



Sharing the Water Resources  
Of the Orange-Senqu River Basin



PROTECTION OF THE ORANGE-SENQU WATER SOURCES  
'SPONGES' PROJECT'  
LESOTHO

Report Number ORASECOM 004/2008  
MAIN FINAL REPORT



October 2008

**TCC**

**Tsoelopele Consultants &  
Contractors (Pty) Ltd.**  
P.O.Box 101, Teyateyaneng 200  
Lesotho  
Phone: +266 2250 0240  
Fax: +266 2250 1476  
e-mail [tcc@leo.co.ls](mailto:tcc@leo.co.ls)

**DHI**  
WATER • ENVIRONMENT • HEALTH

**DHI**  
Agern Allé 5 DK-2970 Hørsholm  
Denmark  
Tel: +45 4516 9200  
Fax: +45 4516 9292  
[dhi@dhigroup.com](mailto:dhi@dhigroup.com)  
[www.dhigroup.com](http://www.dhigroup.com)

**PEMCONSULT**  
PEOPLE • ENVIRONMENT • MANAGEMENT

**PEMCONSULT a/s**  
WILDERS PLADS, BYGN. J, 2 SAL  
DK-1403 KØBENHAVN K  
TEL.: +45 32 952626  
FAX.: +45 32 952646  
[pemconsult@pem.dk](mailto:pemconsult@pem.dk)  
[www.pemconsult.com](http://www.pemconsult.com)

**PROTECTION OF THE ORANGE-SENQU WATER SOURCES  
'SPONGES' PROJECT'  
LESOTHO  
Report Number ORASECOM 004/2008  
MAIN FINAL REPORT  
October 2008**

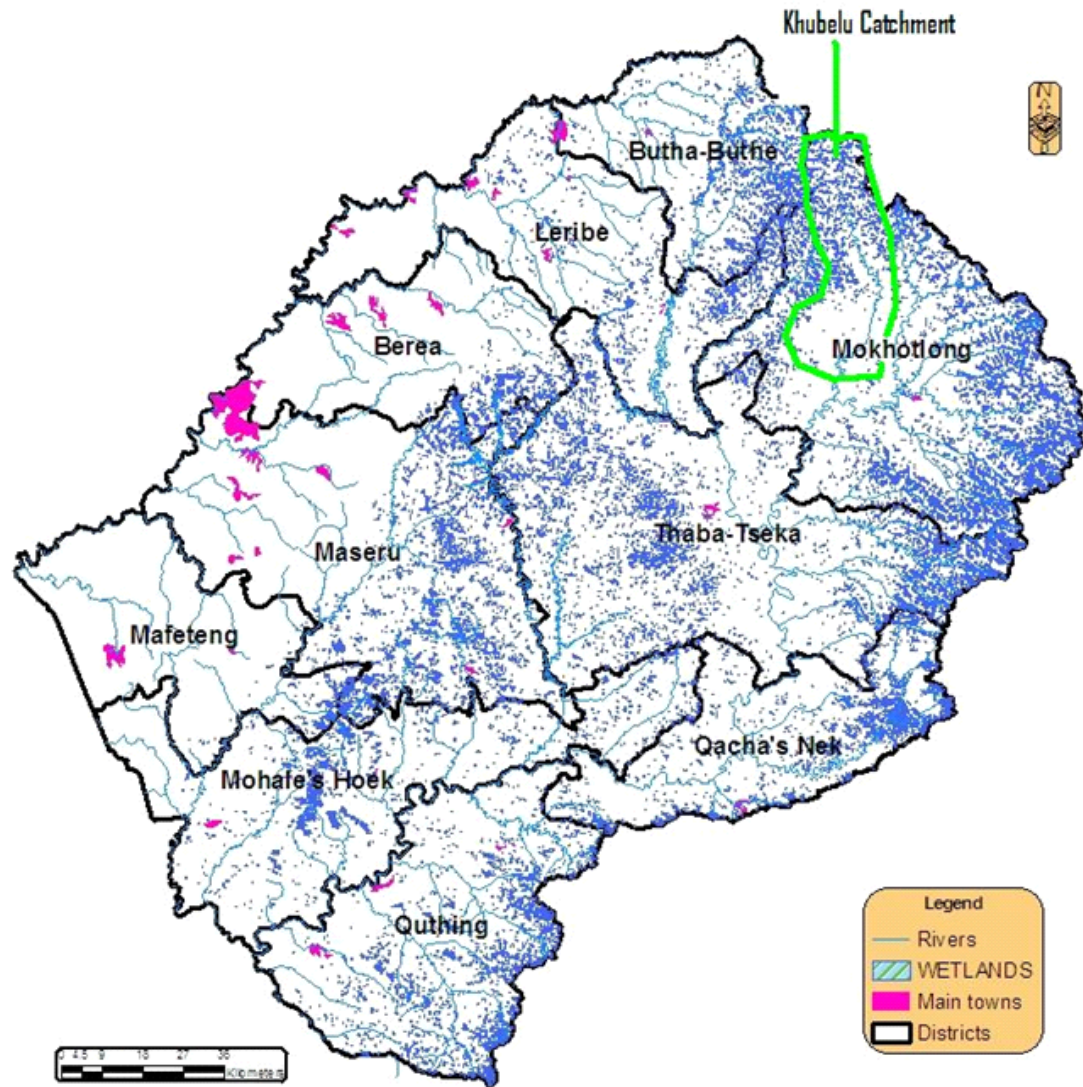
The reporting from the 'Sponges Project' consists of:

- Report Number ORASECOM 001/2008: Feasibility Study of the Protection of Orange-Senqu River Water Sources ('Sponges' Project): Inventory Report, September 2008.
- **Report Number ORASECOM 004/2008: Feasibility Study of the Protection of Orange-Senqu River Water Sources ('Sponges' Project): Main Final Report, October 2008.**

Accompanying the final report under separate cover are:

- 'Project Proposal for Pilot Project for Protection of Orange-Senqu River Water Sources'
- 'Brochure' (English and Sesotho versions) presenting the results of the Feasibility Study
- DVD with all GIS data delivered to Department of Water Affairs

Figure 1: District Map of the Kingdom of Lesotho with Wetlands



## **EXECUTIVE SUMMARY**

This Main Final Report presents the results of the 'Feasibility Study of the Protection of Orange-Senqu River Water Sources ('Sponges' Project) compiled for the Orange-Senqu River Commission (ORASECOM) by PEMconsult<sup>1</sup>, Denmark in association with DHI<sup>2</sup>, Denmark and TCC<sup>3</sup>, Lesotho. The Contract commenced on the 5<sup>th</sup> of November 2007.

The preliminary results of the detailed field investigations, the remote sensing assessments and collection of the existing wetlands data are presented in the 'Inventory Report'<sup>4</sup>. This Final Report summarises the results of the detailed field investigations and includes further analysis and conclusions on the state of the wetlands in the Highlands of Lesotho together with a proposal for the conservation and rehabilitation of the wetlands including capacity building and research. The study focuses on the palustrine wetlands which are of particular importance in the hydrological context since they play a major role in supporting the base flow of the river during the dry season.

### **Results of the inventory phase**

The data collection and improvements to the wetlands data has resulted in an update of the Department of Water Affairs (DWA) Geographical Information System for Wetlands (GIS-WIS) and harmonisation of data from all the sources gathered during study. The further development of the GIS-WIS must take place through a continuous survey, mapping and classification of wetland ecosystems based on the standardised inventory sheets in cooperation with stakeholders at community and district level.

Through an exercise of exclusion of catchment areas based on the established criteria, the Khubelu Catchment area emerged as the area complying clearly with the criteria: i) falling within the category of palustrine wetlands; ii) sources of a major tributaries to the Orange-Senqu River; iii) under pressure from development plans; iv) where little or no information is available; and v) wetlands which seem to be vulnerable and are not earmarked for future projects.

The study has revealed that there is a need for more in-depth research on crucial aspects such as: hydrological dynamics of wetlands; erosion measurement; methodological approaches to rehabilitation and restoration of degraded wetlands and approaches to alternative livelihood options for wetland users.

Concurrent data on rainfall, evapotranspiration and runoff in the smaller highlands catchments with palustrine wetlands are needed to quantify the water retention capacity in the wetlands. Based on the available data, the analysis shows water storage and release between dry and wet periods over the year of approximately 120mm in the Khubelu catchment. Although the wetlands show signs of extensive erosion, the outflow water quality in the surveyed wetlands was good in terms of total dissolved solids, dissolved oxygen and pH. Livestock overgrazing and trampling as well as ice rats and moles are affecting the rate of erosion of the wetlands. It has been observed that the highly degraded wetlands have scanty vegetal cover dominated by shrubs.

---

<sup>1</sup> PEM is the abbreviation of People, Environment and Management.

<sup>2</sup> DHI is the abbreviation for Danish Hydraulic Institute.

<sup>3</sup> TCC is the abbreviation for Tsoelopele Consultants & Contractors (Pty) Ltd.

<sup>4</sup> Report Number ORASECOM 001/2008: Inventory Report, Protection of the Orange-Senqu Water Sources 'Sponges' Project' Lesotho, Final, September 2008

**Benefits from the wetlands**

The Khubelu wetlands are located in the high altitude grazing areas and as such the main benefit to the local population is provision of grazing and water to the grazing animals. Wetlands are also used as a source of important grasses (*Scirpus* sp. and *Merxmullera* sp.) and it was observed that the grasses are diminishing due to the increased overgrazing and over-harvesting. Wetlands are used as a source of drinking water as the water from the wetlands tends to be clean and tasty. The wetlands are also used for washing and laundry while the river serves as an alternative source especially for laundry. Wetlands are sometimes used for traditional rituals and for spiritual purposes.

The main economic benefits from the wetlands for the population of Khubelu are due to their role in sustaining the rangelands since livestock is a main economic activity of the Khubelu inhabitants. The benefits have been quantified in relation to wool and mohair production to about M 1 million over a five year period. The analysis has shown that the wetlands' regulation of water flow is very important and in the situation where large dams are planned the degradation of wetlands would potentially have a high economic impact as the reduced natural storage would have to be replaced by increased storage capacity of the new dams. The cost of replacing a 10% reduction in the natural storage capacity in the catchment has been estimated at approximately M 50 million.

**Management of the wetlands**

Based on the findings from the study of the Khubelu catchment it emerges that the protection and conservation of the wetlands cannot be separated from the general management of the natural resources in the highlands of Lesotho. The most important influence on the natural resources and the wetlands in the highlands is from livestock grazing and livestock is at the same time important for the livelihood of the population.

Proper management of wetlands rests on effective rotational grazing that allows the wetlands to rest. The previous range management procedures are no longer effective and a concerted effort by Government of Lesotho is needed to establish effective range management. Proper grazing plans and implementation of these plans including physical inspection of the wetlands at Khubelu by chiefs and councils is very crucial since they issue grazing permits to the livestock owners. The involvement of the Principal Chiefs, Local Government structures, herders and communities around the wetland areas in day-to-day management of the wetlands is important. This will require the development and implementation of strategies for periodic training and awareness-raising.

The possibilities of establishing the upper Khubelu Catchment as a protected area could potentially have a number of benefits for biodiversity and for the communities in the Khubelu catchment. A trans-frontier protected area covering the entire Drakensberg escarpment from Oxbow to Sehlabathebe would provide possibilities for unique experiences for tourism and combined with implementing the principles of benefit sharing and development of village guesthouse accommodation this could provide income for the population in the Lesotho highlands. The Drakensberg escarpment is the 'water tower', not only for the Orange-Senqu but also for the rivers in the Kwazulu Natal area and a protected area offers possibilities for better control of grazing and wildfires that impact the quality of water and the water storage capacity of the wetlands in the area.

The results of the study are described in detail in Chapter 2.

**Programme for conservation, rehabilitation and protection of the wetlands**

A programme for conservation, rehabilitation and protection of the wetlands in the highlands of Lesotho would need to address the wetlands issues in a participatory approach where capacity building is an integrated part of the activities. To ensure

continuity and replication of the results it is important that the activities are carried out by the local communities and the local government structures.

The **overall objective** of the proposed programme is: *'Holistic protection and conservation of the 'Sponges' in the Khubelu catchment that will demonstrate a methodological approach for the sustainable management of the wetlands benefiting the population as well as the environment and securing long-term availability and quality of water from the Upper Orange-Senqu catchment area.'*

**Four specific objectives** are proposed addressing the main aspects of the programme and grouped according to the main implementing stakeholders. The proposed specific objectives and the related outputs are:

**Specific Objective 1:** *'Improved livelihood for the population in the Khubelu catchment based on sustainable range management'*. The main implementing stakeholders will be the Community Councils (CCs) in the Khubelu Catchment in cooperation with livestock owners, grazing associations, the Principal Chief in Malingoaneng and the Range Management Department in Mokhotlong. The proposed outputs are:

- Output 1.1: Managed Resource Committee (MRC) established for the Khubelu Catchment
- Output 1.2: Grazing plan for Khubelu catchment based on re-established range management areas (A-B-C) according to CC boundaries and the responsibilities of chiefs and CCs
- Output 1.2: MRC and capacitated herders, livestock owners, grazing associations, CCs and chiefs manage Khubelu rangelands in a sustainable manner
- Output 1.4: Capacitated District Administration supporting sustainable land-use planning and effective livestock and range management

**Specific Objective 2:** *'Degraded wetlands in the Khubelu catchment rehabilitated'*. The main implementing stakeholders will be the CCs in the Khubelu Catchment in cooperation with the communities and the Soil Conservation Department in Mokhotlong. The proposed outputs are:

- Output 2.1 Grasses (Vetiver and local grasses) for biological rehabilitation of gullies tested in the Khubelu catchment
- Output 2.2 CCs capacitated in implementation and maintenance of biological rehabilitation of wetlands
- Output 2.3 Designs of physical gully control structures tested in the Khubelu catchment
- Output 2.4 Rehabilitated wetlands monitored and maintained

**Specific Objective 3:** *'Erosion from road drainage prevented'*. The main implementing stakeholder will be the Roads Department in Maseru. The proposed outputs are:

- Output 3.1 Designs of environmentally safe road drain discharge structures tested in the Khubelu catchment
- Output 3.2 Guidelines and design standards for road drain discharge structures
- Output 3.3 Road Department technical staff capacitated in environmentally sound drainage designs

**Specific Objective 4:** *'Results of monitoring of wetlands in the Khubelu Catchment, research and collection of lessons learned available for replication in other catchments'* The main implementing stakeholders will be the Department of Water Affairs in cooperation with other national level government and non-governmental stakeholders and the National University of Lesotho. The proposed outputs are:

- Output 4.1 Stakeholder roles and strategies in wetlands, water resources and natural resource management in Lesotho clarified and agreed
- Output 4.2 MRC monitoring system (including wetlands GIS) established and operating
- Output 4.3 Hydrological station and weather station established in the upper Khubelu catchment and operated and maintained in cooperation with the MRC
- Output 4.4 Research results on wetlands hydrology in the highlands of Lesotho available and influencing future wetlands protection programmes
- Output 4.5 Research results on programme impact on livelihood, mining, livestock and range management practices available and influencing programmes in other catchments
- Output 4.6 Feasibility Study for establishing the upper Khubelu catchment as a protected area.

The activities resulting in these outputs are described in detail in Chapter 3 and the log-frame for the proposed programme is described in Annex C including the assumptions and the monitoring indicators. Annex C also contains the time schedule for the activities and the budget. The overall budget is M 24.0 million to be implemented over a 5 year period including a contribution from Government of Lesotho of M 7.0 million for salaries, allowances and transport for staff from government departments, Mokhotlong District Council and the 4 CCs.

The main thrust of the programme will be to introduce sustainable natural resources management including developing locally based funding mechanisms so that in the longer term, the natural resource management will not depend on outside funding but will be based in, and funded by the local communities and the local government structures.

The principle for allocation of funding will therefore be that the programme should provide funding for once-off inputs that are needed to start the activities e.g. pilot demonstration projects, capacity building, research etc. while the recurrent inputs e.g. salaries, labour costs, allowances and transport costs for Government staff, Councils, Committees and Associations shall be covered by the government and local government budgets and/or future local revenue sources e.g. contribution from livestock farmers.

The activities are proposed to be managed through a programme approach with a programme secretariat established in Mokhotlong or Mapholaneng to support the many different stakeholders in the implementation of the programme.

The focus will be on empowering the local government structures to fulfil their mandate in management of the natural resources. Implementation will therefore be based on strengthening the CCs and the Mokhotlong District Council including the relevant government departments in the district to implement the conservation and rehabilitation measures in a learning-by-doing process rather than a 'stand alone project approach'. There will thus not be a separate capacity building programme as the capacity building needs to be integrated into the activities to be effective.

The activities are proposed for a 5-year period. Wetlands and natural resources management are long-term activities and a shorter implementation period is unlikely to produce sustainable results as the main aim of the programme is capacitating the local partners for developing management tools and using these in the management of the Khubelu catchment.

The main implementing actors would be the relevant departments in Mokhotlong District and the CCs in the Khubelu catchment area. The staff of the programme support office

would be providing technical assistance and capacity building to the local government actors. The programme support office and the stakeholders in Mokhotlong would establish the needed coordination and management committees for the effective implementation of the programme. At national level the 'Wetlands Committee' could be fulfilling the role of 'Programme Steering Committee' for the implementation of the programme, possibly by including the ORASECOM Executive Secretary and a representative from the funding agency when addressing issues specifically for the Khubelu Catchment Programme.

Financial management is likely to be most effectively administered by the programme support office providing funding to the CCs and the District Council where appropriate. The Councils would report on the use of the funds using their normal accounting systems and only where these do not provide adequate transparency and accountability would the programme support office work with the partners to improve the systems. The alternative of providing project support to the DWA as an implementer is likely to be complicated as the Department does not have the financial system in place for transfer and financial management of funds used by the local governments.

The programme support office is envisaged to be manned by a team of specialists that can provide input as required and support the local partners as needed and when needed according to work plans agreed between the partners and the support office. The budget includes a full time coordinator/ administrator to manage the day to day programme activities including financial management and reporting. To ensure clear definition of planning, reporting and financial management responsibilities, it is likely that the management of the programme support office would most efficiently be contracted out to a consulting company or consortium of consulting companies to provide the right mix of local knowledge and specific expertise.

### **Action Plan**

The various partners have been consulted on the programme outlined above and the action plan for implementation of the programme would include:

- ORASECOM in cooperation with the Government of Lesotho identify funding sources for the programme;
- Detailed assessment and appraisal of the programme by the identified funding agency and the stakeholders in Lesotho;
- Signing of agreement on the implementation of the programme between the Government of Lesotho, ORASECOM and the funding agency;
- Signing of 'Memo of Understanding' between the involved CCs, the Principal Chief, the District Council in Mokhotlong, Government of Lesotho and ORASECOM clarifying the roles and responsibilities for implementation of the programme;
- Tendering for the management of the programme amongst consulting companies in the Orange-Senqu riparian countries and award of contract;
- Implementation of the programme in the Khubelu Catchment;
- Monitoring of the implementation by the Wetlands Committee and coordination with other initiatives on wetlands management in Lesotho e.g. by Maluti-Drakensberg Trans-frontier Project, Lesotho Highlands Development Authority (LHDA) and DWA funded by the Millennium Challenge Corporation.



## LIST OF CONTENTS

<b><i>Executive Summary</i></b>	<b><i>iv</i></b>
<b><i>1. Introduction</i></b>	<b><i>1</i></b>
1.1 Background	1
1.2 Project Objectives	3
1.3 Approach and Methodology	3
<b><i>2. Summary of Information on the wetlands</i></b>	<b><i>6</i></b>
2.1 Establishment of the GIS data base on wetlands	6
2.2 Study Areas	8
2.3 Inventory of the Khubelu Wetlands	9
2.4 Uses of the Khubelu Wetlands	16
2.5 Water Storage in the Khubelu Wetlands	28
2.6 The Cost of Degradation and Potential Benefits	35
2.7 The Management of the Khubelu Wetlands	44
2.8 Training Needs Assessment	49
2.9 Summary of Conclusions	52
<b><i>3. Conservation, Rehabilitation and Protection Programme</i></b>	<b><i>54</i></b>
3.1 Programme Content	54
3.2 Programme Objectives	55
3.3 Programme Outputs	56
3.4 Programme Activities	57
3.5 Programme Organisation and Management	66
3.6 Action Plan	67
<i>Annex A: RunOff Data Analysis</i>	<i>69</i>
<i>Annex B: Storage and Low Flow Analysis for SG11, SG14 and SG15</i>	<i>73</i>
<i>Annex C: Log-frame And Activity Plan and Budget</i>	<i>79</i>
<i>Annex D: List of People Consulted</i>	<i>91</i>
<i>Annex E: Minutes from Stakeholder Consultations</i>	<i>97</i>
<i>Annex F: Bibliography</i>	<i>105</i>

## LIST OF FIGURES

Figure 1: District Map of the Kingdom of Lesotho with Wetlands	iii
Figure 2: Khubelu Catchment and its Wetlands Area	8
Figure 3: Map of the studied Wetlands	9
Figure 4: Mamputhule Wetland - Ice Rats and erosion	12
Figure 5: Cause – effect of rodents and wetland degradation	13
Figure 6: Sehlole Wetland – gully erosion and sheet erosion	14
Figure 7: Natural vegetation: <i>Geum capensi</i> (left); Alien vegetation: <i>Cirsium vilgare</i> (right)	14
Figure 8 Community Council Boundaries	16
Figure 9: Infrastructure in Khubelu Catchment	18
Figure 10: Letseng-la-Terae mining activities	19
Figure 11: Khubelu Grazing Area Map	22
Figure 12: Sheep and Goat statistics	24
Figure 13: Cattle, donkey and horses	24
Figure 14: Location of river gauging stations and rainfall stations	28
Figure 15: SG36 Average Monthly Runoff – Rainfall – ET - Storage	30
Figure 16: SG36 Ten Year Average Monthly Storage.	30
Figure 17: Total storage/ release in the Khubelu Catchment	31
Figure 18: Livestock Statistics Mokhotlong District 1983 to 2005	32
Figure 19: Low Flow Analysis of SG36 Data	33
Figure 20: Tsehlanyane monthly minimum flow rate from 1959 to 1992.	33
Figure 21: Benefits derived from Khubelu Wetlands	35
Figure 22: Biophysical changes necessary for Valuing wetlands degradation and conservation	36
Figure 23: Schematic for wetlands services Total Economic Valuation (TEV)	36
Figure 24: Methods for estimating environmental values	37
Figure 25: Mohair Output in Khubelu      Figure 26: Mohair Productivity	40
Figure 27: Wool output in Khubelu      Figure 28: Wool productivity	41
Figure 29: Proposed Wetlands Management Structure	45
Figure 30: Runoff relationship SG11 Tsehlanyane and SG15 Lekhalong la Lithunya	69
Figure 31: Runoff relationship SG14 Motete and SG15 Lekhalong la Lithunya	69
Figure 32: Runoff relationship SG11 Tsehlanyane and SG14 Motete	70
Figure 33: SG14 Motete runoff compared to rainfall	71
Figure 34: SG11 Tsehlanyane runoff compared to rainfall	71
Figure 35: SG15 Khalong la Lethunya runoff compared to rainfall	72
Figure 36: SG36 Khubelu runoff compared to rainfall	72
Figure 37: SG11 Runoff, Rainfall, ET and Storage (10 yr monthly average)	73
Figure 38: SG11 10 year average storage	73
Figure 39: SG11 Runoff, Rainfall, ET and Storage (5 yr monthly average)	74
Figure 40: SG11 5 year average storage	74
Figure 41: SG14 Runoff, Rainfall, ET and Storage (10 yr monthly average)	75
Figure 42: SG14 10 year average storage	75
Figure 43: SG15 Runoff, Rainfall, ET and Storage (8 yr monthly average)	76
Figure 44: SG15 8-yr average storage	76
Figure 45: The number of days per year with flow less than 0.02 cumec at Tsehlanyane.	77
Figure 46: The number of days per year with flow less than 0.03 cumec at Tsehlanyane.	77
Figure 47: The number of days per year with flow less than 0.04 cumec at Tsehlanyane	78

## LIST OF TABLES

Table 1: Characteristics of surveyed Khubelu wetlands.....	11
Table 2: Quality of water flowing out of surveyed wetlands .....	12
Table 3: Predominant Vegetation Cover.....	15
Table 4: Khubelu population figures.....	17
Table 5: Villages participating in the Field Inventory.....	20
Table 6: Descriptive Statistics on the participants .....	21
Table 7: Percentage change in Mohair productivity (2003-2007).....	40
Table 8: Percentage change in wool productivity (2002/03-06/07).....	41
Table 9: Changes in the availability of the wetlands services due to degradation.....	42

## ABBREVIATIONS

CC	Community Council – Lowest level of Local Government
CROPWAT	Crop water requirement model
DEM	Digital Elevation Model
DHI	Danish Hydraulic Institute
DO	Dissolved Oxygen
DRWS	Department of Rural Water Supply
DWA	Department of Water Affairs, Lesotho
ET	Evapotranspiration
EU	European Union
FAO	Food and Agriculture Organisation (of United Nations)
FGDC ESRI	Federal Geographic Data Committee - Environmental Systems Research Institute
FFEM	French Global Environmental Facility
GIS	Geographic Information Systems
GPS	Global Position System
IWRM	Integrated Water Resource Management
LHDA	Lesotho Highlands Development Authority
LHWP	Lesotho Highlands Water Project
LPMS	Livestock Products Marketing Services
LSPP	Department of Land Surveys and Physical Planning
M	Maloti (currency of the Kingdom of Lesotho)
MAE	Mean Annual Evaporation in mm
MAFS	Ministry of Agriculture and Food Security
MAP	Mean Annual Precipitation in mm
MAR	Mean Annual Runoff in mm
m.a.s.l.	Metres above sea level
MDTP	Maloti-Drakensberg Trans-frontier Project
MFLR	Ministry of Forestry and Land Reclamation
MIS	Management Information System
MLG	Ministry of Local Government
MNR	Ministry of Natural Resources
MRA	Managed Resource Area
MRC	Managed Resource Committee
MTEC	Ministry of Tourism, Environment and Culture

NES	National Environment Secretariat
NGO	Non-Governmental Organizations
NUL	National University of Lesotho
ORASECOM	Orange-Senqu River Commission
PEM Consult	People, Environment and Management
pH	Power of Hydrogen - measure of the acidity or alkalinity
PIU	Project Implementation Unit (ORASECOM)
PRSP	Poverty Reduction Strategy Paper
RAMSAR	International Convention on Wetlands
SADC	Southern African Development Community
SPOT	Satellite Images
SPSS	Statistical Package for Social Scientists
TCC	Tsoelopele Consultants & Contractors (Pty) Ltd.
TDS	Total Dissolved Solids
TOR	Terms of Reference
UTM	Universal Transverse Mercator
WASA	Water and Sewerage Authority
WHO	World Health Organisation
WIS	Wetlands Information System
WGS	World Geodetic System

## 1. INTRODUCTION

This Final Report presents the results of the 'Feasibility Study of the Protection of Orange-Senqu River Water Sources ('Sponges' Project) compiled for the Orange-Senqu River Commission (ORASECOM) by PEMconsult<sup>5</sup>, Denmark in association with DHI<sup>6</sup>, Denmark and TCC<sup>7</sup>, Lesotho. The Contract commenced on the 5<sup>th</sup> of November 2007.

The preliminary results of the detailed field investigations, the remote sensing assessments and collection of the existing wetlands data are presented in the 'Inventory Report'<sup>8</sup>. This final report presents the final result of the study. It summarises the results of the detailed field investigations and includes further analysis and conclusions on the state of the wetlands in the Highlands of Lesotho together with a proposal for the conservation and rehabilitation of the wetlands including capacity building and research. The study focuses on the palustrine wetlands which are of particular importance in the hydrological context since they play a major role in supporting the base flow of the river during the dry season.

### 1.1 BACKGROUND

The Orange-Senqu River system has its sub-basins in Botswana, Namibia, South Africa and the entire river system in Lesotho as its main tributary source. The total catchment of the Orange-Senqu River covers 850.000 km<sup>2</sup>, of which 30.690 km<sup>2</sup> forms the Kingdom of Lesotho and while constituting only 4% of the basin area, the river systems in Lesotho contribute approx. 45% of the Orange-Senqu runoff. Most of the water sources originate in the rugged mountainous terrain in the Highlands of Lesotho above 2,000 metres above sea level (m.a.s.l) where the terrain, rainwater and run-off form a myriad of wetlands which are valued for their hydrological functions such as their support to river flow, through the storage and subsequent slow release of rain-water through springs and into streams and rivers. The wetlands are also associated with soil stabilization, sediment and toxin retention, nutrient removal and transformation and organic matter production and export.

Lesotho's alpine wetlands are rare ecological features in Southern Africa. They are distinct floristically and structurally from other wetland systems in Southern Africa. The wetlands fall under three broad categories: a) the *palustrine wetlands* are the dominant type and these includes mires (bogs and fens) most of which are found at high altitude, at valley heads and at the upper reaches of rivers – these have been referred to as "sponges"; b) *lacustrine system* consisting of artificial impoundments for water supply and soil conservation work; c) *riverine systems* along the rivers and streams.

The wetlands of Lesotho are primarily important for their hydrological functions and they have directly and indirectly become the source of livelihoods and income for the country. Currently the river systems, which emanate from the wetlands, maintain the necessary quality and quantity of water which has been harnessed through the Lesotho Highlands

---

<sup>5</sup> PEM is the abbreviation of People, Environment and Management.

<sup>6</sup> DHI is the abbreviation for Danish Hydraulic Institute.

<sup>7</sup> TCC is the abbreviation for Tsoelopele Consultants & Contractors (Pty) Ltd.

<sup>8</sup> Report Number ORASECOM 001/2008: Inventory Report, Protection of the Orange-Senqu Water Sources 'Sponges' Project' Lesotho, Final, September 2008

Water project (LHWP) to support one of the major sources of foreign income for Lesotho.

Despite the importance of these wetlands to the people and the economy, the systems continue to be degraded, mainly because of infrastructure development, uncontrolled livestock grazing and trampling, behavioural strategies of ice rats<sup>9</sup> (*Otomys sloggetti robertsi*) and moles, siltation and erosion, encroachment by cultivation and overexploitation of resources.

The extent of the desiccation and degradation of the wetlands has not been quantified but a few examples quoted in literature, research and reports highlight the poor condition, and a wide range of usually linked causes, and hence the need for a coordinated approach to their management.

The members of Southern African Development Community (SADC), including Lesotho, recognised the importance of wetlands in the mid-1980's and called on member states to develop national programmes to conserve and manage wetlands. At the same time, the LHWP was established by a Treaty between the governments of Lesotho and South Africa. Currently the revenue from the water provided by the Lesotho Highlands to South Africa amounts to an average of about M 15 million per month. It is believed that the wetlands play an important role in controlling the factors that could otherwise negatively impact the water quality and quantity in the Orange-Senqu River.

In year 2000 the countries of Botswana, Lesotho, Namibia and South Africa established the Orange-Senqu River Commission (ORASECOM) under the SADC Protocol on Shared Watercourses<sup>10</sup> to strive towards greater cooperation, strengthened regional solidarity and enhanced socio-economic development advocating the sustainable management of the river and its sources.

With the assistance of the SADC Regional Wetlands Conservation Project Phase II<sup>11</sup> the Government of Lesotho established a Wetlands Unit in the Department of Water Affairs in 2003, constituted the Wetlands Committee in 2004 and formulated a National Wetlands Management Programme in 2005. The main purpose of the Wetlands Programme is to provide a comprehensive coordinated national framework that will guide conservation, management and wise use of the wetlands and associated resources for economic prosperity and improved livelihoods. The present project has been developed in order to support the implementation of the priority actions stipulated in this framework. The ORASECOM, through its Project Implementation Unit (PIU) is responsible for the management of the project implementation and technical quality assurance. The funding has been provided by the French Global Environmental Facility (FFEM) and the Member States.

Accordingly, the objectives of the project are congruent with, and will contribute to the objectives outlined in other national strategies including the Lesotho Water and Sanitation Policy, National Wetlands Management Programme, the Poverty Reduction Strategy and the 2020 National Vision for Lesotho.

---

<sup>9</sup> Ice rats live in colonies of up to 17 individuals and construct complex underground burrows, into which they retire when temperature and radiation levels are high in summer (Schwaibold and Pillay, 2006). They inhabit areas with short vegetation on which they feed. They do not dig in waterlogged areas therefore wetlands with gully erosion provide an ideal habitat: soft ground and close to feeding areas.

<sup>11</sup> SADC 1998, revised 2000, by the Norwegian Agency for Development Cooperation (NORAD)

## 1.2 PROJECT OBJECTIVES

The objectives of the Project are to:

- Make an assessment of the potential benefits which result from the protection of the wetlands of the Upper Orange-Senqu basin in Lesotho through:
  - Identification of the potential benefits of wetland management
  - Identification of potential costs of wetland degradation in the Upper Orange-Senqu basin
- Identify priority areas for actions through:
  - Identification of the most vulnerable people
  - Identification of highly functional wetlands
- Identify research gaps that can be addressed within the next two years:
  - Identify research areas and topics
  - Identification of critical information needed
- Suggest and plan a coordinated strategy between different programmes in the area
- Development of a strategy for generating appropriate information
- Development of a methodological approach for the sustainable management of the wetlands in the Upper Orange-Senqu Sub-basin in Lesotho.

It is understood that the Visions of the Project are to:

- Secure long-term availability and quality of water from the Upper Orange-Senqu catchment area;
- Establish a holistic protection and conservation action plan for the sustenance of the 'Sponges' (essentially the palustrine wetlands) that will provide a methodological approach for the sustainable management of the wetlands benefiting the population in the areas as well as the environment.

The above stated project objectives are interlinked in such a way that they clearly express two **Specific Objectives/ Outputs**:

- i) Establishing accurate information on the extent and state of the palustrine wetlands for decision-making on wetlands management;
- ii) Putting in place an appropriate Action Plan for the sustainable management of the palustrine wetlands.

## 1.3 APPROACH AND METHODOLOGY

### 1.3.1 Inventory Stage

The implementation of the project has followed the approach and methodology described in the Consultant's Proposal and further elaborated in the Inception Report. The following activities have been undertaken during the study in order to gain detailed knowledge on the wetland situation in the Upper Orange-Senqu Sub-basin in Lesotho:

- 1) **Spatial Data Collection and Analysis** in order to:
  - Consolidate and unify the Geographical Information System (GIS) data on wetlands collected from available sources into the Wetlands Information System (WIS) platform in a common geo-reference system as well as to suggest formats and a structure for the metadata management;

- Identify information gaps;
- Assist in the interpretation of the GIS data for the selection of areas for detailed field assessment;
- Capacitate Department of Water Affairs (DWA) staff in the use and maintenance of the GIS system and the future generation of appropriate information.

A team with a representative from DWA and an additional research assistant<sup>12</sup> has worked together under the supervision of the Consultant<sup>13</sup> on the compilation of data from the respective government Ministries and Non-Governmental Organisations (NGOs). The DWA personnel have been involved in the whole process thus benefiting from on-the-job training.

2) **Field Inventory** in the selected study areas in order to:

- Assess the conditions in selected study areas
- Assessment of stakeholder perceptions and capacity building needs
- Identify priority areas for action

The field inventories have been based on the development of a standardised wetlands inventory sheet and a quantitative data collection instrument in the form of a questionnaire. The questionnaire was designed in such a way that it collected data for the sociological analysis as well as the economic cost benefit analysis at the same time. Data entry and analysis was carried out using the 'Statistical Package for Social Scientists' (SPSS)<sup>14</sup>.

Research assistants were trained and supervised for undertaking the work. The questionnaires were administered to herders and household heads or their spouses within the Khubelu River catchment. A total of 91 questionnaires were filled by the trained research assistants including DWA personnel who had joined for purposes of capacity building.

3) **Inventory of existing information and activities** in order to learn from experiences and opinions from the various stakeholders.

- *Central level:* Stakeholder analysis at central level was conducted by the team and discussed with members of DWA based on meetings with central level stakeholders. The meetings were qualitative in character following a checklist although additional questions, not on the checklist, were asked depending on the responses from the attendants;
- *District level:* Three district administrations were assumed to be involved with the use and management of the Khubelu catchment area and wetlands: Leribe, Butha-Buthe and Mokhotlong. The district administrators were very instrumental in bringing together their planning units and related professionals for their participation in the structured meetings and discussions with the team of consultants concerning the conditions, management and use of the wetlands specific to the Khubelu catchment. The meetings were qualitative in nature;
- Review of available documentation from past and present projects within the sector including lessons learned;

---

<sup>12</sup> Mr. T. Mefi, DWA and Ms R. Mabote, Research Assistant

<sup>13</sup> Denvertch GIS Specialist, Phomolo Mohapi

<sup>14</sup> SPSS Inc. Headquarters, 233 S. Wacker Drive, Chicago, Illinois 60606



- Review of on-going work on soil conservation, protection and rehabilitation of wetlands.

### **1.3.2 Design Stage**

The development of a conservation, rehabilitation and protection programme was informed by the information and knowledge on the wetlands that had been gained during the inventory stage. The design of the programme was further informed by an impact assessment and quantification of the benefits deriving from the wetlands.

An important and integrated part of the programme will be the capacity building plan for formal and on-the-job training of local communities, livestock owners, herders, local councillors and government officials.

The plans for conservation, rehabilitation and protection of the wetlands integrated with capacity building have been further developed into an action plan for a pilot programme for addressing the urgent conservation and rehabilitation needs. The plan was discussed with the 'Reference Group' in Mokhotlong District and the national level stakeholders in the Wetlands Committee.

The proposed programme has been described in a log-frame format commonly used for donor proposals and attached as an annex to this report.

The programme has been presented to the ORASECOM Steering Committee and finalised according to the comments from the steering committee. A brochure has also been prepared and printed in order to communicate the results of the study to a range of stakeholders.

The following sections present and summarise the key findings of the study.

## **2. SUMMARY OF INFORMATION ON THE WETLANDS**

### **2.1 ESTABLISHMENT OF THE GIS DATA BASE ON WETLANDS**

#### **2.1.1 Existing Wetlands Data**

The available data on wetlands were retrieved from DWA. The original projection of the data is Universal Transverse Mercator (UTM) 35S which carries the World Geodetic System (WGS) of 1984 and the 1984 World Spheroid. As the data have been manipulated by different users it has been projected to unknown projections without identification of the name and type of the projection of the metadata and therefore the DWA GIS would not display the data in a coherent manner.

All data and corresponding layers have been analysed by the team and projected into the UTM 35S<sup>15</sup> to provide DWA with a functioning GIS for the wetlands.

The wetlands mapped and digitised by different projects are:

- Katse Wetlands
- Part of Mokhotlong Wetlands
- Mohale Wetlands
- Maluti Drakensberg Trans-frontier Project (MDTP) Area Wetlands

In close cooperation with the DWA staff all available spatial data was collected from all available sources<sup>16</sup> and analysed in view of the establishment of a common geo-reference system including metadata.

#### **2.1.2 Proposed Common Platform**

Based on the analysis of the available spatial and meta-data a common GIS-WIS platform was proposed and agreed with DWA. The final GIS delivered to DWA consists of a single polygon coverage containing in excess of 69,000 individual wetlands, which have been coded according to hydrological landscape position re “valley bottom” (channelled/non-channelled) or “seep”. The data are supplied in ArcShapefile format in UTM35S (WGS84) map projection.

This GIS WIS platform is compatible with the Regional Management Information System (MIS) established for the Integrated Water Resource Management Plan for the Orange-Senqu basin.

In addition to the mapped wetlands the following digital datasets are supplied to DWA on the final data DVD:

- Schwabe & Whyte mapped wetlands (Mohale and Katse), 1:250.000, 1993
- Combined SPOT5 (satellite images interpretation) and Schwabe & Whyte wetlands, 1:250.000, 1993

---

<sup>15</sup> The details of the GIS are described in the Inventory Report Annex A: Technical Report 1: Spatial Data compilation and analysis, Denver Technologies (Pty) Ltd. 2008

<sup>16</sup> Sources: DWA, Lesotho Highlands Development Authority (LHDA), Ministry of Natural Resources (MNR), Maluti Drakensberg Trans-frontier Project (MDTP), Ministry of Forestry and Land Reclamation (MFLR), Ministry of Agriculture and Food Security (MAFS), Land Survey and Physical Planning (LSPP), Land Use Planning Division (LUPD)

- 90m Digital Elevation Model (DEM) and derived slope dataset 1:250.000, MDTP, 2006
- 20m DEM and derived slope data set, 1:250.000, MDTP, 2006
- Roads Infrastructure, 1:250.000, Land Survey and Physical Planning (LSPP)
- Basic Soils for Lesotho, 1:250.000, Carroll and Bascomb, 1967
- Soil Association Map, 1:250.000, Soil and Water Conservation Department, 1979
- Present land-use for Lesotho extracted from the MDTP vegetation map, 1:250.000, DWA, 2008
- Vegetation Map, 1:50.000, Martin Leroy, Department of Range Management, 1983-86
- Geology of Lesotho, 1: 250.000, DWA, data derived from 1947-49, Geology of the Basotho Land.
- Rivers, 1:250.000, MDTP, 2006
- Boreholes layer, 1:250.000, DWA constantly upgraded
- Mayor rainfall stations including those bordering Lesotho in South Africa, from 1950' to present.

### 2.1.3 Recommendations on Wetlands Data

Sound decision-making on the conservation and wise use of wetlands in Lesotho is hindered by the absence of easily accessible and reliable information. This study has now collected most of the relevant GIS information from other institutions and deposited it at DWA. However, the current DWA GIS-WIS platform including the available data from all the other sources gathered during the study provides only spatial information and lack attributes such as the Why? What? How? which need to be recorded systematically in the meta-data.

As an initial step it has been suggested to standardize the Wetlands Inventory Sheet (refer to the Inventory Report Annex B) and Socio-Economic Questionnaires (refer to the Inventory Report Annex C) and allow for their inclusion as attributes to the corresponding layers. For the systematic recording and management of the meta-data, it is recommended to use the FGDC ESRI<sup>17</sup> especially since DWA is using ArcView 9.2 and its successors for manipulation of data and maps. The GIS data should be provided in decimal degrees preferably in the WGS 1984 projection for other users to easily project it to other preferred projections.

It is recommended that the further development of the GIS WIS should continue through:

- Continuous survey, mapping and classification of wetland ecosystems based on the standardized inventory sheets easily recorded in the attributes and hence meta-data;
- Establishment and operationalisation of the necessary links from the national wetland database at DWA to related data such as geology, soils, socio-economic information, vegetation, land-use etc;
- Analysing the roles in wetlands management at local, district and national level and establish a data collection and information system for monitoring the state of the wetlands that will serve the stakeholders at all levels;
- Continuous production of information materials for wetland management at all levels.

---

<sup>17</sup> Federal Geographic Data Committee – Environmental Systems Research Institute

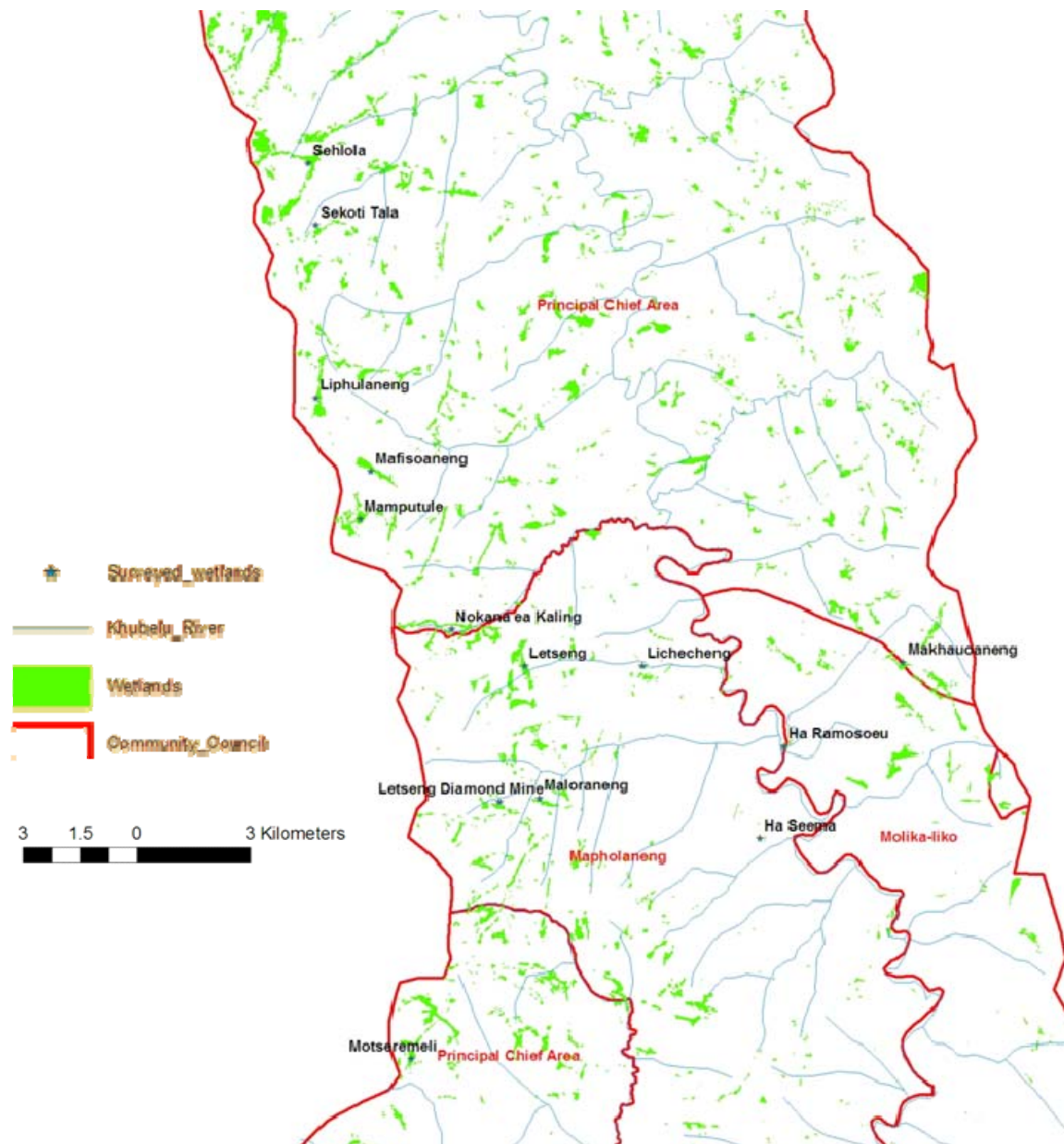


## 2.3 INVENTORY OF THE KHUBELU WETLANDS

### 2.3.1 Wetlands in Khubelu

The Khubelu catchment is located in Mokhotlong district on the border with Butha-Buthe district. Remote sensing media in the form of SPOT satellite imagery, colour photographs and GIS interpretation were used to obtain a general idea of the conditions in the area and to produce the wetland maps before activities in the field. Analysis using remote sensing and GIS will generally not yield accurate results unless coupled with ground verification to detail the actual extent of the area, topography, ecological and biological attributes as well as hydrologic conditions.

Figure 3: Map of the studied Wetlands



Letseng la Terai diamond mine is located on the catchment divide of the Khubelu catchment and draws water from and discharge effluent and mine spoils to the wetlands.

### 2.3.2 Inventory

The inventory was conducted in the middle and upper sections of the Khubelu catchment. The wetlands in this area are classified as *palustrine wetlands* consisting mainly of mires (bogs and fens). These are found at high altitude (2,000 to 2,700 m.a.s.l.) at valley heads and at the upper reaches of the river. Only some of the wetlands within these two sections were studied in detail.

The wetlands were selected based on a) representativeness, b) whether they appeared healthy or not and c) accessibility.

To guide the field work and to supplement the GIS data, a field protocol including data sheets was developed in close cooperation with DWA and in accordance with the RAMSAR Guidelines for wetland data collection. An example of the inventory sheet is included in the Inventory Report Annex B. For each wetland the following attributes were recorded:

- Geographic coordinates
- Altitude
- Site name
- Wetland area
- Aspect (direction of slope)
- Slope
- Landform setting
- Wetland flora (species, genus and abundance)
- Erosion extent and severity
- Sketch map of the wetland site

Vegetation on the mires is predominantly short mixed sedge and grass meadows interspersed by taller vegetation. Mean annual evapotranspiration is approximately 920 mm in the highlands of Lesotho and the average annual rainfall is 1168 mm measured at Oxbow. Table 1 describes the characteristics of the wetlands in Khubelu catchment according to the survey data on erosion, slope, area and outflows.

**Table 1: Characteristics of surveyed Khubelu wetlands**

NAME	LONGITUDE	LATITUDE	EROSION	SLOPE %	AREA M <sup>2</sup>	OUTFLOW (l/sec)
Ha Ramosoeu	28.94623	-28.99714	Moderate	24%	6,634	0.159
Ha Seema	28.94124	-29.01716	Low	0%	2,308	0.000
Lets'eng	28.88116	-28.98073	Low	7%	69,790	2.000
Lets'eng Mine	28.87517	-29.01097	Low	10%	28,074	2.128
Lichecheng	28.91116	-28.97998	Low	7%	3,884	0.131
Liphulaneng	28.82929	-28.92312	Very high	10%	128,706	5.882
Mafisoaneng	28.84286	-28.93807	High	13%	128,313	0.084
Makhauoaneng	28.97475	-28.97894	Moderate	23%	31,048	3.125
Maloroaneng	28.88689	-29.01015	Moderate	21%	53,588	0.333
Mamputule	28.83982	-28.94855	Very high	10%	66,246	3.448
Mots'eremeli	28.85444	-29.06593	High	8%	54,656	1.586
Nokana ea Kaling	28.86384	-28.97278	High	16%	282,837	2.083
Sehlola	28.82601	-28.87131	Very high	8%	136,607	1.000
Sekoti Tala	28.82877	-28.88626	Very high	12%	43,832	1.124

### 2.3.3 Water Quantity

Generally outflow of less than 6 litres/sec have been recorded in the wetlands sampled during the month of February 2008 (Table 1). This once-off measurement of flow does not show any relation between the state of erosion and the average flow per m<sup>2</sup> of wetlands. A thorough analysis of the hydrology of the wetlands would require detailed survey data e.g. concurrent rainfall, evaporation, vegetation and run-off data over a longer period in wetlands with different stages of erosion to be able to draw conclusions on the relation between the vegetation/ erosion and the flow from the wetlands. This is one of the aspects that could be relevant for detailed research.

### 2.3.4 Water Quality

Although discharge rates were high on wetlands with heavy signs of erosion, the outflow water quality was generally good. The variability of Dissolved Oxygen (DO) in the wetland water is low but generally indicating good quality water (Table 2). Values between 12.8 mg/l and 7.5 mg/l are normally considered acceptable for good quality fresh water<sup>19</sup>. The lower values measured in the Khubelu wetlands shows that the aquatic vegetation is using the oxygen for respiration. It was also observed that aerobic conditions resulting from higher forms of aquatic vegetation in the wetland could reduce the DO below the stipulated values (Hem, 1989). The pH seems also to be normal for this type of wetlands. The pH falls within stipulated International water quality standards of pH range of 5.0 to 9.0 for South Africa and 6.5 to 8.5 for World Health Organisation (WHO) and the European Union (EU).

<sup>19</sup> in the temperature range between 5 and 30 °C

**Table 2: Quality of water flowing out of surveyed wetlands**

Site name	Longitude	Latitude	Salinity	TDS (mg/L)	pH	DO mg/L
Ha Ramosoou	28.94623	-28.99714	0.1	97.0	7.31	2.53
Ha Seema	28.94124	-29.01716	0.0	127.5	7.73	1.05
Lets'eng	28.88116	-28.98073	0.2	203.0	8.00	1.72
Lets'eng Diamond Mine	28.87517	-29.01097	0.2	204.0	8.04	1.71
Lichecheng	28.91116	-28.97998	0.1	103.9	7.34	2.95
Liphulaneng	28.82929	-28.92312	0.0	25.6	7.45	1.66
Mafisoaneng	28.84286	-28.93807	0.0	39.5	6.86	3.71
Makhauoaneng	28.97475	-28.97894	0.0	47.3	7.71	1.94
Maloroaneng	28.83982	-28.94855	0.1	68.4	7.37	1.62
Mamputule	28.88689	-29.01015	0.0	34.0	7.92	2.16
Motseremeli	28.85444	-29.06593	0.0	31.4	7.25	1.35
Nokana ea Kaling	28.86384	-28.97278	0.0	38.7	7.59	2.36
Sehlola	28.82601	-28.87131	0.0	26.7	7.66	1.78
Sekoti tala	28.82877	-28.88626	0.0	23.9	7.22	1.70

Based on the limited test results during this study, the wetlands seem still to perform their water purification function reasonably well although some degree of degradation was observed. The relation between degradation of the wetlands and water quality is one of the aspects that could be covered in the research accompanying the proposed rehabilitation and conservation programme (see Chapter 3)

### 2.3.5 Wetlands Degradation

Some of the surveyed wetlands were dissected by deep gullies indicating elevated erosion rates. As some of these wetlands are on steeper slopes, the apparent loss of vegetative cover has rendered them vulnerable to wind and water erosion. The degradation of the wetlands vegetative cover may reduce the ability of the wetlands soil to dissipate the erosive water forces. As such, rills and channels have formed resulting in gullies with extended soil scouring.

**Figure 4: Mamputhule Wetland - Ice Rats and erosion**



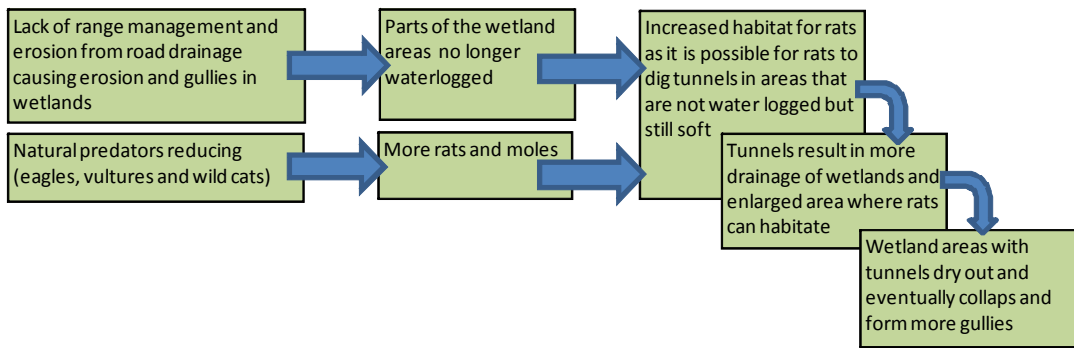
Livestock trampling and rodents (Figure 4) also have an effect on the rate of erosion and water storage. Ice rats dig tunnels in areas of the wetlands that are not water logged. Moles have also been observed around the drying parts of the wetlands. Moles are subterranean rodents that inhabit areas close to their food source and they prefer softer



ground. They make tunnels which lead to the bulbs and tubers they feed on. These underground tunnels are sometimes close to the surface and they can be observed as mounds which eventually collapse and form a drainage system that further drains water out of the wetlands.

The rodents are natural habitants of the mountain areas next to the wetlands however the cause – effect relationship illustrated on Figure 5 is showing that the reduction of the natural predators together with the erosion of wetlands caused by overgrazing and road drainage has an accelerating effect on the number of rodents living in and further degrading the wetlands. Eroded wetlands are an ideal habitat for the rodents as they prefer soft ground that is not waterlogged. Prolonged periods of drought also dry the edges of the wetlands making it possible for the rodents to dig tunnels and access the bulbs and tubers. When the wetland after rains again gets waterlogged, these areas are more prone to erosion as the tunnels are weakening the combined structure of soils and vegetation in the wetlands.

**Figure 5: Cause – effect of rodents and wetland degradation**



To break the circle of further wetland degradation caused by the rodents it is necessary to address the two root causes by i) improving the range management and reduce erosion from road drains and ii) improve the biodiversity and wildlife balance to ensure that the natural predators are present in the area. This would also have to be combined with a rehabilitation of the already drained wetlands to restore the waterlogged condition that the rodents cannot live in.

According to Marneweck and Grundling (1999) cited in National Wetlands Management Programme (2005), the potential maximum inferred water storage of the Lesotho highlands wetlands is estimated to be 817,845m<sup>3</sup> while the current storage is stated to be 522,470m<sup>3</sup> (i.e. 64%) inferring an average water loss due to degradation of 36%. The erosion rates measured by sediment yields have yet to be studied over a longer period of time in order to establish the interrelationship between erosion, water flow, and degradation of the wetlands.

**Figure 6: Sehlola Wetland – gully erosion and sheet erosion**



Judging from the composition of the vegetation cover, 9 out of 14 wetlands studied showed heavy to moderate signs of degradation (Table 3). Most of these wetlands were located close to the main road. Only a few livestock farmers move their livestock to the lowlands or foothills during winter indicating that they may not give the pastures or wetlands time to regenerate.

It has also been observed that the highly degraded wetlands have scanty vegetal cover and dominated by shrubs, *Oxalis sp.*, *Geum capensi* (*Geumcapensi*), short sedge grasses, *Helichrysum chionosphaerum*, carex, *Festuca* and *Festuca Caprina* as an indication of degradation. A healthy wetland is characterised by abundance of *Carex sp.*, *Scirpus sp.* and *Merxmullera sp.*

**Figure 7: Natural vegetation: *Geum capensi* (left); Alien vegetation: *Cirsium vilgare* (right)**



The following Table 3 illustrates the extent of degradation of the vegetation cover within the wetlands study area.

**Table 3: Predominant Vegetation Cover**

Site name	Altitude	Aspect	Setting	Slope %	Dominant plant species	Healthy (H) Degraded (D)
Lichecheng	2572	North	valley bottom	13	Carex Sp (70%), <i>Scenecio Aspeulus</i> (28%) <sup>20</sup>	H
Letseng	2925	North east	valley bottom	7	<i>Merxmullera sp</i> (70%), <i>Senecio sp.</i> (5%), <i>Oxalis sp.</i> (5%)	H
Makhauoaneng	2649	South East	seep	23	Short sedge grass (60%), <i>Geum capensi</i> (10%), <i>Cirsium vilgare</i> (10%)	D
Ha Seema	2340	South west	valley bottom	0	<i>Scirpus</i> 90%, <i>Rorippa sp</i> (10%)	H
Mamputule	3107	East	valley bottom	10	Short sedge grass (50%), <i>Geum capensi</i> (40%), <i>Silaginella caffrorum</i> (9%)	D
Liphulaneng	3140	North	valley bottom	10	<i>Geum capensi</i> (70%), Short sedge grass (25%), <i>Cotula sp.</i> (4%)	D
Tlaeeng	3051	East	valley bottom	16	<i>Geum capensi</i> (70%), Short sedge grass (30%)	D
Malroaneng	2711	South West	valley bottom	21	Short sedge grass (30%), <i>Geum capensi</i> (20%), <i>Oxalis sp</i> (20%), <i>Helicrysum</i> (11%)	Partly D
Motseremeli	2914	North West	valley bottom	8	<i>Geum capensi sp.</i> (70%) <i>Cotula sp.</i> (30%),	D
Letseng	2877	South West	valley bottom	10	<i>Merxmullera</i> (90%), <i>Senecio sp.</i> (5%), <i>Oxalis sp.</i> (1%), <i>Geum capensi sp.</i> (5%)	H
Sehlola	2915	South East	valley bottom	8	<i>Cotula sp.</i> (30%), <i>Trifolium sp.</i> (30%), Moss (30%) <i>Geum capensi.</i> (5%),	Partly H
Mafisoaneng	2979	South East	valley bottom	13	Short sedge grass (50%), <i>Oxalis sp.</i> (25%) <i>Cotula Sp</i> (10%) <i>Festuca</i> (10%),	D
Basali	3074	East	seep	12	<i>Geum capensi sp.</i> (80%), Short sedge grass (9%), <i>Cotula sp</i> (10%)	D
Ha Ramosoou	2431	South west	seep	24	<i>Geum capensi sp.</i> (45%), <i>Scirpus sp</i> 25%), Moss sp (30%)	Partly D

<sup>20</sup> Remaining % up to 100% indicates bare ground without vegetation

## 2.4 USES OF THE KHUBELU WETLANDS

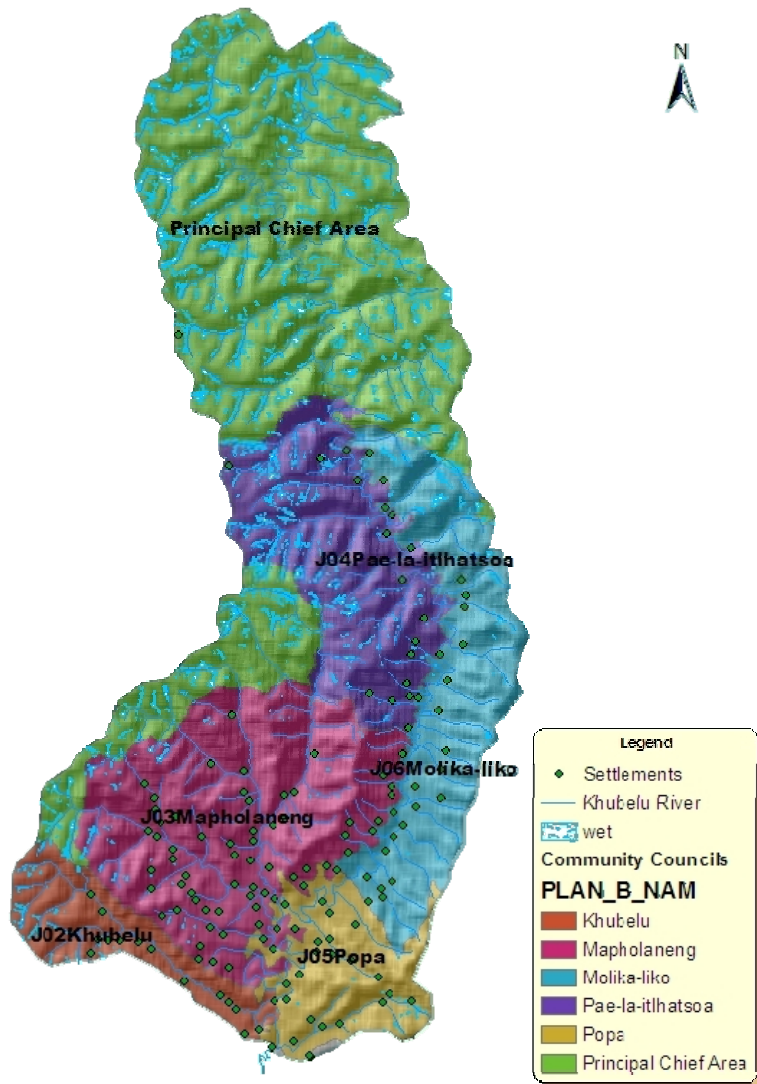
### 2.4.1 Local Governments

Within the Khubelu catchment there are five Local Government Community Councils (CCs), namely:

- J02 Khubelu
- J03 Mapholaneng
- J04 Pae-l'a-itlhatsoa
- J05 Popa
- J06 Molika-Liko

The majority of villages within the Khubelu catchment area are located in the lower catchment area far from the wetlands. A smaller group of villages are located in the middle section of the catchment in close proximity to wetlands as illustrated on the map in Figure 2 and Figure 8. These villages are: Paelaitlhatsoa, Ha Seema, Maloraneng, Ha Ramosoau, Patiseng, Matlakeng, Ha Boraki, Ha Qobo, Lichecheng and Moeaneng (Koung). The remaining settlements close to the wetlands are cattle-posts located in the upper section of the catchment area – many of the cattle-posts in the far northern part of the catchment are no longer in use. The villages and the CC boundaries are shown on the map in Figure 8.

Figure 8 Community Council Boundaries



The approach for the socio-economic data collection involved both the survey using an administered questionnaire and qualitative interviews with key informants that included the range management officers, the District administrative staff and the CCs. In the presentation of the survey results, the responses from some of the smallest villages have been included under one representative village name.

## 2.4.2 Population in the Khubelu Catchment

Population data per CCs is available from the Bureau of Statistics preliminary results of the 2006 population census while population data per village are not yet released. The population in the Khubelu catchment of approximately 20,000 people (Table 4) has therefore been estimated according to the proportion of the CCs that fall within the catchment. Estimating the population that has access to and utilise the natural resources from the catchment is more complex as some livestock owners from other areas under the jurisdiction of the principal chief will have access to grazing permits in the Khubelu catchment, while also the livestock owners resident in the Khubelu catchment will have access to grazing outside the catchment.

**Table 4: Khubelu population figures**

<b>Khubelu Population</b>	<b>Male</b>	<b>Female</b>	<b>total CC</b>	<b>Khubelu</b>	
J02 Khubelu	4,261	4,429	8,690	30%	2,607
J03 Mapholaneng	4,223	4,383	8,606	100%	8,606
J04 Pae-l'a-itlhatsoa	1,005	1,075	2,080	100%	2,080
J05 Popa	3,304	3,421	6,725	50%	3,363
J06 Molika-Liko	3,155	3,084	6,239	50%	3,120
Total	<b>15,948</b>	<b>16,392</b>	<b>32,340</b>		<b>19,775</b>

The most vulnerable people in the Khubelu catchment have been identified during the stakeholder analysis as the poor in the area whose livelihood comes from subsistence farming and livestock and especially the female or child headed households.

## 2.4.3 Infrastructure

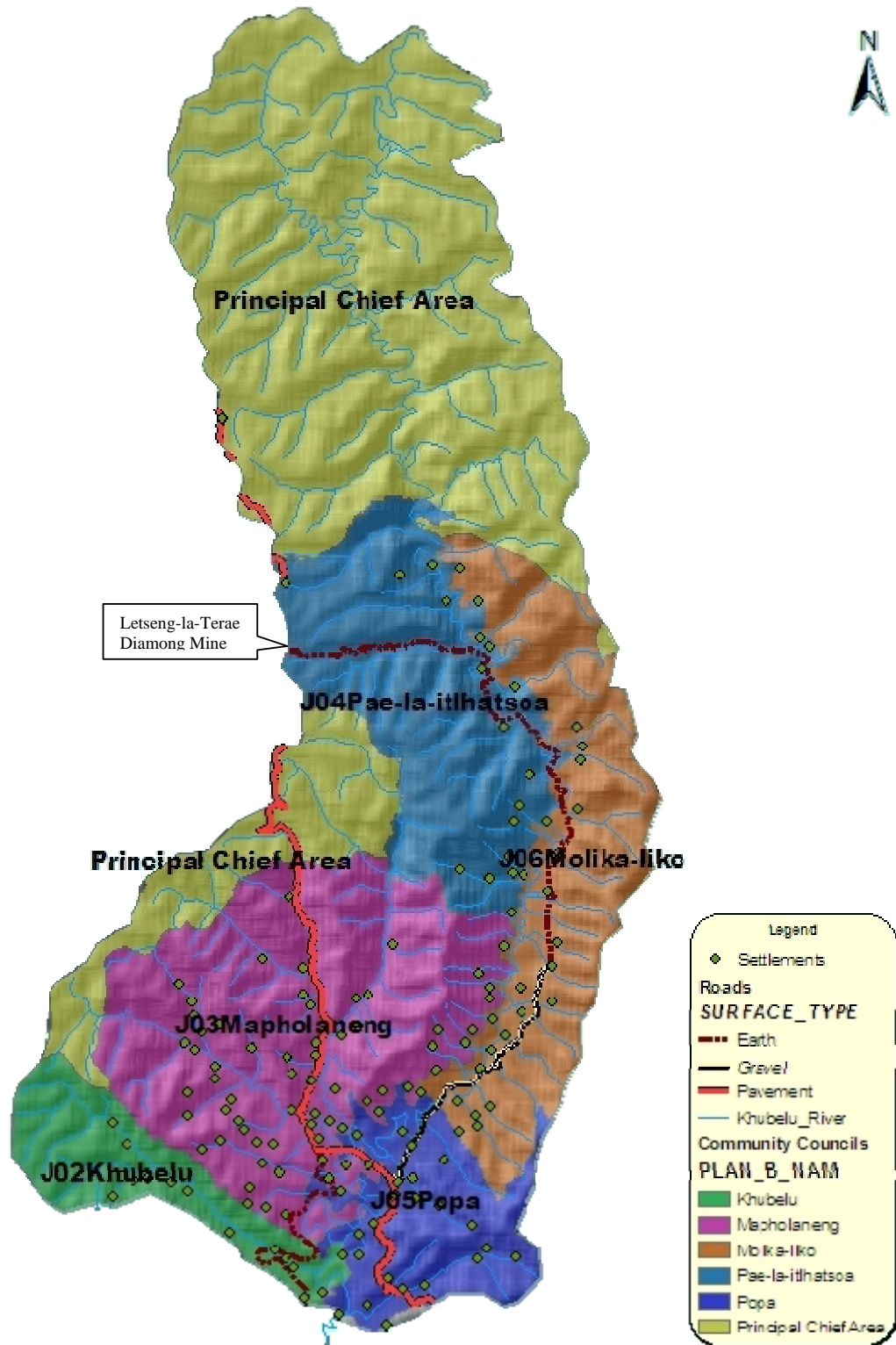
The main road infrastructure in the Khubelu catchment is the tarred road to Mokhotlong from the lowlands that runs through the western and southern part of the catchment. A gravel/ earth road connects the villages in the middle part of the catchment with the main road, near the Letseng-la-Terae mine in the mid western part and near Mapholaneng in the southern part. This road is only accessible with 4 wheel drive vehicles and not accessible during heavy rains. There is no road access to the northern part of the catchment.

The affects of road infrastructure on the wetlands can be seen in two parts:

- During the construction where the road alignment crosses the wetland, and where the increased population and activities around road camps result in erosion;
- After completion of the road construction, the longer term effect is on the drainage of the area since the drains along the sides of the road and the cross-drainage structures such as culverts change the natural runoff pattern in the area crossed by the road, generally concentrating the flow of water at a few discharge points typically at low-points in the alignment – corresponding to the areas where the wetlands are situated.

The road infrastructure is shown in Figure 9

Figure 9: Infrastructure in Khubelu Catchment



#### 2.4.4 Mining Activities

The Letseng-la-Terae diamond mine is situated at the mid-western edge of the catchment. The mine does not use chemicals in the production activities and the sediments in effluent from the production activities are settled in the large ponds visible on the aerial photo (Figure 10) before the effluent is discharged into the natural drainage channels.

Although these measures have been taken to minimise the affect of the mine on the environment, the mining activities affect the wetlands in various ways:

- The increase in activity and population around the mine result in increased erosion;
- The deposit of mine spoils on wetland areas;
- The drainage from the mine infrastructure and excavations is changing the natural drainage pattern, similar to the effect of road infrastructure described above;
- Drainage from the mine spoils containing sediments affecting the downstream wetlands and water courses.

These aspects are all evident at the Letseng-la-Terae mine as shown on the aerial photos in Figure 10.



**Figure 10: Letseng-la-Terae mining activities**

Small-scale mining activities were not identified in the Khubelu catchment. However in the neighbouring areas around Kao such activities are prolific and must be included in a programme for protection of the wetlands in general.

## 2.4.5 Socio-economic Data Collection

The inventory took place during the rainy season in February where rivers are full and isolate some of the villages even when on foot. A total of 91 persons have been interviewed of whom 49% were males and 51% females. They were composed of 55% household heads, 34% spouses, 6% herders and 2% others. On average they were aged 48 years with the age range of 72 years. Household size was on average 6.5 members inclusive of their herders. On average, households have two herders whose ages differ with the mean age for the older herder being 17 years and those of the second herder being 14 years. This suggests that most of the livestock owners still use young children to herd their livestock and this has implications on their educational levels and a possible capacity building programme for protection of the wetlands. In this study it was found that most of the herders had attended school at lower primary level having attended for an average of 2-3 years. There were those who have not attended school at all.

**Table 5: Villages participating in the Field Inventory**

## 2.4.6 Socio-economic Results

The household physical assets included fields and trees such as peach, willow and poplar in very small numbers. In terms of access to land, some of the households have no fields and some of the respondents have up to 6 fields although their sizes are small. On average, respondents had a least one field of average size approximately 4 acres. Fewer of the respondents have up to 3 fields ranging from 2-2.5 acres.

Village	Number of participants	Percent
Ha Nthimolane	31	33.7
Ha Seema	7	7.6
Lichecheng	5	5.4
Maloraneng	12	13.0
Matlakeng	12	13.0
Moeaneng	11	12.0
Paelaitthatsoa	13	14.1
<b>Total</b>	<b>91</b>	<b>100</b>

Table 6 shows respondents' livestock ownership as analysed from their responses indicating the importance of livestock, especially sheep, goats and cattle. However there is a wide disparity among the respondents regarding livestock ownership.



**Table 6: Descriptive Statistics on the participants**

Item Description	Number of respondents	Min	Max	Mean	Std. Div
Respondent's Age	91	18	90	48	17
Household members incl herders	88	1	15	6.5	2.7
Household herders	53	0	13	1.5	1.8
Household herders' age	47	0	33	17	6.8
Household herder 2 age	23	0	23	13.7	8.6
Household herder 1 schooling	42	0	6	1.52	1.9
Household herder 2 schooling	23	0	6	1.5	1.9
Fields owned by household	65	0	6	1.1	0.6
Field 1 size (acres)	62	0	12	4.1	2.6
Field 2 size (acres)	25	0	7	2.5	1.7
Field 3 size (acres)	5	0	7	1.8	3.0
Household cattle	49	0	32	9.1	8.8
Household sheep	41	0	90	26.8	27.4
Household goats	26	0	50	8.1	13.4
Household donkeys	41	0	4	1.4	1.2
Household horses	39	0	4	1.5	1.0
Household peach trees	36	0	10	2.2	2.0
Household willow trees	13	0	8	2.4	2.3
Household poplar	14	0	8	2.4	3.1

The quantitative data analysis shows that the majority of women are less knowledgeable than men about the importance of the *palustrine wetlands* as they seldom have work far from their houses. Men, since most of them have been herders, know more than their spouses about the importance of the functions of the wetlands and their condition. They have therefore been more resourceful in responding to the questions regarding the utilisation of Khubelu catchments.

Of the 77 (83%) who responded to the question on their purpose of using wetlands, the majority (46%) use them for grazing their animals, for extracting medicinal plants and for the grasses that they use for handicrafts.

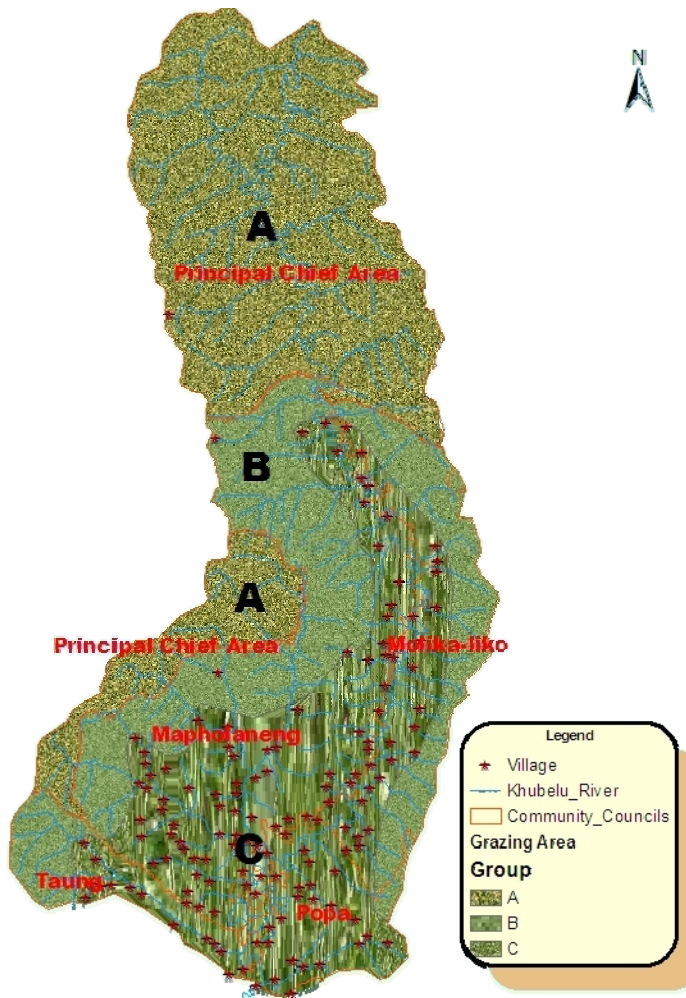
These were followed by 27% of those who use wetlands for all the above mentioned purposes as well as for cultivation. Some (12%) felt that the wetlands were good only for grazing their animals. Similarly water from the wetlands was seen to be good for animals (32%). 33% responded that the water was used for human consumption as it is clean and tasty. This was confirmed by the interviews with the district technical staff.

### 2.4.7 Khubelu Catchment as Cattle-post Area

The terminology used for grazing areas in Lesotho is shown in the text box. Figure 11 provides a map showing the boundaries of the A-B-C grazing areas in the Khubelu catchment.

According to the interviews, some livestock farmers move their livestock to the lower areas (B and C) during winter; while others leave their livestock in the highland pastures (A) all year round despite the risk of disasters with heavy snowfall that can occur in winter and the problems with cattle thefts.

**Figure 11: Khubelu Grazing Area Map**



There are two area A (under the jurisdiction of the Principal Chief) in the Khubelu catchment:

**I:** The northern part of the catchment that is far from road infrastructure and close to the boundary to South Africa.

**Terminology for Grazing Areas:**

**A:** Summer grazing areas with cattle posts in the upper catchments areas located outside the boundaries of the Community Councils. Grazing controlled by the Principal Chiefs;

**B:** Grazing areas and cattle posts in the middle catchments located inside the Community Council boundaries with recommended grazing between May and September controlled by the Community Councils (presently the principal chief also issues permits for area B);

**C:** grazing areas located close to the villages with recommended grazing between June and November controlled by the Community Councils

In this area the wetlands and the rangelands are in a healthy state due to reduced grazing because of stock theft problems and lack of accessibility as the livestock owners prefer using areas with easy road access – differently from the past where horses were the main mode of transport in the mountains.

**II:** The area A in the western part of the catchment. The wetlands and the rangelands in this area are heavily degraded as this part is close to the main road from Oxbow to Mokhotlong and is used extensively for grazing.

The reduced use of the upper Area A for grazing naturally results in further strain on the rangelands and overgrazing in the lower part of area A close to the main road and in areas B and C.

**Cattle:** Out of the 46 respondents who owned cattle, 78% of them send their cattle to the cattle-post (A) while only 20% graze in the lower areas (B and C). Of the 78% utilising grazing area A, about 14% leave their cattle at the cattle-post all year round. 25% of the respondents reported that their cattle remained at the cattle-post for at least three seasons. This indicates that the wetlands in Area A may not be given appropriate time to regenerate.

**Sheep:** 27 respondents owned sheep and all of them send their sheep to the cattle-post in area A. 56% of the respondents send them for summer grazing in area A after which they move to area B.

**Goats:** 12 respondents owned goats (13%), of which 91% confirmed that they normally graze their goats at the cattle-post in area A.

**Donkeys and horses:** 23 respondents owned donkeys. 35% of the respondents send their donkeys to the cattle-post in area A. Most of the horses remain at home and graze locally in area C. Only 9% of the 23 respondents who own horses send them to the cattle-post in area A. It was claimed by some respondents that horses were left to roam wild at the cattle-posts, but this was denied by others and the field team only observed few horses grazing in area A.

#### 2.4.8 Livestock Statistics

Statistics on the livestock that grazes the Khubelu catchment are not easily available. Information has been analysed from different sources:

- i) The livestock data from Bureau of Statistics providing district figures. The district figures have been allocated to the Khubelu catchment in proportion to the area;
- ii) Information collected from the Malingoaneng Principal Chief's office on the number of permits issued for the last two years and identification of the cattle-posts in the Khubelu catchment combined with information from the Mokhotlong-Sanqebethu Managed Resource Area indicating that 44% of the livestock is covered by grazing permits.
- iii) Information from the wool sheds in the area on the number of sheep and mohair goats that have been sheared in the last 5 years. The woolshed estimates are based on an estimated proportion of animals sheared at the surrounding woolsheds grazing in the Khubelu catchment as shown in the table combined with that a proportion shear their animals at home<sup>21</sup>.

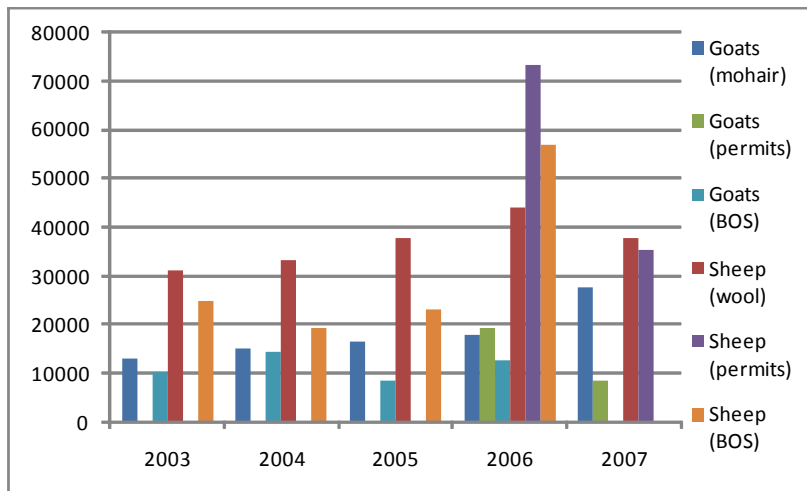
Proportion	Woolshed
20%	Senqu
100%	Mapholaneng
10%	Semenanyane
80%	Matlakeng

Figure 12 and Figure 13 illustrate the difficulties in reconciling the livestock statistics:

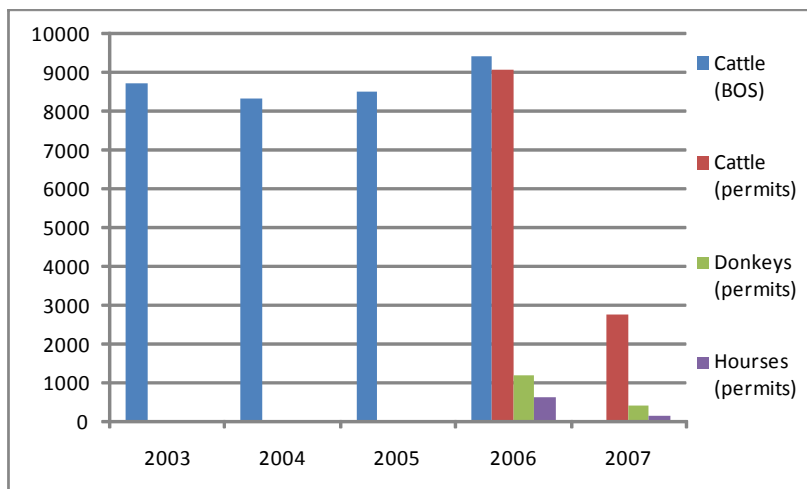
---

<sup>21</sup> The proportion shearing at home is estimated at 17% according to a recent detailed survey in the Mokhotlong-Sanqebethu Managed Resource Area (MRA Management Plan, December 2007)

**Figure 12: Sheep and Goat statistics**



**Figure 13: Cattle, donkey and horses**



From the analysis of the different statistics the following likely number of livestock grazing in the Khubelu catchment can be suggested:

- Cattle:** approximately 10,000 heads of cattle based on the proportion of the number of cattle in Mokhotlong District and the permits issued in 2006 by the principal chiefs office
- Sheep:** approximately 40,000 to 50,000 sheep based on the statistics from the woolsheds, the district data and the permits. The higher figure of 75,000 in 2006 indicated on Figure 12 might be due to better compliance with the permit system than indicated by the survey in Mokhotlong-Sanqebethu.
- Goats:** approximately 25,000 and raising based on the statistics from the woolsheds, the district data and the permits.
- Donkeys:** approximately 1,000 based on the permit information
- Horses:** approximately 500 based on the permit information

### **2.4.9 Range Management**

Livestock is important culturally and as the traditional depository for wealth (outside the formal banking and taxation systems) for the population in the area and this must be appreciated in order to understand the livestock management practices and the difficulties in reducing the quantity of livestock to more sustainable levels.

The interviews with the district officers, the Principal Chief of Malingoaneng and other stakeholders indicate that the system of grazing permits is no longer complied with as there is some confusion over the responsibilities for grazing control between the Chiefs and the CCs. The data from the livestock records by the police are also no longer reliable as the programme for tagging the livestock with electronic chips initiated in 2005 was never completed and stopped in 2006.

The separation of the Ministry of Agriculture into the Ministry of Agriculture and Food Security (MAFS) (including livestock) and the Ministry of Forestry and Land Reclamation (MFLR) (including range management) has further segregated the public sector responsibilities for controlling degradation of natural resources due to overgrazing. Combined with the lack of clarity by the communities on the responsibilities of the new local government structures and the Chiefs indicate that there is a need for capacity development of all the stakeholders in range management to halt the degradation of the natural resources and the wetlands.

#### **2.4.10 Wetlands as a source of water for animals**

The wetlands in Khubelu catchment are used for the provision of water to the grazing animals and the herders as most of the cattle-posts are located around or within the wetlands.

#### **2.4.11 Wetlands as a source of important grasses**

Wetlands are used as a source of important grasses for crafts. Although this is deemed very important by the respondents, very few of those interviewed sold these grasses for economic gains. Among the different wetland plant species, the grasses have particular value as they are used for making brooms, Basotho hats and baskets. Herders and vendors harvest them for weaving these products and selling them. Some of these grasses are getting in very short supply due to the increased overgrazing and over-harvesting.

#### **2.4.12 Wetlands as a source of water for human consumption and laundry**

Wetlands are used as a source of drinking water. Water from the wetlands tends to be clean and tasty and is preferred by the local people. In the Khubelu catchment, some of the major wetlands are far away from settlements and therefore the water from wetlands is generally not used for home consumption. However, the herders use the water for themselves and their livestock.

In most of the cases, rivers serve as the source of drinking water if springs are not available. When asked about sources of water for human consumption other than the wetlands, 55% of 63 respondents reported that they draw water from the river. 43% use springs while 3% have access to tap water. For washing or laundry, the river serves as the common source. It is also the main source of water for livestock drinking, and for performing traditional and spiritual rituals.

People in the Khubelu catchment are used to walking; therefore walking to a distant source of water is generally not a problem. Some of the respondents who have donkeys use them for hauling water especially water for laundry.

#### **2.4.13 Wetlands as a place for performing traditional and spiritual rituals**

Wetlands are sometimes used for traditional rituals and for spiritual purposes. Basotho believe in the use of water especially directly from the natural sources for performing their traditional and spiritual rituals. Running water is normally preferred because it is believed that it will remove all their misfortunes and they will remain clean. According to the interviewees, the most famous place for the rituals is Soloane in the Khubelu catchment.

#### **2.4.14 Khubelu Wetland Utilisation for mining activities at Letseng la Terai**

Letseng la Terai mine is situated at the ridge of Khubelu catchment. Some of the water for running the mining activities used to be drawn from the wetlands within the Khubelu catchment. The mine is now supplied with water from a dam at the top of the catchment close to the mine.

#### **2.4.15 Khubelu River as a source of electricity**

The Khubelu River is used as a source for generating electricity at the Tlokoeng Hydro-power plant serving Mokhotlong. The plant is no longer operational but the proposed LHWP Phase II dam at the confluence of Senqu and Khubelu Rivers is likely to be used for generating electricity. The Tlokoeng Hydropower plant is designed as a 'run of river' power station and is supplemented with diesel generation during low flow periods.

#### **2.4.16 Conclusion on the use of the wetlands**

The overarching use of the wetlands in the highlands of Lesotho is for grazing of livestock and improved range management is the most important factor in sustainable wetlands management.

The issues raised in 2.4.12 on responsibilities for range management indicate that there are too many different actors with sometime overlapping responsibilities leading to incoherent range management. The previous grazing control system is no longer effective as the responsibilities are divided between the CCs (grazing area B and C), the Principal Chiefs (grazing area A), the Livestock Department in MAFS advising farmers on livestock, the Range Management Department in MFLR responsible for advising on grazing plans<sup>22</sup> as well as the Ministry of Home Affairs/ Police responsible for registering livestock for purposes of controlling stock theft.

At the level of livestock owners, Grazing Associations are expected to assist in the management of rangeland but because the large livestock owners are often boycotting the grazing associations, this renders them largely ineffective. Stock theft aspects add to the reluctance of livestock owners to register and seek grazing permits since they are reluctant to register livestock that do not rightfully belong to them.

---

<sup>22</sup> The Principal Chief is not using any grazing plans when issuing grazing permits.

The lack of range management is a serious problem in terms of degradation of the natural resources including the wetlands. This issue is important for the development of the capacity building plan as any training will be ineffective if the roles of the different local and central government institutions in range management and grazing control are not clear and respected by the communities in the area.

The work by the Range Management Department e.g. under the MDTP on developing grazing management plans has no impact if the local government (CCs and Principal Chief) do not make use of these plans when issuing grazing permits. The division of responsibility for grazing permits between the Principal Chiefs (Area A) and CCs (Areas B and C) also seems to be ineffective as the livestock is expected to move between the areas during the year – therefore two different institutions can not effectively manage the allocation of grazing.

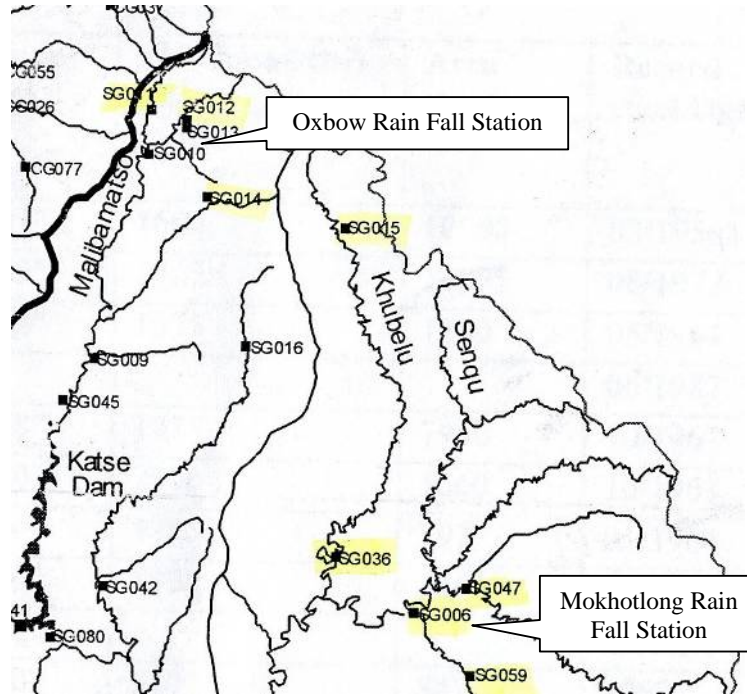
## 2.5 WATER STORAGE IN THE KHUBELU WETLANDS

### 2.5.1 Water Resource Data

The available data on runoff<sup>23</sup> and rainfall relevant for the Khubelu catchment (Figure 14) are:

Figure 14: Location of river gauging stations and rainfall stations

- Lekhalong la Lithunya hydrometric station (SG 15): the only hydrometric station in the upper Khubelu catchment; data available only from 1962 to 1970 when the station was closed;
- Motete hydrometric station (SG 14): located in a neighbouring catchment with similar characteristics to the sub-catchments in the upper Khubelu. Data available from 1962 to 1986 when the station was closed;
- Tsehlanyane hydrometric station (SG 11): located in a neighbouring catchment with similar characteristics to the sub-catchments in the upper Khubelu. Data available from 1962 to 1986, when the station was closed;
- Khubelu - Tlokoeng hydrometric station (SG 36): most important station for the Khubelu catchment as it measures the outflow from the whole catchment, however since it covers the whole catchment, the effect on runoff of the state of the wetlands in the upper section of the catchment is diluted by runoff from the rest of the catchment. Data available from 1966 to 2008, station still active;
- The closest rainfall stations are in Oxbow and Mokhotlong with data covering the period since the early 1940s;
- There are no monitoring data on evapotranspiration in the area.



### 2.5.2 Runoff relationships between stations

The runoff relationship between SG15 Khubelu at Lekhalong la Lithunya and the neighbouring stations, SG 11 Tsehlanyane and SG 14 Motete are presented in Annex A

<sup>23</sup> All run-off data are based on water level readings in rivers analysed with the rating curves for the respective stations to provide data on water flows



together with the runoff – rainfall relationships. Only short data series are available for these stations and there are some inconsistencies in the older data making it difficult to draw conclusions from the analysis. The data have been used mainly to compare results to the longer time data series for SG36 Khubelu at Tlokoeng as presented below.

Because of the difference in size of catchment (approx 50km<sup>2</sup> and 800 km<sup>2</sup>) and geographical location (>50km) there is no relationship between the runoff data for the smaller catchments and SG36 Khubelu at Tlokoeng.

### 2.5.3 Available data for analysis

The data that are available to analyse changes in runoff over a longer period up to the present are therefore SG36 data over 40 years from 1966 to 2008. The smaller catchments SG11 and SG14 with measurements over 24 years from 1962 to 1986 could also provide some insight however the data do not show current trends.

Rainfall data are available from Oxbow and Mokhotlong. There is a large variation in the rainfall between the two stations with Oxbow having approximately 1200mm of annual rainfall and Mokhotlong only approximately 600mm. The Oxbow data are more representative of the rainfall patterns in the upper and middle Khubelu catchment, and the Mokhotlong data are more representative for the rainfall in the lower part of the catchment. It must be noted that since there are considerable variations in rainfall over short distances e.g. the 70km between Oxbow and Mokhotlong due to the topography of the highlands, detailed analysis of the hydrological functions of the wetlands would require local rainfall data representative for the Khubelu catchment.

Evapotranspiration (ET) values estimated by the Food and Agriculture Organisation (FAO) during the calibration of crop water requirement (CROPWAT)<sup>24</sup> model have been used as the input data (sunshine, wind speed, humidity) for calculating evapotranspiration are not available from the Oxbow or Mokhotlong meteorological stations.

The monthly ET data are therefore standard for each year and more detailed analysis would require that local data with corresponding values of rainfall, ET and runoff would be available.

### 2.5.4 Water Balance in Khubelu Catchment

Wetlands surface and ground water dynamics was assessed for the Khubelu catchment area by using a water-balance approach. The conceptual framework for this approach is that change in water storage within the wetlands resulted from rainfall minus evapotranspiration and surface runoff:

$$\text{Storage} = P - ET - R$$

Where, P = Rainfall; ET = Evapotranspiration; R = Surface runoff

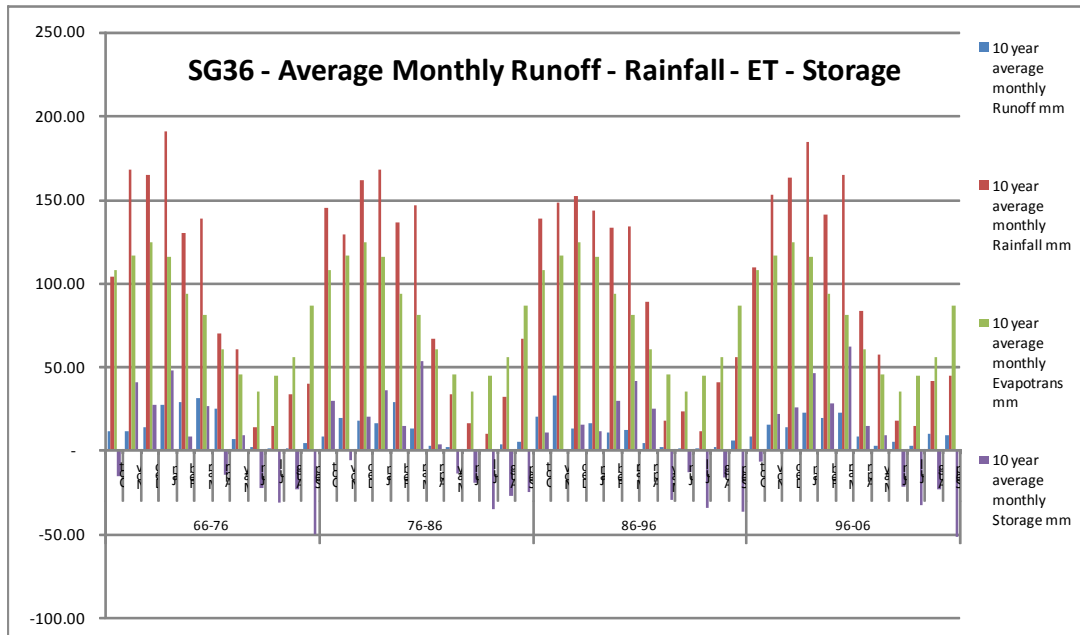
Monthly rainfall data from Oxbow and Mokhotlong were used together with corresponding flow rate data at SG36 Khubelu at Tlokoeng and the ET data from the CROPWAT model.

---

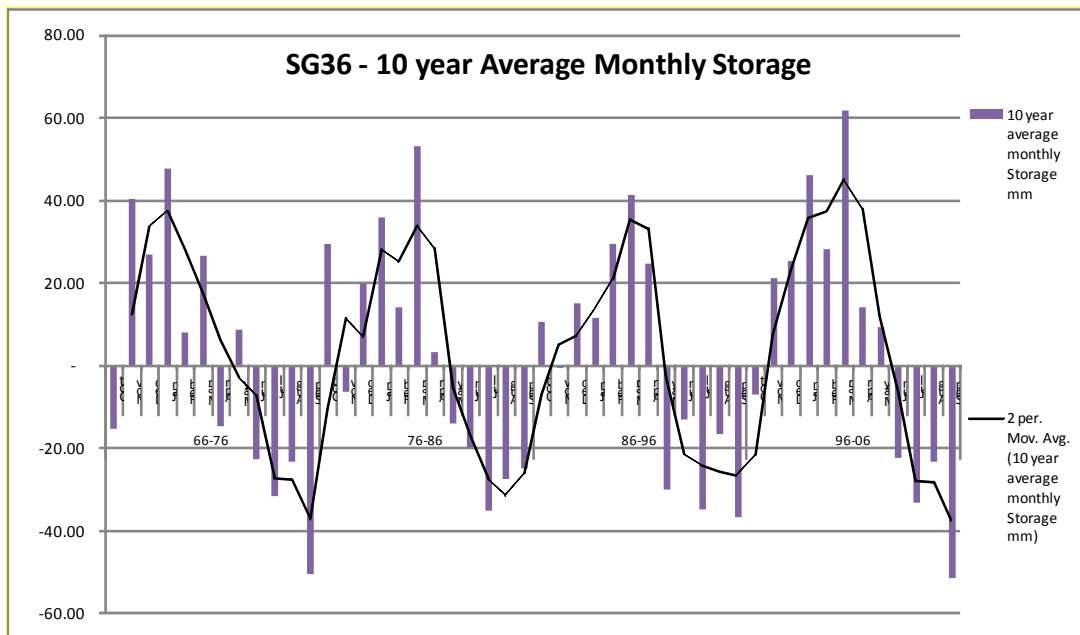
<sup>24</sup> CROPWAT model based on climatic database of 3262 stations of 144 countries worldwide. CROPWAT is a tool for standard calculations for evapotranspiration and crop water use studies published by FAO panel of experts in 1990 in FAO Irrigation and Drainage Paper No. 49

The data illustrated on the graph in Figure 15 are the monthly average figures over a decade i.e. the October data for 66-76 represent the average of runoff data for the months of October from 1966 to 1976.

**Figure 15: SG36 Average Monthly Runoff – Rainfall – ET - Storage**



**Figure 16: SG36 Ten Year Average Monthly Storage.**



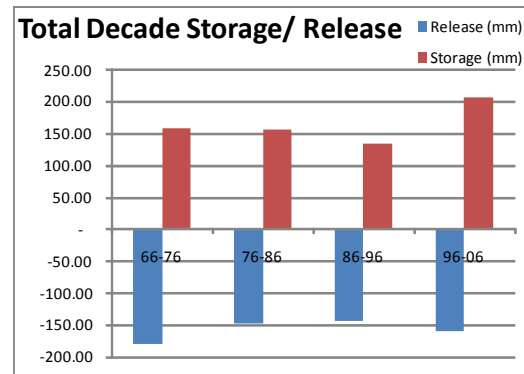
To ensure that missing data<sup>25</sup> is not affecting the analysis, the gaps in flow data are filled with 30 days average flow data from the same data the previous year. The ET data are monthly data from the CROPWAT model and therefore the same for the 4 decades. The

<sup>25</sup> A few daily flow measurements in Sept/Oct 87 and Feb/ Mar/ Apr 88 that are clearly out of proportion with the rainfall and normal flows are also replaced with average data from the previous year

analysis shows very similar and consistent trends in the relationship between rainfall, ET and runoff resulting in a net addition to water storage in the summer months (October to April) and release of water during the winter months (May to September).

**Figure 17: Total storage/ release in the Khubelu Catchment**

The water storage fluctuations are illustrated in Figure 16. The 'two-period-moving-average-graph' shows very consistent shape for each decade. It appears that there is a significant decrease in water storage in the decade from 1986 to 1996 but that the catchment has recovered to the previous storage levels as also shown in Figure 17 illustrating the total storage and release over the four decades that has been analysed.



The calculation of water storage is done in a simple model where a proportion can be applied to the rainfall and ET data in recognition of the weather data for Oxbow not being representative for the entire Khubelu catchment. The calculation presented in Figure 16 and Figure 17 is based on 90% of the Oxbow and 10% of the Mokhotlong rainfall and ET data. The proportion is determined so that the model shows a small positive net storage in the catchment representing a recharge of groundwater that is flowing out of the catchment underground.

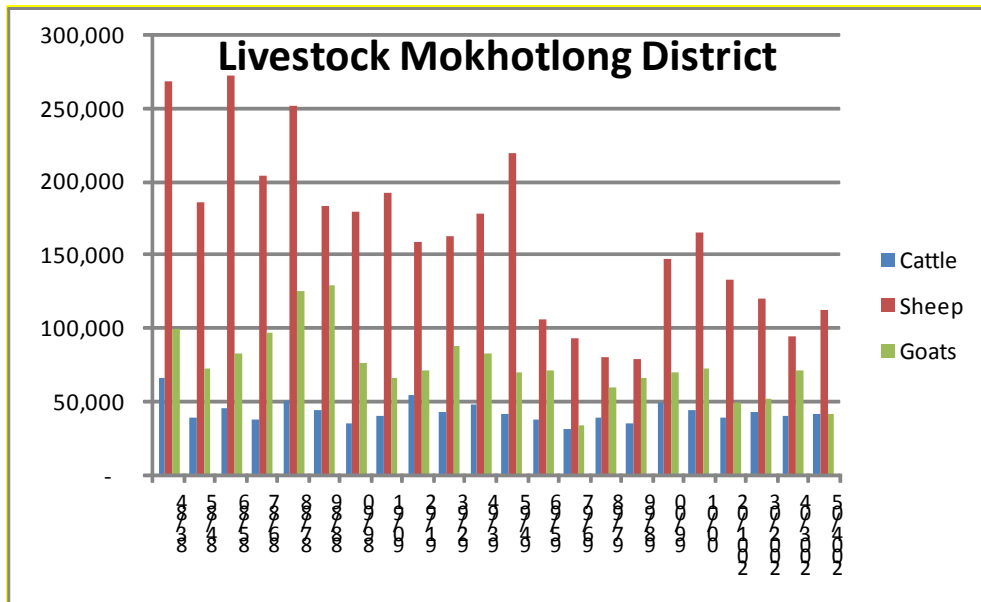
### 2.5.5 Water Retention and Degradation

While recognising the limitations of this analysis and the quality of data, the changes in water storage could illustrate the relationship between the grazing practices, soil erosion and water storage in wetlands and the catchment as such. The period after 1996 coincides with the period where livestock theft became so serious a problem that the livestock owners stopped sending livestock for summer grazing in the upper Area A of the Khubelu catchment. The inspection of the upper catchment in June 2008<sup>26</sup> also confirmed that the vegetation in the upper areas of the catchment is healthy and that most of the previous cattle posts are disused.

Analysis of the livestock statistics for Mokhotlong District from Bureau of Statistics (Figure 18) further reveals that a high number of livestock prior to the mid-1990s might have contributed to the diminishing water storage prior to 1995 and the decrease in livestock numbers after 1995 could have contributed to improvements in the catchment and the increase in water storage in the Khubelu Catchment

<sup>26</sup> Visit arranged by ORASECOM for filming of video on the sources of the Orange-Senqu with participation of Mr. Albert Makomoreng Makaaka, Resource Person on the Sponges Study

**Figure 18: Livestock Statistics Mokhotlong District 1983 to 2005**



**2.5.6 Water Balance in Smaller Catchments**

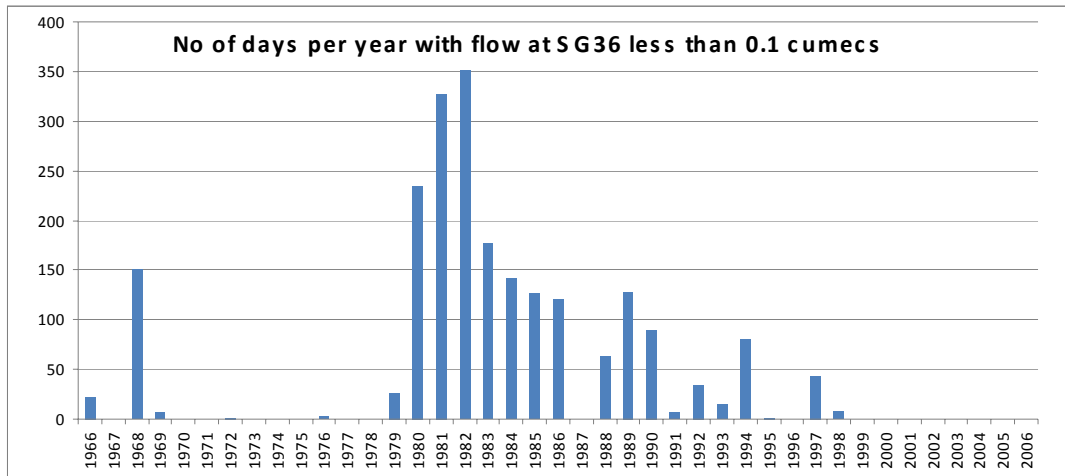
A similar analysis of water balance has been carried out for the data from SG11, SG14 and SG15 to determine if a similar clear picture of water storage would emerge for the smaller catchments. The results are shown in Annex B. The results are similar for the two catchments SG11 and SG14 where the data are available for a 20 year period. However, there is not a clear relationship in the first decade of analysis for SG11. Some inconsistency in the older rainfall/ runoff data (runoff highs and lows not corresponding to rainfall peaks) makes it difficult to make a convincing analysis. The model used for the results in Annex B use Oxbow rainfall data and a proportion of the ET as a variable to produce a net positive groundwater recharge value in recognition that the general ET data might not be representative for the small catchments at high elevations close to the escarpment. 100%, 98% and 86% of ET figures were found to give balanced groundwater recharge figures for SG15, SG 14 and SG 11 respectively.

**2.5.7 Low Flow Analysis**

An assessment of low flows was performed by applying a frequency analysis where the numbers of days with flow measurements lower than a stipulated threshold value were counted each year. The low flow assessment is based on that a high frequency of minimum flows below a stipulated threshold value will indicate a diminishing ability of wetlands to store water and release to the base flow.

The analysis of the low flows in the Khubelu Catchment measured at SG36 at Tlokoeng includes all the daily flows from 1966 to 2006. The analysis shows a significant trend with changes in the mid90s consistent with the results of the storage analysis above indicating that in the last 10 years there has not been a day with flows less than 0.1m<sup>3</sup>/sec as illustrated on Figure 19. Inquiries at DWA have not revealed any information on changes or maintenance to the monitoring equipment that could explain this significant change.

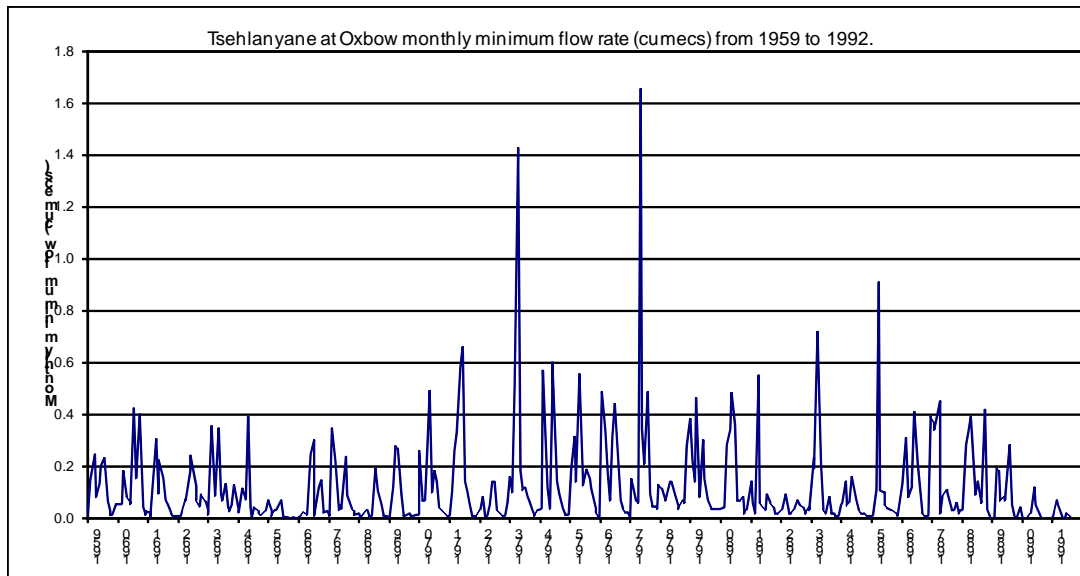
**Figure 19: Low Flow Analysis of SG36 Data**



The assessment of low flows was also carried out for the Tselhanyane gauging station (SG11) using the daily flows from 1959 to 1992<sup>27</sup>. The threshold values were set at minimum flows of 0.02, 0.03 and 0.04 m<sup>3</sup>/s respectively. The analysis reveals a general increase in the frequency of low flows for all these threshold values apart from exceptional high number of days with low flows in 1965. The details of the results are presented in Annex B.

A hydrograph of monthly minimum daily flow for the Tselhanyane gauging stations (SG11) from 1959 to 1992 is shown in Figure 20.

**Figure 20: Tselhanyane monthly minimum flow rate from 1959 to 1992.**



Low flow rates were consistently observed in the early years from 1959 to 1970. From 1971 onwards the trend is not very clear but the minimum flow rate during this period remains generally high and there is a decline in the 1980s. This period in the 1970s of high catchment base flow also coincides with the period when proper range management

<sup>27</sup> Excluding 1970 to 1974 as daily discharge data were not available at DWA in this period

initiatives were adhered to by the Ministry of Agriculture<sup>28</sup>. Generally the hydrograph does not show any clear trend thereafter.

### 2.5.8 Weaknesses in the Analysis

The results presented above are interesting as they show (and quantify) the relationship between the water storage in wetlands/ groundwater and the use of the catchment area for livestock grazing. The result with an apparent improvement in water storage in the last years can however not be considered proven as the analysis has a number of weaknesses in the data foundation such as:

- Rainfall data are from the meteorological stations at Oxbow and Mokhotlong at distance of 20 to 30km from the Khubelu catchment and the methodology to use a combination of data from the two stations is not accurate;
- The ET data are average estimated values and not based on the actual climatic conditions in the specific years;
- The runoff measurements are for the entire Khubelu catchment that includes areas with different characteristics from the upper catchment – the lower parts are cultivated and generally more eroded than the upper parts.

Any conclusion and proper quantification of the effect of wetland degradation on water storage will therefore need consistent data collection where the data are collected in the same time series and location for rainfall, ET and runoff as well as water quality and sediment data collection. Re-opening of the hydrometric station SG15 in Khubelu (or alternative site) and establishment of a weather station is included in the programme described in Chapter 3.

### 2.5.9 Quantification of Wetlands Storage

The analysis of the water storage capacity of the wetlands in the Khubelu catchment is especially interesting as the Khubelu catchment contributes directly to the planned dam for phase II of the LHWP. Water storage not provided by the wetlands and released on an annual basis would otherwise have to be constructed to provide constant supply over the year. The volume of water released from storage in the Khubelu catchment during the winter months is approximately 85 Mm<sup>3</sup> and it fluctuates about 10% during the decades that have been analysed. Based on this (preliminary and inaccurate) analysis the capacity of the new dam on the confluence of the Senqu and Khubelu rivers would therefore need to be increased by 8 Mm<sup>3</sup> if a programme for protection of the Khubelu wetlands is not implemented that will limit the degradation of the environment and the reduction in natural water storage corresponding to the past changes.

---

<sup>28</sup> Makhoalibe, 2008; personal communication

## 2.6 THE COST OF DEGRADATION AND POTENTIAL BENEFITS

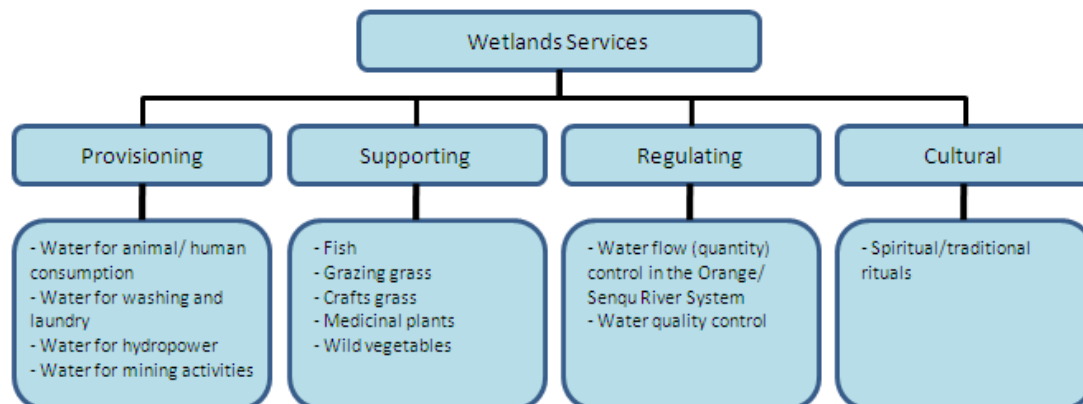
### 2.6.1 Wetlands Services

Wetlands benefits/services in the Khubelu Catchment can be grouped into four categories:

- i) **Provisioning:** Provisioning services consist of resources obtained from the wetlands for direct use by humans and animals (e.g. water);
- ii) **Supporting:** Wetlands support survival/growth of fish and other aquatic resources. They provide moisture recharge function necessary for growth of vegetation (e.g. grazing and thatch grass, medicinal plants, wild vegetables, shrubs). These are called supporting services of the wetlands;
- iii) **Regulating:** The wetlands regulate the quantity and quality of water flow in the Orange River System. They are also associated with stabilization, sedimentation and toxin retention, nutrient removal and transformation and organic mater production and export;
- iv) **Cultural:** Wetlands provide aesthetic, recreational and cultural values.

From the socio-economic surveys conducted in the study area, the benefits derived from the Khubelu Wetlands are summarised in Figure 21 below.

**Figure 21: Benefits derived from Khubelu Wetlands**

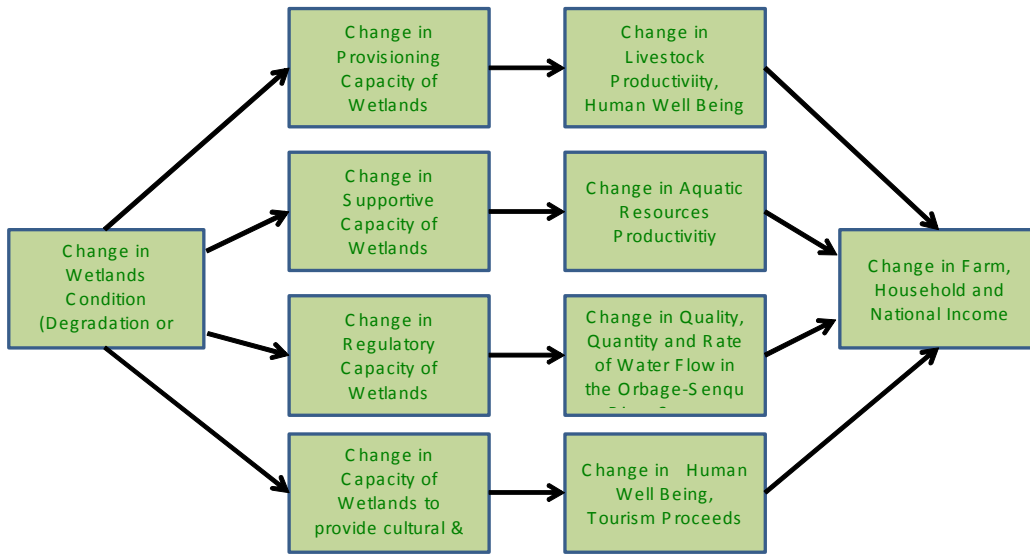


### 2.6.2 Cost of Degradation

From Figure 21 it is evident that the benefits/services of the wetlands extend beyond the wetlands themselves. The assessment of the costs of degradation of the wetlands and potential benefits is therefore based on the entire Khubelu Catchment, which is sustained by the wetlands within the catchment.

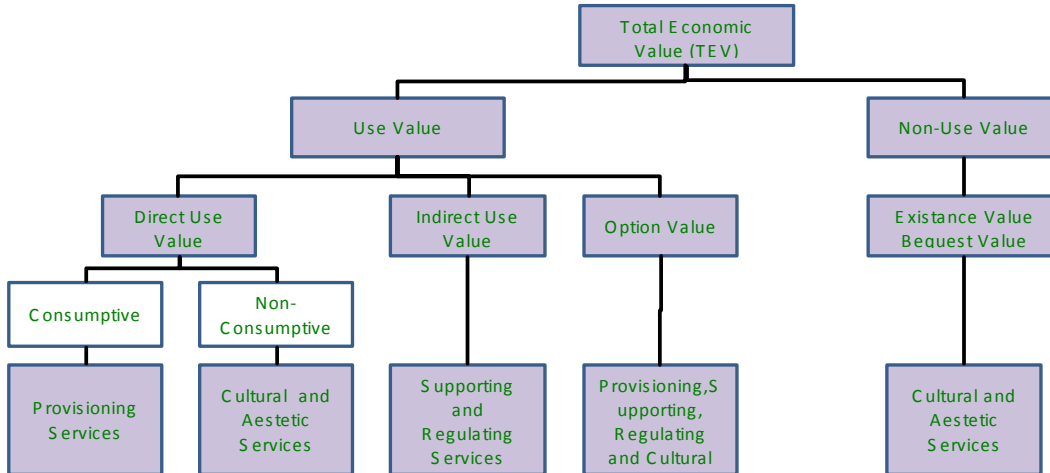
To assess the costs of the wetlands degradation or benefits of conservation, it is imperative to first know the magnitude of biophysical changes in the services provided by the wetlands before such changes can be converted into monetary value. Figure 22 shows the conceptual framework used in assessing the benefits/costs of changes in the condition of the wetlands

**Figure 22: Biophysical changes necessary for Valuing wetlands degradation and conservation**



Assessment of costs of degradation and benefits from conservation is based on the economic concept of value which disaggregates Total Economic Value (TEV) into two categories: use and non-use values. Figure 23 provides the schematic of these categories of value as they relate to wetlands services' values.

**Figure 23: Schematic for wetlands services Total Economic Valuation (TEV)<sup>29</sup>**



Use values refer to the value of the wetlands resources used by households for consumption or production purposes. They include tangible and intangible goods and services that are either currently used directly (direct use values) or indirectly (indirect use values) or have a potential to provide future options of use values (option values). Direct use comprises consumptive (leading to reduction in wetlands resources/services, e.g. stock watering, household/domestic consumption of water) or non- consumptive uses

<sup>29</sup> Source: Adapted from the MEA (2003).



(no reduction in wetlands resources/services, e.g. recreational and cultural amenities). Indirect use values include regulatory and supportive services of wetlands, where wetlands are used as intermediate input for production of final goods and services to households (e.g. fish and wild vegetables). Option values comprise the value held by households for preserving the option to use wetlands in future, either directly or indirectly, even though they may not currently be deriving any utility.

Households also hold value for knowing that some wetlands resources/ services exist (for cultural and religious reasons), even if they never use that resource/ service directly. This kind of value is usually known as existence value or bequest value where the resource is left to posterity. Non-use values comprise the value that households hold for knowing that wetlands resources/services exist, even if they never use them directly. Due to data constraints, this analysis includes only use values (direct and indirect) to value provisioning, supporting and cultural services of the wetlands.

### 2.6.3 Techniques for valuing services

Most of the wetlands services are not sold in the formal markets and as such their prices are not determined by markets as in the case of other marketable commodities. Because of the failure of markets to determine values for non-marketed services, there are two major classes of techniques for measuring the value on non-market goods identified by literature: i) revealed preference approaches, and ii) stated preference approaches (Kahn, 1998). Figure 24 below gives different techniques under each approach [details can be obtained from standard natural resource and environmental economics texts<sup>30</sup>.]

**Figure 24: Methods for estimating environmental values<sup>31</sup>**

	REVEALED PREFERENCE (OBSERVED BEHAVIOR)	STATED PREFERENCE (HYPOTHETICAL)
DIRECT	<i>Direct Observed</i> Competitive market price Simulated markets	<i>Direct Hypothetical</i> Bidding games Willingness-to-pay Questions
INDIRECT	<i>Indirect Observed</i> Travel cost Hedonic property values Referendum voting Contingent referendum Mitigation/prevention values Productivity/cost measures	<i>Indirect Hypothetical</i> Contingent ranking Contingent activity

Revealed preference approaches look at decisions people make regarding activities that utilize or are affected by wetlands services to reveal the value of the service. As such, wetlands service values are imputed from behaviour of individuals observed in markets. For tradable goods and services this behaviour is depicted by the willingness-to-pay or the demand-function. Therefore, values are derived from preferences revealed by consumers' behaviour, hence why the approach is also referred to as the 'revealed preference' approach. Since the choices are based on prices, the data reveal values directly in monetary units. For traded environmental goods and services, consumers have the opportunity to reveal their preferences for such a good compared to other substitutes

<sup>30</sup> See for example Freeman (1993), Dixon et al. (1994), Tietenberg (2000), Pearce and Turner (1990)]

<sup>31</sup> Source: Adapted from Freeman (1993).

or complementary commodities through their actual market choices, given relative prices and other economic factors.

However, many wetlands services are not privately owned and not traded and hence their demand curves cannot be directly observed and measured. In some cases though, wetlands services though not privately owned, are traded in the informal markets, e.g. medicinal plants, wild vegetables, thatch grass and fish. In such cases, values are derived from 'surrogate' informal markets.

Stated preference methods elicit values directly from individuals, through survey methods. The values are derived from hypothetical markets where individuals state their preferences for wetlands services through surveys. For example, to determine the value of wetlands services, households can be directly asked what value place on wetlands services. That is, how much they would be willing to pay for conservation of such services or how much they will be willing to accept as compensation for the wetlands to be degraded. Bidding games or willingness to accept/pay questions are used in this case. With this information the demand curve or willingness to pay function for the wetlands services can be derived and its total value estimated from the derived function. The stated preference approach was not used in this analysis since the time was not adequate to conduct willingness to pay surveys.

When ecological services or goods enter production functions of marketed goods as productive inputs, their values can be observed indirectly through examination of changes in product and factor prices and in the producer's quasi-rents, for example, the value of the wetlands in producing wool and mohair. In this case the wetlands enter the wool and mohair production indirectly through the quality of the rangelands. The production approach is used to estimate the costs of wetlands degradation due to degraded rangelands.

From the inventory phase findings and the socio-economic surveys, the most important services provided by the wetlands in the Khubelu catchment, in order of importance, are: i) regulation of quality and quantity flow of water in the Orange-Senqu River system, ii) supporting rangelands, iii) supporting of grafts grass, medicinal plants and wild vegetables; and iv) provision of water for stock watering, domestic use, hydropower and mining activities.

#### **2.6.4 The cost of loss of regulatory service of flow of water**

The Khubelu wetlands are a fraction of myriad wetlands which contribute to the quality and quantity of water that flow within the Orange-Senqu River System. Although the precise contribution of the wetlands to the system is not known, they are significant to the sustainability of the future phases of the LHWP which currently generates M15 million per month for the economy of Lesotho and provides water direly required for the industrial and domestic expansion in the Gauteng province of South Africa. The money is an important source of foreign exchange and covers a significant part of Lesotho's budgetary needs.

Information from the inventory mapping of the wetlands indicates that the wetlands have been degraded at varied degrees ranging from low to severe, which has affected the capacity of the wetlands to perform their function of purifying and regulating the flow of water in the catchment. The erosion has contributed to increased sedimentation of water downstream the wetlands and thus in the Orange-Senqu River System. The available information does not provide the exact magnitudes by which the quantity and quality of water within the catchment, and the Orange River system, have been impacted upon to

allow the conclusive economic assessment of this cost. To do the assessment, data on trends in the changes of the wetlands condition, changes in their capacity to provide services and resultant changes in the availability of such services is paramount. Notwithstanding, it suffices to say that the observed amount of degradation on the wetlands threatens their capacity to provide the critical service of regulating the water in the system and thus, the sustainability of the LHWP and proceeds thereof.

The very preliminary assessment based on the available data at SG36 at Tlokoeng as presented in 2.5 above indicates that the changes in water storage in the Khubelu catchment over the last 40 years are in the magnitude of 8 Mm<sup>3</sup>. Should this storage be provided by artificial storage it implies an investment of approximately ZAR 50 million<sup>32</sup>. Due to the limitations in the data used for the analysis in Chapter 2.5 this should not be regarded as an indication of the exact value. The calculation is only included here as an indication of the magnitude of the high value of wetlands for water supply infrastructure.

### **2.6.5 The cost of wetlands degradation based on the loss of rangelands**

The wetlands in the catchment play an important role in supporting growth of grazing grass and thus the quality of the rangelands within the catchment. Although the catchment provides rangeland to a diverse range of livestock, it predominantly hosts small ruminants (sheep 60% and goats 30% of total livestock). The statistics of livestock within the catchment are discussed in Chapter 2.4.11 above. Sheep and goats in Lesotho are main export revenue earner of the agricultural sector through their bi-products: wool and mohair. Last year they contributed M52 and M16 millions respectively to the economy of Lesotho and farmers involved in wool and mohair production<sup>33</sup>.

Given their economic significance, the cost of degradation of the wetlands with respect to their contribution to the condition of the rangelands is based on the contribution of the rangelands to the production of the wool and mohair. The indirect productivity measure is used calculate the cost. The data used are on mohair and wool output recorded by the major woolsheds in the catchment: i) Senqu, ii) Mapholaneng, iii) Semenanyane and iv) Matlakeng. Figure 25 and Figure 27 show 5 years trends in the stocking rates and corresponding wool and mohair output in the catchment. Figure 26 and Figure 28 show corresponding productivity of wool and mohair in the catchment over the same period and their percentage changes are shown in Table 7 and Table 8.

---

<sup>32</sup> Based on a common planning figure of USD 1 per m<sup>3</sup> for construction cost of large storage dams

<sup>33</sup> Livestock Products Marketing Services (LPMS), 2008

Figure 25: Mohair Output in Khubelu

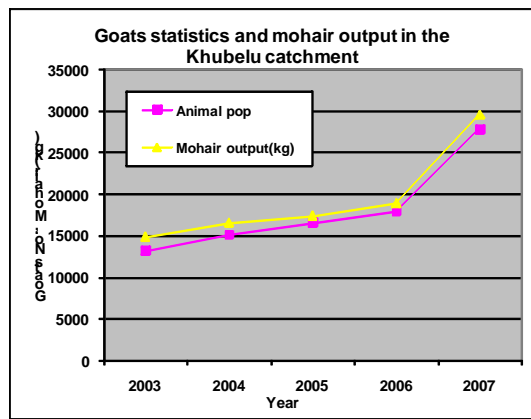


Figure 26: Mohair Productivity<sup>34</sup>

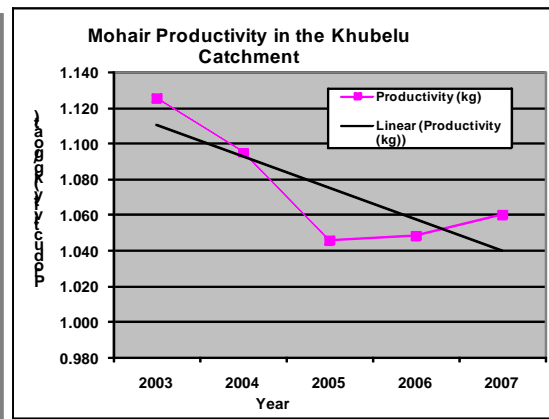


Table 7: Percentage change in Mohair productivity (2003-2007)

Year	Animal pop	Mohair output(kg)	Productivity (kg)	Change in productivity (%)
2,003	13,235	14,894	1.125	
2,004	15,131	16,569	1.095	-3
2,005	16,648	17,409	1.046	-5
2,006	18,033	18,904	1.048	0
2,007	27,863	29,543	1.060	1
<b>TOTAL</b>	<b>90,910</b>	<b>97,319</b>		<b>-6</b>

From Figure 25 and Figure 27 it is observed that over the period of five years (2003-2007), there was a steady increase in the stocking rates and output (kg) of wool and mohair. However, these increases were coupled with steady declines in the productivity of wool and mohair over the same period (Figure 26 and Figure 28), which maybe be an indication of overstocking and poor rangelands. This translates in loss of productivity of 6% and 7% for mohair and wool, respectively (Table 7 and Table 8). In the case of mohair, this loss is equivalent to 5, 839 kg over the period of five years, which translates into the monetary loss of M187,000.- given the 2006/07 mohair average price of M48.90/kg (Livestock Products Marketing Services (LPMS), 2008). For wool, the 7% productivity loss is equivalent to 37,087 kg, which translates into the monetary loss of M1,050,000.- given the 2006/07 wool average prices of M28.31/kg (LPMS, 2008). Based on this analysis, the total cost of the Khubelu wetlands due to degraded rangelands is M1,237,000.- over the period of five years or M248,000.- per year, which is significant given that this only relates to the livestock owners in Khubelu and that the Highlands population is the poorest in the country. Nationally, the loss represents forgone foreign exchange earnings by the country. Due to macro-sector linkages and multiplier effects, nationally this cost is much higher.

<sup>34</sup> Source: Derived from data obtained from LMPS (2008)

Figure 27: Wool output in Khubelu

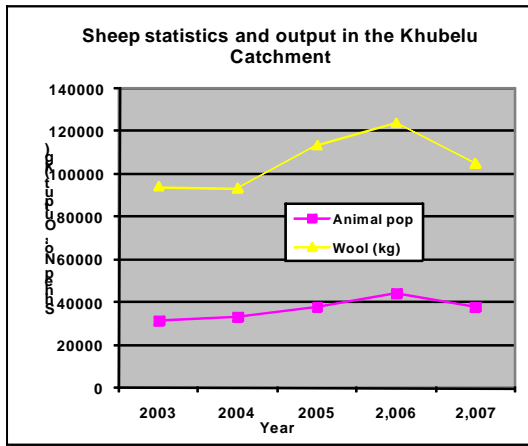


Figure 28: Wool productivity

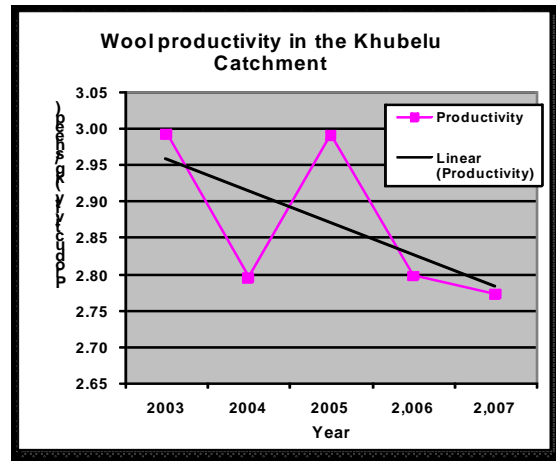


Table 8: Percentage change in wool productivity (2002/03-06/07)

Year	Animal pop	Wool (kg)	Productivity	Change in productivity (%)
2003	31,451	94,127	2.99	
2004	33,386	93,331	2.80	-7
2005	37,917	113,390	2.99	7
2,006	44,340	124,057	2.80	-6
2,007	37,835	104,904	2.77	-1
<b>TOTAL</b>	<b>37,835</b>	<b>529,807</b>		<b>-7</b>

It should be noted that the estimate given above is a crude and understated measure of the cost of wetlands degradation associated with loss of rangelands since the estimate includes only, albeit significant, wool and mohair values. Other bi-products of goats and sheep, like meat, have been excluded from the analysis as well as their other uses, like payment of dowry. The estimates presented here are definitely underestimating the impact of degradation on the livelihood of livestock farmers in Khubelu as benefits from other livestock like cattle, horses and donkeys have also not been included in the analysis due to lack of adequate market data like in the case of wool and mohair. The impact on cattle farming could be of a similar magnitude.

### 2.6.6 The cost of wetlands degradation based on loss of livelihoods

From the discussion in 2.4, the Khubelu wetlands are a source of livelihood for about 20,000 households who live in villages within the vicinity of these wetlands. The wetlands are a source of water for stock watering, domestic use and host variety of grasses that households use to make handicrafts. The wetlands are also useful for performing traditional and spiritual rituals. Table 9 below gives a summary of these services and changes in their availability.

**Table 9: Changes in the availability of the wetlands services due to degradation**

Wetland Service	Change (-/+)	Severity of change
Craft grass	Negative	Not known
Drinking water for livestock	Negative	Not known
Water for domestic use	Negative	Not known
Water for performing spiritual and traditional rituals	Not clear	Not known

From Table 9, the impact of the wetlands degradation on the availability of these services has not been quantified, which makes valuation of the cost difficult. However, compared to the cost of the wetlands reduced capacity to regulate the flow and storage of water in the Orange-Senqu River System and support for the rangelands, this cost is minimal. This does not, in anyway, undermine the value of these services. While they may value low in monetary terms, they are significant for the sustenance of livelihoods of the people of Khubelu and it is important that research efforts be stepped up to accurately map the changes in the availability of these services and resultant changes in their values.

### **2.6.7 Mining and Hydro-power**

The Khubelu wetlands provide water for mining activities at Letseng la Terai and used to serve as a source for the Tlokoeng Hydro-power plant. Available information does not indicate whether these two economic activities have suffered from reduced water in the wetlands and to what extent, which makes an assessment of cost difficult. The preliminary results of the water storage provided by the wetlands for release in dry periods would have had a significant impact on the power generation during winter months in the Tlokoeng hydro-power plant if this plant was still operational, although the design of the plant incorporates diesel generation in periods of low flow.

### **2.6.8 Conclusion on the cost of degradation of the wetlands**

The greatest cost of the degradation of the Khubelu wetlands is ascribed to the loss of rangelands and water storage capacity of the wetlands. This loss is estimated at M51 million, which is an underestimation since the cost of degraded rangelands does not include other livestock values like draught power prided by cattle, horses and donkeys, wealth embodied in the livestock and other subsistence uses on the livestock. Also, the cost estimates do not include any cost associated with reduced ability of degraded wetlands to remove nutrients and pollutants from the water.

The Khubelu wetlands provide a myriad of benefits and it is important to quantify and measure their total value for informed policy decisions. At the moment valuation is difficult because of inadequate data. It is therefore recommended that research that closely records the condition of the wetlands, trends in their changes and changes in their capacity to provide services be stepped up. Equally important, is to record anthropogenic changes in the wetlands so we can clearly understand changes in the wetlands conditions as they relate directly to human effects.

### **2.6.9 Potential benefits from the wetlands conservation**

The benefits of the Khubelu wetlands have been highlighted throughout this report and can be summarised as: sustenance of the wetlands ecosystems and biodiversity in the Khubelu catchment which provide human beings with sources of livelihoods, sustain livestock and regulate water storage, quality and flow in the Orange-Senqu River System.

These benefits are not only important for the livelihoods of the Khubelu people, but also for the growth of the economy of Lesotho and of the other riparian countries of the Orange River Basin. Conservation of the wetlands is expected to reverse the losses that are already experienced due to the degradation of the wetlands and ensure sustainable flow of the services/benefits from the wetlands.

## **2.7 THE MANAGEMENT OF THE KHUBELU WETLANDS**

### **2.7.1 Introduction**

Management of wetlands can be divided into four levels: a) Central level. b) Local Government at District level; c) Local Government at CC/ chiefdom level and d) at livestock owner and herder level.

In the absence of a National Wetlands Policy several sector policies, laws and strategies make provision for protection and wise use of wetlands. These include: National Environmental Act (2001), National Water Policy (1999), Livestock and Range Management Policy, National Environmental Policy (1996), Land Husbandry Act (1969), National Strategy on Lesotho's Biological Diversity, Conservation and Sustainable Use (2000), Land Policy Review Commission Report (2000), National Report on Climate Change (2000), and the draft Strategy for Integrated Water Resources Management for Lesotho (2007).

The conservation and management of wetlands is a cross cutting issues that involves a number of stakeholders each addressing one or two issues affecting wetlands management. They include the ministries or departments within them; the district councils, the CCs, chiefs, grazing associations and herders.

### **2.7.2 Central level**

At central level the livestock registration is the responsibility of the Ministry of Home Affairs under the Livestock Registrar. MAFS is responsible for extension services and advice to the farmers concerning livestock but the Ministry neither registers livestock nor plans for grazing areas. Management of natural resources is by the Local Government Act a mandate of the Ministry of Local Government (MLG). The MFLR is the major stakeholder regarding management of the wetlands together with the Wetlands Unit of the Ministry of Natural Resources (MNR). The Department of Range Management in MFLR is responsible for overseeing the rangelands around the wetlands and advising on proper stocking units per carrying capacity. They have no punitive powers where the stocking rate has been exceeded. They can again advise the local authorities.

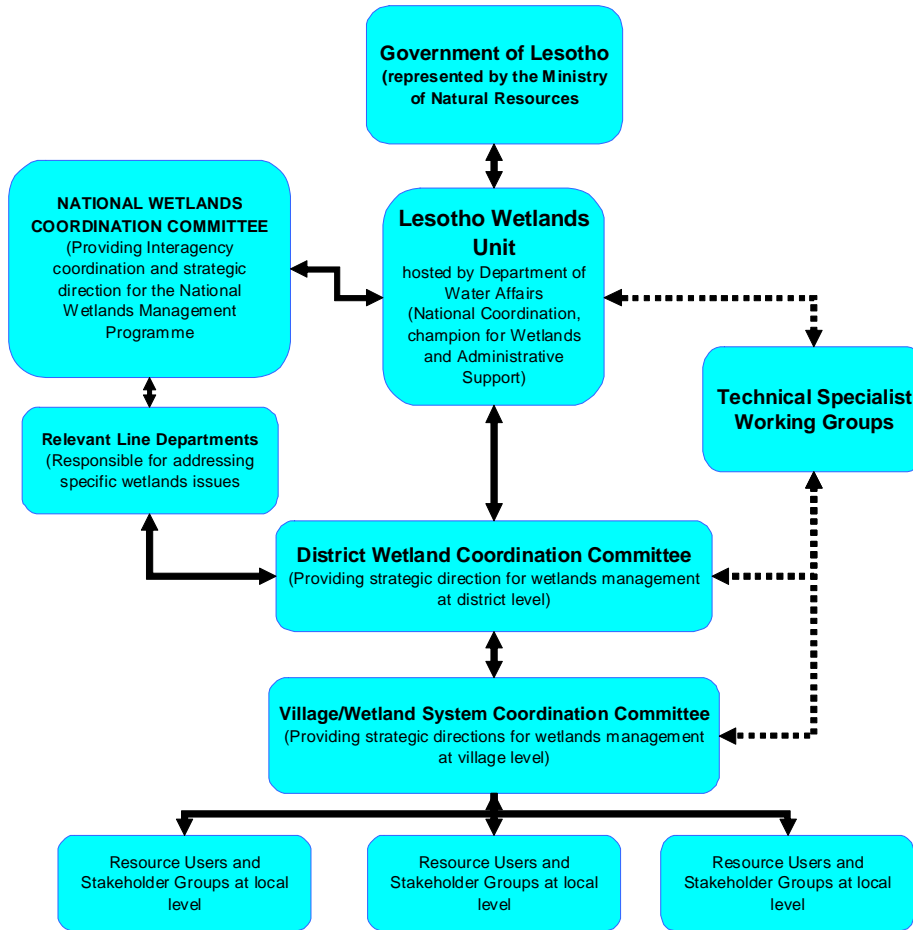
It became evident during the interviews that for a long time, since 1983, the exercise of calculating the stocking rates and the carrying capacity has not been undertaken and livestock owners for various reasons have been very reluctant to give the correct livestock figures when they are being issued grazing permits in the different zones. Ivy D. and Turner S. (1996) argued that the Range Management and Grazing Control (Amendment) Regulations of 1992, which imposed annual fees on livestock contributed to the reluctance of farmers to reveal the true herd size. Other reasons from the interviews include issues of livestock theft where the owners do not want to reveal their herd size, some of which could be illegally owned.

Overgrazing is a main issue in management of natural resources in Lesotho and the fragmentation of responsibilities at central level for livestock and range management seems to be problematic in relation to sustainable management of the rangelands including the wetlands.



In the absence of a National Wetlands Policy and the apparent uncertainties concerning mandates and responsibilities, the MNR has developed a National Wetlands Management Programme (2005) which attempts to establish a clear and comprehensive institutional framework for management of the wetlands. Figure 29 below illustrates the proposed institutional framework for wetlands management<sup>35</sup>.

**Figure 29: Proposed Wetlands Management Structure**



The detailed studies in the Khubelu catchment indicate that the overriding use of the wetlands is for livestock and the conservation of wetlands cannot be separated from the problems of effective range management in Lesotho in general – therefore the lack of clarity of responsibilities for range management is one of the key issues to be addressed in order to improve the conservation of the wetlands.

### 2.7.3 Management of wetlands by Local Government at District level

The Khubelu River catchment is under the jurisdiction of Mokhotlong district under the principal chief of Malingoaneng. In the past livestock from Botha Bothe and Leribe were grazing at Khubelu but this practice has stopped due to fear of livestock theft. The

<sup>35</sup> Lesotho National Wetlands Management Programme, March 2005

catchment therefore currently falls under the chief of Malingoaneng. The consultant team therefore, focused its interviews on Mokhotlong district Officials and inhabitants.

At local level, the following ministries are perceived to have a major stake in the management and rehabilitation of wetlands: MFLR, MLG and MNR. Ministry of Works is responsible for ensuring that the construction of roads takes cognisance of the importance of wetlands and take preventive measures when constructing drainage along the roads. This does not happen as the culverts were seen to cause serious erosion in general and also affecting wetlands. While the MAFS is no longer involved in the management of livestock it is still responsible for advising farmers on good livestock rearing practices.

According to the Local Government Act, the management of wetlands is the mandate of the MLG through its administrative structures at District and CC levels. The areas outside the gazetted boundaries of the CCs fall under the jurisdiction of the Principal Chiefs. Most of the high altitude pastures including the *palustrine wetlands* within the Khubelu catchment fall outside the boundaries of the CCs and are thus managed by the principal chief Sekonyela of Malingoaneng Ward (grazing area A). The lack of clarity and full understanding of the legal and institutional framework for wetlands management have in places translated into poor management practices at community level.

The decentralisation process is still ongoing and the CCs do not yet fulfil their mandates concerning management of natural resources including wetlands management. The complexity of this process creates uncertainties and foot dragging within the parent line ministries as commented by some of the people interviewed. This makes the transition difficult at the district level. The office of the District Administrator for Mokhotlong is expected by law to oversee the developments that are taking place within the *palustrine wetlands* of Mokhotlong including those of Khubelu.

#### **2.7.4 Management of Wetlands at Community/Chiefdom level**

According to the interviews, the chiefs play an important role at community level in cooperation with the CCs in controlling grazing of all types of livestock. However, due to poor management and law enforcement at this level, it has become difficult to control all year round cattle-post grazing in grazing area A. Some of the livestock owners have taken advantage of this and maintain large herds in the highlands.

The mandate for management of grazing lands is not clear in the minds of communities. 46% of the community members (66 respondents) believe that the chiefs are the ones who manage the wetlands and 53% maintained that it was the chief together with the committee members who had the jurisdiction over grazing land restrictions. When it comes to decision-making regarding the utilisation of wetlands, 54% reported that the chief and the committee worked together as opposed to the 46% who said the chief alone made all decisions. However, most respondents felt that grazing rotation should be exercised earnestly and that the chiefs and all those who are concerned should stop their leniency on defaulters. Furthermore, they felt that zoning of cattle-posts should be done and adhered to in order to prevent overgrazing.

Some livestock owners (7%) in Khubelu are member of the grazing associations introduced and established by the MDTP. The grazing associations are responsible for policing the rangelands. In the view of some villagers they are respected since they tend

to engage more in law enforcement. They can impound trespassing livestock on restricted rangelands. Although being in existence for some years the membership of the grazing associations is low. This makes management very difficult as it becomes difficult to allocate permissions for who should graze where and when among association members and non-members.

### **2.7.5 Wetland management by herders**

Day to day management of the pastures and wetlands is in reality taken care of by the herders. Although most of the time herders take orders from the livestock owners as to where to graze and when, they are the ones who are capable of destroying the wetlands through burning and allowing the livestock to overgraze. They therefore have to be involved in the decision making.

Out of the 31 (34%) herders who responded to the question on whether they had received training for the management of wetlands, 8 herders (26%) reported that they had been trained. 74% said herders were never trained on wetland management. Out of those who said they received training, 96% confirmed that the government has taken the initiative to train the herders. While this is important, it could also be true that some have never received training as herders come in and out of herding livestock depending on their age.

### **2.7.6 Benefits of Protecting the upper Khubelu Catchment**

The possibilities of establishing the upper Khubelu Catchment as a protected area could potentially have a number of benefits for biodiversity and for the communities in the Khubelu catchment. Efforts are on the way to establish the area to the east of Khubelu, the Senqu Sources, as a protected area and enlarging this area would provide more opportunities for protection of wildlife and biodiversity as well as increasing the tourism potential.

The nature in the upper Khubelu catchment is unique – on the northern side it borders the escarpment with remarkable mountain features such as the 'amphitheatre'. A trans-frontier protected area covering the entire Drakensberg escarpment from Oxbow to Sehlabathebe would provide possibilities for unique experiences for tourists travelling on foot or horseback along this impressive mountain range. Combined with implementing the principles of benefit sharing and development of village guesthouse accommodation this could provide good opportunities for income generation for the population in the Lesotho highlands.

The following aspects could potentially benefit from the establishment of a protected area:

- Improved biodiversity and protection of the many unique species in the Lesotho highlands and the Afro-Alpine ecosystems – in relation to degradation of the wetlands this could improve the balance of species in the area and reintroduce the natural predators to the rats and moles that are exacerbating the erosion of the wetlands;
- Control of cross-border stock theft problems that contribute to the difficulties in establishing effective range management in the mountain areas;
- Eco-tourism and income possibilities for the local communities – systems for benefit sharing can be established so that the income from commercial tourism activities contribute to the livelihood in the communities as well as opening business possibilities for village type of guesthouses;

- Protection of water sources – the Drakensberg escarpment is the 'water tower', not only for the Orange-Senqu but also for the rivers in the Kwazulu Natal area and a protected area offers possibilities for better control of grazing and wildfires that impact the quality of water and the water storage capacity of the wetlands in the area.
- A well established protected area could provide the legal background and the financial resources for patrolling the area and improving the control over misuse e.g. hunting wild animals, lighting bushfires, grazing, and transit of stolen livestock.

The programme presented in Chapter 3 includes a feasibility study for establishing the upper part of the Khubelu catchment as a protected area.

## **2.8 TRAINING NEEDS ASSESSMENT**

### **2.8.1 Training Needs**

The following information on training needs has been collected as part of the data collection interviews with stakeholders during the inventory and design stages. One of the key findings is that the wetlands conservation cannot be separated from range management as livestock is by far the most important use for the population of the highland areas. Any training to increase the understanding and appreciation of the value of wetlands will be ineffective if effective range management is not introduced – any amount of training and awareness-raising will not prevent the herders from letting their flocks graze the wetlands if there is not adequate grazing elsewhere.

As documented in 2.6 above, the previous procedures for grazing controls are no longer effective and there is confusion in the communities about the roles of the chiefs and the new CCs as well as grazing associations in range management. The first step, as a prerequisite before any training can be effective will therefore be to establish and reach consensus on a clear strategy for range management in Lesotho. In accordance with the division of roles in Government between the Livestock Division in MAFS, Range Management Department in MFLR, the Police for livestock registration and the Chiefs and CCs this is an issue that needs attention at highest political and administrative level to change the situation from the present practically non-functioning range management.

As evident in the previous chapter, it has not been possible at this stage to establish accurately the present level of livestock grazing in the Khubelu catchment and there are no recent assessments of the carrying capacity of the Khubelu ranges. It will be vital for the wetlands conservation plan to establish the level of livestock and the carrying capacity to determine if a reduction in livestock levels will be needed. The training will therefore focus on capacitating the various stakeholders to effectively implement a range management strategy that is likely to include effective livestock registration, assessment of rangeland carrying capacity and development of grazing plans, effective link between the grazing plans and issuing of grazing permits as well as patrolling the adherence to the grazing regulations.

The landscape in Mokhotlong district clearly shows that most range areas close to the villages are overgrazed and effective range management is likely to include some reduction in the number of livestock. Unpopular methods such as effective registration and taxation of large herds of livestock could be one of the mechanisms that need to be employed and this would require high level political decisiveness – it was attempted in the early 1990s but abandoned. It must be emphasised that sustainable livestock management will have a positive impact on poverty and livelihood for the population in the mountains. The subsistence livestock keeping by the general population is not problematic but there are a few very rich households with large number of livestock that pose a problem for the environment. More accurate data on livestock ownership is needed to substantiate this.

### **2.8.2 Previous Training**

The interviews revealed that the Range Management Department has taken steps in forming range management associations, through which training can be facilitated to implement plans for protecting the rangelands. The department has trained herders in 2007 on the protection of the rangelands including water sources and wetlands. Chiefs

and the CCs have also undergone training as part of the MDTP. The MDTP has played a major role in training the Community Conservation Forum which was formed for the Senqu Sources Protected Area and some of the members of this forum came from the villages within Khubelu catchment. They were trained on tourism issues, environmental protection and range management protection. The Strategic Environmental Assessment also conducted information dissemination of their results to the communities after conducting a study for MTDP on the feasibility study of a protected area concept for the Senqu Sources.

Within the Khubelu catchment, a Range Management Association has been formed at the same time that they were formed in other areas such as Tlhanyaku Managed Resource Area (MRA), of the Senqu Sources project by MDTP. The Khubelu MRA as it is known, is said to be active and ensures that members attend their monthly meetings and conduct grazing plans together. During MDTP phase, they were trained on range management protection and formation and sustainability of grazing associations. Interviews revealed that the membership is limited and this and the effectiveness of the Khubelu MRA will need to be enhanced.

### **2.8.3 Village Level**

The results of interviews have shown that most of the livestock owners and herders have limited formal education. They have in most cases gone up to primary level of education. Provided a range management strategy is in place, the livestock owners and herders will need follow-up training in the correct procedures for livestock registration and grazing permits. The interviews have shown that despite the efforts by the Range Management Department and the MDTP, there is no effective range management in place. The training shall also be complemented with awareness-raising on the value of wetlands and benefit from good environmental management in general.

Livestock owners should receive their own training that is different from that of the grazing associations since most of them have not joined. They should be trained on range management regulations to provide the understanding that sustainable range management is in everybody's interest. They should be made to appreciate the issues that surround protection of wetlands as well as other protection programmes. The reason being that according to the interviews, not only the herders should be blamed for environmental degradation, but herd owners and other elders as well. In some cases they appear to be the ones who facilitate the burning of grass and 'stealing' of rangelands that have been identified as restricted areas. The livestock owners do not like the idea that they are restricted and prevented from grazing their livestock.

The MFLR has been training people on establishing buffer strips and planting important grasses for their livestock as well as for environmental protection. This should be a continuous programme as herders are replaced with younger boys who are still ignorant about protection of rangelands.

### **2.8.4 Community Council level**

Following the establishment of clear procedures for range management, the CCs, the chiefs and the grazing associations will need training in correct implementation of the procedures. The capacity building will need to include the necessary tools for administering the range management procedures. The training should be complemented by general awareness-raising on environmental management and the value of the wetlands. While some chiefs are represented in the CCs, it will be necessary to train them separately from the rest of the council members in order to change their mindset. The

uncertainties that the establishment of the councils has created, has left some of the chiefs who are not members feeling as though they should continue doing things the old way and this is creating problems.

Capacity building at CC level shall include data collection and information management so that accurate data can be provided to the district level for management of rangelands and wetlands.

New developments within the catchment will have an impact on the use and protection of wetlands. E.g. the new lodge recently established in Paelaitlhatsoa will obviously attract tourists to the area and next to the lodge is a health clinic which will also bring many people to the area instead of going to Mapholaneng. These developments could benefit from training of communities on the management of tourist activities. The wetlands have important medicinal plants and their harvesting is done by those who want to use them without control from either the chief or the councils. Some of the people using the plants have no knowledge of the tools to use that do not uproot the plants so that they can continue to regenerate.

### **2.8.5 Mokhotlong District**

The interviews established that the staff in the district administration in Mokhotlong is well aware of the problems in range management, but seems powerless in addressing the problems – not due to lack of capacity – but because of lack of a clear strategy for range management and support from highest level in the implementation of the strategy. One exception is the technical staff of the Roads Department who clearly sees the design criteria for road drainage as 'getting rid of the water as fast as possible'. Demonstration of environmentally sound road drains with the necessary retention structures to limit the flash flows is clearly needed. Capacity building at district level would need to include data collection and information management on wetlands and range management.

### **2.8.6 National Level**

At the national level the interviews have revealed that there are two aspects that need to be addressed: i) building consensus around a range management strategy at highest political and administrative level – this might be facilitated by study tours to areas outside Lesotho with examples of good range management; and ii) analysis of the present curriculum for primary and secondary schools on the environmental management aspects and ensure that natural resources management, range management and wetlands protection is properly addressed in the curriculum.

## **2.9 SUMMARY OF CONCLUSIONS**

### **2.9.1 Wetlands Information**

The current DWA GIS-WIS platform has been updated and harmonised with data from all the sources gathered during study. The available data provide only spatial information and lack attributes such as the Why? What? How? which need to be recorded systematically in the metadata. As an initial step it has been suggested to standardize the Wetlands Inventory Sheet (Inventory Report Report Annex B) and Socio-Economic Questionnaires (Inventory Report Report Annex C) and allow for their inclusion as attributes to the corresponding layers. The further development of the GIS-WIS must take place through a continuous survey, mapping and classification of wetland ecosystems based on the standardised inventory sheets in cooperation with stakeholders at community and district level.

### **2.9.2 Selection of Study Area**

Through an exercise of exclusion of wetlands based on the established criteria, the Khubelu Catchment area surfaced as the area complying clearly with the criteria: falling within the category of palustrine wetlands; sources of a major tributaries to the Orange-Senqu River; under pressure from development plans; where little or no information is available; and wetlands which seem to be vulnerable and are not earmarked for future projects.

### **2.9.3 Research**

There is a need for more in-depth research on crucial aspects such as: hydrological dynamics of wetlands; erosion measurement; methodological approaches to rehabilitation and restoration of degraded wetlands and approaches to alternative livelihood options for wetland users.

### **2.9.4 The Status of the Wetlands**

More data analysis is needed to establish the trends in water retention capacity in the wetlands however the preliminary analysis shows water storage and release between dry and wet periods over the year of approximately 120 mm in the Khubelu catchment. Actual data from the Khubelu catchment on rainfall and ET are needed to provide better estimates. Although wetlands show signs of extensive erosion, the outflow water quality in the surveyed wetlands was good in terms of total dissolved solids, dissolved oxygen and pH. Livestock overgrazing and trampling and ice rats and moles are affecting the rate of erosion of the wetlands. It has been observed that the highly degraded wetlands have scanty vegetal cover and most of those were shrubs.

### **2.9.5 Quantification of the Benefits of the Wetlands**

The Khubelu wetlands are located in the high altitude grazing areas and as such the main benefit is provision of grazing and water to the grazing animals. Wetlands are used as a source of important grasses (*Scirpus sp.* and *Merxmullera sp.*) Few of those interviewed



sell the grasses from the wetlands. It was observed that the grasses were diminishing due to the increased overgrazing and over harvesting.

Wetlands are used as a source of drinking water as the water from the wetlands tends to be clean and tasty. The wetlands are also used for washing or laundry while the river serves as an alternative source especially used for laundry.

Wetlands are sometimes used for traditional rituals and for spiritual purposes.

The main economic benefits from the wetlands for the population of Khubelu are due to their role in sustaining the rangelands since livestock is a main activity of the Khubelu inhabitants. The benefits have been quantified to about M 1 million over a five year period. The analysis has shown that the function as regulation of water flows is very important and in the situation where large dams are planned the degradation of wetlands would potentially have a very large economic impact. The cost of replacing a 10% reduction in the natural storage capacity in the catchment has been estimated at approximately M 50 million.

#### **2.9.6 Management of the wetlands**

Proper management of wetlands rests on effective rotational grazing that allows the wetlands to rest. The previous range management procedures are no longer effective and a concerted effort by Government of Lesotho is needed to establish effective range management. Proper grazing plans and implementation of these plans including physical inspection of the wetlands at Khubelu by chiefs and councils is very crucial since they issue grazing permits to the livestock owners. The involvement of the Principal Chiefs, Local Government structures, herders and communities around the wetland areas in day to day management of the wetlands is important. This will require the development and implementation of strategies for periodic training and awareness-raising. To govern and guide wetland management it is necessary that a Wetlands Management Policy is formulated. This should eventually be enacted.

### 3. CONSERVATION, REHABILITATION AND PROTECTION PROGRAMME

#### 3.1 PROGRAMME CONTENT

##### 3.1.1 Wetlands and Range Management

Based on the findings from the study of the Khubelu catchment it emerges that the protection and conservation of the wetlands cannot be separated from the general management of the natural resources in the highlands of Lesotho. The most important influence on the natural resources and the wetlands in the highlands is from livestock grazing and livestock is at the same time important for the livelihood of the population.

A programme for conservation, rehabilitation and protection of the wetlands in the highlands of Lesotho would need to address this in a participatory approach where capacity building is an integrated part of the activities. To ensure continuity and replication of the results it is important that the activities are carried out by the local communities and the local government structures. The following issues would need to be addressed:

Understanding the terms:

**Conservation:** conserve an area in its present state – ensure that outside forces and socio-economic development activities does not negatively affect the wetlands;

**Protection:** protect an area from further degradation, prevent that erosion does not take place;

**Rehabilitation:** to rehabilitate, to restore, recover or regenerate an area to a former state more desirable than the present.

The measures needed to conserve and protect the wetlands are similar and distinct from the measures for rehabilitation.

- Range management issues including capacity building of the stakeholders from the district level to CCs, Chief, livestock owners and herders in the preparation and administration of grazing plans and regulations and sensitisation on the value of wetlands. At national level the capacity building would concentrate on clarification between the line ministries on the roles and responsibilities at local level for management of livestock. The Government of Lesotho and the MDTP has developed methodology for the Managed Resource Area approach and production through conservation approach and these should be built upon/replicated in the Khubelu catchment rather than developing alternative approaches.
- Rehabilitation of the degraded wetlands: General principle: *'prevention is better than cure'*: the focus should be on conservation measures rather than rehabilitation, and rehabilitation should be prioritised to areas where the alternative of no action would lead to further degradation of the wetlands. Biological methods should be preferred and physical structures should only be implemented where the degradation is so severe that the biological methods are unlikely to succeed. Physical structures should be combined with biological measures. The planning and implementation of rehabilitation programmes shall be centred in the local government structures using a participatory approach.
- Road infrastructure changes the natural drainage and inappropriate discharge structures cause erosion. The Roads Department is aware of this and development

of appropriate designs and capacity building of the technical staff and consultants is needed.

- More information on the wetlands is needed and further clarification of the roles and responsibilities at local level is needed to ensure that the activities of the different national level stakeholders complement each other in management of natural resources.
- Capacity for monitoring of the wetlands should be build at local level to promote sustainable management at local level and providing data for the national level analysis of wetlands development.
- Integrated data collection on runoff, rainfall, ET climatic factors, water quality and sediments is needed to understand better the functions of the wetlands.
- More information is needed on how a programme for protection of the wetlands will impact livelihood for the local communities and the mining, livestock and range management practices.

**PRSP:** The community representative from Malefiloane, quoted at the start of this chapter, said that: “.measures to prevent (soil erosion) were limited because people had started to depend on Government measures and incentives.” His words echo the findings of numerous evaluations of projects carried out over the last decade, and carry a clear warning for planning future interventions. They suggest that Basotho have developed a perception of soil conservation as something only carried out by Government, or only undertaken where payment is made. Unless a radically new approach is adopted, where soil is conserved because it increases productivity of land that is individually owned or worked, there is little hope of progress. Steps in this direction have been taken in the past by encouraging a ‘production through conservation’ approach.

## 3.2 PROGRAMME OBJECTIVES

### 3.2.1 Overall Objective

The overall objective of the programme is formulated in line with the objective for the present study: *‘Holistic protection and conservation of the ‘Sponges’ in the Khubelu catchment that will demonstrate a methodological approach for the sustainable management of the wetlands benefiting the population as well as the environment and securing long-term availability and quality of water from the Upper Orange-Senqu catchment area.’*

### 3.2.2 Specific Objectives

The specific objectives addressing the main aspects of the programme are proposed to be:

- *Improved livelihood for the population in the Khubelu catchment based on sustainable range management*
- *Degraded wetlands in the Khubelu catchment rehabilitated*
- *Erosion from road drainage prevented*
- *Results of monitoring of wetlands in the Khubelu Catchment, research and collection of lessons learned available for replication in other catchments*

These immediate objectives are formulated as the end of programme situation.

### **3.3 PROGRAMME OUTPUTS**

#### **3.3.1 Outputs related to Objective 1**

The proposed outputs related to improved livelihood from sustainable range management are:

- Output 1.1: Managed Resource Committee (MRC) established for the Khubelu Catchment
- Output 1.2: Grazing plan for Khubelu catchment based on re-established range management areas (A-B-C) according to CC boundaries and the responsibilities of chiefs and CCs
- Output 1.2: MRC and capacitated herders, livestock owners, grazing associations, CCs and chiefs manage Khubelu rangelands in a sustainable manner
- Output 1.4: Capacitated District Administration supporting sustainable land-use planning and effective livestock and range management

#### **3.3.2 Outputs related to Objective 2**

The proposed outputs related to rehabilitation of degraded wetlands are:

- Output 2.1 Grasses (Vetiver and local grasses) for biological rehabilitation of gullies tested in the Khubelu catchment
- Output 2.2 CCs capacitated in implementation and maintenance of biological rehabilitation of wetlands
- Output 2.3 Designs of physical gully control structures tested in the Khubelu catchment
- Output 2.4 Rehabilitated wetlands monitored and maintained

#### **3.3.3 Outputs related to Objective 3**

The proposed outputs related to erosion from road drains are:

- Output 3.1 Designs of environmentally safe road drain discharge structures tested in the Khubelu catchment
- Output 3.2 Guidelines and design standards for road drain discharge structures
- Output 3.3 Road Department technical staff capacitated in environmentally sound drainage designs

#### **3.3.4 Outputs related to Objective 4**

The proposed outputs related to monitoring and sustainable management of wetlands are:

- Output 4.1 Stakeholder roles and strategies in wetlands, water resources and natural resource management in Lesotho clarified and agreed
- Output 4.2 MRC monitoring system (including wetlands GIS) established and operating
- Output 4.3 Hydrological station and weather station established in the upper Khubelu catchment and operated and maintained in cooperation with the MRC
- Output 4.4 Research results on wetlands hydrology in the highlands of Lesotho available and influencing future wetlands protection programmes

- Output 4.5 Research results on programme impact on livelihood, mining, livestock and range management practices available and influencing programmes in other catchments
- Output 4.6 Feasibility Study for establishing the upper Khubelu catchment as a protected area.

### **3.4 PROGRAMME ACTIVITIES**

#### **3.4.1 Activities related to Output 1.1**

The proposed activities related to output 1.1 Managed Resource Committee (MRC) established for the Khubelu Catchment:

- Consultations at national, district and community level on functions of the MRC or similar structures for natural resources management at local level: The MRC would be a committee established by the CCs in the Khubelu area. The establishment should be discussed with the local government at national and district level and should be informed by the experiences with the MRC in the near by Mokhotlong-Sanqebethu Managed Resource Area. The Ministry of Tourism, Environment and Culture (MTEC) promotes Managed Resource Committees (MRCs) for the Managed Resource Area (MRA) concept, founded on the principles of community-based natural resource management, which aims at empowering the local community to manage all natural resources within their jurisdiction in a sustainable manner. The MRA can be under the jurisdiction of a single CC, but where the catchment area include more CCs these can agree to form a single MRA. The high cattle post areas are excluded from CC jurisdiction and the inclusion of the Principal Chiefs with the CCs neighbouring such areas are needed. The MRA concept represents a broadening of the Range Management Area (RMAs) since RMAs specifically focus on sustainable use of forage resources, while MRAs address management of all natural resources within a specific management unit. RMAs are seen as part of, or falling within, the MRAs. The proposed establishment of Catchment Management Committees in the new Water Resource Management Bill will also need to be taken into account to avoid overlapping and conflicting structures at local level.
- Workshop for the communities, Chiefs, CCs and district stakeholders on establishment of MRC: The process followed by MDTP should be studies and the experiences utilised for the establishment of management structures in the Khubelu catchment. The process is likely to involve a number of consultations with different stakeholders as well as a common workshop to ensure that the roles and responsibilities are clear for all stakeholders
- Formulation and gazetting of bylaws for MRC: One of the most important tools for the MRC will be the bylaws and the formulation of these must be done appropriately in line with the local government legislation and properly gazetted for the MRC to be effective in managing grazing in the catchment.

### **3.4.2 Activities related to Output 1.2**

The proposed activities related to output 1.2 Grazing plan for Khubelu catchment based on re-established range management areas (A-B-C) according to CC boundaries and the responsibilities of chiefs and CCs:

- Data collection on livestock in the Khubelu Catchment: The livestock statistics from different sources are not accurate as shown in Chapter 2.6. A livestock census must be carried out and procedures established for the MRC to have accurate data to base the grazing plan and regulation on.
- Data collection on the natural resources, vegetation, soil types etc in the Khubelu Catchment: The grazing plan must take into account the carrying capacity of the rangeland in the different parts of the Khubelu catchment and a survey of the catchment using GPS and mapping in a GIS system will have to be carried out.
- GIS mapping of range management areas and formulation of proposed grazing plan: The livestock statistics and the information on carrying capacity together with the CC boundaries will inform the preparation of a map showing the grazing areas (A-B-C) and the rotation systems that might be applicable for sustainable management of the catchment.
- Workshop and consultations with the livestock owners, Chiefs, CCs and district stakeholders on the grazing plan and agreement: The grazing plan shall be prepared in a participatory process and the results must be well disseminated to all the stakeholders to facilitate that the plan will be adhered to.

### **3.4.3 Activities related to Output 1.3**

The proposed activities related to output 1.3 MRC and capacitated herders, livestock owners, grazing associations, CCs and chiefs manage Khubelu rangelands in a sustainable manner:

- Training workshops for herders, livestock owners, grazing associations, MRC members and chiefs in grazing regulations: Extensive training of the different stakeholders is likely to be required such as sensitisation of the herders in the value of the wetlands and the grazing regulations; training of livestock owners to ensure that they become members of the grazing associations and understand that the grazing regulations is for their benefit as it will sustain their livelihood; training of the CCs, MRC members and the Chiefs in the administration of grazing permits and understanding the grazing plan. The activities with the MRC should include development of a strategy for how the MRC can sustain its activities financially in the longer term e.g. fees paid by the livestock owners, levy on tourist activities etc.
- Administration of grazing permit systems by CCs and Chiefs and inspection of range lands: The programme should monitor the administration of the grazing permit system and assist the CCs and the Chiefs with appropriate tools and resources for administration of the regulations.
- Monitoring of compliance with the grazing regulations and reporting: The gap between the present situation with no grazing plan and little compliance with the grazing permits and the desired situation with sustainable management according to a good quality grazing plan and compliance with regulations is very wide and

will not be filled instantly. The process of achieving increasing compliance shall be monitored so that lessons can be learnt from the process and approaches adjusted according to the experiences.

#### **3.4.4 Activities related to Output 1.4**

The proposed activities related to output 1.4 Capacitated District Administration supporting sustainable land-use planning and effective livestock and range management:

- Consultations at national, district and community level: consultations would address livestock management and improved livestock registration, control of stock theft, improved livestock breeds versus reduction in numbers etc. The systems for livestock registration do not work optimally and the programme should work with the stakeholders at district and national level to find ways of improving the present situation.
- Capacity building of the Department of Range Management in Mokhotlong: capacity building will include tools for land use planning (GIS system for support to MRCs) and improve the capacity for analysing and managing the natural resources including participatory planning skills. The range management department will be the main stakeholder in supporting the CCs and the MRC in preparing the grazing plans. The tools such as GIS systems is likely to be most effectively applied at district level as they need a high level of professional expertise.
- Provide a Grazing Control Officer for Khubelu and possibly a Range Technical Officer: The present staffing of the Department of Range Management will not be sufficient to support the MRC with patrolling the areas. The programme could include a Grazing Control Officer provided the Government is committed to take over the position after the end of the programme. Alternatively the MRC could investigate ways of fulfilling this duty – using the principle that as much as possible the management of the catchment should be in the hands of those directly affected.
- Support to implementation of livestock registration in Khubelu and livestock improvement programmes: Provided a strategy for livestock registration is agreed, the programme could support the implementation of this in Khubelu. This could be in line with the present practice that it is done by the police or alternatively the grazing associations and the MRC could develop strategies for effective registration and work with the police to curb stock theft.

#### **3.4.5 Activities related to Output 2.1**

The proposed activities related to output 2.1 Grasses (Vetiver and local grasses) for biological rehabilitation of gullies tested in the Khubelu catchment:

- Study of previous research on biological gully control and preparation of scope for pilot testing projects: The approach to rehabilitation of the eroded wetlands should be based on protection if the wetlands can regenerate the vegetation cover if left undisturbed. The first alternative should be biological protection using the indigenous plants by transplanting them within the wetlands. Where this is not possible the use of vetiver grass or other alternatives should be tested. Vetiver can

survive in temperatures down to -15°C and might be a good alternative in the highlands of Lesotho but that needs to be tested.

- Implementation of approximately ten Pilot sites: The detailed survey of the catchment will identify a number of potential pilot sites that should be selected so that experiences on the different types of biological protection can be tested. The selection should be done by the MRC so that there is a clear link to the implementation of the pilot projects that should be carried out by the local government structures.
- Monitoring of results in the pilot sites and documentation of lessons learned: The MRC and the Range Management Department will follow the implementation and results of the pilot projects closely and document the lessons learned so that these can inform the continued work in the catchment and elsewhere.

### **3.4.6 Activities related to Output 2.2**

The proposed activities related to output 2.2 CCs capacitated in implementation and maintenance of biological rehabilitation of wetlands:

- Training workshops for MRC and CC members in implementation and maintenance of biological rehabilitation of wetlands: The results of the pilot projects should be used to continue the rehabilitation of other wetlands in the Khubelu catchment. The nature of biological rehabilitation is so that it is likely that the initial work will need to be followed up by replanting or maintenance of the new vegetation, and a continuous programme of monitoring and work on the wetlands is likely to be needed.
- Support to CCs in implementation of rehabilitation projects including materials: The programme should include resources for continuing the rehabilitation of wetlands by the CCs but should focus on putting in place mechanisms for sustaining these activities in the longer run.

### **3.4.7 Activities related to Output 2.3**

The proposed activities related to output 2.3 Designs of physical gully control structures tested in the Khubelu catchment:

- Study of gully rehabilitation structures and design of pilot project in Khubelu wetlands: The detailed survey of the catchment will identify some wetlands where the biological rehabilitation will need to be supplemented by physical structures e.g. if deep gullies cross the wetland. The structures need to be well designed to avoid the situation with some of the previous rehabilitation attempts where there have been negative effects of establishing gabions in the drainage channels. The design will need to take into account that the when embedded in the side of the gullies into wetland do not become drains that further destroys the wetlands.
- Support to CCs in implementation of rehabilitation projects in the Khubelu wetlands: The programme shall provide resources for the CCs to continue the rehabilitation projects – however the emphasis shall be on the CCs developing ways of sustaining these activities in the future.



### 3.4.8 Activities related to Output 2.4

The proposed activities related to output 2.4 Rehabilitated wetlands monitored and maintained:

- Support to MRC in establishing monitoring programme for rehabilitated wetlands: The experiences of the rehabilitation shall be monitored by the MRC so that the results influence future rehabilitation work in the Khubelu. The programme shall support the MRC in the establishment of a simple monitoring programme that can capture the most important information on the effectiveness of the rehabilitation work.
- Regular monitoring of rehabilitated wetlands: The MRC shall monitor the rehabilitated wetlands e.g. on a quarterly basis over a longer period until the rehabilitation is stable and sustained after which the rehabilitated wetlands shall be monitored in line with the other wetlands in the catchment.
- Support to CCs in implementation of remedial measures if needed: Some of the rehabilitation work is likely to fail and remedial action will be needed to correct what went wrong. A very important aspect of rehabilitation is continued follow-up and maintenance of the measures that have been put in place. The MRC should be supported in developing work procedures that recognise the need for consistent follow-up.

### 3.4.9 Activities related to Output 3.1

The proposed activities related to output 3.1 Designs of environmentally safe road drain discharge structures tested in the Khubelu catchment:

- Support to Roads Department in design of environmentally safe discharge structures: The design activities will include survey of pilot sites, design, preparation of BOQ etc. The programme will support the Roads Department in the identification of 2 – 3 sites on the tarred and the gravel roads through the Khubelu catchment where the road drains are presently causing erosion problems and assist in the design of water retention structures that can discharge the water in a manner that cause less impact. The activities will include design and preparation of bills of quantities and tender documents if the structures are of a magnitude that contractors will be engaged for implementation. The experiences from the Lesotho Highlands Development Authority (LHDA) on construction of road drainage through sensitive areas and rehabilitation of these areas should be utilised.
- Implementation of pilot demonstration structures: The structures will be implemented and supervised by the Roads Department.
- Monitoring and reporting on the effect of the pilot structures: The results of the pilot projects will be monitored on a quarterly basis by the MRC in cooperation with the Roads Department technician in Mokhotlong to identify and rectify any short-comings in the design.

#### **3.4.10 Activities related to Output 3.2**

The proposed activities related to output 3.2 Guidelines and design standards for road drain discharge structures:

- Study of experience internationally of environmentally safe road drainage designs: The design of the pilot projects shall be informed by the experiences internationally and these together with the results of the pilot projects shall be documented to inform future designs.
- Development of guidelines and design standards based on results of pilot project and international best practices: The experiences shall be documented in guidelines and design standards by the Roads Department so that these experiences can influence the design and implementation of road projects in other areas of Lesotho.

#### **3.4.11 Activities related to Output 3.3**

The proposed activities related to output 3.3 Road Department technical staff capacitated in environmentally sound drainage designs:

- Training workshops for Roads Department design engineers and supervisors in road drainage design and implementation: The draft guidelines and design standards shall be disseminated to the relevant engineers and technicians in the roads department to ensure that experiences of the department are fully captured in the guidelines.
- Workshop for consultants on the guidelines and design standards for road drainage: The final guidelines shall be disseminated to the consultants engaged by the road department for design of roads in Lesotho to facilitate that future road construction takes these into account in the alignment and design of drainage systems.

#### **3.4.12 Activities related to Output 4.1**

The proposed activities related to output 4.1 Stakeholder roles and strategies in wetlands, water resources and natural resource management in Lesotho clarified and agreed:

- Study of functions related to NRW/ WRM and wetlands in MFLR, MAFS, MNR, MTEC at national and district level and of local government structures and civil society stakeholders: The various line ministries are proposing different structures for local governments to take care of natural resources management and the environment, e.g. the wetlands strategy has village and district level structures, the MDTP approach with MRC under the CCs cover natural resources management, the new Water Resources Management Bill propose catchment management committees. For any of these to be effective it is very important that overlaps are avoided and that the roles and responsibilities are clear. Also for the most efficient use of the scarce resources it is important that an effective and simple structure for management at local level is established that is fully integrated into supports the local government structures. These aspects need to be clarified at national level and a clear division of responsibilities for range management, livestock and management of natural resources including wetlands agreed and supported by all the line ministries.

- Preparation of draft function analysis report outlining the roles of stakeholders at all levels on monitoring and management of wetlands: The consultation on functions should be documented in a report that clearly outlines the roles.
- Consultations including workshops at national and district level on functions: The results shall be disseminated to stakeholders at all levels – without buy-in from all levels the management of wetlands at local level is not likely to be sustainable.
- Preparation of function analysis report and dissemination of results including action plan for implementation: The implementation in the Khubelu catchment is likely to include the activities described above on the capacity building of the various local level stakeholders in natural resources management.

### **3.4.13 Activities related to Output 4.2**

The proposed activities related to output 4.2 MRC monitoring system (including wetlands GIS) established and operating:

- Design and implementation of simple monitoring system for MRC monitoring of resources incl wetlands in Khubelu: The monitoring of wetlands at national level will have to be based on data from the local level and the MRC will need to establish a monitoring system that suits their own needs as well as provide data for the national Wetlands GIS. The activities in the Khubelu area will be integrated in the activities described above for establishing tools for preparation of grazing plans and monitoring of rehabilitated wetlands. These systems shall be designed so that the data are structured to feed into the national system. The principle of 'simple few key indicators that provide reliable data' rather than 'all would like to have information' should be used to guide the development of the information system. This will imply that the MRC will collect the detailed data that are needed for their purpose and data on a few key indicators shall be submitted to the national level. The experience with the data collection formats during the inventory stage of this project will inform the collection tools for the MRC data
- Training of MRC and CCs in monitoring of wetlands and support to data collection: The monitoring system will need to be supported at both national and local level and the MRC will be trained in the management of the data.
- Reporting to DWA, quality control and feedback to MRC on wetlands data: The data management system will only be effective if the data are used and when those responsible for data collection get feedback on the use of the data. Therefore feedback from the DWA on the use of the data and the relation to wetlands in other catchments will be an important part of sustaining the information systems.

### **3.4.14 Activities related to Output 4.3**

The proposed activities related to output 4.3 Hydrological station and weather station established in the upper Khubelu catchment and operated and maintained in cooperation with the MRC:

- Specification, study of possibility of rehab of SG015, and procurement of hydrological station and weather station in the upper Khubelu catchment: The assessments of water storage presented in this report are based on some

approximations on the data and further studies to understand better the hydrological functioning of the wetlands will require that there is consistent data available on runoff, rainfall, the parameters influencing ET such as sunshine, wind and humidity as well as water quality and sediment data. As this data will be required over a longer period to provide substantial knowledge on the wetland dynamics in different climatic conditions the monitoring would need to be integrated into the regular DWA and Meteorology Department's monitoring. These possibilities and the recurrent budget implications should be investigated including the possibility of involving the MRC in the operation and maintenance of the monitoring stations.

- Agreement and training of MRC in the operation and maintenance of the monitoring stations: Follow-up on data collection and data control. A possible outcome could be that the MRC would provide the data from the monitoring and receive some revenue for providing the data – that would be one way of sustaining the functioning of the MRC and ensuring that data are submitted to the district and national level. These aspects would have to be discussed and agreed and the MRC (or alternative arrangements) trained in the operation and maintenance of the monitoring stations. Which ever solution is found it is likely to require regular follow-up from central level as the equipment is specialised and will need qualified maintenance and oversight to provide accurate data.

#### **3.4.15 Activities related to Output 4.4**

The proposed activities related to output 4.4 Research results on wetlands hydrology in the highlands of Lesotho available and influencing future wetlands protection programmes:

- Design of research programme and specification of data requirements: The National University of Lesotho is a potential partner in the research programme in cooperation with the DWA. The possibilities shall be discussed at an early stage so that the design of the monitoring equipment can be informed by the requirements for the research programme.
- Recurrent analysis of data from Khubelu monitoring and possible adjustments to the data collection programmes: The data from the monitoring station shall be assessed on a regular basis from the start so that the situation is avoided where early systematic mistakes are not detected and rectified.
- Analysis, preparation of research report and dissemination to stakeholders locally and ORASECOM countries: The research results shall be documented at the end of the programme and discussed and disseminated to all interested parties locally and in the riparian countries and if the results are providing substantive results and insight into wetlands hydrology, also internationally.

#### **3.4.16 Activities related to Output 4.5**

The proposed activities related to output 4.5 Research results on programme impact on livelihood, mining, livestock and range management practices available and influencing programmes in other catchments:

- Design of research programme and specification of data requirements: Also here the National University of Lesotho could be a potential partner. The baseline data will be provided by the data collection that is necessary for the preparation of the grazing plan for Khubelu and the researchers shall be involved at an early stage to design the data collection formats and the data that will be required for follow-up on the effect on the livelihood in the area.
- Recurrent analysis of data from Khubelu monitoring and possible adjustments to the data collection programmes: The data shall be analysed in regular intervals to detect any short-comings early on and correct the data collection tools and methods where needed.
- Analysis, preparation of research report and dissemination to stakeholders locally and ORASECOM countries: The research results shall be documented at the end of the programme and discussed and disseminated to all interested parties locally and in the riparian countries and internationally if the results are providing substantive results and insight into livelihood aspects of improved wetlands and natural resources management.

#### **3.4.17 Activities related to Output 4.6**

The proposed activities related to output 4.6 Feasibility Study for establishing the upper Khubelu catchment as a protected area:

- Preparation of TOR and tendering for consultant for feasibility study: The possibilities and the pros and cons of establishing the upper Khubelu catchment – Mont-aux-Sources as a protected area could be further investigated based on the experiences by the MDTP on the Senqu-sources protected area. It could also be considered to establish a wider protected area for the whole escarpment as all these areas have similar characteristics. These activities would naturally need to be coordinated with the enactment of the Nature Conservation Bill, 2005 that is still pending. A first step would be to prepare the Terms of Reference (TOR) and tender for a consultant to prepare a feasibility study. This could alternatively be done by the programme support team but it might be more effective to contract a separate consultant to provide the specific legal and institutional expertise that is needed for this specialised study.
- Consultation with stakeholders: consultations at local, district and national level as well as regional on the purpose and benefits for protecting the upper Khubelu catchment areas (and possibly the entire Drakensberg escarpment).
- Assessment of the social, technical, financial, legal and environmental feasibility of establishing a protected area: The consultant in cooperation with the programme team and stakeholders would document all the aspects of establishing a protected area and quantify the benefits and costs.
- Preparation and presentation of a feasibility report: The results would have to be presented at local and national level in both Lesotho and South Africa.
- Implementation of outcome of feasibility study: The programme in the Khubelu catchment should support the implementation of the outcome of the feasibility study and assist in establishing the local management structures that might be required.

## **3.5 PROGRAMME ORGANISATION AND MANAGEMENT**

### **3.5.1 Programme Budget**

The log-frame for the proposed programme is described in Annex C including the assumptions and the monitoring indicators. Annex C also contains the time schedule for the activities and the budget.

The overall budget is M 24.0 million to be implemented over a 5 year period including a contribution from Government of Lesotho of M 7.0 million for salaries, allowances and transport for staff from government departments, Mokhotlong District Council and the CCs.

### **3.5.2 Programme Management**

The activities described above are proposed to be managed through a programme approach with a programme secretariat established in Mapholaneng to support the many different stakeholders in the implementation of the programme.

The main implementing actors would be the relevant departments in Mokhotlong District and the CCs in the Khubelu catchment area. The staff of the programme support office would be providing technical assistance and capacity building to the local government actors.

The programme support office and the stakeholders in Mokhotlong would establish the needed coordination and management committees for the effective implementation of the programme. At national level the 'Wetlands Committee' could be fulfilling the role of 'Programme Steering Committee' for the implementation of the programme, possibly by including the ORASECOM Executive Secretary and a representative from the funding agency when addressing issues specifically for the Khubelu Catchment Programme.

The programme support office is envisaged to be manned by a team of specialists that can provide input as required and support the local partners as needed and when needed according to work plans agreed between the partners and the support office. The budget includes a full time coordinator/ administrator to manage the day to day programme activities including financial management and reporting. To ensure clear definition of planning, reporting and financial management responsibilities, it is likely that the management of the programme support office would most efficiently be contracted out to a consulting company or consortium of consulting companies to provide the right mix of local knowledge and specific expertise.

The programme budget includes the establishment of an office in Mapholaneng. The office facilities could eventually after the end of the programme be handed over to the CCs to be used as the office for the MRC in the Khubelu area as a centre for the activities in the catchment including the administration of grazing permits.

Financial management is likely to be most effectively administered by the programme support office providing funding to the CCs and District Council where appropriate. The CCs and the District Council would report on the use of the funds using their normal accounting systems and only where these do not provide adequate transparency and accountability would the programme support office work with the partners to improve the systems. The alternative of providing project support to the DWA as an implementer is

likely to be complicated as the Department does not have the financial system in place for transfer and financial management of funds used by the local governments

### **3.5.3 Implementation Strategy**

The main thrust of the programme will be to introduce sustainable natural resources management including developing locally based funding mechanisms so that in the longer term, the natural resource management will not depend on outside funding but will be based in, and funded by the local communities and the local government structures.

The principle for allocation of funding will therefore be that the programme should provide funding for once-off inputs that are needed to start the activities e.g. pilot demonstration projects, capacity building, research etc. while the recurrent inputs e.g. salaries, labour costs, allowances and transport costs for Government staff, Councils, Committees and Associations shall be covered by the government and local government budgets and/or future local revenue sources e.g. contribution from livestock farmers.

The focus will be on empowering the local government structures to fulfil their mandate in management of the natural resources. Implementation will therefore be based on strengthening the CCs and the Mokhotlong District Council including the relevant government departments in the district to implement the conservation and rehabilitation measures in a learning-by-doing process rather than a 'stand alone project approach'. There will thus not be a separate capacity building programme as the capacity building needs to be integrated into the activities to be effective.

The activities are proposed for a 5-year period. Wetlands and natural resources management are long-term activities and a shorter implementation period is unlikely to produce sustainable results as the main aim of the programme is capacitating the local partners for developing management tools and using these in the management of the Khubelu catchment.

## **3.6 ACTION PLAN**

The Programme Proposal outlined above is available in a separate document that can be used by ORASECOM and the Lesotho Government to seek funding for the programme.

A draft of the Brochure describing the results of the study has been prepared in both English and Sesotho and printed in 5000 copies to be used to disseminate the information about the Sponges Study and the proposed programme to stakeholders.

The various partners have been consulted on this programme during the implementation of the study. The action plan for implementation of the programme would include:

- ORASECOM in cooperation with the Government of Lesotho identify funding sources for the programme;
- Detailed assessment and appraisal of the programme by the identified funding agency, ORASECOM and the stakeholders in Lesotho;
- Signing of agreement on the implementation of the programme between the Government of Lesotho, ORASECOM and the funding agency;
- Signing of 'Memo of Understanding' between the involved CCs, the Principal Chief, the District Council in Mokhotlong, Government of Lesotho and ORASECOM clarifying the roles and responsibilities for implementation of the programme;

- Tendering for the management of the programme amongst consulting companies in the Orange-Senqu riparian countries and award of contract;
- Implementation of the programme in the Khubelu Catchment;
- Monitoring of the implementation by the Wetlands Committee and coordination with other initiatives on wetlands management in Lesotho e.g. by Maluti-Drakensberg Trans-frontier Project, LHDA and DWA funded by the Millennium Challenge Corporation.



## ANNEX A: RUNOFF DATA ANALYSIS

The relationship between the runoff in the three catchments covered by SG11 Tsehlanyane, SG14 Motete and SG15 Lekhalong la Lithunya are illustrated in the graphs below. There is a good correlation between the three catchments with a coefficient of approximately 0.65<sup>36</sup>.

Figure 30: Runoff relationship SG11 Tsehlanyane and SG15 Lekhalong la Lithunya

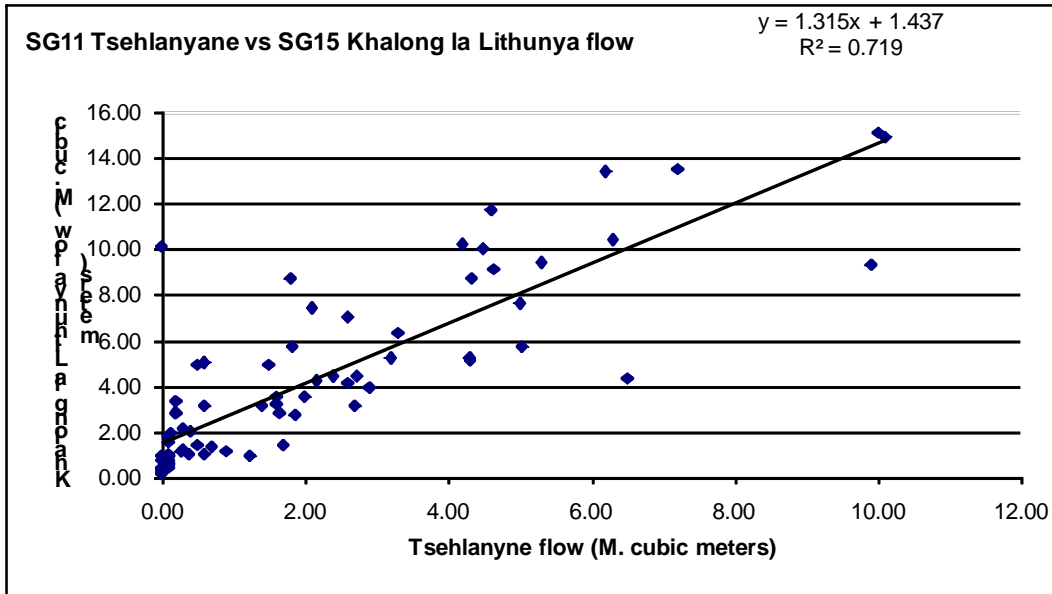
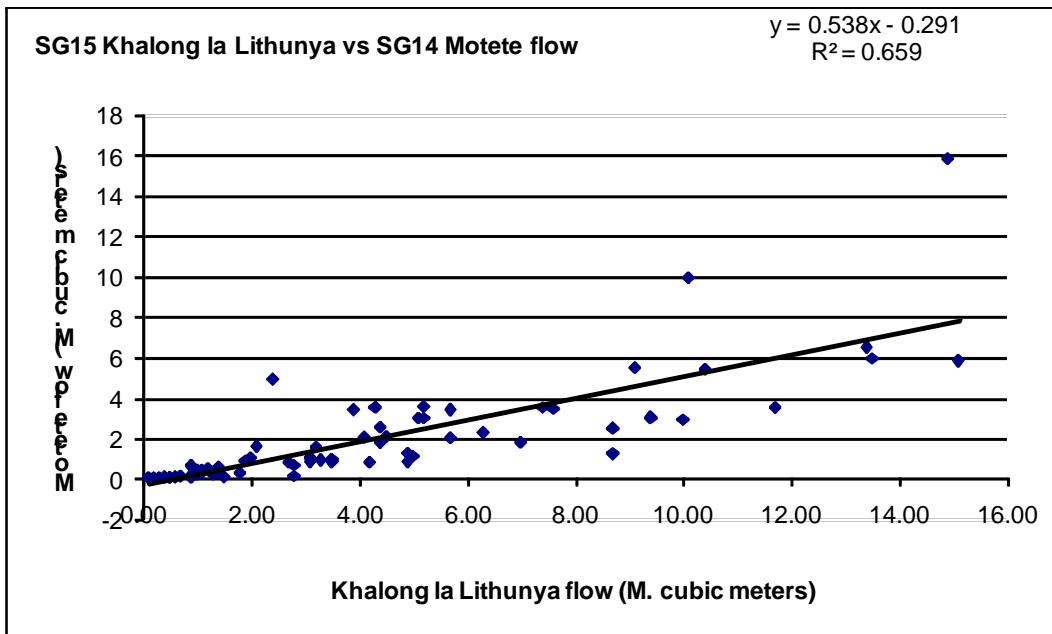
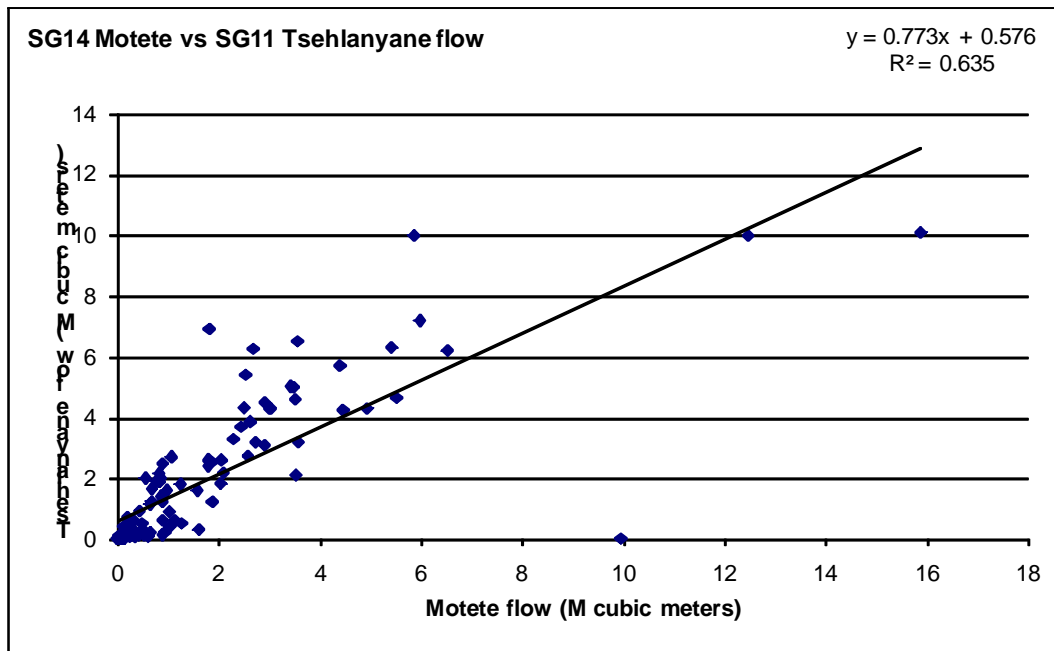


Figure 31: Runoff relationship SG14 Motete and SG15 Lekhalong la Lithunya



<sup>36</sup> Some of the unusual data such as 23.5 mill m3 in February 2006 for SG15 are eliminated in the comparison since it is likely to be a mistake as it does not correspond to rainfall or runoff in the other catchments.

**Figure 32: Runoff relationship SG11 Tsehlanyane and SG14 Motete**



**Run-off Rainfall statistics**

A strong relationship between rainfall and runoff is usually associated with cascading systems where surface detention and storage are minimal. The vegetal cover plays an important role in surface and ground water dynamics. Lack of vegetal cover will diminish storage considerably as also documented by the Marneweck and Grundling study from 1999. The following graphs show a correlation coefficient of approx 0.5 between the runoff and rainfall for the 3 catchments that have been analysed.

Figure 36 shows the relation between runoff and rainfall for the Khubelu catchment at Tlokoeng based on the average monthly values over the 10 year periods between 1966 and 2006. The correlation of 0.47 indicates on one hand that there is a distance between the rainfall station in Oxbow and on the other hand that there is considerable retention of water taken place in the catchment. Rainfall data from the Khubelu catchment would be needed to improve the analysis.

Figure 33: SG14 Motete runoff compared to rainfall

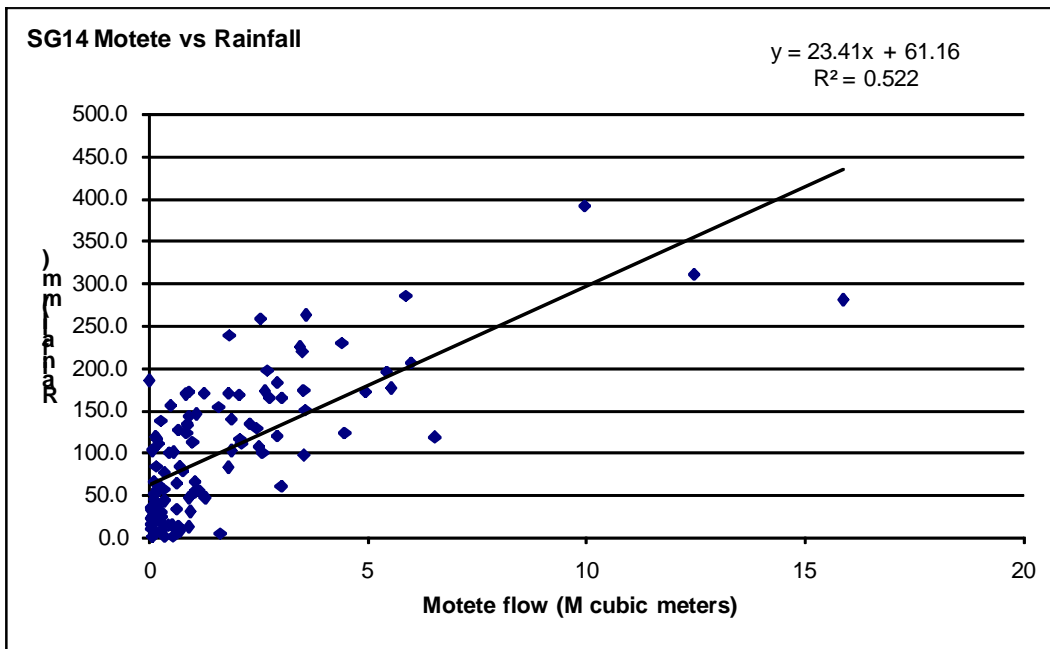


Figure 34: SG11 Tsehlanyane runoff compared to rainfall

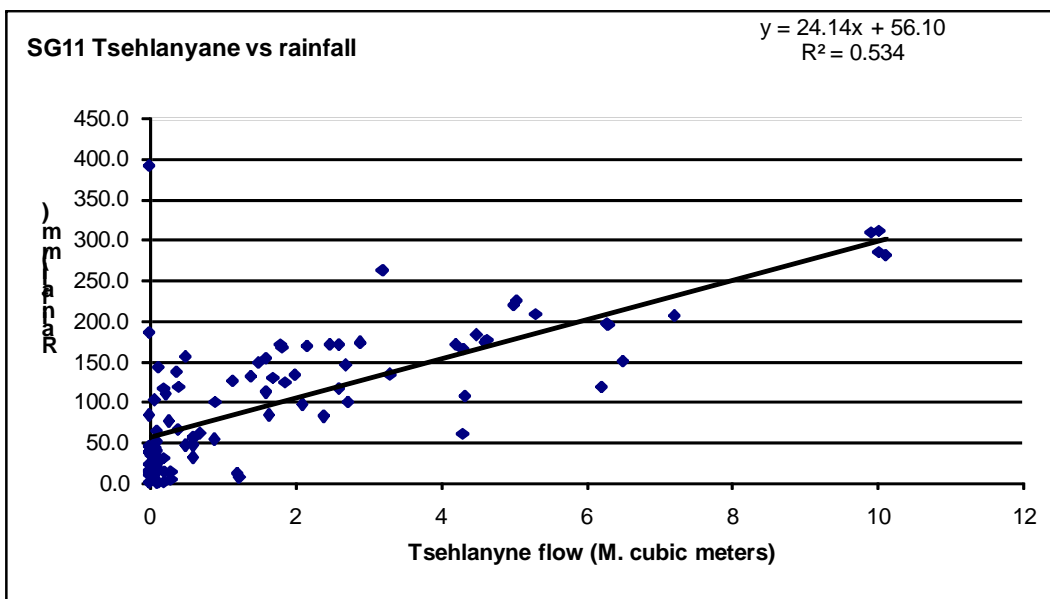


Figure 35: SG15 Khalong la Lethunya runoff compared to rainfall

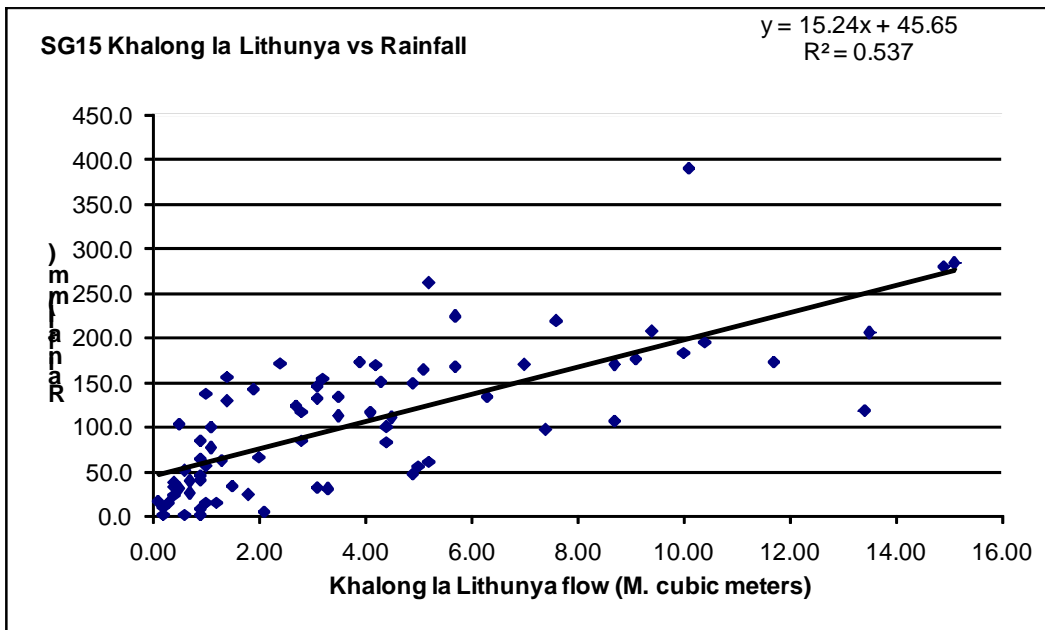
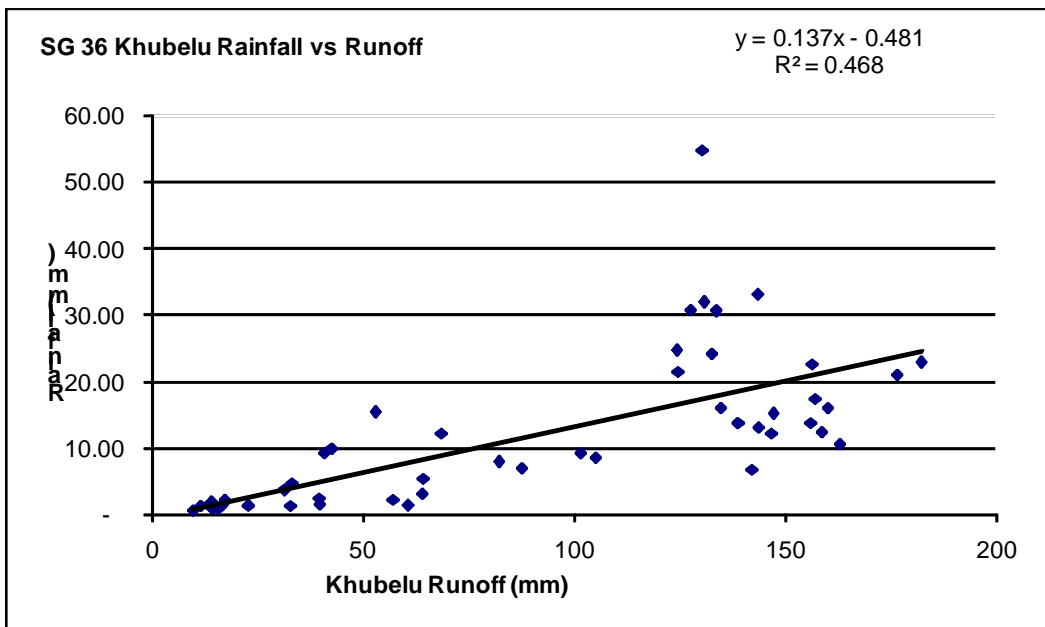


Figure 36: SG36 Khubelu runoff compared to rainfall



## ANNEX B: STORAGE AND LOW FLOW ANALYSIS FOR SG11, SG14 AND SG15

The analysis of storage for the three smaller catchments SG11 Tsehlanyane, SG14 Motete and SG15 Khalong la Lithunya are illustrated in the graphs below. The picture is similar to the analysis presented in chapter 2.5 for the larger Khubelu catchment, however the available data covers only 20 years and 8 years respectively. The trend in the data from the mid-60s to the mid 70s does not seem to be consistent – this might be due to inconsistency/gaps in the runoff data.

Figure 37: SG11 Runoff, Rainfall, ET and Storage (10 yr monthly average)

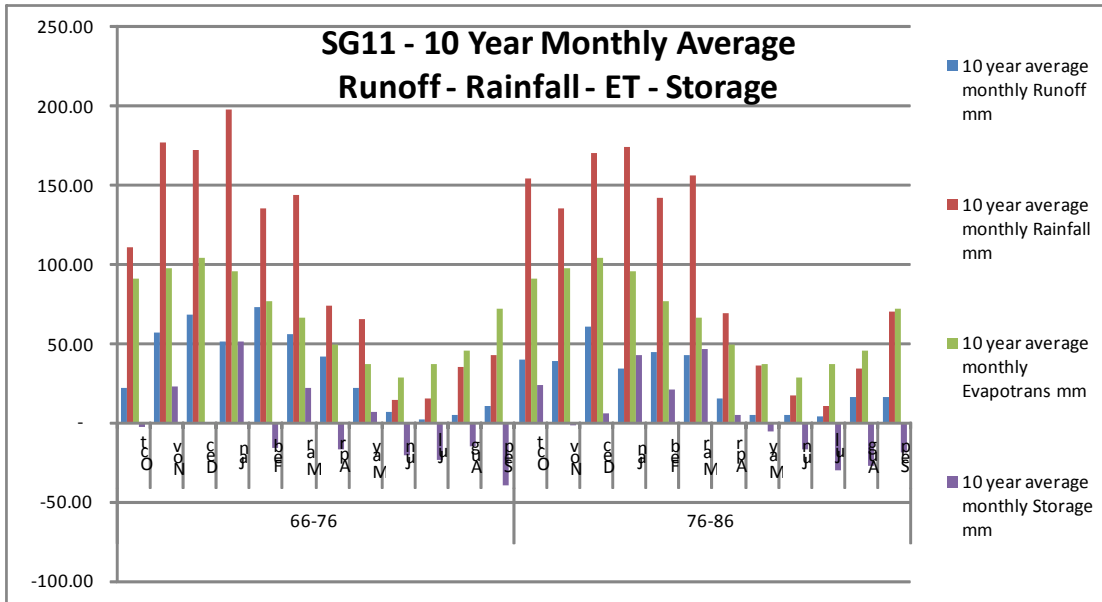


Figure 38: SG11 10 year average storage

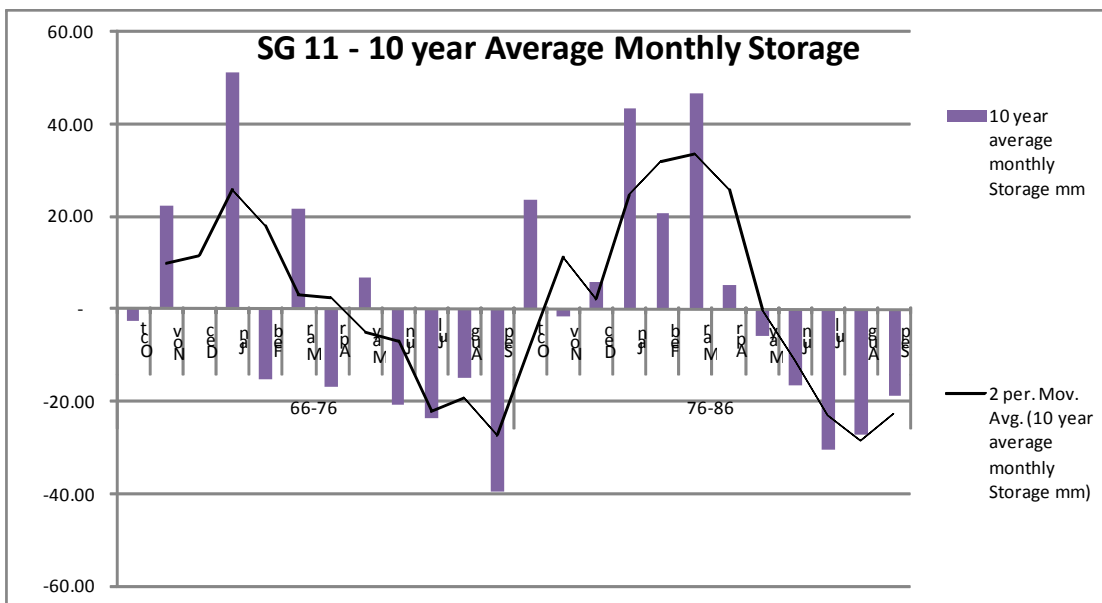


Figure 39: SG11 Runoff, Rainfall, ET and Storage (5 yr monthly average)

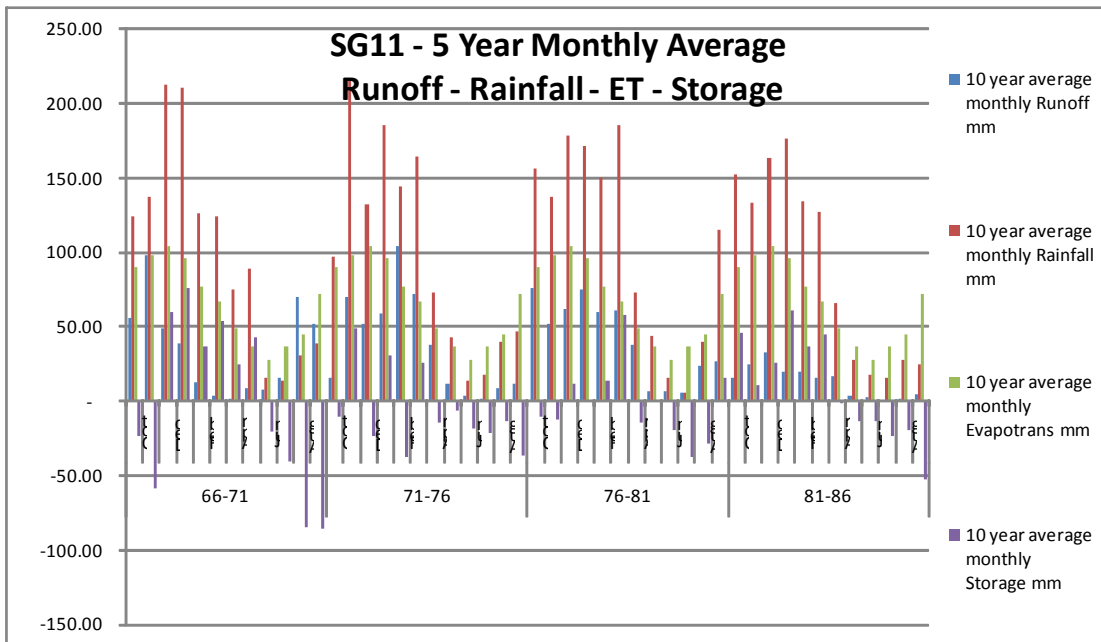
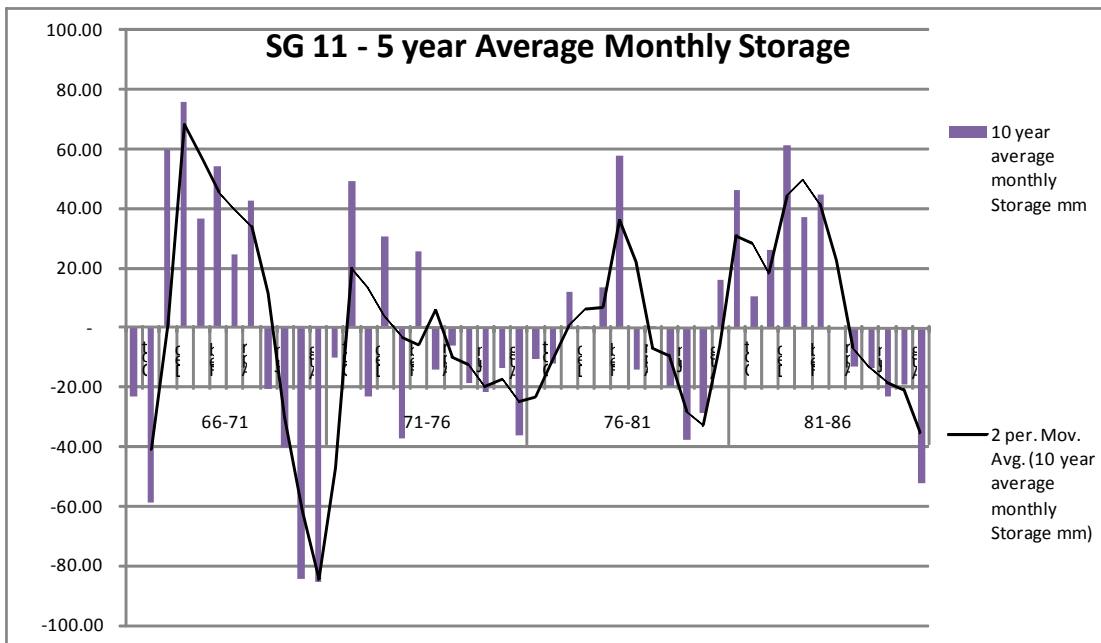


Figure 40: SG11 5 year average storage



The SG11 analysis has been presented with ET values of 86% of the values presented in the CROPWAT model to provide a situation with a small groundwater recharge over the period. The storage varies between 130mm and 90mm for the two 10-year periods.

Figure 41: SG14 Runoff, Rainfall, ET and Storage (10 yr monthly average)

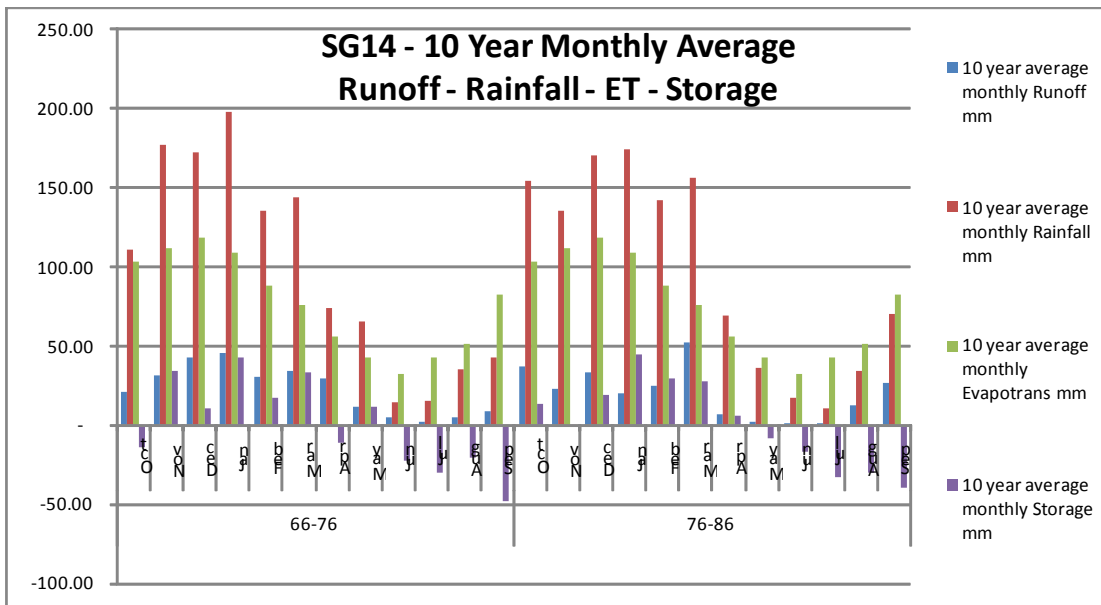
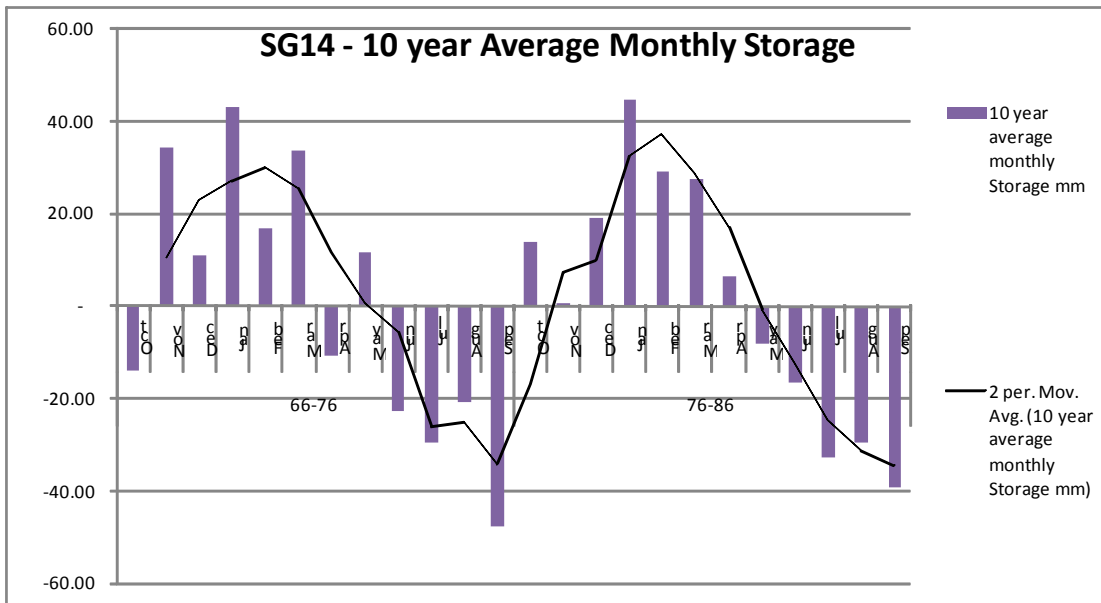
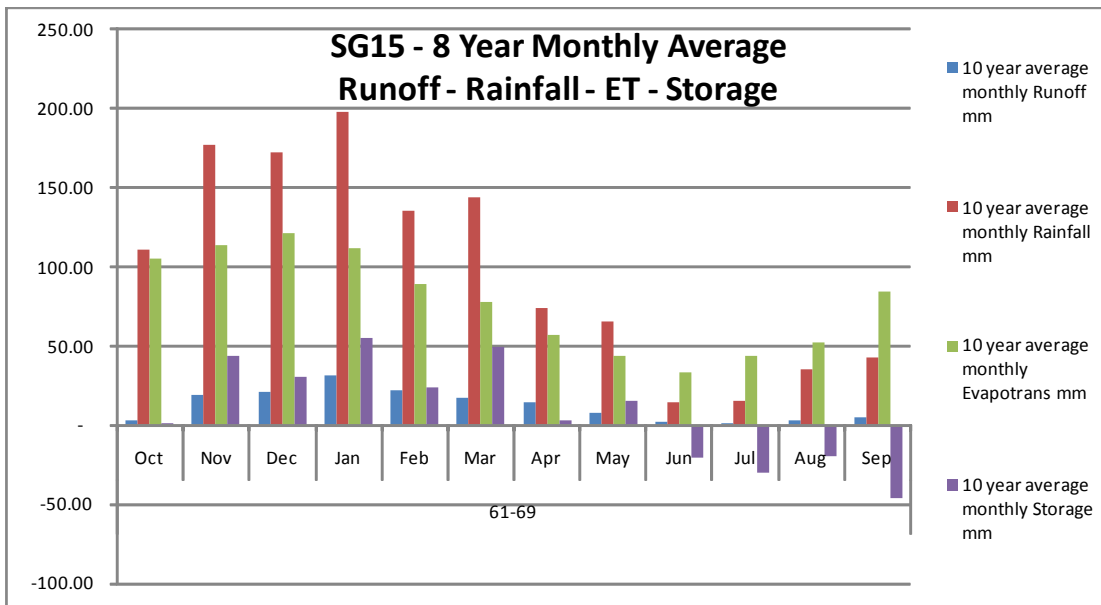


Figure 42: SG14 10 year average storage

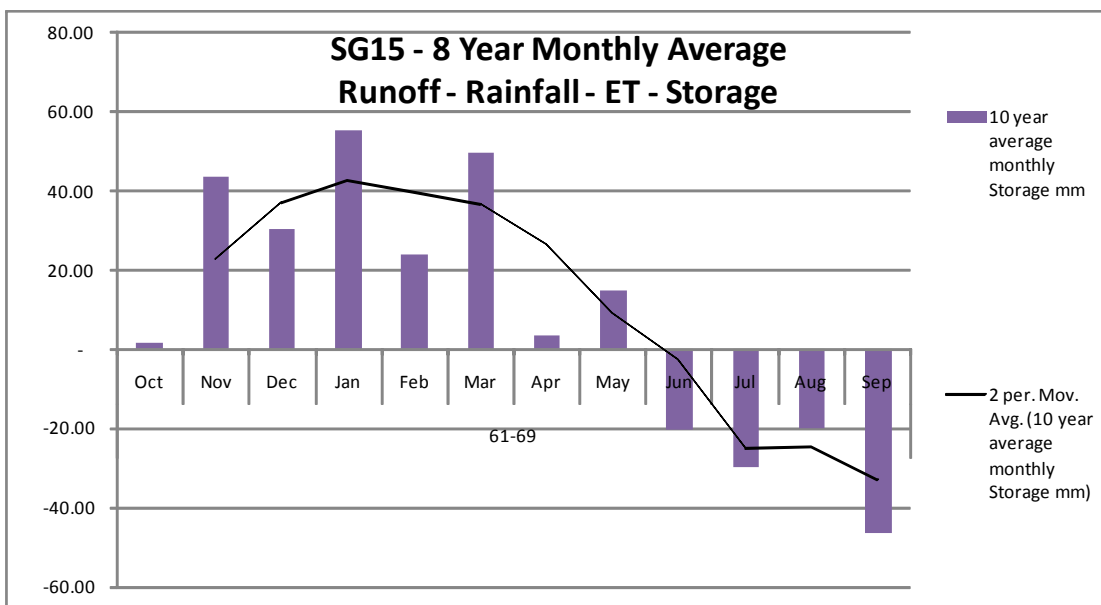


The analysis for SG14 has been done with 98% of the CROPWAT ET values. Storage varies between 125mm and 145mm for the two 10 year periods

**Figure 43: SG15 Runoff, Rainfall, ET and Storage (8 yr monthly average)**



**Figure 44: SG15 8-yr average storage**



The analysis for Khalong la Lethunya has been done with ET values of 100% of the CROPWAT model figures. The annual storage and recharge over the year were approximately 90mm.



### Low-flow analysis for SG11

Figure 45: The number of days per year with flow less than 0.02 cumec at Tshlanyane.

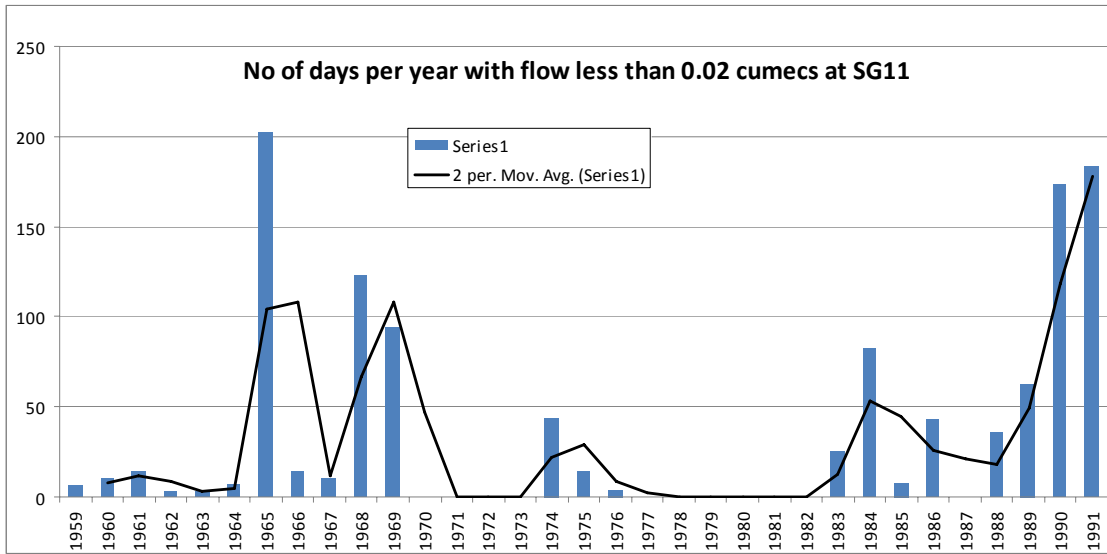
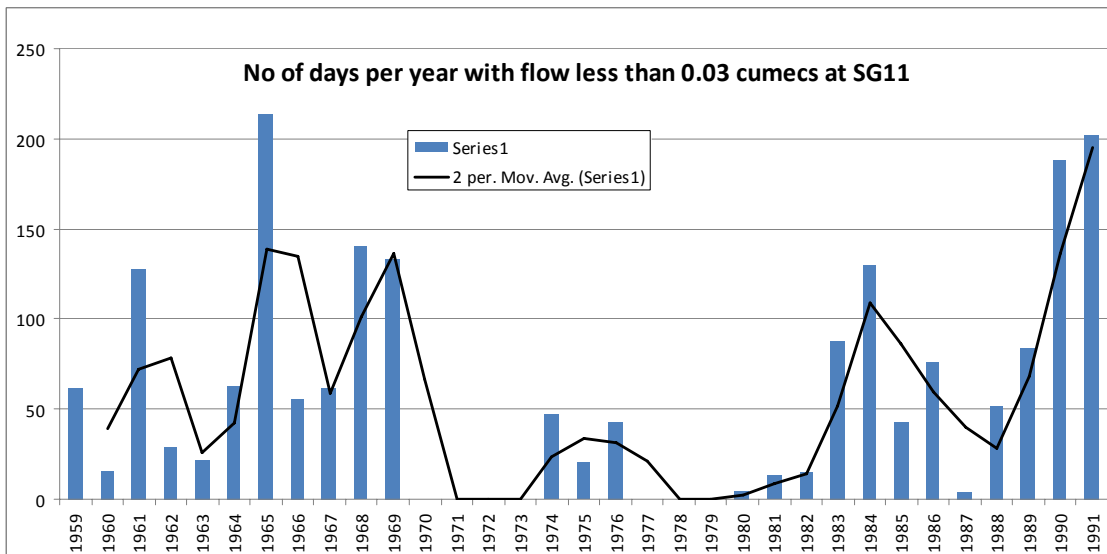
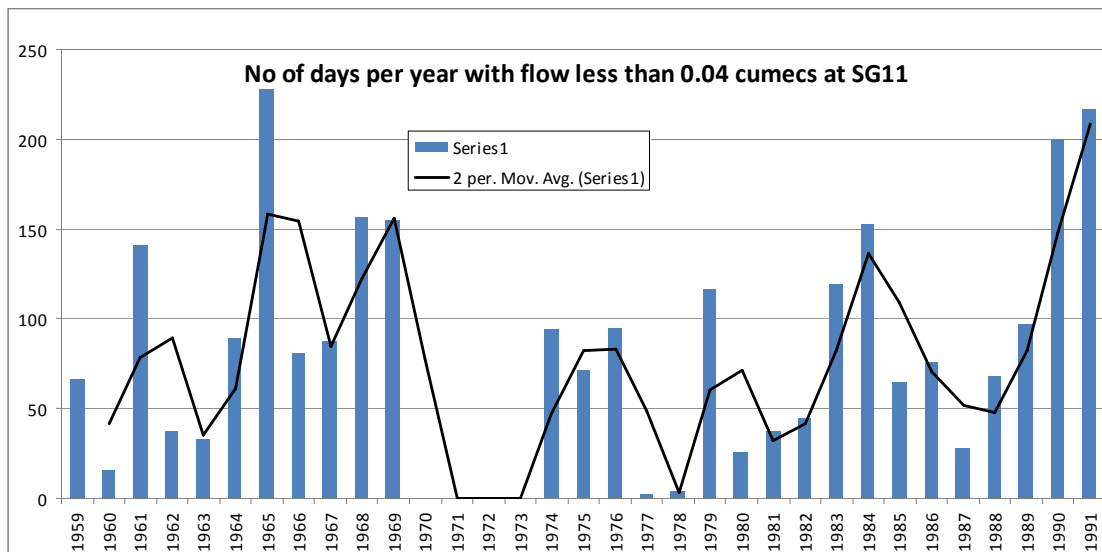


Figure 46: The number of days per year with flow less than 0.03 cumec at Tshlanyane.



**Figure 47: The number of days per year with flow less than 0.04 cumec at Tsehlanyane**



**ANNEX C: LOG-FRAME AND ACTIVITY PLAN AND BUDGET**

***Programme for Protection and Conservation of the upper Orange-Senqu Catchment Area***

<b>Logical Framework Analysis</b>		<b>Critical Assumptions</b>	<b>Indicators</b>	<b>Means of Verification</b>
<b>Development Objective</b> Holistic protection and conservation of the 'Sponges' in the Khubelu catchment that will demonstrate a methodological approach for the sustainable management of the wetlands benefiting the population as well as the environment and securing long-term availability and quality of water from the Upper Orange-Senqu catchment area		<b>From Output to Objectives</b>		
	<b>Immediate Objectives</b>		<b>Indicators for effectiveness</b>	
<b>1</b>	Improved livelihood for the population in the Khubelu catchment based on sustainable range management	Improved range management will be complemented by improved genetic characteristics of livestock and effective measures to curb livestock theft	% Increase in income from livestock	- Wool and Mohair statistics - Bureau of Statistics - Lesotho Agricultural Situation Report (annual data analysed for Mokhotlong district/ respective CCs)
<b>2</b>	Degraded wetlands in the Khubelu catchment rehabilitated	Biological rehabilitation methods proves to be effective in the highlands of Lesotho	% of Khubelu of wetlands in need of rehabilitation	Improved Wetlands GIS/ data base
<b>3</b>	Erosion from road drainage prevented		% of new roads in Lesotho constructed with environmentally safe drainage	Survey by Roads Department
<b>4</b>	Results of monitoring of wetlands in the Khubelu Catchment, research and collection of lessons learned available for replication in other catchments	The Khubelu programme has a positive effect that is worth replicating	No of positive results from Khubelu programme replicable in other catchments	Evaluation at the end of programme

	<b>Output</b>	<b>Critical Assumptions from Activities to Output</b>	<b>Indicators for efficiency</b>	<b>Means of Verification</b>
<b>1</b>	<b>Outputs related to improved livelihood from sustainable range management</b>			
<b>1.1</b>	Managed Resource Committee (MRC) established for the Khubelu Catchment	The CCs in the Khubelu catchment will participate actively in the MRC	MRC established and functioning (yes/no)	Progress report from programme
<b>1.2</b>	Grazing plan for Khubelu catchment based on re-established range management areas (A-B-C) according to CC boundaries and the responsibilities of chiefs and CCs	The stakeholders will agree on a sustainable grazing plan	Grazing Plan available (yes/no)	Grazing Plan document and map
<b>1.3</b>	MRC and capacitated herders, livestock owners, grazing associations, CCs and chiefs manage Khubelu rangelands in a sustainable manner	The stakeholders respect the grazing plan and regulations All major livestock owners become members of grazing associations	Compliance with grazing regulations (%) Proportion of livestock owners members of grazing association (%)	MRC report to CCs
<b>1.4</b>	Capacitated District Administration supporting sustainable land-use planning and effective livestock and range management	District Administration and National Ministries interested and prioritise livestock management (registration and stock improvement programmes etc.)	Proportion of livestock registered (%) Proportion of improved livestock (%) combined with overall number of livestock (+/- %)	Report from Livestock Department (format to be developed)
<b>2</b>	<b>Outputs related to rehabilitation of degraded wetlands</b>			
<b>2.1</b>	Grasses (Vetiver and local grasses) for biological rehabilitation of gullies tested in the Khubelu catchment	Vetiver and other grasses prove effective in gully rehabilitation in the highlands of Lesotho	No of test sites No of successful test sites	Progress report from programme
<b>2.2</b>	CCs capacitated in implementation and maintenance of biological rehabilitation of wetlands	The CCs interested in and prioritise wetlands rehabilitation	No of wetlands rehabilitated	CC/ programme progress report
<b>2.3</b>	Designs of physical gully control structures tested in the Khubelu catchment	Physical gully control structures prove effective in the highland wetlands	No of physical structures implemented No of physical structures successful in rehabilitating gullies	CC/ programme progress report
<b>2.4</b>	Rehabilitated wetlands monitored and maintained	The CCs willing and prioritise monitoring and maintenance of wetlands	Proportion of Khubelu wetlands monitored per year (%)	Monitoring reports from MRC
<b>3</b>	<b>Outputs related to erosion from road drains</b>			
<b>3.1</b>	Designs of environmentally safe road drain discharge structures tested in the Khubelu catchment	Cost effective water retention/ flow reducing structures will be appropriate	No of discharge structures completed	Progress report from Roads Department

	<b>Output</b>	<b>Critical Assumptions from Activities to Output</b>	<b>Indicators for efficiency</b>	<b>Means of Verification</b>
<b>3.2</b>	Guidelines and design standards for road drain discharge structures		Good quality document on design standards available (yes/no)	Design Standard Document
<b>3.3</b>	Road Department technical staff capacitated in environmentally sound drainage designs	Road Department will prioritise environmental aspects in road design	No of staff trained	Progress report from Roads Department
<b>4</b>	<b>Outputs related to monitoring and sustainable management of wetlands</b>			
<b>4.1</b>	Stakeholder roles and strategies in wetlands, water resources and natural resource management in Lesotho clarified and agreed	Possible to reach agreement on roles and responsibilities for natural resources management	Report on NRM/WRM/ Wetlands functions approved by all stakeholders (yes/no)	Function analysis report Stakeholder workshop report
<b>4.2</b>	MRC monitoring system (including wetlands GIS) established and operating	CCs and MRC prioritise monitoring of the wetlands	Proportion of Khubelu wetlands covered by Wetlands GIS/ data base (%) Proportion of Khubelu wetlands data updated annually (%)	Wetlands GIS
<b>4.3</b>	Hydrological station and weather station established in the upper Khubelu catchment and operated and maintained in cooperation with the MRC	CCs and MRC willing to maintain the monitoring stations	Measuring stations established (yes/no) Completeness of monitoring data (%)	Report on data capture
<b>4.4</b>	Research results on wetlands hydrology in the highlands of Lesotho available and influencing future wetlands protection programmes	DWA and MRC will provide reliable data	Research Report available (yes/no)	Report
<b>4.5</b>	Research results on programme impact on livelihood, mining, livestock and range management practices available and influencing programmes in other catchments	The Khubelu programme has a positive effect that is worth replicating	Research Report available (yes/no)	Report
<b>4.6</b>	Feasibility Study for establishing the upper Khubelu catchment as a protected area	Stakeholders agree on the establishment of a protected area in the upper Khubelu catchment	Feasibility Report available (yes/no)	Report











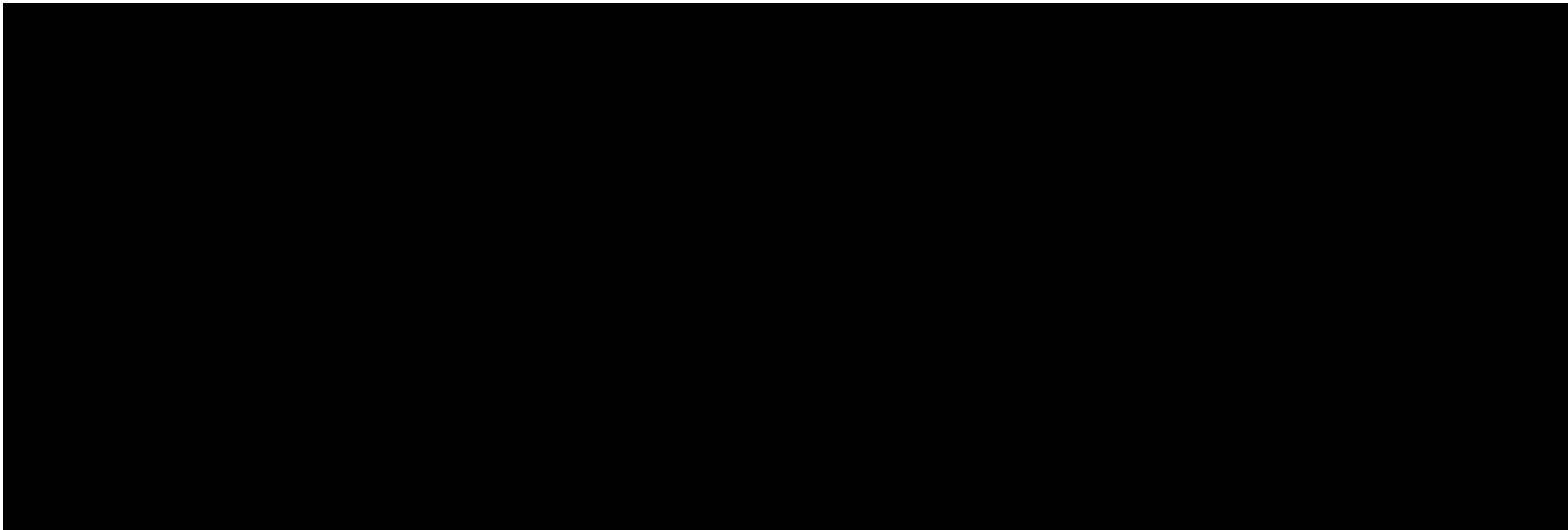
Programme for Protection and Conservation of the upper Orange-Senqu Catchment Area		Programme Costs									GOL Costs (salaries, transport and allowances)					
		Programme Cost				Annual Budgets					GOL Costs	Annual Budgets				
		Investments	Recurrent costs	TA	Programme Expenditures	Year 1 (incl Inception)	Year 2	Year 3	Year 4	Year 5		Year 1 (incl Inception)	Year 2	Year 3	Year 4	Year 5
<b>Activities</b>																
<b>1.1</b>	<b>Activities related to output 1.1 Managed Resource Committee (MRC) established for the</b>	0	80,000	160,000	240,000	240,000	0	0	0	0	238,000	238,000	0	0	0	0
1.1.1	Consultations at national, district and community level on functions of the MRC		20,000	40,000	60,000	60,000	0	0	0	0	56,000	56,000	0	0	0	0
1.1.2	Workshop for the communities, Chiefs, CCs and district stakeholders on establishment of MRC		20,000	40,000	60,000	60,000	0	0	0	0	56,000	56,000	0	0	0	0
1.1.3	Formulation and gazettement of bylaws for MRC		40,000	80,000	120,000	120,000	0	0	0	0	126,000	126,000	0	0	0	0
<b>1.2</b>	<b>Activities related to output 1.2 Grazing plan for Khubelu catchment based on re-established</b>	0	320,000	420,000	740,000	530,000	210,000	0	0	0	707,000	528,500	178,500	0	0	0
1.2.1	Data collection on livestock in the Khubelu Catchment		50,000	60,000	110,000	110,000	0	0	0	0	217,000	217,000	0	0	0	0
1.2.2	Data collection on the natural resources, vegetation, soil types etc in the Khubelu Catchment		150,000	100,000	250,000	250,000	0	0	0	0	217,000	217,000	0	0	0	0
1.2.3	GIS mapping of range management areas and formulation of proposed grazing plan		100,000	240,000	340,000	170,000	170,000	0	0	0	189,000	94,500	94,500	0	0	0
1.2.4	Workshop and consultations with the livestock owners, Chiefs, CCs and district stakeholders on the grazing plan and agreement		20,000	20,000	40,000	0	40,000	0	0	0	64,000	0	64,000	0	0	0
<b>1.3</b>	<b>Activities related to output 1.3 MRC and capacitated herders, livestock owners, grazing</b>	0	20,000	240,000	260,000	0	122,857	45,714	45,714	45,714	1,113,000	0	255,000	286,000	286,000	286,000
1.3.1	Training workshops for herders, livestock owners, grazing associations, MRC members and chiefs in grazing regulations		20,000	80,000	100,000	0	100,000	0	0	0	112,000	0	112,000	0	0	0
1.3.2	Administration of grazing permit systems by CCs and Chiefs and inspection of range lands			80,000	80,000	0	11,429	22,857	22,857	22,857	714,000	0	102,000	204,000	204,000	204,000
1.3.3	Monitoring of compliance with the grazing regulations and reporting			80,000	80,000	0	11,429	22,857	22,857	22,857	287,000	0	41,000	82,000	82,000	82,000
<b>1.4</b>	<b>Activities related to output 1.4 Capacitated District Administration supporting sustainable</b>	0	936,000	520,000	1,456,000	736,000	468,000	84,000	84,000	84,000	840,000	509,600	309,400	7,000	7,000	7,000
1.4.1	Consultations at national, district and community level on livestock management and improved livestock registration, control of stock theft, improved livestock breeds vs reduction in numbers etc			160,000	160,000	160,000	0	0	0	0	56,000	56,000	0	0	0	0
1.4.2	Capacity building of range management department in Mokhotlong incl tools for land use planning (GIS system for support to MRCs) and improve the capacity for analysing and managing the natural resources including participatory planning skills		300,000	200,000	500,000	300,000	200,000	0	0	0	189,000	113,400	75,600	0	0	0
1.4.3	Provide a Grazing Control Officer for Khubelu (to be taken over by GOL after end of programme)		336,000	0	336,000	0	84,000	84,000	84,000	84,000	28,000	0	7,000	7,000	7,000	7,000
1.4.4	Support to implementation of livestock registration in Khubelu and livestock improvement programmes		300,000	160,000	460,000	276,000	184,000	0	0	0	567,000	340,200	226,800	0	0	0

Programme for Protection and Conservation of the upper Orange-Senqu Catchment Area		Programme Costs									GOL Costs (salaries, transport and allowances)					
		Programme Cost				Annual Budgets					GOL Costs	Annual Budgets				
		Investments	Recurrent costs	TA	Programme Expenditures	Year 1 (incl Inception)	Year 2	Year 3	Year 4	Year 5		Year 1 (incl Inception)	Year 2	Year 3	Year 4	Year 5
<b>Activities</b>																
<b>2.1</b>	<b>Activities related to output 2.1 Grasses (Vetiver and local grasses) for biological rehabilitation of</b>	200,000	135,000	240,000	575,000	445,000	104,000	8,667	8,667	8,667	819,000	532,000	229,600	19,133	19,133	19,133
2.1.1	Study of previous research on biological gully control and preparation of scope for pilot testing projects		35,000	40,000	75,000	75,000	0	0	0	0	35,000	35,000	0	0	0	0
2.1.2	Implementation of 10 Pilot sites	200,000	50,000	120,000	370,000	370,000	0	0	0	0	497,000	497,000	0	0	0	0
2.1.3	Monitoring of results in the pilot sites and documentation of lessons learned		50,000	80,000	130,000	0	104,000	8,667	8,667	8,667	287,000	0	229,600	19,133	19,133	19,133
<b>2.2</b>	<b>Activities related to output 2.2 Community Councils capacitated in implementation and</b>	400,000	60,000	240,000	700,000	0	140,000	186,667	186,667	186,667	476,000	0	56,000	140,000	140,000	140,000
2.2.1	Training workshops for MRC and CC members in implementation and maintenance of biological rehabilitation of wetlands		20,000	120,000	140,000	0	140,000	0	0	0	56,000	0	56,000	0	0	0
2.2.2	Support to CCs in implementation of rehabilitation projects incl materials	400,000	40,000	120,000	560,000	0	0	186,667	186,667	186,667	420,000	0	0	140,000	140,000	140,000
<b>2.3</b>	<b>Activities related to output 2.3 Designs of physical gully control structures tested in the</b>	400,000	50,000	200,000	650,000	650,000	0	0	0	0	462,000	462,000	0	0	0	0
2.3.1	Study of gully rehabilitation structures and design of pilot project in Khubelu wetlands		10,000	80,000	90,000	90,000	0	0	0	0	35,000	35,000	0	0	0	0
2.3.2	Support to CCs in implementation of rehabilitation projects in the Khubelu wetlands	400,000	40,000	120,000	560,000	560,000	0	0	0	0	427,000	427,000	0	0	0	0
<b>2.4</b>	<b>Activities related to output 2.4 Rehabilitated wetlands monitored and maintained</b>	200,000	70,000	280,000	550,000	100,000	112,500	112,500	112,500	112,500	315,000	35,000	70,000	70,000	70,000	70,000
2.3.1	Support to MRC in establishing monitoring programme for rehabilitated wetlands		20,000	80,000	100,000	100,000	0	0	0	0	35,000	35,000	0	0	0	0
2.3.2	Regular monitoring of rehabilitated wetlands		10,000	120,000	130,000	0	32,500	32,500	32,500	32,500	140,000	0	35,000	35,000	35,000	35,000
2.3.3	Support to CCs in implementation of remedial measures if needed	200,000	40,000	80,000	320,000	0	80,000	80,000	80,000	80,000	140,000	0	35,000	35,000	35,000	35,000
<b>3.1</b>	<b>Activities related to output 3.1 Designs of environmentally safe road drain discharge</b>	500,000	80,000	160,000	740,000	650,000	22,500	22,500	22,500	22,500	245,000	210,000	8,750	8,750	8,750	8,750
3.1.1	Support to Roads Department in design of environmentally safe discharge structures including survey of pilot sites, design, preparation of BOQ etc		50,000	40,000	90,000	90,000	0	0	0	0	35,000	35,000	0	0	0	0
3.1.2	Implementation of pilot structures	500,000	20,000	40,000	560,000	560,000	0	0	0	0	175,000	175,000	0	0	0	0
3.1.3	Monitoring and reporting on the effect of the pilot structures		10,000	80,000	90,000	0	22,500	22,500	22,500	22,500	35,000	0	8,750	8,750	8,750	8,750
<b>3.2</b>	<b>Activities related to output 3.2 Guidelines and design standards for road drain discharge</b>	0	20,000	60,000	80,000	50,000	30,000	0	0	0	28,000	19,600	8,400	0	0	0
3.2.1	Study of experience internationally of environmentally safe road drainage designs		10,000	20,000	30,000	30,000	0	0	0	0	14,000	14,000	0	0	0	0
3.2.2	Development of guidelines and design standards based on results of pilot project and international best practices		10,000	40,000	50,000	20,000	30,000	0	0	0	14,000	5,600	8,400	0	0	0
<b>3.3</b>	<b>Activities related to output 3.3 Road Department technical staff capacitated in environmentally</b>	0	40,000	40,000	80,000	0	80,000	0	0	0	21,000	0	21,000	0	0	0
3.3.1	Training workshops for Roads Department design engineers and supervisors in road drainage design and implementation		20,000	20,000	40,000	0	40,000	0	0	0	14,000	0	14,000	0	0	0
3.3.2	Workshop for consultants on the guidelines and design standards for road drainage		20,000	20,000	40,000	0	40,000	0	0	0	7,000	0	7,000	0	0	0

Main Final Report, Report Number ORASECOM 004/2008

Programme for Protection and Conservation of the upper Orange-Senqu Catchment Area		Programme Costs									GOL Costs (salaries, transport and allowances)					
		Programme Cost				Annual Budgets					GOL Costs	Annual Budgets				
		Investments	Recurrent costs	TA	Programme Expenditures	Year 1 (incl Inception)	Year 2	Year 3	Year 4	Year 5		Year 1 (incl Inception)	Year 2	Year 3	Year 4	Year 5
<b>Activities</b>																
<b>4.1</b>	<b>Activities related to output 4.1 Stakeholder roles and strategies in wetlands, water resources and</b>	0	55,000	220,000	275,000	275,000	0	0	0	0	203,000	203,000	0	0	0	0
4.1.1	Study of functions related to NRW/ WRM and wetlands in MoFLR, MoAFS, MNR, MoTEC at national and district level and of local government structures and civil society stakeholders		15,000	120,000	135,000	135,000	0	0	0	0	119,000	119,000	0	0	0	0
4.1.2	Preparation of draft function analysis report outlining the roles of stakeholders at all levels on monitoring and management of wetlands		10,000	20,000	30,000	30,000	0	0	0	0	14,000	14,000	0	0	0	0
4.1.3	Consultations including workshops at national and district level on functions		20,000	40,000	60,000	60,000	0	0	0	0	56,000	56,000	0	0	0	0
4.1.4	Preparation of function analysis report and dissemination of results including action plan for implementation		10,000	40,000	50,000	50,000	0	0	0	0	14,000	14,000	0	0	0	0
<b>4.2</b>	<b>Activities related to output 4.2 MRC monitoring system (including wetlands GIS) established</b>	0	75,000	160,000	235,000	170,000	16,250	16,250	16,250	16,250	280,000	105,000	43,750	43,750	43,750	43,750
4.2.1	Design and implementation of simple monitoring system for MRC monitoring of resources incl wetlands in Khubelu		25,000	40,000	65,000	65,000	0	0	0	0	56,000	56,000	0	0	0	0
4.2.2	Training of MRC and CCs in monitoring of wetlands and support to data collection		25,000	80,000	105,000	105,000	0	0	0	0	49,000	49,000	0	0	0	0
4.2.3	Reporting to DWA, quality control and feedback to MRC on wetlands data		25,000	40,000	65,000	0	16,250	16,250	16,250	16,250	175,000	0	43,750	43,750	43,750	43,750
<b>4.3</b>	<b>Activities related to output 4.3 Hydrological station and weather station established in the</b>	750,000	100,000	120,000	970,000	925,000	11,250	11,250	11,250	11,250	175,000	122,500	13,125	13,125	13,125	13,125
4.3.1	Specification, study of possibility of rehab of SG015, and procurement of hydrological station and weather station in the upper Khubelu catchment	750,000	50,000	80,000	880,000	880,000	0	0	0	0	70,000	70,000	0	0	0	0
4.3.2	Agreement and training of MRC in the operation and maintenance of the monitoring stations. Follow-up on data collection and data control		50,000	40,000	90,000	45,000	11,250	11,250	11,250	11,250	105,000	52,500	13,125	13,125	13,125	13,125
<b>4.4</b>	<b>Activities related to output 4.4 Research results on wetlands hydrology in the highlands of</b>	0	120,000	60,000	180,000	40,000	17,500	17,500	17,500	87,500	161,000	42,000	19,250	19,250	19,250	61,250
4.4.1	Design of research programme and specification of data requirements		20,000	20,000	40,000	40,000	0	0	0	0	42,000	42,000	0	0	0	0
4.4.2	Recurrent analysis of data from Khubelu monitoring and possible adjustments to the data collection programmes		50,000	20,000	70,000	0	17,500	17,500	17,500	17,500	77,000	0	19,250	19,250	19,250	19,250
4.4.3	Analysis, preparation of research report and dissemination to stakeholders locally and Orasecom countries		50,000	20,000	70,000	0	0	0	0	70,000	42,000	0	0	0	0	42,000
<b>4.5</b>	<b>Activities related to output 4.5 Research results on programme impact on livelihood, mining,</b>	0	120,000	60,000	180,000	47,778	15,556	15,556	15,556	85,556	175,000	64,556	17,111	17,111	17,111	59,111
4.5.1	Design of research programme and specification of data requirements		20,000	20,000	40,000	40,000	0	0	0	0	56,000	56,000	0	0	0	0
4.5.2	Recurrent analysis of data from Khubelu monitoring and possible adjustments to the data collection programmes		50,000	20,000	70,000	7,778	15,556	15,556	15,556	15,556	77,000	8,556	17,111	17,111	17,111	17,111
4.5.3	Analysis, preparation of research report and dissemination to stakeholders locally and Orasecom countries		50,000	20,000	70,000	0	0	0	0	70,000	42,000	0	0	0	0	42,000

Programme for Protection and Conservation of the upper Orange-Senqu Catchment Area		Programme Costs									GOL Costs (salaries, transport and allowances)					
		Programme Cost				Annual Budgets					GOL Costs	Annual Budgets				
		Investments	Recurrent costs	TA	Programme Expenditures	Year 1 (incl Inception)	Year 2	Year 3	Year 4	Year 5		Year 1 (incl Inception)	Year 2	Year 3	Year 4	Year 5
<b>4.6</b>	<b>Activities related to output 4.6 Feasibility Study for establishing the upper Khubelu catchment</b>	0	470,000	160,000	630,000	0	468,000	66,000	48,000	48,000	329,000	0	129,500	59,500	70,000	70,000
4.6.1	Preparation of TOR and tendering for consultant for feasibility study		240,000	80,000	320,000	0	320,000	0	0	0	35,000	0	35,000	0	0	0
4.6.2	Consultation with stakeholders at local, district and national level as well as regional on the purpose and benefits for protecting the upper Khubelu catchment areas (and possibly the entire Drakensberg escarpment)		100,000	20,000	120,000	0	120,000	0	0	0	70,000	0	70,000	0	0	0
4.6.3	Assessment of the social, technical, financial, legal and environmental feasibility of establishing a protected area		20,000	20,000	40,000	0	28,000	12,000	0	0	35,000	0	24,500	10,500	0	0
4.6.4	Preparation and presentation of a feasibility report		10,000	20,000	30,000	0	0	30,000	0	0	14,000	0	0	14,000	0	0
4.6.5	Implementation of outcome of feasibility study		100,000	20,000	120,000	0	0	24,000	48,000	48,000	175,000	0	0	35,000	70,000	70,000
<b>5</b>	<b>Programme Management</b>	500,000	100,000	5,260,000	5,860,000	1,776,190	1,020,952	1,020,952	1,020,952	1,020,952	217,000	73,000	36,000	36,000	36,000	36,000
5.1	Establish programme office	500,000			500,000	500,000	0	0	0	0	28,000	28,000	0	0	0	0
5.2	Recurent running of programme, financial management and reporting		100,000	5,260,000	5,360,000	1,276,190	1,020,952	1,020,952	1,020,952	1,020,952	189,000	45,000	36,000	36,000	36,000	36,000
		2,950,000	2,851,000	8,600,000	14,401,000	6,634,968	2,839,365	1,607,556	1,589,556	1,729,556	6,804,000	3,144,756	1,395,386	719,619	730,119	814,119



## ANNEX D: LIST OF PEOPLE CONSULTED

### Stakeholders at Central level Contacted in 2008

NAME	DEPARTMENT/MINISTRY	POSITION	TELEPHONE	MOBILE PHONE	ADDRESS
<b>DEPARTMENT OF WATER AFFAIRS</b>					
Mr. S. Lerotholi	DWA				
Ms. L. Motanya	DWA				
Mr. Mefi	DWA				
<b>MINISTRY OF WORKS</b>					
Mr. L. Phooko	Works	Principal Secretary	22323624	58851586	
M. Ntlhakana	Department of Rural Roads	Principal Engineer	22316269	63060216	
K. Mare	Department of Rural Roads	Principal Technical Officer	22316269	58777905	
<b>MINISTRY OF AGRICULTURE AND FOOD SECURITY</b>					
Mr. Mohale Sekoto	Ministry of Agriculture	Principal Secretary	22316410		
Dr. M. Molomo	Department of Livestock	Director of Livestock	22312318		
Mrs. S. Mofolo	Department of Livestock-Fisheries	Principal Livestock Development Officer-Fisheries			
<b>MINISTRY OF TOURISM, ENVIRONMENT AND CULTURE</b>					
S. M. Damane	Department of Environment	Director	223320534	62000010	Box 10993 Maseru 100
Mr. T. Busa	Department of Environment	Environment Officer (EIA)	22311767	58183888	Box 10993 Maseru 100 busatsikoe@yahoo.com

NAME	DEPARTMENT/MINISTRY	POSITION	TELEPHONE	MOBILE PHONE	ADDRESS
M. Rammoko	Environment	Environment Officer	22311767	58856814	rammoko@yahoo.com
M. Mohai	MDTP	DCCP	22312662	62864644	mmohai@maloti.org.ls
M.J. Mosenye	Environment	DNP	22326075/311767	58549460	johnmosenye@yahoo.co.uk
A. Ratsele	Environment	Senior Environment Officer	223111767	58455831	Box 52/10993 Maseru 100 apesi2000@yahoo.com
B. Theko	Environment	R.E	22311767	63134824	bokangtheko@yahoo.com
L.M. Sekhamane	Department of Environment	PEO (O) a.i	22311767	63058262	lmsekhamane@gmail.com
T.P Selikane	Environment-LNP	Manager	22460723	58795796	selikanetp@datacom.co.ls
<b>MINISTRY OF FORESTRY AND LAND RECLAMATION</b>					
Mrs M 'Mota	Ministry of Forestry and Land Reclamation	Principal Secretary		58859532	
Mr. H. Matsipa	Department of Forestry	Acting Director, Forestry Dept.			
Mrs. L.M. Thulo	Department of Range Management	Director, Range Management			
Mr. Thabo	Department of Range Management	Range Management Officer - Planner			
<b>NATIONAL WETLANDS COMMITTEE</b>					
L. Motanya	DWA	Senior Engineer Water Resources			
T. Mefi	DWA	CTO-GIS			
M. Mojakisane	Forestry and Land Reclamation	Conservation Officer			
M. Tsehlo	Participatory Ecological Land Use Management (PELUM)	Country Coordinator			



NAME	DEPARTMENT/MINISTRY	POSITION	TELEPHONE	MOBILE PHONE	ADDRESS
M. Damane	DWA	Hydro-geologist			
M. Lesupi	DRWS	Principal Engineer- DRWS			
P. Mokebe	LHDA	Conservation Officer			

**Stakeholders at District level in meetings held March 19-20, 2008**

NAME	DEPARTMENT/MINISTRY	POSITION	TELEPHONE	E-MAIL	ADDRESS
<b>LERIBE</b>					
Mr. Malefetsane Nthimo	Forestry and Land Reclamation	District Coordinator	58953551	<a href="mailto:maljnthimo@yahoo.com">maljnthimo@yahoo.com</a>	Box 262, Leribe 300
Mr. Makoma Mabaleha	Forestry and Land Reclamation	Range Technical Officer	22400241		Box 262, Leribe 300
Mr. Tlali Lekhela	Agriculture and Food Security	District Agricultural Officer	62345678 22400332		Box 9, Leribe
Mr. N. Makhata	Rural Water Supply	DE	22430235	<a href="mailto:vwss@leo.co.ls">vwss@leo.co.ls</a>	Box 498. Maputsoe 350
Ms. N. Mohapelo	Rural Roads	Technical Officer	22400654 63082227		Box 881, Leribe
Mr. A.M. Lehloenya	Local Government	District Administrator	58883563 22400293		Box 1, Leribe
Mr. Molise Mofolo	Local Government	Chairperson District Council	22400874 58784282		
<b>BUTHA-BUTHE</b>					

NAME	DEPARTMENT/MINISTRY	POSITION	TELEPHONE	E-MAIL	ADDRESS
Mr. R. Majoro	District Administration	Administrative Manager (Act)	22460202 58927311		Box 2 Butha-Buthe 400
Mr. L. Ramokotso	Meteorology	Technical Officer	22461791 58529175		Box 743 Butha-Buthe 400
Mr. T. Khechane	WASA	Technical Officer	22460254		Box 331 Butha-Buthe
Mr. T. Bokaako	Agriculture and Food Security	District Irrigation Officer	22460490/ 215 58765079	<a href="mailto:Thoso_bokaako@yahoo.com">Thoso_bokaako@yahoo.com</a>	Box 15, Botha-Bothe
Mr. T. Lethunya	Agriculture and Food Security	District Animal Production Officer	22460490 63143674		P.O. Box 15 Botha-Bothe 400
<b>MOKHOTLONG</b>					
Ms. Makhothatso Tsita	Local Government	District Administrator	22920202/291 58974992	<a href="mailto:makhothatso@yahoo.com">makhothatso@yahoo.com</a>	Box 45 Mokhotlong 500
Mr. Ntai Lepheana	Ministry of Agriculture and Food Security	District Agricultural Officer	22920359 62775403		Box 11 Mokhotlong 500
Ms. Mamathe Makhaola	Rural Water Supply	District Engineer	22920256 63776363	<a href="mailto:rws@leo.co.ls">rws@leo.co.ls</a>	Box 110 Mokhotlong, 500
Mr. Chesetsi Ntsiki	Agriculture and Food Security	District Extension Officer	22920211		Box 11 Mokhotlong, 500
Mr. Leboela	Letseng-la-Terae Mine	Health Safety and Environment Manager	62844992		

**Stakeholder meeting Held at Senqu Hotel Mokhotlong, August 11, 2008**

NAME	VILLAGE/Department	Position	Address	Telephone	Cell
Mohanoe Tuke		GCS Khubelu	Khatleli , P.O 245 Mapholaneng		58485353
Thabo Polihali	LMPS Mokhotlong	STDU	Box 29, Mokhotlong	22920203	58061574
'Masakoane Sakoane	Tiping, Mapholaneng J03	Council	P.O.Box 2 Mapholaneng		63263164
Lephele Lethunya	Mofolaneng	Morena CC	Mapholaneng		63170842
Mabatho Nthejane	Ranage Management	Range Management Officer	P/Bag 39, Mokhotlong	22920342	63043927
Mokotjo Sekonyela	Popa	Member	Popa Bx 247, Mapholaneng		58445638
Tlhatlhosi Tlhatlhosi	MOAFS	DAPO	Box 11 Mokhotlong Simontlhatlhosi @gmail.com	22920229	63249713
Paballo Molefi	Paballong	GCS Khubelu, Chair	Paballong , Thaba-limpe P.O Tlokoeng		63261420
Muso Lesefa	Limonkaneng	GCS Khubelu	Limonkaneng P.O. Tlokoeng Box 120		63183938
Liphapang Matubatuba	Paelaitlhatsoa	Wetlands	Limonkaneng P.O. Tlokoeng Box 120		63183938
Tatasela Mothokoa	Tloha-re-bue Local Government Council	Messenger	Tloha-re-bue P.O.Tlokoeng Malingoaneng	Office cell: 58492205	58101056

Tabooane Lekanyane	Lichecheng	Member			
Castone Leshala	Orange River Hoek	Member	Box 137 Mokhotlong		
Khabele Mohasane	Limonkaneng	Herder	Limonkaneng, Mokhotlong		
Masekete Thene	Molikaliko Mafulane J06	Local CC Member	P.O.Box 137		
Molefe Mpesi	District Office				

**ANNEX E: MINUTES FROM STAKEHOLDER CONSULTATIONS****Please refer to the Inventory Report Report for records of meeting until June 2007****Record of Stakeholder group discussions on educational needs, August 2008:****Grazing Associations****a. Herders**

Formal training for herders should be established where they get trained to obtain at least a Primary leaving School Certificate. In the past GROW (an NGO at Mokhotlong) used to offer informal literacy training for herders although its concentration was in the Mokhotlong ward and less at Malingoaneng. Workshops should also be held for herders where they are trained on the protection of rangelands, river sources and wetlands. They should also be taught about good behaviour

**b. Grazing Associations**

There should be a map that demarcates the grazing areas A, B and C and people trained about the difference in these sections.

C. Grazing associations' activities include the following:

- Inspection of rangelands
- Impounding of trespassing animals
- Registration of animals

**Recommendations**

- a. In order to facilitate the smooth running of the executive committee and the rangers should be given an incentive.
- b. The principal chief and the police should protect the rangers and grazing associations when they are conducting the activities mentioned above
- c. Joint workshops for grazing associations, chiefs and community councils should be held to iron out their differences and promote common understanding of their responsibilities in the protection of the rangelands and wetlands as the two are intertwined. In such workshops, participants should be provided with accommodation since many come from remote areas and per diem as an incentive.

**Participants**

Mr. Paballo Molefi	Member of Association
Mr. 'Muso Lesefa	Member of Association
Mr. Khabele Mahasane	Herder
Mr. Liphapang Matubatuba	Wetlands committee
Mr. Taboane Lekanyane	Farmer

### **Lesotho Mounted Police Service (STDU)**

Participant: Mr. Thabo Polihali

1. The LMPS should be provided with the grazing policy and be taught about it.
2. A rangelands map that demarcates the grazing areas of A, B and C should be provided. The police should be taught on how to use this map to assist in the protection of the rangelands and wetlands. They should also be taught about its meaning to the police in order to facilitate their job.
3. Herders should be provided with the grazing permits as well as the identification documents of their livestock at the cattle posts to avoid stock theft and for ease of reference when needed. This will also help in ensuring that livestock numbers are kept within the recommended carrying capacities.
4. Herders should be clearly taught about range management procedures.
5. Police should always be invited to the workshops that are discussing range management issues so that they could continue to learn.
6. Law enforcement should be ensured and law upheld by everybody involved.
7. All concerned parties should integrate patrolling of the rangelands in their activities in order to strengthen their protection and management.

### **Chiefs and Local Government Community Councils**

We require workshops in the following areas:

- a. Chiefs and principal chiefs responsibilities in the mountains and cattleposts in light of the introduction of community councils
- b. Local government councils responsibilities regarding management of grazing areas to resolve disputes between them and chiefs about C grazing areas and how far they stretch.
- c. Who should issue grazing permits for C grazing areas between grazing associations and community councils?
- d. Simple ways of livestock registration

Group Members

Morena Castene Leshota – O.R. Hoek

Morena Mokotjo Sekonyela- Popa

Tatasela Mothokoa – Principal Chief's Office, Malingoaneng

Morena Lephele Lethunya – Mofolaneng JO3

'Masakoane Sakoane – Community Council Mapholaneng JO3

'Masekete Thene – Community Council Molikaliko, JO6

Mr. Molefe Mpesi – DA Office

**District Officers in Range Management:**

The following capacity building needs were identified

Course	Position	Number	Qualification	Staff Shortage
GIS Environmental Impact Assessment	1. Range Management	1	BSC Agric	-
	• Range Officer	1	Diploma Agric	2
	• Range Technical Officer			
	2. Livestock Production	1	Diploma Agric	-
	• Animal Production Officer	1	Diploma Agric	-
	• Area Technical Officer			
Wetland Management Computer Literacy	Range Technical Officer	1	Diploma Agric	2
	Area Technical Officer	1	Diploma Agric	-
Map reading Rangeland inventory and monitoring	Grazing control supervisors	2	Form C & E	2
	Agricultural assistants	3	Cert Agric	2

## Group Members

Ms. 'Mabatho Nthejane

Mr. Mohanoe Tuke

Mr. Tlhatlhosi Tlhatlhosi

**Ministry of Forestry and Range Management:**

Qualifications levels for staff that would carry out management of the RMA:

1. A Grazing Control Supervisor – Ability to read and write, and knowledge of the boundaries of the grazing areas; Knowledge of the range management regulations
2. Range Technical Officer- Diploma:
  - Range Science/ Forestry/ Natural Resources
  - Conflict Management
  - Public address and extension
  - Mapping

**Capacity Building needs identified by Department of Water Affairs (DWA)**

Name	Present Qualification	Institution offering desired course	Desired Course
P. Matete- Engineer	B-Tech	Tswane University of Technology	Environmental Engineering (MSC)
M. Maseatile Senior Systems analyst	MSC water resources engineering and management		GIS Management (GIMS Johannesburg) MBA (SA/UK)
M. Fanana Environmental Officer	BSC (Hons) Environmental Management		MSc Environmental Management
M. George Water resources engineer	MSC Water & Environmental Management		Project Management
T. Mefi Chief Technical Officer	Diploma in Surface Water GIS Management		GIMS Johannesburg



## **Ministry of Works, Roads Department: Request for Mainstreaming Environmental and Social Issues in Ministry's Activities**

### **Environmental Policy**

The Ministry's policy in issues related to environment is as follows:

***Ensuring the integration of environmental and socio-economic issues in the planning, implementation and operations and maintenance of transport infrastructure and services.***

The Ministry will implement the policy by:

- a) *Improving the planning and decision making processes regarding environmental and socio economic dimensions of the transport sector activities.*
- b) *Providing guidance in promoting ecologically sustainable transport*
- c) *Managing and mitigating key bio-physical and socio-economic impacts of the transport sector activities.*
- d) *Raising awareness by training and otherwise towards mainstreaming environmental and social safeguards.*
- e) *Building functional relationships with transport sector partners, the community and the allied transport industries*

### **Interim Arrangement which need to be in place for the ministry to implement the policy:**

- a. The ministry will establish environmental unit consisting of the following staff:
  - i. Principal Environmental Officer
  - ii. 3 Senior Environmental and Social Officers
  - iii. Compensation and Resettlement Officer

In order to capacitate the above officers, there is a need to engage two local specialists in issues related to environment and social issues who will train on-the-job newly recruited Ministry's staff.

Name of the Position	Duration	Estimated cost
Senior Social and Environmental Specialist	24months	M960,000
Social and Environmental Specialist	24months	M800,000
Total		M1,760,000

- b. Mainstreaming of the environmental and social issues in the ministry's activities by training Ministry's professionals and technicians who are responsible for ministry's activities is a key to success in the integration of environmental and socio-economic issues in the planning, implementation and operations and maintenance of building and transport infrastructure including services. The ministry therefore, needs funds for training of professionals and technicians as follows:

Name of the Position	Total training person months	Estimated cost
Engineers, Architects, Quantity Surveyors, Building Design Specialist, other professionals in construction and in provision of services	20 person months	M1,500,000
Training of Technicians at TY training Center	60 person months	M800,000

Training of Trainers	5 person months	M300,000
Orientation of Consultants and Contractors through workshops		M300,000
		M2,900,000

The ministry is responsible for construction, upgrading, rehabilitation and maintenance of a road network totalling more than 7500kms of road. Furthermore, the ministry continues to open up access roads in the remote areas of Lesotho. Therefore there is a need to set up a pilot project which will look at most effective and efficient methods of integrating environmental issues in construction within project area (mainly for reduction of negative impacts contributed by existing and new road infrastructure). The lessons learned from the project area will be expanded into other projects and will form part of the training material for Ministry's staff.

The total estimated cost required for the pilot project at the rate of 2,000,000 per Km amounts to M40,000,000.

Total Funds required:

Pilot project	40, 000,000
Training	2, 900,000
Technical Assistant	1,760, 000
<b>Total</b>	<b>M44,660,000</b>

**PROPOSED TRAINING FOR CURRENT DEPARTMENT OF ENVIRONMENT STAFF**

<b>OFFICER DESIGNATION</b>	<b>PRESENT QUALIFICATIONS</b>	<b>PROPOSED TRAINING</b>	<b>DURATION</b>
Principal Environment Officer (Outreach) i. a.	MSc in Environmental Management	PhD in Environmental Education	3 years
Senior Environment Officer (Ec).	MSc in Agric Economics	PhD in Environmental Economics	4 years
Environment Officer (Outreach).	BSc Hons in Agric	MSc in Environmental Management	2 years
Assistant Environment Officer.	BA Hons in Environmental Geography	MSc in Environmental Management	2 years
Senior Environment Officer (Data)	BSc Hons (GIS)	MSc in GIS	2 years
Environment Officer (Data)	BSc Hons	MSc in Environmental Management	2 years
Deputy Director- Parks	BSc Hons in Botany (Plant Ecology)	MSc in Plant Ecology/Systematics	2 years
Natural Resources Officer	BSc Hons in Environmental Management	MSc in Resource Conservation Biology	18 Months
Range Ecologist	BSc Hons in Botany	MSc in Plant Ecology	2 years
Environment Officer (EIA)	BSC	MSc in Environmental Management	2 years
Senior Environment Officer (Pollution Control)	BSc Hons	MSc in Engineering	1 year (UK)

**PROPOSED POSITIONS FOR THE DEPARTMENT OF ENVIRONMENT**

<b>PROPOSED POSITION</b>	<b>NUMBER OF POSITIONS</b>	<b>REQUIRED QUALIFICATIONS</b>
Principal Environment Officer (Outreach)	1	MSc in Environmental Education
Senior Environment Officer (Ec).	3	MSc in Environmental Education
Environment Officer (Outreach).	1	MSc in Environmental Education
Assistant Environment Officer	1	BSc in Environmental Education
Principal Environment Officer (Data)	1	MSc in GIS
Environment Officer (Data)	1	MSc in GIS

Senior Environment Officer (EIA)	1	MSc in Environmental Sciences
Principal Environment Officer (Pollution Control)	1	MSc In Environmental Engineering
Senior Environment Officer (Parks)	2	MSc in Wildlife Management/Nature Conservation
Park Manager	2	BSc in Nature Conservation
Park Technicians	4	Diploma in Natural Resources Management
Park Rangers	10	Certificate in Natural Resources Management

**ANNEX F: BIBLIOGRAPHY**

- Chakela, Q.K. (eds) 1997 State of the Environment in Lesotho. National Environment Secretariat, Ministry of Tourism, Environment and Culture
- DWA 2007 (draft) Inventory of the Wetlands of Lesotho
- GOL 2006. Conservation and Rehabilitation of Wetlands in the Highlands of Lesotho.
- GOL, 1997 Local Government Act 1997
- GOL, 2001 Environmental Act, 2001
- GOL, 2004 Local Government Act (Amendment) 2004
- GOL, 2007 (draft) Task 1 Report: Surface Water Management
- GOL, DWA 2005 Lesotho National Wetlands Management Programme
- GOL, Ministry of Natural Resources 2007 Draft IWRM Strategy for Lesotho
- GTZ 2007 Making Decentralisation Work (resource CD)
- Hem, J.D Study and Interpretation of Chemical characteristics of Natural Water. US Geological Survey paper 2254.
- IUCN 2002 The Lesotho Highland Water Project: Environmental Flow allocations in an International River
- IUCN 2007 The Zambezi Basin Wetlands Project Phase II
- Ivy D.and Turner S., 1996 "Range Management Areas and Grazing Associations – Experience at Sehlabathebe, Lesotho". In Centre for Development Cooperation Services, Successful Natural Resource Management in Southern Africa. Windhoek, Namibia: Gamsberg Macmillan Publishers (Pty) Ltd. Pp117-146
- LHDA 2001 Socio-Economic, Public Health and Nutrition Survey
- LHDA, 2002 Sediment Survey of Katse and Muela Reservoirs
- LHDA, 2005 Sediment Survey of 'Muela, Katse and Mohale Reservoirs'
- LHWP, 1996 Environmental Impact Assessment Phase 1B
- Marneweck and Grundling (1999), Wetlands of the Upper Catchment Areas of the Bokong, Malibatso and Matsoku Rivers in Leribe, Bokhotlong and Botha Bothe Districts of Lesotho. Afridev consultants and Lesotho Highlands Development Authority, Report No. 26/99.
- MCC, 2007 Supplemental Field Studies and Beneficiary Analysis Related to a Proposed Rehabilitation and Conservation Strategy for Wetlands in the Highlands of Lesotho
- MDTP, 2006 Bearded Vulture Population and Habitat Viability Assessment
- MDTP, 2007 Strategic Environmental Assessment For Proposed Senqu Sources Protected Area
- MDTP, 2007 (draft) Spatial Assessment of Biodiversity Priorities in the Lesotho

## Highlands

- Ministry of Natural Resources, Lesotho Water and Sanitation Policy. Maseru, Lesotho (2007).
- Ministry of Natural Resources Draft IWRM Strategy for Lesotho (2007 draft)
- Mokuku, C.; Lepono, T.; Mokhothu, M.; Khasipe, T.; Mokuku, T. (2002). Second state of the environment report Lesotho. National Environment Secretariat. Ministry of Tourism, Environment and Culture
- Mphale (2006). Values, Management and Contributions of the High Altitude Wetlands to Local Livelihoods. Ph.D. Thesis, University of Wales, Bangor
- RAMSAR Guidelines for Inventory, Assessment and Monitoring of Wetlands
- SADC (1995) Protocol on Shared Watercourse Systems in the Southern African Development Community (SADC) Region
- Schwabe, (1992). A preliminary Assessment of an Alpine Wetland in Bokong. Faculty of Agriculture, Department of Grassland Science, University of Natal, Pietermaritzburg
- Dixon, J. A., Scura, L. F., Carpenter, R. A. and Serman, P. B. 1994 Economic Analysis of Environmental Impacts. London: Earthscan
- Freeman, A. M. 1993. The Measurement of Environmental and Resource Values: Theory and Methods. Washington, D. C.: Resources for the Future.
- Kahn, J. R. 1998. The Economic Approach to Environmental and Natural Resources. The Dryden Press.
- Livestock Products Marketing Services (LPMS), 2008 Electronic data sets on wool and mohair production. Ministry of Trade and Marketing, Maseru, Lesotho
- TIETENBERG, T. 2000. Environmental and Natural Resource Economics. Addison Wesley.
- Millennium Ecosystem Assessment (MEA) 2003 Ecosystems and Human Well-being: A Framework for Assessment. A report of the conceptual framework Working Group of the Millennium Ecosystem Assessment. Washington, DC.: Island Press.
- Pearce, D. W. and Turner, R. K. 1990 Economics of Natural Resources and the Environment. Harvester Wheatsheaf