9.2 Ethnic Distribution**

Uganda has over 45 ethnic groups. The 1991 Housing and Population Census lists the major ethnic groups to include the Acholi, Langi, Lugbara and Alur in the Northern region. These are all Nilotic groups.

In the Eastern Region, the significant Ethnic groups include the Basoga, Bagishu, Badama, Bagwere and Banyole. These are Bantu ethnic groups. The biggest ethnic group in Central Region are the Baganda, while the Western Region includes the Batoro, Banyankole, Bakiga and Banyoro. All these are Bantu-speaking ethnic groups.

There are cultural and ethnic differences between a Bantu South and a Nilotic North. The North East is occupied by the Karamojong pastoralists who are Nilo Hamites.

Map 13 shows the distribution of the major ethnic groups in Uganda.

### **3.9.3 Demographic Characteristics for Road Works & Network Planning**

Certain demographic-related data are need to be considered during road works:

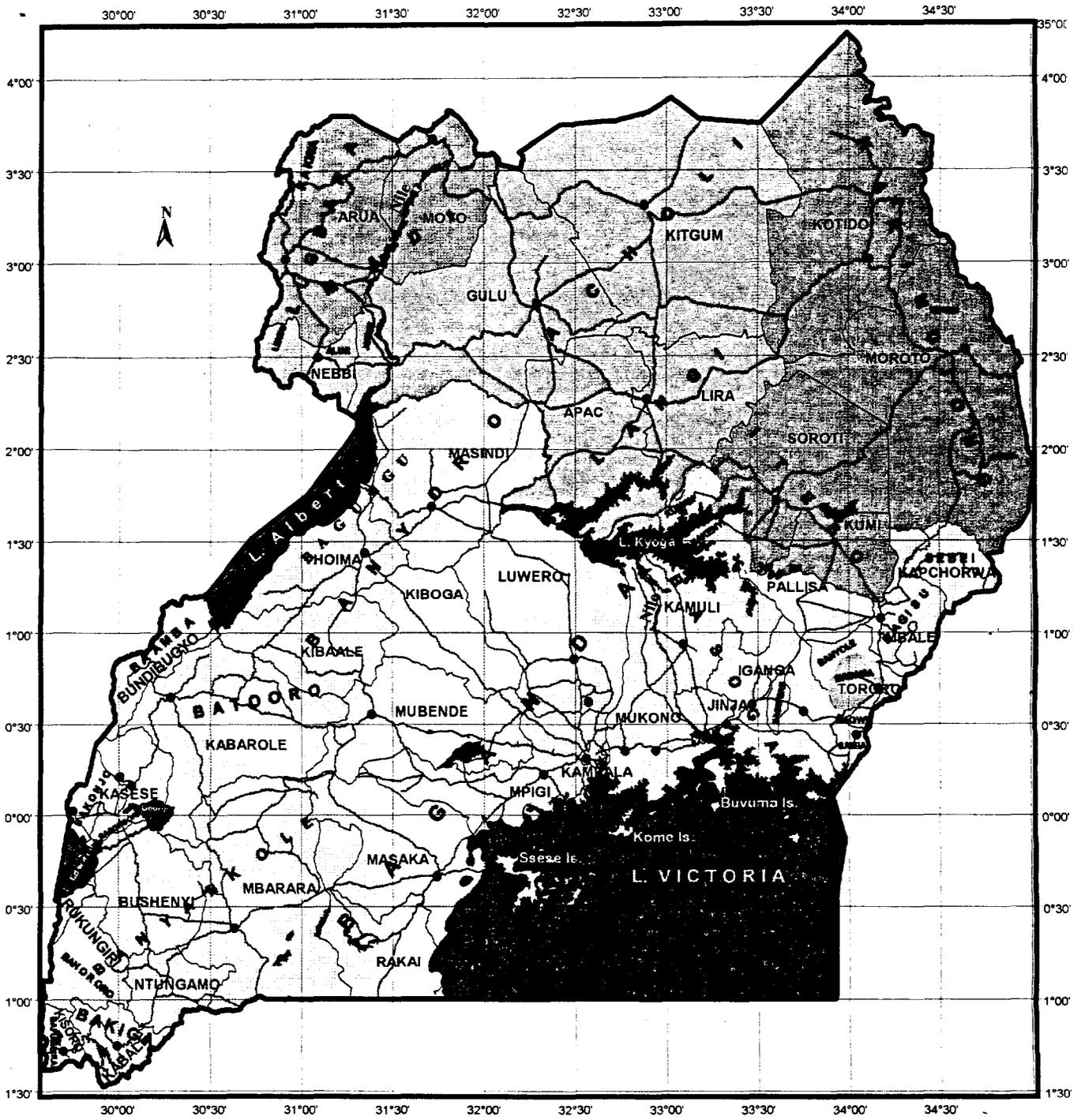
#### Planning stage

- the distance of the centres of population from the road network;
- the volumes of goods moved by current means including headloading, animal transport and by agricultural tractor;
- the volumes of movement by people;
- the opportunity costs of their time and the other costs involved (e.g. the costs of animal transport or of tractors used to transport people);
- the extent of diversion of existing traffic to motor vehicle once the new road is provided.

#### Feasibility stage

- assessment of possible resettlement due to a new road or realignment;
- locations for borrow pits, quarries and contractor's camp should be selected away from settled areas to avoid impacting on the latter negatively;
- rural-urban migration trends to plan for facilities to cater for this

# MAP 13. ETHNIC DISTRIBUTION



**KEY**

PEOPLES	
Bantu	Major town
Nilotic	Water
Nilo-Hamitic	Road
Sudanic	District Boundary
	International Boundary

Source of data: NBS and Dept.

Produced by RS & GIS Lab

- road side interviews ( during traffic survey) are done to sample of vehicles to determine their type, start and end points of their journey. trip purpose, the number of passengers and commodity carried.

#### Design stage

- for geometric design and evaluation of economic benefits, the volume and composition of current and future traffic needs to be known in terms of cars, light goods vehicles, trucks, buses, non-motorised vehicles, etc;
- for structural design purposes of paved roads the number and axle loading of heavier vehicles need to be considered;
- cross-section parameters are related to traffic flows of all types ie. vehicular, pedestrians and non-motorised. Cost effective ways of segregating non-motorised traffic and of providing special crossing facilities are thought of at the earliest stage in the design process.

### **3.10 Environmentally Sensitive Areas**

Environmentally sensitive areas can be defined as areas that are particularly sensitive to development pressures, and where a developing agency needs to strongly incorporate the special needs of such a site into their *modus operandi*. Environmentally sensitive areas can be both ecologically sensitive areas, which are defined by the World Bank (1993) as being "areas that are of significant value in their natural state", or areas that are of socio-cultural significance or sensitivity. Cultural or historical sites and densely populated urban centres are examples of the latter category. In all such areas, extra precautions must be taken to avoid significant environmental impacts. In many cases, this will mean extra investments in mitigation measures, while in some cases these areas will simply have to be avoided, resulting, for example, in the abandonment of a project or the realignment of a section of road. For all projects that will potentially affect environmentally sensitive areas, an EIA is likely to be required.

Ecologically Sensitive Areas as defined by the World Bank (1993) are areas that may contain unique features, maintain key natural processes, support rare plants or animals and their habitats, or provide important breeding areas for wildlife. Some Ecologically Sensitive Areas are natural, while others may have been significantly altered by certain human activities. In terms of management, some Ecologically Sensitive Areas will prosper through "benign neglect" while others will require intensive management to restore or maintain their natural values. Criteria given by the World Bank for Ecologically Sensitive Areas, and corresponding areas in Uganda, and listed in Table 3.25 under categories A-F. Areas that are socio-culturally sensitive are listed under categories G and H.

In summary, Uganda's Environmentally Sensitive Areas (ESAs) can be described as:

- all gazetted parks and reserves that are managed by UWA;
- all gazetted Forest Reserves managed by the Forest Department;
- wetlands;
- desert habitats;
- cultural and historical sites managed by DTWA; and
- densely populated urban centres.

The location of these ESAs can be identified from Maps 2 to 12.

**Table 3.25: Environmentally Sensitive Areas**

Category	Environmentally Sensitive Areas	Areas In Uganda
A	Areas that provide protection of steep slopes, especially in watershed areas, against erosion.	Forests on steep watersheds: generally these areas are already covered by existing NPs and Forest Reserves.
B	Areas that support important natural vegetation on soils of inherently low productivity, that would yield little of value to human communities if transformed.	Grass steppes and tree/shrub steppes; desert habitats that cover some 2,115 square km.
C	Areas that regulate and purify water flow.	Wetlands, which extend over 21,000-30,000 square km.
D	Areas that provide conditions essential for the perpetuation of species of medicinal and genetic conservation value.	Mainly areas in UWA's Protected Area System, the Forest Department's Reserves, and wetlands.
E	Sites that maintain conditions vital for the perpetuation of species that enhance the attractiveness of the landscape or the viability of protected areas.	Mainly areas in UWA's Protected Area System, Forest Department's Reserves, and wetlands.
F	Sites that provide critical habitat that threatened species use for breeding, feeding or staging.	Mainly areas in UWA's Protected Area System, and wetlands.
G	Areas of cultural or historical significance.	The 200+ sites managed by the Antiquities and Museums Department.
H	Areas that are densely populated and are important for human habitation.	All urban centres.

### 3.10.1 Road Works Activities and ESAs

Road works activities in environmentally sensitive areas could disturb or destroy them. Consequently most considerations would revolve around suitable mitigation measures. Some mitigating considerations are:

#### Planning stage

- new roads and realignments should avoid passing through such places and when they must, full environmental analysis must be carried out in order to arrive at feasible mitigating measures for minimising, eliminating or offsetting adverse effects;

- liaison with the authorities responsible for any affected environmentally sensitive areas is essential.

#### Design stage

- provision should be made for rest areas, design features such as deep ditches, narrow shoulders and barriers to discourage road side stops
- contractor's camps, borrow pits, quarries should be sited away from these areas
- provision of traffic signs warning of the danger posed by animals, landslides, and also for informing the public of some of the attractions.

#### Construction stage

- erosion prevention measures should be installed in side ditches in steep grades;
- steep cuts should be avoided;
- in low-lying areas drainage must ensure wetlands on both sides of the roadway will receive waterflow.

## 4. ANALYSIS OF THE POTENTIAL IMPACTS OF THE FRSP

### 4.1 FRSP Activities

A brief description of the First Road Sector Project has been given in Chapter 1 of this document. The major roadworks will arise from the second component of the FRSP (Component B) which comprises:

- i) widening of urban sections of some trunk roads in Kampala from 2 lane to 4 lane roads (dualisation);
- ii) strengthening of the pavement on some roads;
- iii) upgrading of some gravel roads to paved ones
- iv) upgrading 1700 km of feeder roads; and
- v) development of a road to bypass Kampala.

Activities to be undertaken during the improvement of the pavement will greatly depend on the conditions prevailing along each road. Some sections of these roads may require building them up from base, sub-base or sub-grade levels. Activities to be undertaken when upgrading gravel roads to paved ones will also depend on the conditions of the gravel roads.

This chapter is intended to give the reader an indication of the typical impacts that are likely to occur during and as a result of the proposed activities carried out for FRSP road projects. The exact nature, magnitude and significance of each of the potential impacts resulting from these activities will only be determined when EIAs are conducted for each of these road projects.

Mitigation of these environmental and social impacts will be necessary in order to:

- i) minimise or eliminate adverse environmental impacts,
- ii) enhance beneficial impacts, and
- iii) protect the right of individuals and communities to compensation for any losses that may arise.

Mitigation options will depend on the nature of the potential impacts, and for FRSP road projects, will have to consider:

- changes in the locations of new alignments
- changes in design of sections of these roads
- monetary compensation
- replacing damaged property, or resources
- relocation of property, resource (vegetation, infrastructure), and
- rehabilitation of any damages.

Environmental monitoring will have to be undertaken as part of the environmental management of FRSP projects. Monitoring will have the following objectives:

- to ensure compliance with conditions for project approval;
- to determine the effectiveness of mitigation measures;
- to assess the accuracy of impact prediction that will be done during EIAs for each these road projects;

- to provide baseline conditions against which future conditions may be compared with;
- to establish any new impacts that may arise after implementation of these projects.

Since most of the roadworks to be undertaken under the FRSP are common to all its components described above, all the possible roadworks activities are presented below, together with their environmental impacts, mitigation, and monitoring of impacts and mitigation measures.

Although this analysis highlights the negative impacts, it should be noted that road improvement has enormous positive socio-economic benefits. These include improved access to markets, hospitals, schools as well as improved standards of living, and increased national productivity, among others.

## **4.2 Surveying**

### **Activities**

This involves the establishment of the centreline of the road and marking the limit of the road reserve for existing roads or new alignments. Minor clearance of vegetation may be done to facilitate access for the surveying team. Surveying will be done for all components of the FRSP.

### **Impacts**

The potential impact of surveying and pegging the road reserve is the development of **insecurity among land owners** if it is perceived that the road may take up part of their lands. This impact is likely to be significant for the proposed Kampala Bypass, the dualisation of trunk roads in Kampala, and new alignments for existing roads.

### **Mitigation**

The surveying team should inform local leaders before they move into an area. The team must explain the purpose of surveys to minimise insecurity, which may be felt by those who perceive that they may lose land to the road. When the survey team has to work on lands owned by individuals, they must inform these owners whether the road is likely to take up part of their lands. Procedures for receiving compensation for those who may lose land to the road must be clearly explained.

### **Monitoring**

The district road engineers should ensure that these consultations have taken place. Leaders of communities in which surveys will be done should communicate any problems that may arise to the district road engineers.

## **4.3 Land Acquisition**

### **Activities**

The development of the Kampala Bypass, the dualisation of urban sections of trunk roads out of Kampala, and any new alignments on existing roads will require land which was being used for other purposes to be acquired. Negotiations with owners and/or occupiers of such lands will have to be done in order to agree on compensation for any adverse impact of relocation.

## Impacts

Land acquisition has following potential impacts:

- i) *Loss of commercial/residential land.* In most urban centres there is a high probability that individuals have built within the road reserve. These buildings range from commercial/business premises to residential houses. The quality of structures varies from temporary to semi-permanent and permanent structures. Road construction may lead to their removal and subsequent displacement of people and loss of property. As a result, people who lose their residential properties may become destitute, particularly if they do not use compensation provided to obtain alternative shelter. Another impact could be reduced accommodation for tenants and increased rents within the neighbourhood.
- ii) *Disruption of people's livelihoods.* Most of roadside premises are occupied by tenants who have no security of tenure. Some of the on-going economic activities in roadside premises include workshops, markets and dwelling units. Once these are removed it means people's livelihood is disrupted. Apart from loss of family income, there will also be loss of income to urban authorities as a result of displacement/resettlement. This is so because even the "illegal" roadside businesses are known to pay taxes/fees to the urban authorities.
- iii) *Loss of agricultural lands.* Among some of the more densely populated districts, loss of farmland could have very severe consequences. The districts which will be mostly affected include Mbale, Kisoro and Kabale. This is most likely to happen to the poorer households who have small parcels of land. During up-grading of roads from murrum to paved, it is often necessary to create road diversions which often pass through peoples' farms. Apart from disrupting farming activities, this exposes crops and livestock to external hazards such as diseases, thefts, accidents, etc. Often times such diversions do not attract compensation for the poor. Food insecurity, income deprivation and malnutrition also becomes an issue for those who lose agricultural lands.
- iv) *Loss of Access to Common Property.* Road construction may hinder or prevent access to common property such as wells and watering holes, forests, grazing land, and ancestral or religious shrines.
- v) *Joblessness:* This is more serious in urban areas. Job opportunities are likely to decrease after the disruption of these communities and removal of their operational infrastructure such as shops, markets and workshops. Bearing in mind that over 75% of Uganda's labour force is involved in agriculture, the loss of jobs in rural areas is an issue when labourers lose access to land which has been expropriated.
- vi) *Social Disarticulation:* Poorer members of the community affected by resettlement/displacement may not have the social and economic resources to appeal for help if patterns of their social organisations are dismantled. This results in psychological stress and prolonged delays in social rehabilitation. In addition, relocation leads to the break up of social relationships.

All the FRSP road projects have the potential to cause these impacts to some extent, particularly in the case of the Kampala Bypass, realignments for existing roads, and widening of urban trunk roads from 2 lanes to 4 lanes. Pavement strengthening is not likely to generate major impacts since all the roads have road reserves within which agricultural and residential use of the land is not permitted. Similarly upgrading of roads is not expected to cause significant impacts with respect to loss of land, except where realignment of some sections will be done.

## Mitigation

The local authorities and community leaders should be involved when selecting routes of proposed new alignments. The local authorities on their part should ensure that the views of communities regarding route selections are obtained. Once the general route has been agreed upon, the selection of the exact road alignments should wherever possible avoid built up and cultivated areas so as to minimise loss of both residential and cultivated lands.

Compensation is considered a mitigation measure. For expropriated properties compensation is a constitutional requirement in Uganda whereby both property and human rights are protected. (refer Chapter 3). Compulsory deprivation of one's property is prohibited by the Constitution except when the acquisition is necessary for public use among other things; but such acquisition has to be compensated for promptly, adequately and fairly. Road sector planning/development should take this requirement into account. Compensation may be material, financial or both.

Past experience in Uganda (and particularly with respect to road development projects) highlights legislated compensation. In this case compensation provides for the owners of property and makes no allowance for tenants, employees, or squatters (eg. on Mityana-Mubende road and recently on Zana-Kibuye road). This has been unfortunate because the majority of the affected people do not receive any form of compensation, particularly in urban areas.

RAFU/Road Agency in conjunction with the Ministry of Water, Lands and Environment (which deals with compensation) as well as the Office of the Prime Minister (which deals with resettlement) should be transparent when dealing with those who are likely to lose part of their land. The local leaders should be involved during the negotiations for compensation for lands to be taken by the road. The Ministry of Gender, Labour and Social Development should also be involved in land acquisition and measures put in place to minimise adverse impacts, eg. to ensure that money paid as compensation is invested properly for the general good of the affected families.

It is therefore imperative that as part of EIA studies where compensation and relocation are issues, detailed compensation and relocation plans are drawn up.

Acquisition of agricultural lands for the road should be done after harvesting to minimise crop losses, and consequently food insecurity. Those who lose such lands must be given adequate compensation and sufficient time to enable them to acquire alternative pieces of lands before the beginning of the next agricultural season.

Most social impacts are aggravated due to lack of awareness. However, when formal measures are put in place to inform the public about the impacts and the possible mitigation measures, the gravity of impacts can be reduced. For example, if people who are to be displaced by a road are told well in advance, they can plan for relocation. For awareness programmes to be fully appreciated, they should involve the public and take into account gender concerns.

After a road project has disrupted the livelihood of communities, the most desirable option is to restore the incomes of the affected people. This applies for both relocated communities and those whose assets/business have been removed. It may be done after the baseline survey undertaken during the EIA study has identified the socio-economic factors of the disturbed community.

If some households have to be relocated in order to make way for the road, they should be relocated within the same community in order to minimise breaking of family and social relationships.

Often times the construction or improvement of a road may destroy cultural or ancestral sites leading to severe stress. Mitigation measures can include efforts to relocate cultural sites (eg. burial grounds) after all the cultural rites have been performed. On the other hand, some ancestral sites cannot be relocated, in which case mitigation may include arrangements for communities to visit the sites from time to time. It may be that serious counselling can assist the affected community.

### **Monitoring**

The environmental unit within RAFU/Road Agency should be responsible for monitoring the compensation and resettlement processes necessitated by FRSP roads projects. Monitoring should be done annually for a period of about three years after relocation or resettlement. Such monitoring will require close cooperation between the Ministry of Water, Lands and Environment, the Office of the Prime Minister and RAFU/Road Agency.

## **4.4 Recruitment of Labour Force**

### **Activities**

Labour will have to be recruited in order to undertake the various activities of each of the components of the FRSP. The number of people to be employed on each road project will depend on the scale of operation.

### **Impacts**

The recruitment of workers may have the following potential impacts:

- i) Creation of employment opportunities;
- ii) Increase in disposable incomes for households with members employed on road projects;
- iii) Increase in social promiscuity such as gambling, drinking, and prostitution as a result of increased disposable incomes;
- iv) Spread of diseases through the movement of workers and indulgence in promiscuous activities;
- v) Influx of people to areas with road construction projects for the sake of securing employment.

The significance of the above impacts will depend on the number of people to be employed for each project. Recruitment policies such as giving preferences to members of the local community will also determine both the magnitudes and significance of these impacts.

### **Mitigation**

Local communities should be given first preference in the recruitment of unskilled and semi-skilled employees. This will enhance the positive impacts of the FRSP, and minimise influx of people seeking employment on these projects, and the associated development of unplanned settlements. Awareness must be created within the camps with regard to health problems arising from social promiscuity. Contractors should collaborate with health officials so that condoms are made readily available to road construction crews. Gambling and consumption of illicit alcohol within camps used by construction crews should be strictly prohibited. Women should be encouraged to participate in roadworks, and this can be stipulated that women should make up a certain percentage of the workforce, particularly for labour-based maintenance activities.

## Monitoring

The Resident Engineer should be overall in charge of monitoring the conduct of the contractor and his workforce. The contractor's site engineer should keep records of illnesses or abstentions due to illness among the road construction workers. Local health officials should also keep similar records. District engineers should liaise with the police in monitoring criminal activities that may be associated with road construction workers, eg. assaults, thefts, gambling. These records will assist in determining the effectiveness of mitigation measures, or emergence of impacts that were not initially predicted when EIAs were done for these roads.

## 4.5 Plant and Equipment Sites, Materials Stores and Accommodation Sites

### Activities

Road activities will require sites where plant, equipment and construction material can be safely stored. These may be temporary or permanent road maintenance or construction camps. Plant and equipment such as crushers, asphalt plants, haulage trucks, trailers, etc, will need to be located at a specific site. Materials that require storage are cement, lime, bitumen, oils, lubricants, petrol, diesel, explosives, sand, aggregates, gravel, traffic signs, guard rails, concrete products (kerbs, culverts, marker posts, etc), road marking paints, and bitumen adhesives. In addition, employees engaged during road construction may need accommodation depending on whether they have been recruited from local communities or distant places.

### Impacts

Setting aside land for plant and equipment sites, material storage and accommodation of workers will need **temporary acquisition of land** which may be used for other beneficial purposes. Bitumen preparation of bitumen and maintenance of vehicles will result in **spillage** of fuels and bitumen will impair the usefulness of these sites. Materials, oils and lubricants washed away from storage sites has the potential to **contaminate water**. **Solid waste will be generated** at both storage sites and accommodation camps, which could reduce the **aesthetic appeal** of these areas, and contaminates water bodies. Poor **sanitation** at camps accommodating road construction crews will also lead to the contamination of water bodies. There will also be an increased **demand for fuelwood**.

### Mitigation

Plant and equipment sites, materials stores and accommodation camps should not be sited on land which in future could be used for agricultural purposes. Floors of temporary workshops should be lined with concrete to avoid percolation of spilled oils and fuels into groundwater. Used oil should be collected for recycling rather than disposed into pits.

Facilities for collection and the safe disposal of litter should be provided at both sites, workshops and camps. All road construction crews should be under strict instructions that both solid and liquid wastes must be disposed into designated facilities. Routine inspections aimed at assessing the effectiveness of waste management systems should be undertaken by the contractor's site engineer and the Resident Engineer, reporting to the environmental units in the MOWHC/RAFU/Road Agency. Proper toilet facilities should be provided at workshops, accommodation camps and at quarries and borrow pits.

For those road construction projects which will have a significant number of workers who have to be accommodated at camps, the contractor should provide sources of energy for domestic purposes. This could be in the form of firewood obtained from sources approved by the Forest Department, paraffin or electricity.

### **Monitoring**

The contractor's site engineer, the Resident Engineer, district road engineer, district environmental officer, and health officials will need to monitor that agreed standards of waste management and sanitation are being abided with. This will require routine inspections, which may be done once every month or 3 months depending on the duration of road construction.

## **4.6 Land Clearing**

### **Activities**

In the case of new roads such as the Kampala Bypass and new alignments on existing roads, clearing will often involve demolishing structures and cutting vegetation growing along the road. Improvement of the pavement and upgrading of a road will involve cutting of trees and bushes in some sections, and demolishing structures that may have encroached onto the road reserve. All materials cleared from the road will need to be disposed of.

### **Impacts**

Clearing of land during pavement strengthening and upgrading of roads is not likely to cause major and significant impacts as this will be done within the existing road reserve. However, the widening of those roads which will be converted from 2 to 4 lane roads, and clearing during the construction of the Kampala Bypass or where a new road alignment is required, will have the potential to cause the following significant impacts. These include **loss of vegetation; destruction of plant and animal habitats; loss of species of medicinal, economic, or nutritional value; destruction of existing infrastructure**, eg. buildings, electrical transmission lines, telephone lines, water and waste water pipelines;

### **Mitigation**

Loss of vegetation can be minimised by avoiding protected areas, forests (gazetted or otherwise important forests) and wetlands.

Rare and/or endangered plant and animals species found along the road should be relocated, if possible, or an alternative route should be suggested to preserve these species. Seeds of rare and/or endangered plant species should be collected and submitted for storage at the national herbarium. Plants of medicinal and economic value should be salvaged and given to local communities.

### **Monitoring**

The contractor's site engineer and the Resident Engineer will have to monitor that only plants within the road construction area are cleared. This will require that trees which should be cut are first marked using paint before this has been done. The district road engineers, district environmental officers, and Forest Department need to independently monitor clearance of vegetation.

## 4.7 Quarries and Borrow Pits

### Activities

Hardstone and gravel have to be extracted for the sub-base, base and surfacing in road construction and improvement. Locations of quarry sites are identified at the planning stage. Owners of properties on which potential sites for hardstone and gravel quarries have been identified are first informed about the intention to obtain the material from their properties. If these owners are agreeable to this, then a survey of the quality and quantity of the stone and gravel that is available at each site is conducted. Negotiations will then be undertaken with each of the property owners for an acceptable compensation level, and the rehabilitation process on completion of excavation.

During excavation, all the vegetation is cleared and stacked for use by the land owner. Grass and topsoil are stripped and stockpiled for use during rehabilitation of gravel quarry sites. Then extraction and stockpiling of overburden is done.

Borrow material is used where the amount of material obtained from cuts cannot cover the sections of fills, and low-lying areas such as swamps. Consequently, borrow pits are often identified during construction. When a potential site for borrow material has been identified, negotiations with the relevant land owner will be conducted so as to agree on compensation, and the rehabilitation process. Thereafter, trees are cut followed by stripping of topsoil. Fill quality material will then be excavated and stockpiled.

### Impacts

The establishment of quarries and borrow pits may cause **conflicts between road agencies and owners of properties** on which these quarries/pits will be developed. Property owners may perceive the MOWHC/RAFU/Road Agency or its contractors of being unfair or exploitative when determining compensation.

Clearing of vegetation for gravel pits will cause some **loss of vegetation**. The significance of this loss of vegetation depends on how valuable the vegetation was on the affected properties; for example if clearing will lead to loss of important habitats, an increase in soil erosion, or loss of firewood sources.

Excavation causes **noise and dust pollution**, leading to discomfort and an increase in respiratory infections.

Collection of water in quarries gravel pits may facilitate **breeding of disease causing vectors**. However, in semi-arid regions, exhausted quarries and gravel pits can be used to **harvest water for irrigation of crops**, or as a **watering pan for livestock**.

### Mitigation

Owners of land on which quarries and borrow pits will be developed have to be adequately compensated. RAFU/Road Agency and the contractors should deal with those who will be adversely affected in a transparent and fair manner. Local leaders should also be involved during the negotiations for compensation, so as to avoid individuals from misinforming other members of these communities. The clearing of vegetation at these sites should be restricted to the area where actual excavations will take place. Therefore before vegetation clearance is done, trees that have to be felled should be marked.

Quarries and borrow pits should be restored or rehabilitated to in as far as is possible to their original conditions. This will require backfilling or smoothing of side slopes and landscaping. For those property owners who wish to use these pits for collecting water or for future excavation, side slopes of these pits must be smoothed and the quarry/pit perimeter fenced. The dangers associated with the breeding of vectors causing diseases in these pits must be fully explained to the owners and the local community.

### **Monitoring**

The district road engineers, Resident Engineers and district environmental officers will have to monitor that property owners are compensated for material taken from their lands and that agreed rehabilitation processes for quarries and borrow pits have been followed by the contractors.

## **4.8 Access roads**

### **Activities**

If quarries, borrow areas, and construction camps are not served by existing roads, then temporary access roads will have to be constructed. Where quarries and borrow pits occur on privately owned land, negotiations with the relevant land owners have to be done so as to agree on the locations, method of construction, and rehabilitation of these access roads.

The construction of access roads may entail:

- i) shifting fences,
- ii) clearing of vegetation and stripping topsoil,
- iii) grading and shaping to enable shedding of water,
- iv) formation of temporary side drains and offshoots, and installation of cross culverts if necessary,
- v) compaction of existing ground or of an improvement layer.

When an access road is no longer required, it will be obliterated by ripping the ground to facilitate revegetation without encouraging soil erosion.

### **Impacts**

The construction and use of access roads may cause the **loss of vegetation, erosion of soils, and reduction of water quality** through deposition of materials washed away from the road surface and drains.

The magnitude and significance of these impacts will partly depend on the extent of vegetation covered and prevailing soils erosion rates in the project area.

### **Mitigation**

Existing roads and tracks should be used wherever possible as access roads in order to minimise clearance of vegetation. Land with steep slopes should be avoided when constructing access roads. Erosion checks (such as stone pitching, scour checks, check dams and/or maintaining a grass cover within drains) should be constructed in drains along access roads.

Adverse effects on water quality due to the delivery of soils eroded along access roads are best minimised by preventing soil erosion along these roads. When these access roads are no longer in use, they should be rehabilitated by loosening the soil through ripping, and planting grass to prevent soil erosion.

### **Monitoring**

The Resident Engineer should ensure that these mitigation measures are put in place by the contractor, and that rehabilitation is done.

## **4.9 Earthworks**

### **Activities**

Earthworks which will be done when upgrading a road may include:

- i) Clearing of vegetation and stripping of topsoil over the area within the road reserve lying between the edges of the existing road and those of the road prism to be constructed;
- ii) Grading, shaping and compacting the existing ground in some sections to receive selected sub-grade;
- iii) Excavating and filling some sections followed by compaction to improve the vertical profile;
- iv) Formation of side drains, and offshoots before laying and compacting the existing (in situ) or improved (imported) sub-grade.

With respect to pavement strengthening, earthworks may include the above activities, and in addition the following activities will be undertaken:

- i) Scarification of the existing shoulder material, to determine its suitability for pavement strengthening, and if found unsuitable addition of new materials or chemical stabilisers such as lime;
- ii) Widening of the road shoulder;
- iii) Widening of embankments on some sections by benching into the existing ground and building up in layers using fill quality material from borrow areas;
- iv) Scarification of the existing bituminous surfacing and failed pavement layers in some sections before adding and mixing in the new materials. Chemical stabilisation of some materials and adding water before compaction;
- v) Carrying out isolated base repairs, by excavating localised areas with unsuitable materials, and replacing this with imported gravel, followed by stabilisation and compaction;
- vi) Scarifying the existing bituminous surfacing and mixing it with base material and stabiliser to form an overlay over some sections;
- vii) Some sections of the road may require to have the geometry of the vertical profile improved which in the case of elimination or reduction of sag curves entail construction of earthworks over the existing paved road layer before laying of pavement layers.

The activities that are likely to be undertaken during the dualisation of trunk roads in urban areas and construction of the Kampala Bypass are given below:

- i) Clearing of vegetation and stripping of topsoil over the corridor within which the second carriageway or the alignment for the Bypass will be accommodated;

- ii) Excavating the road formation in cuts and then use this material if suitable to form the compacted embankments layers;
- iii) Excavating to spoil material that is unsuitable to form the road bed and replacing it with suitable materials from cuts or borrow areas which is compacted in layers;
- iv) Excavating side drains, catchwater drains, offshoots, outfall drains, and foundations of other drainage structures;
- v) Scarifying and compacting the existing material if suitable to form the sub-grade in cuts or laying and compacting selected sub-grade materials. Scarifying and compacting the existing material if suitable to form the sub-grade in cuts or laying and compacting selected sub-grade materials.

### Impacts

Earthworks have several potential impacts. Excavation can lead to **soil erosion**. Stockpiles of earth and cutting and filling can **destroy vegetation**. Rolling boulders can **endanger human life** and property. Such an impact is likely to arise when developing new alignments in hilly areas for those roads that will be upgraded, eg. along the Sironko-Muyembe-Kapchorwa-Suam Road. Earthworks on prominent relief features, particularly in mountainous regions such as those occurring along the Sironko-Muyembe-Kapchorwa-Suam Road and the Kabale-Kisoro-Bunagana Road, may **mar the landscape**.

Cutting in hilly areas may create unstable slopes which may cause **landslides**. Washing away of soil from stockpiles and various other spoil materials into rivers will reduce the quality of water through **increased turbidity**. Haulage trucks moving along undesignated routes are likely to compact the soil. This will reduce the infiltration capacity and promote surface flow, and consequently **soil wash**.

Blasting and movement of haulage trucks will **increase prevailing noise levels**, especially in densely populated areas. If such noise occurs at night, near schools and hospitals, it could have negative and major social impacts.

**Dust** generated by the excavation works and movement of haulage trucks on unpaved roads near settlements has the potential to stain household goods and cause **eye and respiratory infections**. Deposition of dust on horticultural crops will impair their growth and quality.

Earthworks can **damage archaeological, historical and cultural sites**. This may arise during construction of any new alignments on roads that will be upgraded, the Kampala Bypass, and widening of 2 lane to 4 lane roads. Religious sites and buildings of historical importance are very vulnerable to this impact in urban areas such as Kampala, and all other towns in which road works will be done during the FRSP.

### Mitigation

Stockpiles of earth should not be placed where there is vegetation, particularly young plants which have been planted deliberately. Cuts should not exceed the angle of repose which could lead to rock falls, slips, and landslides. Where rock falls, slips, and landslides are likely to occur, unstable materials should be removed from these slopes. Grouting can improve the stability of unstable slopes.

Roads used by haulage trucks during construction should wherever possible be located away from schools, and hospitals. These haulage trucks and other heavy road construction vehicles (caterpillars, dumper trucks) should not be used at night in residential areas. The use of exhaust brakes should be prohibited in built up areas.

Gravel roads used by haulage trucks during road construction should be sprinkled with water to minimise dust emission if these roads are located within settlements.

The Kampala Bypass and new alignments on existing roads should avoid archaeological, historical and cultural sites, wetlands, protected areas and forest reserves. Where this is unavoidable, then relevant experts must be consulted to develop the best solution. All road construction workers must be under strict instruction that once archaeological materials have been found during earthworks, no further work should be done until the permission from the Department of Tourism, Wildlife and Antiquities has been obtained.

Where earthworks have disturbed the landscape, it must be restored, as far as is possible, to its original state, particularly in scenic areas.

### **Monitoring**

Ensuring the earthworks are carried out in an environmentally and socially acceptable manner is the responsibility of the Resident Engineer, or the district engineer in the case of maintenance works. The environmental units in MOWHC/RAFU/Road Agency should oversee that this is done satisfactorily.

## **4.10 Surfacing**

### **Activities**

Surfacing of roads will be done so as to:

- i) protect the pavement from ingress of water which would weaken it;
- ii) provide a smooth and skid resistant riding surface;
- iii) arrest further deterioration of an existing bituminous surfacing which is often evident from cracks, loss of chippings and the formation of potholes; and
- iv) provide a dust free riding surface.

Surfacing of roads will mostly entail application of a single or double surface treatment on roads with light traffic, or an application of an asphalt concrete wearing course on heavily trafficked roads, eg. the Bypass and dualised roads in Kampala. Prior to the application of the surfacing, a bituminous prime coat is applied on the base layer. Application of a surface treatment involves spraying hot bitumen on the road surface followed by placing single size aggregates which range in size from 6 to 20 mm. Bitumen is heated using either electricity, firewood, diesel or gas.

The application of an asphalt surfacing involves spraying a thin film of tar coat followed by the laying of a hot mixture of aggregates, filler, and bituminous binder prepared at predetermined proportions mostly in a stationary plant.

## Impacts

Crushing plants emit substantial amounts of **dust**, and are also very **noisy**. Dust may lead to **respiratory disorders** (particularly for workers), while noise is an irritant.

Firewood used to heat bitumen may **deplete the amount of firewood** available for use by the local community. Heating of bitumen may lead to burning of vegetation due to **accidental fires**. Preparation of bitumen also presents hazards to the workers handling it, in terms of fumes and the risk of hot bitumen spilling on them. The transportation of heated bitumen on roads used by the public creates a **hazard to the other vehicular traffic**.

## Mitigation

The use of firewood for heating bitumen should be prohibited. If this is unavoidable, contractors should consult the Forest Department about acceptable sources of firewood. Contractors should not obtain firewood for this purpose from forests reserves used by local communities for their firewood supply.

Workers handling bitumen or working on crushing plants should be provided with protective gear such as ear muffs and face masks. Crushing and asphalt plants should be sited down wind of settlements, wherever possible. If this is not possible (as in the case of roads traversing through urban areas), then the residents near the plant sites should be told of the intention to site the plants at particular locations.

When heated bitumen is being transported on roads open to the public, warning signs should be placed on vehicles moving this bitumen. In hilly areas where the sight of these vehicles may be hindered, warning signs should be placed along the road indicating the presence of vehicles moving heated bitumen.

## Monitoring

The Resident Engineer and district road engineer should ensure that contractors take heed of recommended mitigation measures. Crushing and asphalt plants should be visited regularly for inspection.

### 4.11 Bridges and Culverts

#### Activities

During the strengthening of pavements, upgrading of roads, widening of 2 to 4 lane roads, there may be a need to repair, replace or modify existing bridges and culverts. Bridges and culverts may have to be widened. In the case of the Kampala Bypass or realignments, new bridges and culverts will have to be constructed.

#### Impacts

The construction of bridges and culverts may cause **overflowing of channel banks** if the structures are inadequately designed, and therefore cause **water logging** which may damage cultivated lands if they are affected. Flow velocities may reduce resulting in **deposition of sediments**, and thereby causing changes to the channel profile. Conversely, the reduction of the channel width would flow velocities to increase and subsequent **scouring of the channel**.

Bridges that are submerged during high flows pose a **hazard** to those who may want to cross them.

Within wetlands such as those that are crossed by the Tirinyi-Pallisa Road and the Mbale-Pallisa Road, bridges and culverts that do not adequately accommodate flow will increase water levels upstream of the road, and therefore cause **widening of wetlands**. Downstream of the bridges or culverts, water levels may reduce and consequently cause **shrinking of the wetlands**.

### **Mitigation**

All the above-mentioned impacts would not occur if the bridges or culverts did not hinder the flow of water below or through them. Therefore bridges and culverts must be designed to accommodate design floods. Bridges should ideally be oriented perpendicular to the flowing water so as to avoid restriction to flow of water. Where river banks are erodible, gabions and other measures to minimise erosion should be put in place. Culverts must be levelled appropriately so that they are self-cleaning.

Where a bridge is likely to be overtopped frequently staff gauges indicating water depth above the bridge should be erected so as to warn those who may be tempted to cross flooded bridges.

### **Monitoring**

Resident Engineers and district road engineers should undertake routine inspections of channel conditions at bridges and culverts to determine any possible occurrence of erosion and deposition of materials within channels.

## **4.12 Drains**

### **Activities**

For existing roads, drains may need cleaning, widening, and strengthening against erosion. On new roads such as the Kampala Bypass and dual carriageway roads, drainage requirements may entail the provision of the following drainage facilities:

Catchwater drains	are constructed away from the road and collect runoff before it gets to the road.
French drains	are sub-surface structures which drain water under the road and away from it.
Kerb drains	are erected along the edges of the road surfacing in area with high fills, and drain runoff from the road, down the side slopes using chutes.
Mitre drains	are sometimes referred to as offshoots. They drain water away from the side drains.
Side drains	run parallel and adjacent to the road. They drain water from the road and adjacent lands, and dispose it away from the road.

### **Impacts**

Drains commonly cause **soil erosion** and subsequent development of **gullies** due to high flow velocities along them. Gully formation along side drains presents a **hazard to traffic, human and animal lives**. In addition, gullies may erode the road structure itself. Discharge of sediments eroded from drains **reduces water quality** by increasing turbidity.

Inadequate drainage may lead to **flooding** of agricultural lands and homesteads; this is sometimes also caused by discharge from offshoots.

Drains may **interfere with access** to properties, particularly where they are deep and no provision has been made for crossing them.

### **Mitigation**

Soil erosion checks should be put in place where ever necessary along drains. These checks include scour checks, paving of drains, stone pitching at inlets and outlets to culverts, stabilisation basins. Offshoots should not discharge into agricultural lands and homesteads, and the construction of infiltration ditches must be considered as an alternative. However, if offshoots must discharge onto agricultural or private land, then provision must be made for the safe discharge of water (for example by constructing artificial waterways).

The deterioration of the water quality due to the discharge of eroded soils into rivers is best avoided by preventing soil erosion within road drains.

### **Monitoring**

The Resident Engineers/district road engineer should ensure that all these measures are put in place before contractors are certified to have completed road construction. When the road is operational, the district road engineer should routinely inspect drains for any soil erosion or siltation that may be taking place within them.

## **4.13 Diversions**

### **Activities**

When road construction is being conducted on an existing road, traffic will need to be diverted into other roads if these exist. Where diversion roads are non-existent, one lane of the road under rehabilitation would have to be closed to traffic while work is taking place on the other. If this is not possible a temporary diversion road may be constructed within the road reserve. In some cases temporary diversion roads may have to be put up on lands that are privately owned. Negotiations with the relevant land owners will have to be undertaken regarding construction procedure, rehabilitation, and compensation.

### **Impacts**

Diversions may necessitate the **clearing of vegetation**.

On roads with heavy traffic, detours may cause traffic congestion and therefore increase travel times. Traffic congestion, and detours on unpaved roads will also generate **noise and air**

**pollution** from exhaust fumes. Diversions which are not adequately sign posted can increase **traffic accidents**. Detours along existing roads may lead to increased accidents involving locals especially the elderly and children who need to adjust to the sudden increase in traffic flow.

Unplanned diversions may cause **soil erosion** and subsequent formation of **gullies**.

### **Mitigation**

Wherever possible, diversions should utilise existing roads. If this is unavoidable, then trees should only be cut within that portion required for the road only. On completion of road construction, these detour roads should be rehabilitated by ripping and planting grass.

In areas with high volumes of traffic, warning signs of the presence of diversions should be placed along the road where there are still opportunities for road users to use alternative roads. Diversion roads or detours should be selected so that they can handle anticipated peak traffic without causing unreasonable delays to traffic.

### **Monitoring**

The Resident Engineer and district road engineer should routinely monitor problems that may arise due to diversion roads. This will require having open lines of communication with leaders of communities which are affected by these diversion roads.

#### **4.14 Rehabilitation/Restoration**

The nature of the rehabilitation to be undertaken will depend on the damage caused to various environmental attributes. Traditionally rehabilitation, which is sometimes referred to as final clearance, involves the following activities:

- i) Demolishing temporary structures put up during road construction, eg. workshops.
- ii) Cleaning of sites used for storing road construction materials, and temporary camps used for accommodating road construction workers.
- iii) Disposal of bitumen wastes.
- iv) Smoothing and landscaping of borrow pits and in some cases backfilling them using spoil materials.
- v) Backfilling and landscaping gravel pits where this had been agreed upon with land owners.
- vi) Covering boulders and stones exposed during road construction.
- vii) Ripping and re-vegetating temporary access roads.

#### **4.15 Impacts on Women**

The impacts described above will affect men, women and children. Thus when planning mitigation measures due consideration should be given to men, women and children. If this is done, disadvantaged groups especially women can benefit from the implementation of impact mitigation measures.

The following areas will be of direct benefit to women if affirmative action is taken.

- i) *Employment Opportunities.* Planting of embankments, grubbing, and mulching can provide employment opportunities for women.. In addition at camp sites women can be employed to cook for the workforce, maintain the campsite, improve sanitation in the camp, restore the campsite after use to its original condition (as far as is possible), etc. A deliberate policy to employ women is required during the construction, maintenance and management of roads.
- ii) *Health.* As mitigation against the spread of infectious diseases especially sexually transmitted diseases, employees may be subjected to regular health examinations. Women employed on the road projects can also take advantage of these measures to improve on their health as well as that of their children.
- iii) *Road Safety.* During and after road construction, it is recommended that cycle paths, foot paths, road signs and road furniture are put in place and communities should be sensitized to use them. This will directly benefit children and their mothers who are the most frequent pedestrian users of the road facility.
- iv) *Local Production Stimulation.* Improved roads stimulate increased production which in turn increases tasks for women. The introduction of non-motorized transport eg. donkeys to transport produce to the markets, would enhance this impact, while decreasing the work load on women.

## 5. PUBLIC PARTICIPATION IN ROAD SECTOR DEVELOPMENT

### 5.1 Public Involvement in Road Sector Development

Community involvement is an essential element of environmental management of roads. It is necessary therefore to develop procedures and skills for informing the public and other interested parties about proposed road projects. Consultation and participation should be used to include the community in the decision-making process.

There are a number of advantages which accrue from public involvement. These include the following:

- Non-technical factors in the assessment of environmental factors will be highlighted. This removes problems which could be experienced in road project implementation through lack of timely consultation.
- Public consultation dispels rumours and negative publicity resulting from information which reaches the public through informal channels. Information is often general and frequently inaccurate, unless it has come through a public involvement programme.
- Public consultation helps to disseminate information which can be the basis of constructive dialogue between road proponents and other stakeholders.
- It gives the community an opportunity to make an input.
- In some cases, public consultation can reduce the incidence of involuntary resettlement to voluntary resettlement. The main objective in relocation programmes is to reduce forced resettlement as much as possible.
- It identifies the different roles played by men and women in environmental road management programmes.
- Public participation highlights the plight of disadvantaged groups whose voice would not have been heard. In resettlement programmes women and other individuals who live on community property are more adversely affected by resettlement.
- It assists in identifying alternative road designs for reducing resettlement.
- It identifies local machinery through which resettlement and compensation arrangements can be handled.

On the other hand, failure to involve the public can be counterproductive, especially to the community. Among the negative social impacts, the following are more common to those who have been resettled or displaced:-

- **Landlessness:** Land expropriation takes away the foundation upon which social and economic production systems are constructed.

- **Joblessness:** This affects both urban and rural resettlers. The dual carriageway in Kampala and the roads to be constructed through other urban centres are likely to disrupt shopkeepers, shop-workers and small business men and women.
- **Homelessness:** For the same reasons as above some families may remain homeless for long periods if resettlement programmes are not community responsive through public participation and consultation.
- **Marginalisation:** If roads pass through farms they can make them economically not viable. Owners of such farms if they were not involved in public participation would feel marginalised. This can lead to food insecurity.

## **5.2 Public Involvement and Gender Concerns in Road Sector Management**

A recent study (ref. Elizabeth Kharono, unpublished) on the DANIDA supported road construction programmes in Uganda did reveal that a number of omissions existed with respect to public participation and gender concerns. In the earlier planning and design phases there had been consultations with people, especially at the district level, but no gender analysis was carried out and subsequently no gender desegregated data was obtained. Although the targeted group included all the people in the districts where the feeder road projects operated, they were not categorized by gender. The study concluded that although the projects were on feeder roads construction and maintenance and included sensitisation of the district leaders, the implications of the project on women and women's situation was not addressed. A number of other gaps existed, including the following:

- the gender perspective does not consistently run through the whole process of analysis and recommended actions;
- there is an obvious absence of recommendations which specifically address gender considerations;
- the proposed recruitment process for workers, contractors and technical staff does not include measures to increase participation by women.

The National Environment Management Authority (NEMA) provides guidelines and procedures for public participation and involvement in the overall EIA processes. Unfortunately, these guidelines are gender neutral. For example the involvement of women in the process is not highlighted. There is provision for holding public hearings. Participants in public hearings are not necessarily gender balanced. The foregoing is not in line with the requirements of the *Local Government Statute 1995* which address gender imbalances so as to increase the involvement of the communities in decision making and improving delivery of services.

On the other hand the World Bank *Environmental Assessment Sourcebook* stipulates that participation is an involuntary process in which people, including marginal groups such as the poor, women and minorities, come together with project authorities.

## 6. ENVIRONMENTAL CONSIDERATIONS IN MOWHC DOCUMENTATION

### 6.1 Provisions for Environmental Consideration

The importance of environmental consideration at all stages of the road project cycle is clearly brought up by the existence of provisions for protecting the environment in the MOWTC's Road Design Manual and Maintenance Manual, and in tender documents including the General Specifications for Road and Bridge Works.

In this chapter, the existing provisions regarding environmental issues in the MOWTC's standard documents including the Conditions of Contract are highlighted so that road engineers involved in environmental management as well as EIA practitioners can use this chapter as a reference. These provisions are presented in tabular form for ease of reference.

The contents of this chapter intend to impart a sound understanding of environmental issues that affect road works by emphasising on:

- i) the importance of incorporating environmental mitigation measures during the preparation of the detailed design of a road project;
- ii) the inclusions of details of the contractor's obligations *vis-a-vis* protecting the environment during preparation of contract documents for road construction/maintenance works.
- iii) the need to have in the Bill of Quantities, for costing purposes, explicit items for environmental mitigation measures.
- iv) the need for inclusion of special clauses in the road construction/maintenance supervision contract committing the consultant responsible for supervision to undertake and ensure, in the same way as for the contractor, that all directives, legislation and specific clauses in the contractor's contract concerning environmental protection and improvement are complied with.

Thus in addition to listing the relevant environmental clauses, suggestions have made for additional clauses that should be included in these documents in order to enhance their environmental content.

**Table 6.1: Road Design Manual: Environmental Aspects**

SECTION	ITEM	EXISTING PROVISIONS	PROPOSED ADDITIONS
4.GEOMETRIC DESIGN	4.1 INTRODUCTION	Design standard adopted must take into account the environmental road conditions.	
	4.2 SELECTION OF DESIGN STANDARDS	<p>Selection of design standards is related to road function ,volume of traffic and terrain , with additional procedures for the recognition and appropriate treatment of potential hazards. Special signing will only be necessary where the information available to the driver may lead to incorrect interpretation and consequent danger.</p> <p>Cross-section parameters are related to traffic flows of all types, and will vary with the requirements of vehicular traffic and with the needs of pedestrians and non-motorised traffic vehicles.</p>	<p>For roads passing through environmentally sensitive areas, the cross-section can be modified to reduce the impact by using narrower widths, lower vertical alignments, smaller cuts and fills and flatter side slopes. Providing longer sight lines for drivers will reduce collisions with animals.</p>
	4.6 PROVISION FOR NON-MOTORISED TRAFFIC	<p>Two features which are recommended where large numbers of non-motorised users travel on the shoulders are:</p> <ul style="list-style-type: none"> <li>• The shoulders should be sealed</li> <li>• They should be clearly segregated by the use of edge of carriageway surface markings or other measures.</li> </ul>	<p>Allowance for cycle and footpaths complete with safety fences should be made in the design.</p> <p>Traffic signs prohibiting parking on the shoulders should be catered for.</p>

SECTION	ITEM	EXISTING PROVISIONS	PROPOSED ADDITIONS
	4.12 SAFETY	<p>Non-motorised traffic should normally be segregated onto sealed shoulders of appropriate width. Clear delineation is essential and may be achieved by road markings , use of different coloured surface, surface texture or kerb features.</p> <p>Kerb features may include edge strips or intermittent placement of slightly raised blocks. They must be clearly marked and should only be introduced on roads of Design Class I and II, ie. Bitumen roads in Category A (Primary roads)and Category B (Secondary roads)</p> <p>Traffic on the approach to crossing facilities, or through villages where many crossing pedestrian movements are concentrated may be slowed down by the use of road humps or other pavement features like rumble strips.</p> <p>Shoulder width must reflect the characteristic of these non-motorised traffic using it.</p> <p>Design features should be such that the effects of a driver loosing control and swerving off the road will be minimised by :</p> <ul style="list-style-type: none"> <li>• not having steep open side drains</li> <li>• not having trees planted immediately adjacent to the road.</li> <li>• having guard-rails installed only at sites of known accidents risks because of their high installation and maintenance costs.</li> </ul>	<p>Provision of parking bays at all major centres to discourage heavy vehicles from parking on the road or roadside particularly at night. These parking bays should be provided just outside major settlements to avoid disturbance.</p> <p>Provision for the introduction of behaviour modifiers, such as noise producing textures, especially when approaching or going through an environmentally or sociologically sensitive area, or a hazardous section.</p> <p>Provision for overhead footbridges or underpasses/tunnels. Provision for the widening of bridges to provide for segregated footpaths.</p>

SECTION	ITEM	EXISTING PROVISIONS	PROPOSED ADDITIONS
6.ROAD FURNITURE	6.1 GENERAL	Road Furniture represents a collection of marginal elements intended to improve the driver's perception and comprehension of the continually changing appearance of the road.	The public should be sensitised on the need to maintain the road furniture.
	6.2 TRAFFIC ISLANDS	<p>Traffic islands are generally included in the design for the following purposes:</p> <ul style="list-style-type: none"> <li>• separation of conflicts</li> <li>• control of angle of conflict</li> <li>• reduction of excessive pavement areas</li> <li>• regulation of traffic and indication of proper use of junction</li> <li>• arrangements to favour a predominant turning movement</li> <li>• protection of pedestrians</li> <li>• protection and storage of turning vehicles</li> <li>• location of traffic signs.</li> </ul>	The kerbs defining the traffic islands should be clearly painted so that they are visible.
	6.3 KERBS	<p>The edging to vehicle paths at junctions, bus-stops or parking bays can be clearly marked by the use of kerbs.</p> <p>Where there is a footpath or cycle track alongside the carriageway a continuous edge kerb combined with a reflectorised line is recommended.</p>	Delineating kerbs to be clearly painted so that they are visible.

SECTION	ITEM	EXISTING PROVISIONS	PROPOSED ADDITIONS
	6.4 MARKER POSTS	Marker posts are intended to make drivers aware of potential hazards such as abrupt changes in shoulder width, abrupt changes in the alignment ,approaches to structures etc. They assist in a timely perception of the alignment and when equipped with reflectors, provide good optical guidance at night.	Having marker posts with reflectors installed on sections of road going through animal habitats would by their reflectivity at night help to keep the animals away from the path of motorists.
	6.5 SAFETY FENCES	A safety fence shall be provided at sections or point of traffic hazard, such as fixed objects along the edge of the shoulder, high fills, steep side slopes at escarpments or along water courses etc., where the hazard of hitting the safety fence is considered a desirable substitute for a more serious accident.	To lower the impact of road noise, noise barriers in the form of earth-mounds or walls of wood, live fences e.g. euphorbia and cypress, metal, or concrete could be employed to form a solid obstacle between the road and roadside communities
	6.6 OTHER FENCES AND GATES	By having them on the edges of the road reserve they serve the purpose of controlling access to developments and preventing encroachment of the road reserve by these developments.	

SECTION	ITEM	EXISTING PROVISIONS	PROPOSED ADDITIONS
	6.7 TRAFFIC SIGNS AND ROAD MARKINGS	Traffic signs should provide essential information to drivers for their safe and efficient manoeuvring on the road. Road markings delineate the pavement edges and thereby clarify the paths that vehicles are to follow. Traffic sign road marking plans should be prepared, with reference to the Manual for Traffic Signs in Uganda, as an integral part of the design process.	Traffic signs prohibiting hunting, warning of the dangers of fires and of animals crossing the road and forbidding vehicles to stop should be erected on stretches of road going through the Parks, Forest Reserves and Protected Areas.

SECTION	ITEM	EXISTING PROVISIONS	PROPOSED ADDITIONS
8 HYDROLOGY AND DRAINAGE	8.2 BASIC POLICY ON DRAINAGE DESIGN	<p>The basic policy followed in the design of road drainage is as follows:</p> <ul style="list-style-type: none"> <li>a) In rural areas, soils and physical features permitting, the road shall be drained into the road reserve,</li> <li>b) Where natural watercourse and drainage channel exists the road reserve shall be drained directly into them,</li> <li>c) Where conditions necessitate drainage beyond the reserve, additional land shall be acquired for the necessary drainage channels, but this should be the exception rather than the rule.</li> </ul>	<p>Provision for the digging of infiltration ditches and soak-pits within the road reserve if water cannot be discharged into lower catchment.</p> <p>Provision for erosion protection works on the outfall drains beyond the road reserve and acquisition of land for the same should be made to cover distances upto where safe discharge can be made.</p>
	8.4 HYDRAULIC CULVERTS	<p>Scour of the drainage structures can be eliminated by the effective use of:</p> <ul style="list-style-type: none"> <li>a) gabion mattresses</li> <li>b) handplaced or dumped rip-rap</li> <li>c) stone pitching (plain or grouted)</li> <li>d) concrete (in situ or interlocking blocks.)</li> <li>e) cut off wall at the culvert exit.</li> </ul>	

SECTION	ITEM	EXISTING PROVISIONS	PROPOSED ADDITIONS
	8.5 DRAINAGE OF THE ROAD PRISM.	<p>The control of stormwater from the road surface should be by means of channels and gutters , while catch water drains, mitre banks and berms are used outside the road prism.</p> <p><u>Drainage channels</u></p> <p>These include gutters ( formed by kerbs and asphalt berms), chutes, side drain ditches, toes of fill channels, channels formed by catch water berms and mitre banks.</p> <p>The amount of erosion control and maintenance can be minimised largely by the use of :</p> <ul style="list-style-type: none"> <li>a) flat side slopes, rounded and blended with the natural terrain</li> <li>b) mitre banks and berms</li> <li>c) protective coverings such as concrete lining, stone pitching, grass sodding and hydroseeding.</li> </ul> <p>Alternatively rock cut offs acting as weirs could be installed in the channel at regular intervals. A drainage channel should be graded to produce velocities that neither erode nor cause deposition in the channel.</p> <p><u>Drainage of Road Pavement</u></p> <p>High fills should be provided with asphalt type berms or concrete kerb and channel combinations to prevent erosion of the fill slopes. Water collecting along such gutters should be discharged at regular intervals into open chutes down the fill slope. Pipes chutes are not favoured.</p>	<p>The channels that carry water originating from the road prism to beyond the road reserve boundaries, should be designed as part of the drainage system of the road in order to avoid/reduce the damage eg. sedimentation, erosion etc. that they cause on the features into which they discharge.</p> <p>By constructing intercepting ditches, bypass channels, settling ponds etc., muddy water from de-watering work for structure foundations shall be prevented from entering into streams, flowing or dry rivercourses, lakes and underground water courses.</p>

SECTION	ITEM	EXISTING PROVISIONS	PROPOSED ADDITIONS
	8.6 SUBSURFACE DRAINAGE	<p>The aim of subsurface drainage is the removal of detrimental quantities of ground water to ensure stable road bed and side slope conditions.</p> <p>Two types of subsurface drain may be necessary in road construction:</p> <ul style="list-style-type: none"> <li>• Pipe Subsurface Drains</li> <li>• Stabilisation Trenches.</li> </ul>	<p>Ensure water is drained to safe recipient body so as not to cause impacts e.g. soil erosion at discharge point.</p>

**Table 6.2: MOWTC's General Specifications For Road And Bridge Works Vol. IIIA, 1992**

SECTION	CLAUSE	EXISTING PROVISIONS	PROPOSED ADDITIONS
1200 GENERAL REQUIREMENTS AND PROVISIONS.	1213-Contractor's activities in respect of Property outside the Site Boundary and services moved, damaged or altered	<p>a) Contractor to enter borrow areas or temporary access roads after agreeing in writing with the owner of the properties in respect of the following matters:</p> <ul style="list-style-type: none"> <li>i) The location, extent and use of borrow areas, haul roads, construction roads and bypasses outside the site boundary;</li> <li>ii) Compensation for land or materials taken or for land temporarily used or occupied;</li> <li>iii) Reinstatement of property occupied, used, damaged or destroyed or compensation therefore in lieu of reinstatement.</li> </ul> <p>These arrangements shall be signed by all the parties concerned and delivered to the Engineer.</p> <p>On completion of his operation the Contractor shall obtain, from the owner concerned, a written statement that either:</p> <ul style="list-style-type: none"> <li>i) the owner is satisfied that the Contractor has fulfilled his obligations under any written agreement, or in the absence of a written agreement, that</li> <li>ii) the owner is satisfied that he has received all the compensation he is entitled to and also is satisfied that all property occupied including borrow areas, haul roads, construction roads is properly restored and in a satisfactory condition.</li> </ul>	<p>New introductory paragraphs:</p> <p>The provisions of this Clause shall apply <i>mutandis mutandis</i> to:</p> <ul style="list-style-type: none"> <li>• those areas approved for the purpose of disposing of spoil material; and</li> <li>• those areas occupied by the Contractor for his establishment on site or for any other purpose and for the Engineer's office and laboratory.</li> </ul>
	1220 - Water	The contractor shall make his own arrangements for procuring water needed for construction and other purposes. All sources of water used must be approved by the Engineer	<p>Add new paragraphs</p> <p>To avoid competition with local communities for:</p> <ul style="list-style-type: none"> <li>i) water resources, the contractor is to provide water for his camp by either drilling a borehole or having water supplied by bowsers without stressing the aquifer or water source.</li> </ul>

SECTION	CLAUSE	EXISTING PROVISIONS	PROPOSED ADDITIONS
	1224 - Use of Explosives and Demolition.	The Contractor will be permitted to use explosives for breaking up rock and hard material during excavations, for demolishing existing structures etc., subject to meeting the various conditions eg. ensure safety to persons, properties, public utilities etc.	<p>In addition to any requirements of local regulations, the contractor shall adopt precautions when using explosives which prevent scattering of rocks, stumps or other debris outside the work area, and prevent damage to surrounding trees, shrubbery and vegetation.</p> <p>Special care to be taken near pipelines especially those conveying oil and sewage because of the risk of contamination in case of damage.</p> <p>The people likely to be affected by the blasting should be informed in advance and no such blasting should be carried out at night.</p>
1300 CONTRACTOR'S ESTABLISHMENT ON SITE	1302- General requirements	<p>a) Camps, Equipment and Testing Facilities. The choice of all sites for the establishment of camps shall be to the approval of the Engineer. This will include accommodation, sanitary conveniences, maintenance and testing facilities necessary for his personnel, equipment, stores, process control etc.</p> <p>b) Legal Regulations and Responsibility to the Public. The Contractor shall take the necessary steps to comply with the terms of the General Conditions of Contract, particularly in respect of insurances and indemnities required, and he shall comply with all regulations of Statutory Authorities.</p> <p>c) Handing Over of the Site. The site will be handed over to the contractor in lengths and areas as specified in the Special Provisions.</p>	<p>Add the following new paragraphs to subclause 1302(a)</p> <p>To avoid competition with local communities for:</p> <ul style="list-style-type: none"> <li>i) water resources, the Contractor is to provide water for his camp by either drilling a borehole or having water supplied by bowsers without stressing the aquifer or water source.</li> <li>ii) fuelwood, the Contractor is to provide alternative fuel options (electricity, gas, kerosene ) or a central canteen to economise on fuel or fuelwood/charcoal usage and not to deplete local fuelwood supplies.</li> </ul> <p>The Contractor shall also make arrangements for the provision of:</p> <ul style="list-style-type: none"> <li>i) food supplies for workers to minimise local price inflation</li> <li>ii) health facilities for the workforce, including provision of anti-malarials and prophylactics against STDs.</li> </ul>

SECTION	CLAUSE	EXISTING PROVISIONS	PROPOSED ADDITIONS
			<p>To avoid air pollution from asphalt plants and crushers, the Contractor shall ensure that plant and equipment are not located near homesteads or settlements. He shall also ensure that vehicles and construction plant receive regular and effective maintenance to avoid emission of large quantities of exhaust fumes and spillage of oils and lubricants.</p> <p>By using such turbidity control measures as gravel-filter entrapment dikes, approved flocculating processes that are not harmful to fish, recirculation systems for washing of aggregates etc., wastewater from aggregate processing, concrete batching or other construction operations will be made to contain as little as possible of settleable material before being discharged into streams, watercourses or other surface waters.</p> <p>All waste water and sewage from office, residential and mobile camps shall be piped to soak pits or other disposal areas constructed in accordance with local government regulations, and where and when such regulations require it the Contractor shall obtain a permit or other appropriate documentation approving the disposal methods used.</p> <p>All used fuels, oils, other plant or vehicle fluids, and old tyres and tubes shall be collected to a central disposal area on a daily basis and disposed of in a manner approved by the Engineer and not harmful to the environment.</p>

SECTION	CLAUSE	EXISTING PROVISIONS	PROPOSED ADDITIONS
			<p>The Contractor's workshops, office and yard area shall be located and arranged in a manner to preserve trees and vegetation to the maximum practicable extent. On abandonment, all temporary buildings, including concrete footing and slabs, and all construction materials and debris shall be removed from the site. The area shall be re-graded as required, so that all surfaces drain naturally, blend with the natural terrain and are left in a condition that will facilitate natural revegetation, provide for proper drainage and prevent erosion.</p> <p>Provision be made for the wearing of safety vests/jackets by all the workforce and also masks and ear muffers for those working on asphalt plants and with drilling equipment respectively.</p>
<p>1400 ACCOMMODATION, SERVICES, AND ATTENDANCE FOR THE ENGINEER'S STAFF.</p>	<p>1404- Services for the Engineer's staff.</p>	<p>a) Sanitary arrangements. When no Municipal sewage treatment is available, the Contractor shall provide the necessary septic tanks for all latrines.</p> <p>Waste water and septic tank effluent shall be taken into properly designed trench-drains. The Contractor shall also provide for the removal of all rubbish.</p> <p>When the construction of septic tanks or water borne sewerage is not feasible, the Contractor shall construct conservancy tanks and arrange for the removal and disposal of sewage.</p>	<p>Removal and disposal of sewage shall be carried out in a manner that is acceptable to the local Public Health Authorities.</p>

SECTION	CLAUSE	EXISTING PROVISIONS	PROPOSED ADDITIONS
1500 ACCOMMODATION OF TRAFFIC	1501 - Scope	This section covers the construction and maintenance of the necessary detours and bypasses, barricades and signs, and everything necessary for the safe and easy passage of all public traffic during the construction period and during the Defects Liability Period and also the obliteration of the bypasses as they become redundant.	<p>Add the following new sub-clause 1502(j)</p> <p>The Contractor will be held liable for any damage resulting from dust originating from detours and bypasses. To minimise the damage from noise and dust the contractor shall:</p> <ul style="list-style-type: none"> <li>i) use low dust standard road surface materials</li> <li>ii) retain live fences along the detours</li> <li>iii) dampen the surface periodically</li> <li>iv) install speed calming devices like speed humps, rumble strips especially near and in settlements, schools and hospitals.</li> </ul> <p>As far as possible deviations should remain within the road reserve and after completion of the road works should be rehabilitated/landscaped and replanted</p>
	1512 - Measurement and Payment..	Payment shall be made in two equal instalments in respect of each section. The first instalment will be made suitable bypasses have been approved for use. The second instalment shall become due when the traffic can be accommodated on the new road, all bypasses have been obliterated and all general obligations of the Contractor have been complied with, all to the satisfaction of the Engineer.	
1700 CLEARING AND GRUBBING	1702 - Clearing and Grubbing	<ul style="list-style-type: none"> <li>a) The extent of Clearing (removal of all trees including the disposal of all material resulting thereof ) and Grubbing shall be as instructed by the Engineer.</li> <li>b) Conservation of Topsoil together with any grass and other suitable vegetation shall be as ordered by the Engineer.</li> <li>c) Conservation of Flora</li> </ul>	Designated flora includes trees listed on the Reserve species list of the Forest Department.

SECTION	CLAUSE	EXISTING PROVISIONS	PROPOSED ADDITIONS
		<p>Where provided for in the Special Provisions, certain designated flora encountered shall be carefully protected by the Contractor. He shall include in his tendered rates for clearing and/or grubbing, for the careful removal and planting of the flora in a protected and fenced-off area and on completion of the road., for the replanting in suitable positions in the road reserve in accordance with the Engineer's instructions.</p>	
	<p>1703 - Execution of Work. 1703(a) - Areas to be cleared and/ or Grubbed.</p>	<p>The portions of the road reserve that fall within the limits of the road prism, as well as certain borrow areas may require to be cleared and /or grubbed. The Engineer shall designate the areas to be cleared and such areas shall not necessarily be limited to those mentioned above.</p>	<p>1703(a) Add the following paragraph:</p> <p>The Contractor shall control the clearing and/ or grubbing to ensure that the portions of the road reserve that fall outside the limits of the construction width or such areas as the Engineer shall designate, shall not be cleared and / or grubbed.</p>
<p>2100 SURFACE WATER AND DRAINAGE.</p>	<p>2101- Scope.</p>	<p>This section covers all work in connection with the excavation and construction of open drains, subsurface drains, banks and dikes at the locations and to the sizes, shapes, grades and dimensions as shown on the Drawings or as directed by the Engineer.</p>	<p>Add the following to the first paragraph:</p> <p>There will be provision for the digging of infiltration ditches and soak pits within the road reserve if water cannot be discharged into lower catchment.</p> <p>Provision shall be made for the implementation of measures, as will be directed by the Engineer to prevent/reduce damage e.g. sedimentation, erosion, water pollution as a result of outfall drains discharging into the lower catchment beyond the road reserve, water collected in the side drains.</p>

SECTION	CLAUSE	EXISTING PROVISIONS	PROPOSED ADDITIONS
2400 PITCHING, STONEMWORK AND EROSION PROTECTION.	2401 - Scope.	Scope- This section covers the furnishing of materials and construction of a protective covering in stone pitching, or cast in situ concrete pitching on exposed surfaces such as earthslopes, drains and stream beds, as well as heavier protection in the form of rip rap all as shown on the Drawings or ordered by the Engineer.	
3100 BORROW MATERIALS	3101-Scope	This section covers the work involved in obtaining borrow materials for work under this Contract, including negotiations, except as provided hereinafter, with owners of the land on which borrow areas are started. Clearing the site, stripping and disposing of excess overburden, excavating selected material for use of the works and finishing off the borrow areas.	The provisions of the clauses in this section shall apply <i>mutandis mutandis</i> to materials to be got from hard stone quarries.
	3102- Negotiations with Owners and Authorities.	<p>a) The Contractor shall, before entering private property for the purpose of opening borrow pits, constructing access roads, temporarily occupying certain land or inspecting the areas concerned negotiate with and serve notice upon the owners of his intention of doing so, all in accordance with National legislation and the provisions of Clause 1213 hereof.</p> <p>b) The Contractor shall settle all claims in respect of royalties, loss of crops or other matters to which the owner may be entitled in terms of National legislation as a result of the Contractor's entering upon, and temporary occupation of private land, use of haul roads and his removal of material from the landowner's property.</p>	<p>Add the following new paragraphs to subclause (a) of this clause:</p> <p>The Contractor shall have previously submitted a plan in respect of each borrow/quarry area covering:</p> <ul style="list-style-type: none"> <li>• location and area ;</li> <li>• access arrangements;</li> <li>• a working plan, giving an outline of the direction, phasing and depth of working;</li> <li>• a reinstatement plan, giving details of final grading, drainage and sediment control re-soiling and re-vegetation measures and design after-use;</li> <li>• arrangements for consultation with <ul style="list-style-type: none"> <li>a) the owner of the property</li> <li>b) any affected community.</li> </ul> </li> </ul> <p>The plan must indicate where stripped topsoil will be stockpiled for later re-use in reinstatement and how it will be protected from intervening erosion.</p>

SECTION	CLAUSE	EXISTING PROVISIONS	PROPOSED ADDITIONS
			<p>The agreement shall be subject to prior approval by the Engineer and by the local Environmental Officer and must contain the following provisions:</p> <ul style="list-style-type: none"> <li>i) Full reinstatement including planting, of property occupied, used, damaged or destroyed to existing or better condition;</li> <li>ii) Compensation in lieu of full reinstatement will not be approved unless the landowner wishes, with the approval of the local Environmental Officer and the Local Council to: <ul style="list-style-type: none"> <li>a) use the area after being levelled as a construction site for buildings;</li> <li>b) allow water to collect for use as a fish pond or for recreational purposes eg. water sports;</li> <li>c) continue exploiting the material site commercially .</li> </ul> </li> </ul> <p>In all the above cases the areas will have to be made safe by fencing to restrict access.</p>
3100 BORROW MATERIALS	3104 (a) Clearing and Grubbing, Topsoil and Overburden.	The Contractor's rate for borrowed material must include for clearing, grubbing and the removal of topsoil and overburden.	
	3105- Finishing off Borrow Areas.	On completion of his operations in a borrow area the Contractor shall reinstate the entire area so as to blend with the surrounding area to permit the re-establishment of vegetation. For this purpose the borrow area shall be shaped to even contours.	Reinstatement shall include grass cover using either seed with fertiliser according to soil analysis, or vegetative grass cover all in accordance with the advice which the Contractor shall obtain from the Agriculture Department, and preferably will restore the site to a productive use, such as pasture/grasslands or as a woodlot.

SECTION	CLAUSE	EXISTING PROVISIONS	PROPOSED ADDITIONS
		<p>All material in and around the borrow area, whether spoil from road building operations, excess stockpiled material, oversized material left in the borrow pit, material resulting from the clearing and grubbing operations and excess overburden, shall be used or disposed of as directed by the Engineer.</p> <p>Material not capable of supporting vegetation shall be buried and used in shaping the borrow area and subsequently covered with soft material. All available soft material shall be spread evenly to the thickness directed and where sufficient material is not available for this purpose to cover the entire area, the remaining portions shall be scarified along the contours so as to avoid undue erosion.</p> <p>All haul roads shall be obliterated and the surface scarified, earthbanks constructed to prevent erosion and all damaged fences and other structures reinstated.</p> <p>The shaping and the finishing-off of the borrow pit shall be done in such a way that the borrow pit will be properly drained whenever practicable and where required the Contractor shall place earthbanks to divert any surface water away from the borrow area. The finishing-off of the borrow area shall be to the entire satisfaction of the Engineer, and the Contractor shall submit to the Engineer a signed certificate from the landowner stating that he is fully satisfied with the finishing-off of any borrow area. The Contractor's attention is drawn to the provision of clause 1213 above in this respect.</p>	<p>The Contractor shall protect the grass cover from grazing for one growing season or a minimum of six months. Reinstatement shall obviate safety hazards by benching end walls in rock and grading faces in other materials.</p> <p>Borrow areas/quarries shall be finally screened from the road, if possible by reforestation along the roadside.</p> <p>The finishing of the borrow area/ quarry shall, as much as possible, be completed before the equipment is moved to another one and shall also be to the satisfaction of the District Environmental Officer.</p>
3100 BORROW MATERIALS	3108- Measurement and Payment.	Procuring and furnishing borrow material shall not be payable directly but shall be considered as a subsidiary obligation of the Contractor covered under the contract prices paid for the various items of work in which the materials are used.	<p>Add the following paragraph:</p> <p>The unit prices for procuring and furnishing borrow materials/hard stones shall be separate from the prices of reinstating the borrow pits/quarries.</p>

SECTION	CLAUSE	EXISTING PROVISIONS	PROPOSED ADDITIONS
		<p>It shall include full compensations for all obligations, expenses, operations and work prescribed in Section 1200 of the Specifications as well as all supervision, labour, equipment, tools and incidentals necessary thereto, including all such expenses as may be necessary to control test all materials, to drain and protect borrow areas and to complete all negotiations with and payment to landowners as specified as well as clearing and grubbing, removal of topsoil and overburden and the final shaping and finishing-off of the borrow pit.</p>	
<p>3400- CONSTRUCTION OF THE ROAD SUBGRADE</p>	<p>3406-Stripping of Topsoil, Clearing and Grubbing.</p>	<p>Prior to starting any cut excavations, road bed preparations or embankment construction, the contractor shall obtain from the Engineer his instructions regarding any stripping of topsoil or clearing and grubbing that may be required.</p>	
	<p>3407-Cut and Borrow.</p>	<p>a)Dimensions of Cuts. The dimensions of cuts shall be generally in accordance with the details of the typical cross-sections and interchange etc., as shown in the Drawings and further defined or amended during the course of construction by instructions from the Engineer. The Contractor shall obtain instructions in advance from the Engineer regarding the slopes of the sides of cutting etc.</p> <p>f) Disposal of Surplus Material Any surplus material arising from excavations, including any waste or oversize material bladed off the road, shall be disposed of as directed by the Engineer who may require that the material be utilised in uniform widening of fills or the flattening of slopes, or be deposited in such places and for such purposes as he may direct. Spoil material shall not require compaction but must, if required be spread, shaped, given a smooth surface such as is normally obtained with careful bulldozer operations.</p>	<p>Add the following paragraph to subclause (f) The Engineer shall approve dumping of surplus material where it will not have a visual impact and most preferably in borrow pits/quarries for the purpose of restoration. Dumped material to be spread, covered with a topsoil layer and re-vegetated.</p>

SECTION	CLAUSE	EXISTING PROVISIONS	PROPOSED ADDITIONS
		<p>g) General. The Contractor shall exercise proper care when excavating cuts not to loosen, where this can be avoided, any material outside the specified cut line, whether by ripping, blasting or other means and thereby endangering the structural stability of the slopes or subsequently causing undue erosion or disintegration the batters.</p>	
<p>3400- CONSTRUCTION OF THE ROAD SUBGRADE</p>	<p>3408- Finishing of Slope;</p>	<p>c) General. Except in solid rock the tops and bottoms of all slopes, including the slopes of drainage ditches, shall be rounded as indicated on the Drawings or as ordered by the Engineer. When so directed by the Engineer adjustment in slopes shall be made to avoid injury to standing trees and to harmonise with the existing landscape features. The slopes of cuts and fills which are designated for grassing shall, after finishing be prepared for grass planting and/or topsoil for grass planting as specified in Section 5700</p>	
	<p>3415- Protection of Road Prism and Structures</p>	<p>All cuts and fill slopes shall be maintained by the Contractor until final acceptance of the road. All erosion and flood damage to the slopes shall be properly repaired, as specified in Clause 1219. Side drains discharging from cuts and all other drains shall be so constructed as to avoid damage to fill by erosion.</p>	

SECTION	CLAUSE	EXISTING PROVISIONS	PROPOSED ADDITIONS
5100-GABIONS	5101-Scope	<p>This section covers the construction of gabion walls and aprons for the construction of retaining walls, lining of channels, revetments and other anti-erosion structures.</p> <p>Generally gabions shall be galvanised steel wire-mesh cages packed with rock.</p>	
5200 - GUIDE BLOCKS.	.5201 - . Scope	<p>This section covers the supply and erection of guide blocks in position and in accordance with the dimensions as shown on the drawings or as directed by the Engineer.</p>	
5300- GUARD RAILS	5301 - Scope	<p>This section covers the supply, installation and maintenance of metal plate beam guard-rails at locations and in conformity with the details, dimensions and design shown on the drawings or as directed by the Engineer.</p>	

SECTION	CLAUSE	EXISTING PROVISIONS	PROPOSED ADDITIONS
5400 - ROAD SIGNS	5401-Scope	<p>This section covers the supply and erection of permanent road traffic signs alongside and over the carriageway, ramps and cross roads at interchanges and at the locations indicated on the drawings or as directed by the Engineer.</p> <p>f) Time of erection Road traffic signs shall be erected immediately prior to the opening of the road to the public traffic unless otherwise decided by the Engineer.</p>	
	5407 - Protection and Maintenance	The Contractor shall protect the completed road signs against damages until it is finally accepted by the Employer, and he shall maintain the road signs until the defects liability certificate is issued.	

SECTION	CLAUSE	EXISTING PROVISIONS	PROPOSED ADDITIONS
5500 - ROAD TRAFFIC MARKINGS	5501 - Scope	This section covers the permanent marking of the road surface with white or yellow painted lines or symbols as indicated on the drawings or where required by the Engineer.	
5600 - LANDSCAPING AND GRASSING	5601 - Scope	This section covers the landscaping of areas outside the road prism, the establishment of vegetation for functional and aesthetic purposes on cut and fill slopes and such other areas as may be required.	Change the section head to read 'LANDSCAPING AND REVEGETATING'
	5602 - Materials	<p>a) The type of fertiliser to be used shall be one of the following:</p> <ul style="list-style-type: none"> <li>i) Agricultural lime</li> <li>ii) Super phosphate</li> <li>iii) Limestone ammonium-nitrate</li> </ul> <p>b) Grass cuttings shall be fresh cuttings of an approved type.</p> <p>c) Grass seed - only good quality fresh seed shall be used and the types of seed in the seed mixture shall be as in Clause 5606 (b).</p> <p>d) Topsoil Topsoil shall consist of fertile loamy soil and shall be obtained wherever suitable material occurs, either in the road reserve from areas where cuts and fills are to be constructed or from borrow areas to be cleared. The Engineer shall indicate to the Contractor his requirements regarding the quantity of topsoil required and the areas from which it shall be selected and removed.</p> <p>If the Contractor fails to conserve topsoil as instructed, he shall obtain suitable substitute material from other sources at no extra cost to the Employer.</p> <p>Where so specified, the Contractor shall procure and furnish topsoil from his own source outside the site, such source shall be approved by the Engineer.</p>	<p>Add the following new subclauses;</p> <p>g) Avenue/Roadside Tree Planting; Avenue trees, where so required shall be planted at least 1.50m inside the limits of the road reserve on both sides of the road, at 5.00m centres longitudinally, or as the Engineer may direct.</p> <p>h) Planting of Shrubs and Trees on Slopes: Shrubs and trees shall be planted on the slopes as will be directed by the Engineer.</p> <p>The contractor shall provide complete maintenance for a period of one year after planting, including erecting protection cages, watering, clearing around the tree etc.</p>

**Table 6.3: MOWTC's Maintenance Manual (1998)**

CHAPTER	SECTION	EXISTING PROVISIONS	PROPOSED ADDITIONS
4. ROAD SAFETY	4.1 GENERAL	<p>Road accidents are caused by human factors, the condition and design features of the road, the mechanical condition of vehicles and the environment. Road maintenance can decrease road accidents by contributing to road condition and design. The following have been identified as causes of road accidents in Uganda on which road maintenance can affect.</p> <ul style="list-style-type: none"> <li>• Narrow shoulders</li> <li>• Lack of road markings, signs and furniture</li> <li>• Potholed roads</li> <li>• Inadequate drainage</li> <li>• Tight bends on rural roads</li> </ul> <p>The pavements should therefore be kept in a state that is safe to road users. Pavements should be pot hole-free and edges of pavement should be in good shape.</p> <p>Road signs, road marking and guard rails should all be provided on roads to guide and assist drivers and promote safety. Maintenance of such provisions should be done as a routine and should form a vital component of the entire road maintenance programme.</p>	<p>Reference should be made to sections 5200, 5300, 5400 and 5500 of M O W T C's General Specifications for Road and Bridge Works Vol. IIIA, 1992.</p> <p>The public should be sensitised on the need to preserve the traffic signs, guard-rails, guide posts, bridge railings, etc.</p>

CHAPTER	SECTION	EXISTING PROVISIONS	PROPOSED ADDITIONS
	4.2 SAFETY MEASURES AND TRAFFIC CONTROL	<p>When maintenance work is carried out on or close to the carriageway, all the adequate measures have to be taken to warn and protect road users and maintenance workers. All supervisors and foremen must be instructed on safety measures , including traffic control and the use of the temporary road signs. Each road maintenance group should be provided with signs appropriate to the work it is carrying out and all foremen and supervisors should be trained in their use and layout. All temporary signs must be removed as soon as the work they relate to is complete. During the maintenance work safety vests/jackets should be worn by all of the workforce. All vehicles and equipment should carry yellow flashing warning lights. If warning light is not available, vehicles and equipment should carry a red flag. Reference should be made to the M. O. W. T. &amp; C's General Specifications for Road and Bridge Works Volume IIIA 1992 Section 1500: Accommodation of Traffic.</p>	<p>Protective clothing to include masks and ear muffers that are to be worn by those working on asphalt plants and with drills/jack hammers respectively.</p>
5. ROAD RESERVE	5.1	<p>A road system is not complete without a road reserve. Road reserves, like the name suggests, can be used to provide area for road construction. This often happens when a road is to be upgraded or widened. Road reserves also improve the visibility of a road way. In view of their importance to the entire road, reserves should be selfishly guarded. Developers should not be allowed to encroach on road reserve the first time.</p> <p>It otherwise becomes a lot harder to evict a developer from the road reserve once serious development has already been made. Such developments may include buildings, crop gardens etc.</p>	<p>The people living along the road should be sensitised against encroaching on the road reserves. The Road Reserve boundary should be clearly marked using posts placed at fixed intervals of say 0.5 km.</p>
6. ENVIRONMENTAL ISSUES	6.1 GENERAL	<p>Roads and road operations affect the environment in a number of ways such as air and water pollution, noise, dust, erosion etc. This chapter provides a summary of measures that are currently recommended in order to take consideration the five topics in water management, soil conservation, sand encroachment, protection of vegetation and roads that pass through villages. (Adapted from Road Maintenance and the Environment published by the World Bank).</p>	<p>Reference to be made to the Annex to MOWTC's General Specifications for Road and Bridge Works Volume IIIA, 1992.</p>

CHAPTER	SECTION	EXISTING PROVISIONS	PROPOSED ADDITIONS
	6.2 INSTITUTIONAL ASPECTS	Management that incorporates environmental considerations in road maintenance requires consultations between the various parties, preparation of environmental regulations for the three categories of works- routine maintenance, periodic maintenance and rehabilitation- and adoption of the necessary support measures for managing such operations.	
	6.2.1 Parties involved	a) M.O.W.T.& C through the Department of Maintenance b) public works Companies c) consultants, consulting firms and research and training institutions.	
	6.2.2 Contractual relations among the various parties	<p>Road maintenance contracts tend to be awarded to the formal (large companies, SME's, small contractors) or the informal private sector (village communities, NGO's etc.). The main types of roads maintenance contracts are as follows:</p> <p>a) contracts for studies of road maintenance works, relating to the study of maintenance needs (routine, periodic and rehabilitation works ), preparation of detailed designs and the formulation of contract tender documents; b) contracts for the supervision and monitoring of maintenance works contracts; c) road maintenance contracts awarded to the contractor.</p> <p>These types of contracts should include clauses pertaining to environmental protection and improvement on areas adjacent to the road through the road maintenance works.</p>	

CHAPTER	SECTION	EXISTING PROVISIONS	PROPOSED ADDITIONS
	6.2.3 Road Maintenance Works.	<p>Certain clauses should be included in contracts for the execution of conventional maintenance tasks, in order to take into account the road environment. These clauses should focus mainly on the following points;</p> <p>a) General obligations of the contractor The road maintenance works contract should include a list of all guidelines and regulatory and legal texts governing the environment and its improvement. The obligations of the contractor will remain in effect until the final acceptance of those works which will be delivered only after full completion of the environmental improvement works envisaged in the contract.</p> <p>b) areas surrounding worksite facilities: the set-up of the planned facilities will be subject to prior approval following submission of a description detailing the provisions designed to protect the environment and what will be done to restore the site upon completion of the maintenance works. Arrangements are to be included in order to avoid polluting water drainage.</p> <p>c) precautions during the execution of the maintenance works: in the daily organisation of the worksite, the contractor must take all appropriate measures to minimise any environmental damage by applying contractual provisions ( limiting the areas used for equipment movement and borrow pit areas, scarifying and rehabilitating the areas used for worksite operation, safeguarding of vegetation during the works and restoration of plant cover etc.)</p> <p>d) safeguarding/restoration of natural runoff flows: limit water pollution caused by suspended matter</p> <p>e) protection to the local living conditions alongside the road during and after the works.</p>	

CHAPTER	SECTION	EXISTING PROVISIONS	PROPOSED ADDITIONS
	6.2.4 Support measures	<p>A true environmental improvement and road maintenance policy is viable only if the parties involved are active players.</p> <p>Training: Priority in environmental training must be given to those responsible for the design/programming and execution of road projects. The program should be made to increase the awareness and training of other public and private parties.</p> <p>Training programs already exist.</p>	
	6.3 TECHNICAL ASPECTS	<p>Taking the environment into consideration in road maintenance activities involves adopting technical measures that are translated into norms or standards by reason of the repetitive nature of the operations involved.</p>	<p>Reference to be made to Sections 1700, 2100, 2400, 3100, 3400 and 5600 of the MOWTC's General Specifications for Road and Bridge Works Vol. IIIA, 1992.</p>
	6.3.1 Water Management	<p>Water is a precious resource that must be preserved but it can be damaging to village roads and can erode fertile land.</p> <p>Roadway water: The creation of turnouts (or mitre drains) which extend along contour levels is recommended. On the flattest terrain, retention basins of various sizes can be put in place.</p>	<p>The unit prices for digging, outside the road reserve, of runouts (intended to carry runoff from the road to a point where the water does not cause erosion ) and water storage basins( to receive runoff water from the road ) should be separated from that for open drain excavation within the road reserve.</p>
	6.3.2. Soil Conservation	<p>Roadway and embankment soil. On sections with definite slopes, measures to guide the water down to the foot of the embankment (curbs, water lines, gullies, drainage channels along the embankment are necessary).</p> <p>Embankments can be protected against erosion by adding topsoil and sowing local species of grass, planting tufts of grass with tap roots (<i>parsipalum</i>, <i>vetiver</i>) in a hex pattern or laying strips of sod.</p> <p>Ditches. In order to prevent erosion of the sides and bottom of ditches, it is necessary to reduce the quantity of water (by creation of additional turnouts) and slow down its flow(by construction of appropriate devices). Planting grass on the sides of ditches can be an intermediate solution for increasing resistance to erosion. When the slope of a ditch is pronounced or the soil is highly susceptible to erosion, concrete or stone lining of the ditch is recommended.</p>	

CHAPTER	SECTION	EXISTING PROVISIONS	PROPOSED ADDITIONS
	6.3.3. Maintaining the vegetation	<p>Selection and careful use of borrow pits can appreciably reduce the damage caused to vegetation by road works. Advantage should also be taken of maintenance activities to replant trees, particularly in villages.</p> <p>In sensitive or protected areas, brush clearing must be limited to the direct needs of the construction or maintenance works (roadbed, limitation of amounts to be dumped, preservation of large trees in the borrow areas) and replanting must be made mandatory.</p>	
	6.3.4 Passage through villages	<p>Simple precautions reduce the disruptions caused to villagers by the execution of road maintenance works.</p> <p>Precautions during the works:- Disruptions caused to local people, particularly residents of the villages passed through, can be appreciably reduced, and at low cost, as follows</p> <p>a) by requiring that the contractor pays special attention to the way in which he organises and executes the work</p> <p>b) by slightly modifying the specifications for the works for example, compacting with sprinkling rather than dry compacting, in order to keep dust down.</p> <p>Permanent improvements:- Normal road maintenance, and especially full scale rehabilitation is an opportunity to be seized to improve or correct the road's passage through a village. The most common measures might be:</p> <p>a) improvement of the longitudinal profile of the road</p> <p>b) widening of the road and creation of parking areas which will significantly improve safety for both residents and road users.</p> <p>c) reinforcement/paving of shoulders which are very exposed to deterioration from truck parking (such reinforcement will mean future maintenance savings)</p> <p>d) improvement(or creation) of a system of draining water from the road.</p>	<p>(Add the following new sub-clauses)</p> <p>c) by erecting speed bumps to lessen the dust raised by and /or reduce the speed of fast moving vehicles.</p> <p>d) by adding compaction to simple reshaping</p>
	6.3.5 Borrow pit reinstatement	<p>Borrow pits and borrow areas should be carefully reinstated. It is good practice to stockpile the overburden (vegetation and "unwanted" top agricultural soils) material, and to spread it over ( after extraction of suitable material for road works), properly landscaped to encourage vegetation, and generally minimise soil erosion and restore the beauty of the environment.</p>	<p>Change the section head to read 'Reinstatement of Borrow pit and Hard Stone Quarry'</p>

CHAPTER	SECTION	EXISTING PROVISIONS	PROPOSED ADDITIONS
		<p>The same treatment should be given to stone quarries.  MOWTC's General specifications for Road and Bridge Works, Volume IIIA section 3100 specifies the use of the borrow materials and quarries.</p>	<p>A unit price should be set for the stockpiling by the contractor of materials at the borrow pits to be used later on for patching, thereby ensuring availability of a stock of suitable materials at the least cost for the labour-based works.</p> <p>A unit price should be set for the spreading of stripped materials from previous works or borrowings in order to foster regrowth of natural vegetation and water drainage.</p> <p>Excavation should be planned such that when one section has been exploited, it is rehabilitated/landscaped and replanted, while excavation of another section begins.</p> <p>The borrow pits/quarries are to be made safe by fencing them off and by limiting their accessibility.</p>

CHAPTER	SECTION	EXISTING PROVISIONS	PROPOSED ADDITIONS
8. METHODS OF WORK	<p data-bbox="378 280 629 402">8.3 MOWTC ROAD DESIGN MAINTENANCE SPECIFICATIONS</p> <p data-bbox="378 443 629 532">M100: MANUAL MAINTENANCE SPECIFICATIONS</p> <p data-bbox="378 638 629 792">M200: MECHANISED MAINTENANCE SPECIFICATIONS M201. PREAMBLE</p>	<p data-bbox="651 443 1534 630">All the debris arising from all the 11 no. manual maintenance activities ranging from M101( weeding of Gravel Carriageways and shoulders) to M111 (Painting of Guard-rails and Headwalls) is to be disposed of at least 25 metres distant from the road centreline, without damaging the road formation pavement or structures or adjacent to public/private property in any way and all to the satisfaction of the Employer.</p> <p data-bbox="651 662 1534 849">These specifications are to be read in conjunction with Volume IIIA- General Specifications for Road and Bridge Works of MOWTC's Standard Contract Documents which shall generally apply to these maintenance works, save only where specific maintenance works are specified herein and to prove to be in conflict with the General Specifications, in which case the particular maintenance specification shall govern.</p> <p data-bbox="651 1019 1534 1174">All the debris arising from each of the 7 no. activities namely M202, M203, M204, M207, M210, M211 and M214 is to be disposed of at least 25 metres distant from the road centreline, without damaging the road formation pavement or structures or adjacent public/private property in any way and all to the satisfaction of the Employer.</p>	<p data-bbox="1555 443 1983 532">Disposal methods to receive the approval of the Local Environmental Committee.</p> <p data-bbox="1555 662 1983 1011">For all the activities requiring material from borrow pits;</p> <ul data-bbox="1555 727 1983 1011" style="list-style-type: none"> <li>• the unit prices for preparation and application of materials should be separated from other prices in order to track the cost of limiting the area used for borrow pits</li> <li>• designated borrow pits to be used in order to avoid uncontrolled spread of the damage to the natural environment.</li> </ul> <p data-bbox="1555 1019 1983 1336">Disposal methods to be also to the satisfaction of the Local Environmental Committee. Because the length of the side or turnouts to be cleaned varies with each road and their environmental impact is different, unit price for ditch cleaning should be separated from that for reshaping and regravelling of the road surface .</p>

## **6.2 Road Construction and Maintenance Contracts**

The following documents comprise the tender for a road project:

Type	Volume	Section	Subject
	-		Invitation to Tender ( under separate cover )
Standard Document	IA	1	Invitation to Tenderers
		2	Documentation for Tender
Guide Document	IB	3	Schedules
		4	Bill of Quantities
Standard Document	II		Conditions of Contract for Road and Bridge Works.
Standard Document	IIIA		General Specifications for Road and Bridge Works
		IIIB	Special Provisions to General Specifications
	IV		Drawings

Consultants acting for the Ministry of Works, Housing and Communications are normally expected to incorporate the standard volumes IA, II and IIIA in their tender package and use these and the guide volume IB to prepare the remainder of their tender package, namely volumes IB, IIIB and IV.

According to Clause 5.2 of Conditions of Contract for Road and Bridge Works Vol. II-Conditions of Particular Application, the documents forming the Contract shall take precedence in the order in which they are set out in the Form of Agreement, as follows:

- a) The Employer's Letter of Acceptance
- b) The Contractor's Tender including separate Memoranda
- c) The Addenda to Tender Documents
- d) The Conditions of Contract, Part II -Conditions of particular Application.
- e) The Conditions of Contract, Part I -General Conditions ( Fourth Edition 1987 published by FIDIC).
- f) The Bill of Quantities
- g) The Drawings
- h) The Special Provisions to the General Specifications
- i) The General Specifications

It is therefore proposed that, at the tender preparation stage, issues pertaining to the environment be handled as follows:

- The Economic Feasibility and Preliminary Engineering Design Report should take into account the recommendations of the Environmental Impact Assessment Study carried out;
- At the Detailed Design Stage any necessary environmental mitigation (or enhancement) measures identified in the feasibility stage should be incorporated into the design and all its construction details drawn up;
- Pre-qualification of contractors for invitation to tender should be made to require, as far as is possible, submission of an environmental protection statement and a health and safety statement, which would then be developed into full action plans in the final bid.

In order to assist with this, existing provisions in the Conditions of Contract which refer to environmental issues are listed in the tables below.

**Table 6.4: Standard Clauses in Conditions of Contract relating to Environmental Issues**

General Conditions	Clause
Engineer's Duties and Powers	2
Priority of Contract Documents	5.2
<b>General Obligations</b>	
Site Operations and Methods of Construction	8.2
Inspection of Site	11.1
Not Foreseeable Physical Obstruction or Conditions	12.2
Employment of Local Personnel	16.4
Safety, Security and Protection of the Environment	19.1
Care of the Works	20.1
Damage to Persons and Property	22.1
Accident or Injury to Workmen	24.1
Compliance with Statutes, regulations	26.1
Fossils	27.1
Royalties	28.2
Interference with Traffic and adjoining Properties	29.1
Avoidance of Damage to Roads	30.1
Clearance of Site on Completion	33.1
<b>Labour</b>	
Engagement of staff and labour	34.1
Housing for Labour	34.4
Accident Prevention Officer; Accidents	34.5
Health and Safety	34.6
Measures against Insect and Pest Nuisance	34.7
Epidemics	34.8
Supply of Foodstuffs	34.10
Supply of Water	34.11
Alcohol, Liquor or Drugs	34.12
Arms and Ammunition	34.13
Festivals and Religious Customs	34.14
Disorderly Conduct	34.15
Records of Safety and Health	35.2
Reporting of Accidents	35.3
<b>Commencement and Delays</b>	
Rights of Way and Facilities	42.3
Restriction on Working Hours	45.1

**Table 6.5: Clauses in the General Specifications for Road and Bridge Works  
Vol. IIIA**

Item	Clause(s)
Contractor's activities in respect of Property outside the Site Boundary	1213
Water	1220
Use of Explosives and Demolition	1224
General requirement on Contractor's Establishment on Site	1302
Services for the Engineer's Staff	1404
Accommodation of Traffic	1501 and 1512
Clearing and Grubbing	1702, 1703 and 1703(a)
Surface Water and Drainage	2101
Pitching, Stonework and Erosion Protection	2401
Borrow Materials	3101, 3102, 3104(a), 3105 and 3108
Construction of the Road Subgrade	3406, 3407, 3408 and 3415
Gabions	5100
Guide Blocks	5201
Guard rails	5301
Road Signs	5401 and 5407
Road Traffic Markings	5501
Landscaping and Grassing	5601 and 5602

Construction details for environmental mitigation measures identified at feasibility stage are normally drawn up by the Consultant in the Book of Drawings which forms Vol. IV of the Contract Document.

The Special Provisions to the General Specifications normally contain a write up on management of environmental matters

The Bill of Quantities would normally contain pay items based on the General Specifications' measurement and payment, for mitigation measures against the impacts on the environment that are to be executed.

The Items in the Bill of Quantities relating to environmental mitigation measures should include the following aspects of work:

**Table 6.6: Environmental Mitigation Measures in the Bill of Quantities**

ITEM	UNIT
a) Improving the Landscape	
Filling borrow pits and quarries by using excavated topsoil/overburden.	m <sup>3</sup>
Sprigging borrow pits, quarries and dump sites.	Ha.
Restoring temporary construction roads.	km
Avenue/Road side tree planting.	no. trees
Replacing cut trees and afforestation.	no. trees
Filling borrow pits/quarries using surplus material excavated from the road.	m <sup>3</sup> -km
b) Protecting the Environment:	
Arresting air pollution ( including dust ).	lump sum
Controlling noise pollution.	lump sum
c) Ensuring safety/ security and social and cultural harmony in local community:	
Excavating turn-outs, infiltration ditches and storage basins beyond the road reserve.	m <sup>3</sup>
Carrying out educational and information programmes.	lump sum
Fencing off camps and danger areas.	lump sum
Establishing workable solid waste management system.	lump sum
Donating the buildings, bore holes etc. to the local community on completion of the project.	lump sum

The section of the Special Specifications dealing with matters relating to the environment should be adopted from the proposed addition to MOWTC's General Specifications to Road and Bridge Works Vol IIIA as described in Section 6.3.1 below.

### **6.3 Recommendations for Inclusion of Environmental Clauses into MOWHC Documentation**

In the tables above, additions to existing clauses in MOWHC documentation have been proposed. In this section, we present recommendations for inclusion of clauses in the various documents

#### **6.3.1 MOWTC General Specifications**

It will be noted that the MOWTC's General Specifications do not have a separate section on environmental protection. The following section should be added to the General Specifications in order to ensure that environmental management considerations are adopted by Supervising Engineers and Contractors alike.

SECTION 1800: ENVIRONMENTAL PROTECTION AND WASTE DISPOSAL.  
Clause 1801 Landscape Preservation

(a) General

The Contractor shall exercise care to conserve the natural landscape and shall conduct his construction operations so as to prevent any unnecessary destruction, scarring, or defacing of the natural surroundings in the vicinity of the work. Except where clearing is required for permanent works, approved construction roads, or excavation operations, all trees, native shrubbery, and vegetation shall be preserved and shall be protected from damage by the Contractor's construction operation and equipment. The edges of clearing and cuts through trees, shrubbery, and vegetation shall be irregularly shaped to soften the undesirable visual impact of straight lines. Movement of labour and equipment within the right-of-way and over routes provided for access to the work shall be performed in a manner to prevent damage to grazing land, crops, or property.

Except as otherwise provided in Section 5600 special reseeding or replanting will not be required under these specifications; however, on completion of the work, all work areas not seeded shall be scarified and left in a condition which will facilitate natural revegetation, provide for proper drainage, and prevent erosion. All unnecessary destruction, scarring, damage, or defacing of the landscape resulting from the Contractor's operations shall be repaired, replanted, reseeded or otherwise corrected as directed by the Engineer, and at the Contractor's expense.

(b) Construction Roads

The location, alignment, and grade of construction roads shall be subject to approval of the Engineer. When no longer required by the Contractor, construction roads shall, if required by the Engineer, be restored to the original contour and made impassable to vehicular traffic. The surfaces of such construction roads shall be scarified as needed to provide a condition which will facilitate natural revegetation, provide for proper drainage, and prevent erosion.

(c) Construction Facilities

The Contractor's workshops, office, and yard area shall be located and arranged in a manner to preserve trees and vegetation to the maximum practicable extent. On abandonment, all temporary buildings, including concrete footings and slabs, and all construction materials and debris shall be removed from the site. The area shall be regraded, as required, so that all surfaces drain naturally, blend with natural terrain, and are left in a condition that will facilitate natural revegetation, provide for proper drainage, and prevent erosion.

(d) Blasting Precautions

In addition to any requirements of local regulations, the Contractor shall adopt precautions when using explosives which will prevent scattering of rocks, stumps, or other debris outside the work area, and prevent damage to surrounding trees, shrubbery and vegetation.

#### Clause 1802 Preservation of Trees and Shrubbery

##### (a) Preservation

All trees and shrubbery which are not specifically required to be cleared or removed for construction purposes shall be preserved and shall be protected from any damage that may be caused by the Contractor's construction operations and equipment. Special care shall be exercised where trees or shrubs are exposed to injuries by construction equipment, blasting, excavating, dumping, chemical damage, or other operations; and the Contractor shall adequately protect such trees by use of protective barriers or other methods approved by the Engineer. The removal of trees or shrubs will be permitted only after prior approval by the Engineer.

The layout of the Contractor's construction facilities such as workshops, warehouses, storage areas, and parking areas; location of access and haul routes; and operation in borrow and spoil areas shall be planned and conducted in such a manner that all trees and shrubbery not approved for removal by the Engineer shall be preserved and adequately protected from either direct or indirect damage by the Contractor's operations.

Except in emergency cases or when otherwise approved by the Engineer, trees shall not be used as anchorages. Where such use is approved, the trunk shall be wrapped in with a sufficient thickness of approved protective material before any rope, cable, or wire is placed.

##### (b) Repair or Treatment of Damage.

The Contractor shall be responsible for injuries to trees and shrubs caused by his operations. The term 'injury' shall include, without limitation, bruising, scarring, tearing, and braking of roots, trunk or branches. All injured trees and shrubs shall be repaired or treated without delay, at the Contractor's expense. If damage occurs, the Engineer will determine method of repair or treatment to be used for injured trees and shrubs as recommended by an experienced horticulturist or a licensed tree surgeon provided by and at the expense of the Contractor. All repairs or treatment of injured trees shall be performed under the direction of an experienced horticulturist or a licensed tree surgeon provided by and at the expense of the Contractor.

##### (c) Replacement

Trees or Shrubs that, in the opinion of the Engineer, are beyond saving shall be removed and replaced early in the next planting season. The replacements shall be the same species, or other approved species, and of the maximum size that is practicable to plant and sustain growth in the particular environment. Replacement trees and shrubs shall be stayed, watered and maintained for a period of 1 year from the date of replacement.

#### Clause 1803 Prevention of Water Pollution

##### (a) General

The Contractor's construction activities shall be performed by methods that will prevent entrance, or accidental spillage, of solid matter, contaminants, debris, and other pollutants and wastes into streams, flowing or dry watercourses, lakes, and underground water sources. Such pollutants and wastes include, but are not restricted to, refuse,

garbage, cement, concrete, sanitary waste, industrial waste, radioactive substances, oil, and other petroleum products, aggregate processing tailings, mineral salts, and thermal pollution.

Dewatering work for structure foundations or earthwork operations adjacent to, or encroaching on, streams or watercourses, shall be conducted in a manner to prevent muddy water and eroded materials from entering the streams or watercourses by construction of intercepting ditches, bypass channels, barriers, settling ponds or by other approved means. Excavated materials or other construction materials shall not be stockpiled or deposited near or on streambanks, lake shorelines, or other watercourse perimeters where they can be washed away by high water or storm runoff or can in any way encroach upon watercourse itself.

Turbidity increases in a stream or other bodies of water that are caused by construction activities shall be strictly controlled. When necessary to perform required construction work in a stream channel, the turbidity may be increased, as approved by the Engineer, for the shortest practicable period required to complete such work. This required construction work may include such work as diversion of a stream, construction or removal of cofferdams, specified earthworks in or adjacent to a stream channel, pile driving, and construction of turbidity control structures. Mechanised equipment shall not be operating in flowing water except as necessary to construct crossings or to perform the required construction.

Wastewater from aggregate processing, concrete batching, or other construction operations shall not enter streams, watercourses, or other surface waters without the use of such turbidity control methods as settling ponds, gravel-filter entrapment dikes, approved flocculating processes that are not harmful to fish, recirculation systems for washing of aggregates or other approved methods. Any such wastewaters, discharged into surface waters shall contain the least concentration of settleable material possible. For the purpose of these specifications, settleable material is defined as that material which will settle from the water by gravity during a 1-hour quiescent detention period.

(b) Compliance with Laws and Regulations

The Contractor shall comply with all applicable Ugandan laws, orders, regulations and water quality standards concerning the control and abatement of water pollution.

Clause 1804 Abatement of air pollution

The Contractor shall comply with applicable Ugandan laws and regulations concerning the prevention and control of air pollution. Notwithstanding the above in conduct of construction activities and operation of equipment, the Contractor shall utilise such practicable methods and devices as are reasonably available to control, prevent, and otherwise minimise atmospheric emissions or discharges of air contaminants.

The emission of dust into the atmosphere shall be strictly controlled during the manufacture, handling and storage of concrete and road aggregates, and the Contractor shall use such methods and equipment as are necessary for the collection and disposal or prevention, of dust during these operations. The Contractor's methods of storing and handling cement and pozzolans shall also include means of eliminating atmospheric discharges of dust.

Equipment and vehicles that show excessive emissions of exhaust gases due to poor engine adjustments, or other inefficient operating conditions, shall not be operated until corrective repairs or adjustments are made.

Burning of materials resulting from clearing of trees and brush, combustible construction materials, and rubbish will be permitted only when atmospheric conditions for burning are considered favourable and when authorised by the Engineer. In lieu of burning, such combustible materials may be disposed of by other methods as provided in Clause 1810 hereof. Where open burning is permitted, the burn piles shall be properly constructed to minimise smoke, and in no case shall unapproved materials, such as tires, plastics, rubber products, asphalt products, or other materials that create heavy black smoke or nuisance odours, be burned.

Dust nuisance resulting from construction activities shall be prevented in accordance with Clause 1805.

#### Clause 1805 Dust Abatement

During the performance of the work required by this specifications or any other appurtenant thereto, whether on right-of-way provided by the Employer or elsewhere, the Contractor shall furnish all the labour, equipment, materials, and means required, and shall carry out proper and efficient measures wherever and as often as necessary to reduce the dust nuisance, and to prevent dust which has originated from his operations from damaging crops, orchards, cultivated fields and dwellings, or causing nuisance to persons. The Contractor will be held liable for any damage resulting from dust originating from his operations under this specifications on the right-of-way or elsewhere. The Engineer may direct sprinkling or other measures for dust abatement if necessary to obtain adequate control.

The cost of complying with this paragraph shall be included in the prices tendered in the Bill of Quantities for other items of work.

#### Clause 1806 Noise Abatement

The Contractor shall comply with applicable Ugandan laws, orders, and regulations concerning the prevention, control and abatement of excessive noise.

Blasting, the use of jackhammers, pile driving, rock crushing, or other operations producing high-intensity impact noise may be performed at night only upon approval of the Engineer.

#### Clause 1807 Light Abatement

The Contractor shall exercise special care to direct all stationary floodlights to shine downward at an angle less than horizontal. These floodlights shall also be shielded so as not to be a nuisance to surrounding areas. No lighting shall include a residence in its direct beam.

The Contractor shall be responsible for correcting lighting problems when they occur as directed by the Engineer.

#### Clause 1808 Preservation of Historical and Archaeological Data.

The Contractor agrees that should he or any of his employees in the performance of this contract discover evidence of possible scientific, prehistoric, or archaeological data he will notify the Engineer immediately giving the location and nature of the findings. Written confirmation shall be forwarded within 2 days. The Contractor shall exercise care so as not to damage artefacts or fossils uncovered during excavation operations and shall provide such co-operation and assistance as may be necessary to preserve the findings for removal or other disposition by the Employer. The Contractor will also report his findings to the Department of Tourism, Wildlife and Antiquities.

Where appropriate by reason of a discovery, the Engineer may order delays in the time of performance, or changes in the work, or both. If such delays, or changes, or both, are ordered, the time of performance and contract price shall be adjusted in accordance with the applicable clause in the General Conditions of Contract.

The Contractor agrees to insert this Clause in all subcontracts which involve the performance of work on the terrain of the site.

#### Clause 1809 Pesticides.

Pesticides include herbicides, insecticides, fungicides, rodenticides, pesticides, surface disinfectants, animal repellents and insect repellents. Should the Contractor find it necessary to use pesticides in work areas of this contract, he shall submit his plan for such use to the Engineer for written approval.

The Contractor shall read and comply with all labelling requirements when using pesticides.

The cost of complying with this Clause shall be included in the prices tendered in the Bill of Quantities for other items of work.

#### Clause 1810 Cleanup and Disposal of Waste Materials.

##### (a) Cleanup

The Contractor shall, at all times, keep the construction area, including storage areas used, free from accumulation of waste materials or rubbish.

All waste water and sewage from office, residential and mobile camps shall be piped to soak pits or other disposal areas constructed in accordance with local government regulations, and where and when such regulations require it the Contractor shall obtain a permit or other appropriate documentation approving the disposal methods used.

All used fuels, oils, other plant or vehicle fluids, and old tyres and tubes shall be collected to a central disposal area on a daily basis and disposed of in a manner approved by the Engineer.

Servicing of plant, equipment and vehicles shall whenever possible be carried out at a workshop area. This workshop area shall be equipped with secure storage areas for fuels, oils and other fluids constructed in such a way as to contain any spillage which may occur, and similar storage where fluids can be stored securely prior to their disposal.

When servicing of plant, equipment and vehicles is carried out away from the workshop area it shall be done at locations and in such a manner as to avoid spillage and contamination of streams and other drainage courses. Any spillage shall be cleaned up by either burning in place or collecting the contaminated soils and burning them at the central disposal area, all to the satisfaction of the Engineer.

Prior to the completion of the work, the Contractor shall remove from the vicinity of the work all plant facilities, buildings, rubbish, unused materials, concrete forms and other like material, belonging to him or used under his directions during construction. All work areas shall be graded and left in a neat manner conforming to the natural appearance of the landscape as provided in Clause 1801.

Any residue deposited on the ground from washing out truck mixers, agitating trucks or any other similar concrete operations shall be buried or cleaned up in a manner acceptable to the Engineer.

In the event of the Contractor's failure to perform the above work, the work may be performed by the Employer, at the expense of the Contractor, and his surety or sureties shall be liable therefor.

(b) Disposal of Waste Material

(i) General

Waste materials including, but not restricted to, refuse, garbage, sanitary wastes, industrial wastes, and oil and other petroleum products, shall be disposed of by the Contractor. Disposal of combustible materials shall be by burying, where burial of such materials is approved by the Engineer; by burning, where burning of approved materials is permitted; or by removal from the construction area. Disposal of non-combustible materials shall be by burying, where burial of such materials is approved by the Engineer, or by removal from the construction area. Waste materials removed from the construction area shall be dumped at an approved dump.

(ii) Disposal of Material by Burying

Only materials approved by the Engineer may be buried. Burial shall be in pits and the location, size and depth of which shall be approved by the Engineer. The pits shall be covered by at least 0.6 metre of earth material prior to abandonment.

(iii) Disposal of Material by Burning

All materials to be burned shall be piled in designated burning areas in such a manner as will cause the least fire hazards. Burning shall be thorough and complete and all charred pieces remaining after burning, except for scattered small pieces, shall be removed from the construction area and disposed of as otherwise provided in this Clause.

The Contractor shall, at all times, take special precautions to prevent fire from spreading beyond the piles being burned and shall be liable for any damage caused by his burning operations. The Contractor shall have available, at all times, suitable equipment and supplies for use in preventing and suppressing fires and shall be subject to all laws and regulations locally applicable for pre-suppression, suppression and prevention of fires.

(iv) Disposal of Material by Removal

Material to be disposed of by removal from the construction area shall be removed from the area prior to the completion of the work under these specifications. All materials removed shall become the property of the Contractor.

Materials to be disposed of by dumping shall be hauled to an approved dump. It shall be the responsibility of the Contractor to make any arrangements with private parties and with local officials pertinent to locations and regulations of such dumping. Any fees for charges required to be paid for dumping of materials shall be paid by the Contractor and shall be included in the prices tendered in the Bills of Quantities for other items of work.

Clause 1811 Measurements and Payment

Except as specifically included in the Bill of Quantities or otherwise provided above, no separate measurement or payment will be made for any work included in this Section, the relevant cost of all these requirements being included by the Contractor in the Bill of Quantities for other items of work.

**6.3.2 Construction and Maintenance Supervision Contracts**

Road construction and maintenance supervision contracts should include the following clauses concerning protection and improvement of the road environment. These clauses will be additional to those customarily incorporated into such contracts.

A. General Clause: Commitment of Supervisory Office

The consultant responsible for supervision shall undertake, in the same way as the contractor, to comply with and to ensure compliance with all directives and legislation concerning environmental protection and improvement as well as the specific clauses included in the contractor's contract.

B. Special Clauses

1) Supervision of Utilisation of Quarries and Borrow Pits

The supervisor/engineer shall ensure proper utilisation by the contractor of the quarries/pits designated by the detailed design with the aim of lessening the environmental impact of his activities as follows:

a) Preparation of materials in the quarry or pit.

The supervisor/engineer shall oversee the preparation of gravel materials in the pit or quarry (stripping, bulking and piling) and mainly:

- the designation of trees to be protected;
- the storage of stripped material in areas where it will not hinder water drainage;
- the restoration of the site around the quarry/pit to its natural state by spreading; the stored stripped material to facilitate water percolation and natural plant regrowth;
- the re-establishment of the previous natural flow patterns;
- the improvement of the site appearance by burying the large blocks of stone which had been dug off;
- the digging of ditches and runouts to carry water and maintenance of access ramps.

The supervisor/engineer shall ensure and report that the work site environment is restored to its natural state, after use, by the contractor.

b) Volume of materials stored in quarry/pit

The supervisor/engineer shall notify the contractor of the volume of material that may require to be stored per quarry/pit for later use. The stockpiles of materials stored for this purpose shall be clearly distinguishable and readily accessible; the supervisor/engineer shall formally turn these stockpiles over to the local authority responsible for their subsequent use.

2) Supervision of Construction and Drainage Works

a) Construction of runouts

The supervisor/engineer shall determine the runouts to be constructed for retention purposes and shall specify:

- their technical specifications
- their length
- their minimum lengthwise gradient

b) Construction of storage basins

The supervisor/engineer shall locate the water storage basins to be constructed in suitable natural sites and shall avoid tree removal. In the field he shall determine the dimensions and position of each basin with respect to the road and specify the rules to be observed regarding environmental protection.

3) Tree Planting

The supervisor/engineer shall instruct the contractor where trees are to be planted and the type of protection to be provided. He shall ensure that the contractor makes provision for the water needed for the trees to grow and promptly to replace any dead trees. The supervisor/engineer shall submit a report stating the number and condition of the plantings at the time of final acceptance.

## 7. SUMMARY

This volume has presented a comprehensive description of the various environmental and social aspects affecting, and affected by, road works activities. This section summarises the contents of the document.

### **7.1 Legal Framework for Environmental Management**

There are a number of legal instruments that address environmental issues. These are:

- Constitution of Uganda, 1995
- Local Governments Act, 1997
- Uganda Wildlife Statute, 1996
- National Environment Statute, 1995
- Land Act 1998
- Water Statute 1995
- Roads Act
- Access to Roads Act
- Forest Act
- Mining Act
- Town and Country Planning Act
- Electricity Act.

The National Environment Statute is perhaps the most important, in that it provides for an institutional framework for environmental management, through the establishment of the National Environment Management Authority; it also specifies management measures, addresses pollution control and stipulates mechanisms for enforcement of the law.

Property rights and compensation are catered for under the following legal instruments:

- Constitution of Uganda, 1995
- Survey Act
- Land Act
- Roads Act
- Access to Roads Act

In addition, the MOWHC general conditions of contract also make provision for compensation.

### **7.2 The Physical, Natural and Social Environment**

#### *Topography*

Uganda is part of the African interior plateau comprising four altitudinal zones:

- i) land below 900 masl,
- ii) land between 900 and 1200 masl,
- iii) land between 1200 masl and 2000 masl, and
- iv) land over 2000 masl.

### *Soils*

A simplified classification gives the main soil types as:

sandy loam and sandy clay loam	8% of land area
red clay-loams	14%
clay loam and sandy loam clay	43%
sandy loam and clay	30%
sandy loam to plastic clays	3%
skeletal/peat soils	2%

### *Rainfall*

There are four rainfall zones:

Zone I	Lake Victoria Region	ranges from 150-1500 mm per year
Zone II	Karamoja	average 325-620 mm per year
Zone III	Western Uganda	average 750-1000 mm per year
Zone IV	Ankole-Southern Uganda	average 1125 mm per year

### *Hydrology*

The drainage network is divided into eight basins:

Lake Victoria Basin	Kyoga Basin
Aswa Basin	Albert Nile Basin
Albert System	Lake Edward System
Kafu Basin	Kidepo Basin

### *Land Use*

The main land uses in the country are:

Protected areas	25.4%	Wetlands and open waters	21.5%
Agriculture	29.7%	livestock	23.2%
Plantations	0.1%	Habitation	0.1%

### *Vegetation*

There are numerous vegetation types found in Uganda, ranging from forests to savannas to wetlands.

### *Flora and Fauna*

Uganda harbours seven of Africa's 18 plant kingdoms, and over 1000 bird species and 335 mammal species have been recorded. In terms of biodiversity therefore, it is one of the most unique places on earth.

### *Protected Areas*

Protected areas in Uganda fall under three categories:

- i) Uganda Wildlife Authority Protected Areas (includes 10 national parks, 10 wildlife reserves, 7 wildlife sanctuaries and 13 community wildlife areas) covering 20% of the total land area of the country;
- ii) Forests. Gazetted forests and reserves cover approximately 6.5% of the country's area. Forest reserves consist of savanna woodland, forest plantation, tropical high forest, and montane catchment areas.
- iii) Wetlands extend over 9 to 12% of the total land area

### *Archaeological and Historic Sites*

There are almost 200 known archaeological and historic sites in Uganda, ranging from Miocene and Pleistocene fossil sites, to stone age sites, to tombs and forts.

## **7.3 Potential Impacts of the FRSP**

FRSP sub-projects may affect the physical environment (eg. soils, water, air), the natural environment (eg. forests, wetlands, etc) and/or the human or social environment (public health, income).

The potential environmental and social impacts that occur during road works are described according to the various activities involved. Impacts result from:

- |   |                        |
|---|------------------------|
| - Surveying                             | - Earthworks           |
| - Land acquisition                      | - Surfacing            |
| - Recruitment of labour                 | - Bridges and culverts |
| - Plant and equipment, stores and camps | - Drains               |
| - Land clearing                         | - Diversions           |
| - Quarries and borrow pits              |                        |

Mitigation of environmental and social impacts is necessary in order to minimise or eliminate adverse environmental impacts; enhance beneficial impacts; and protect the rights of individuals and communities to compensation for any losses that may arise.

Mitigation options will depend on the nature of the potential impacts, and for FRSP road projects, will have to consider:

- changes in the locations of new alignments
- changes in design of sections of these roads
- monetary compensation
- replacing damaged property, or resources
- relocation of property, resource (vegetation, infrastructure), and
- rehabilitation of any damages.

Environmental monitoring is undertaken to ensure compliance with conditions for project approval, to determine the effectiveness of mitigation measures and to predict unforeseen impacts.

#### **7.4 Public Involvement**

It is essential to involve local people in environmental management because:

- they will be most affected by the road project
- they have a good understanding of their local natural and social environment
- they will be able to assist in impact identification and mitigation
- they will be more interested in participating in maintenance of the road if there is a sense of “ownership.”

#### **7.5 Environmental Considerations in MOWHC Documentation**

The tables below summarise provisions in existing MOWHC manuals and documents for environmental management.

**Table 7.1: Standard Clauses in Conditions of Contract relating to Environmental Issues**

<b>General Conditions</b>	<b>Clause</b>
Engineer's Duties and Powers	2
Priority of Contract Documents	5.2
<b>General Obligations</b>	
Site Operations and Methods of Construction	8.2
Inspection of Site	11.1
Not Foreseeable Physical Obstruction or Conditions	12.2
Employment of Local Personnel	16.4
Safety, Security and Protection of the Environment	19.1
Care of the Works	20.1
Damage to Persons and Property	22.1
Accident or Injury to Workmen	24.1
Compliance with Statutes, regulations	26.1
Fossils	27.1
Royalties	28.2
Interference with Traffic and adjoining Properties	29.1
Avoidance of Damage to Roads	30.1
Clearance of Site on Completion	33.1
<b>Labour</b>	
Engagement of staff and labour	34.1
Housing for Labour	34.4
Accident Prevention Officer; Accidents	34.5
Health and Safety	34.6
Measures against Insect and Pest Nuisance	34.7
Epidemics	34.8
Supply of Foodstuffs	34.10
Supply of Water	34.11
Alcohol, Liquor or Drugs	34.12
Arms and Ammunition	34.13
Festivals and Religious Customs	34.14
Disorderly Conduct	34.15
Records of Safety and Health	35.2
Reporting of Accidents	35.3
<b>Commencement and Delays</b>	
Rights of Way and Facilities	42.3
Restriction on Working Hours	45.1

**Table 7.2: Clauses in the General Specifications for Road and Bridge Works  
Vol. IIIA**

<b>Item</b>	<b>Clause(s)</b>
Contractor's activities in respect of Property outside the Site Boundary	1213
Water	1220
Use of Explosives and Demolition	1224
General requirement on Contractor's Establishment on Site	1302
Services for the Engineer's Staff	1404
Accommodation of Traffic	1501 and 1512
Clearing and Grubbing	1702, 1703 and 1703(a)
Surface Water and Drainage	2101
Pitching, Stonework and Erosion Protection	2401
Borrow Materials	3101, 3102, 3104(a) ,3105 and 3108
Construction of the Road Subgrade	3406, 3407, 3408 and 3415
Gabions	5100
Guide Blocks	5201
Guard rails	5301
Road Signs	5401 and 5407
Road Traffic Markings	5501
Landscaping and Grassing	5601 and 5602

**Table 7.3: Sections in the Road Design Manual Dealing with Environment Issues**

<b>Section</b>	<b>Sub-section</b>
4. Geometric Design	4.1 Introduction
	4.2 Selection of Design Standards
	4.6 Provision for Non-Motorised Traffic
	4.12 Safety
6. Road Furniture	6.1 General
	6.2 Traffic Islands
	6.3 Kerbs
	6.4 Marker Posts
	6.5 Safety Measures
	6.6 Other Fences and Gates
	6.7 Traffic Signs and Road Markings
8. Hydrology and Drainage	8.2 Basic Policy on Drainage Design
	8.4 Hydraulic Culverts
	8.5 Drainage of the Road Prism
	8.6 Subsurface Drainage

**Table 7.4: Sections in the Maintenance Manual Dealing with Environmental Issues**

<b>Chapter</b>	<b>Section</b>
4. Road Safety	4.1 General 4.2 Safety measures and Traffic control
5. Road Reserve	5.1 Road reserve
6. Environmental Issues	6.1 General 6.2 Institutional Aspects 6.2.1 Parties involved 6.2.2 Contractual relations among the various parties 6.2.3 Road maintenance works 6.2.4 Support measures 6.3.1 Water management 6.3.2 Soil conservation 6.3.3 Maintaining the vegetation 6.3.4 Passage through villages 6.3.5 Borrow pit reinstatement
8. Methods of Work	8.3 M O W T C Road maintenance specifications

In addition, it is recommended that the General Specifications include a section (Section 1800) exclusively on Environmental Protection and Waste Disposal. This section would address:

- landscape preservation
- preservation of trees and shrubbery
- prevention of water pollution
- abatement of air pollution
- noise abatement
- dust abatement
- light abatement
- preservation of historical and archaeological data
- use of pesticides
- clean up and disposal of waste material
- measurements and payments (inclusion of environmental protection items in the Bill of Quantities).

Construction and maintenance supervision contracts should incorporate general clauses on commitment of the supervisory office to environmental management. In addition the contracts should have special clauses on the supervision of the utilisation of borrow pits and construction of drainage works.

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## Annexes

## ANNEX I: REFERENCES

- ARCADIS-Euroconsult (1998) - *Uganda National Wetlands Conservation and Management Programme*. Draft Final Report of the External Review Mission. For the Royal Netherlands Embassy, Kampala.
- Davenport, T. And R. Matthews (1995) - *A wealth of species come to light*. *Swara* (Nairobi) 18(3):26-29.
- Davenport, T., P. Howard and C. Dickinson (1996) - *Mount Elgon National Park. Biodiversity Report*. Biodiversity Report Series, No. 1. Forest Department, Government of Uganda, Kampala.
- Denny, P. (1993) - Eastern Africa. In: D.F. Whigham, D. Dykyjová and S. Hejný (Eds.), *Wetlands of the World I: Inventory, ecology and management*. Handbook of Vegetation Science 15/2. Kluwer Academic Publ., Dordrecht, Boston and London, p:32-46.
- DoF (1998) - *Nature Conservation Master Plan* (volume 1). The Plan. Forest Department, GOU, Kampala. (in press; expected October 1998)
- Dorst, J. And P. Dandelot (1972) - *Larger Mammals of Africa*. Collins Field Guide. 2nd edition. Harper Collins Publishers, London, Glasgow, Sydney, Auckland, Toronto, Johannesburg.
- GOU (1964) - *The Game (Preservation and Control) Act*. Chapter 226, revised edition 1964. Government of Uganda. Government Printer, Entebbe, p: 3069-3128.
- GOU (1995) - *The National Environment Statute*, 1995. Statutes Supplement No. 3, 19th May 1995. Government of Uganda, Government Printer, Entebbe.
- GOU (1996) - *The Uganda Wildlife Statute*, 1996. Statute No. 14. (also printed as Statutes Supplement No. 8, Uganda Gazette No. 32, volume LXXXIX, 24 May 1996. UPPC Printers, Entebbe). Government of Uganda, Government Printer, Entebbe.
- Greenwood, P.H. (1966) - *Fishes of Uganda*. Uganda Society, Kampala. (unseen)
- Hamilton, A. (1974) - *The history of the vegetation*. In: E.M. Lind and M.E.S. Morrison, East African Vegetation. Longman Group Ltd., London, p: 188-209.
- Hickman, G. (1986) - *Lands and Peoples of East Africa*. Third Edition. Longman Group Ltd., Harlow, U.K., 217 pp.
- Hughes, R.H. and J.S. Hughes (1992) - *A Directory of African Wetlands*. IUCN-WCU, UNEP and WCMC, Gland, Switzerland and Cambridge, U.K.
- Lamprey, R., A. Muhimbura-Atukunda, F. Buhanga, F. Egunga, J. Okecha, J. Omoy and F. Michaelmore (1998) - *Strategic Plan for Biodiversity Conservation in the former Controlled Hunting Areas of Uganda*. Uganda Wildlife Authority. First draft July 1998.. Revised draft due late September.
- Langdale-Brown, I., H.A. Osmaston & J.G. Wilson (1964) - *The vegetation of Uganda and its bearing on land-use*. Government Printer, Entebbe.

- Lind, E.M. and M.E.S. Morrison (1974) - *East African Vegetation*. Longman Group Ltd., London.
- Loveridge, A. (1957) - *Checklist of the Reptiles and Amphibians of East Africa*. *Bull. of the Museum of Comparative Zoology*, Harvard, vol. 117 (2):153-362. (unseen)
- MacKinnon, J. and K. MacKinnon (1987) - *Review of the Protected Area System in the Afrotropical Realm*. IUCN, Gland, Switzerland and Cambridge, U.K.
- Mandahl-Barth, G. (1954) - *The freshwater molluscs of Uganda and adjacent territories*. *Annales du Musee Royal du Congo Belge* (Tervuren). Series 8. *Sciences Zoologiques*, vol. 32. (unseen)
- MNR (1994) - *The National Environment Management Policy for Uganda*; Ministry of Natural Resources; GOU, Kampala.
- MNR (1994) - *The National Environmental Action Plan*. Ministry of Natural Resources, GOU, Kampala.
- MNR (1995) - *National Policy for the Conservation and Management of Wetland Resources*. Ministry of Natural Resources, GOU, Kampala.
- MOWTC (1998) - *Maintenance Manual*; GOU.
- MOWTC (1994) - *Road Design Manual*; GOU.
- MOWTC (1992) - *Tender Documents for Road and Bridge Works*, Vols IA and IB; GOU
- MOWTC (1992) - *Conditions of Contract for Road and Bridge Works*, Vol II; GOU
- MOWTC (1992) - *General Specifications for Road and Bridge Works*, Vol IIIA; GOU
- Muhimbura-Atukunda, A., E. Buhanga, J. Okecha and R.H. Lamprey (1997) - *Draft Regional Protected Area System Plan For The Wildlife Areas Of Karamoja, Uganda*. Uganda Wildlife Authority, Kampala.
- National Biodiversity Unit (1992) - *Uganda Country Study On Costs, Benefits And Unmet Needs Of Biological Diversity Conservation*. Department of Environment Protection, Ministry of Water, Energy, Minerals and Environment Protection, Government of Uganda. SIDA/UNEP.
- National Biomass Study (1996) - *Uganda Land Cover Stratification (Vegetation) with Districts, Counties and Protected Areas (1996)*. Scale 1:900,000. Forest Department, GOU, Kampala.
- NEMA (1996) - *State of the Environment Report for Uganda 1996*. National Environment Management Authority, Kampala.
- NEMA (1997) - *District State of Environment Report for Pallisa District*. National Environment Management Authority, Kampala.

Omoding, J., T. Otim, P.E. Ekisa and N.M. Mutekanga (1996) - *Inventory of wetland biodiversity in Uganda*. Activities, methodologies and results. UNO/RAF/006/GEF Field Document 25. FAO, Kampala, September 1996.

Pitman, C.R.S. (1974) - *A Guide to the Snakes of Uganda*. Revised edition, Wheldon and Wesley, Codicote. (unseen)

Pomeroy, D., H. Tushabe & M. Green (1998) - *Using Biodiversity Data To Review Coverage Of Uganda's Protected Areas*. *Journal of East African Natural History*. (submitted)

Ratter, A. (1998) - Problem Animal Control Workshop. Kampala, 1-3 July 1998. Uganda Wildlife Authority, unpublished report.

Williams, J.G. and N. Arlott (1980) - *A Field Guide To The Birds Of East Africa*. W. Collins, London, Glasgow, Sydney, Auckland, Toronto, Johannesburg.

WCMC (1992) - *Protected Areas of the World: A Review of National Systems*. World Conservation Monitoring Centre, Cambridge, U.K.

World Bank (1993) - *Ecologically Sensitive Sites in Africa*. Volume II: Eastern Africa. Compiled by the World Conservation Monitoring Centre for the World Bank, Washington D.C., USA.

World Bank (1994) - *Roads and the Environment: A Handbook*, Report TWU 13; Washington D.C. USA.

**ANNEX II: THE BIODIVERSITY REPORT SERIES**

Produced in 1996 by the Forest Department, GOU, and are generally edited by Tim Davenport and Peter Howard (on occasion with third parties).

<b>Report #</b>	<b>Forest Reserve(s)</b>
No. 1	Mount Elgon National Park
No. 2	Rwenzori Mountains National Park
No. 3	Budongo Forest Reserve
No. 4	Kalindu-Maramagambo Forest Reserve
No. 5	Kibale National Park
No. 6	Moroto, Kadam and Napak Forest Reserves
No. 7	Labwor Hills Forest Reserves
No. 8	Nyangea-Napore, Rom and Ogili Forest reserves
No. 9	Bugoma Forest Reserve
No. 10	Kagombe, Matiri and Kitechura Forest Reserves
No. 11	Kasyoha-Kitomi Forest Reserve
No. 12	Mount Kei Forest Reserve
No. 13	Mabira Forest Reserve
No. 14	Agoro-Agu and Lokung Forest Reserves
No. 15	Semliki National Park
No. 16	Itwara Forest Reserve
No. 17	Otzi and Era Forest Reserves
No. 18	South Busoga Forest Reserve
No. 19	Bwindi Impenetrable National Park
No. 20	Sango Bay Forest Reserves
No. 21	Morungole, Timu and Lwala Forest Reserves
No. 22	Echuya and Mafuga Forest Reserves
No. 23	Mujuzi, Sesse Islands and Jubiya Forest Reserves
No. 24	Mpanga, Zika and Mpigi Forest Reserves
No. 25	Luwero District Forest Reserves
No. 26	Kilak, Aswa River, Wiceri, Zoka and Opit Forest Reserves
No. 27	Luunga, Namwasa, Taala and Bigwezi-Gunga Forest Reserves
No. 28	Bukaleba and Mukono Forest Reserves
No. 29	West Bugwe and Igwe-Luvunya Forest Reserves
No. 30	Kibeka and Maruzi Hills Forest Reserves
No. 31	Kazooba, Kasana-Kasambya and Nsowe Forest Reserves
No. 32	Rwoho and Kijanabolola Forest Reserves
No. 33	Kisangi Forest Reserve