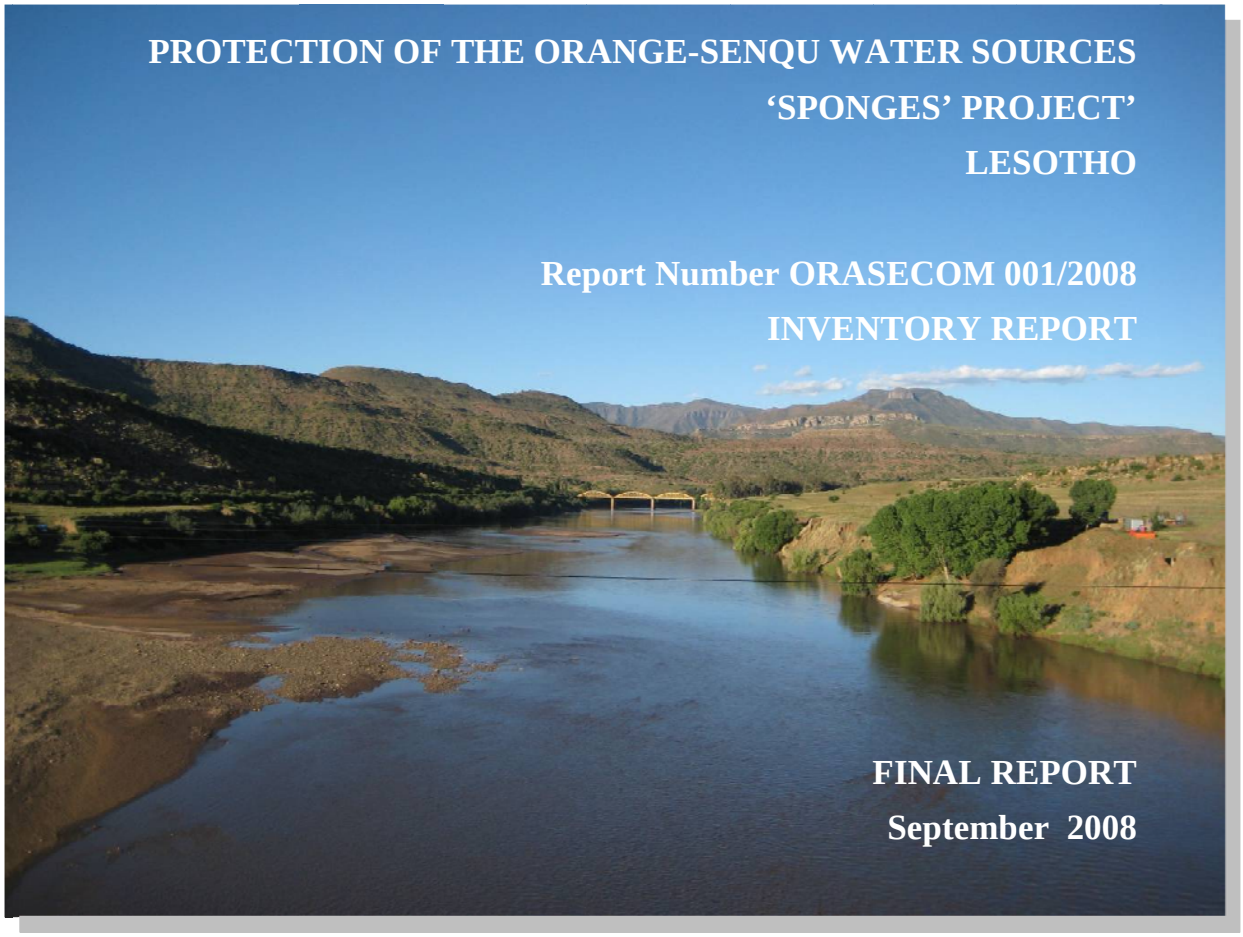
Sharing the Water Resources
Of the Orange-Senqu River Basin

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

Report Number ORASECOM 001/2008
INVENTORY REPORT



FINAL REPORT
September 2008

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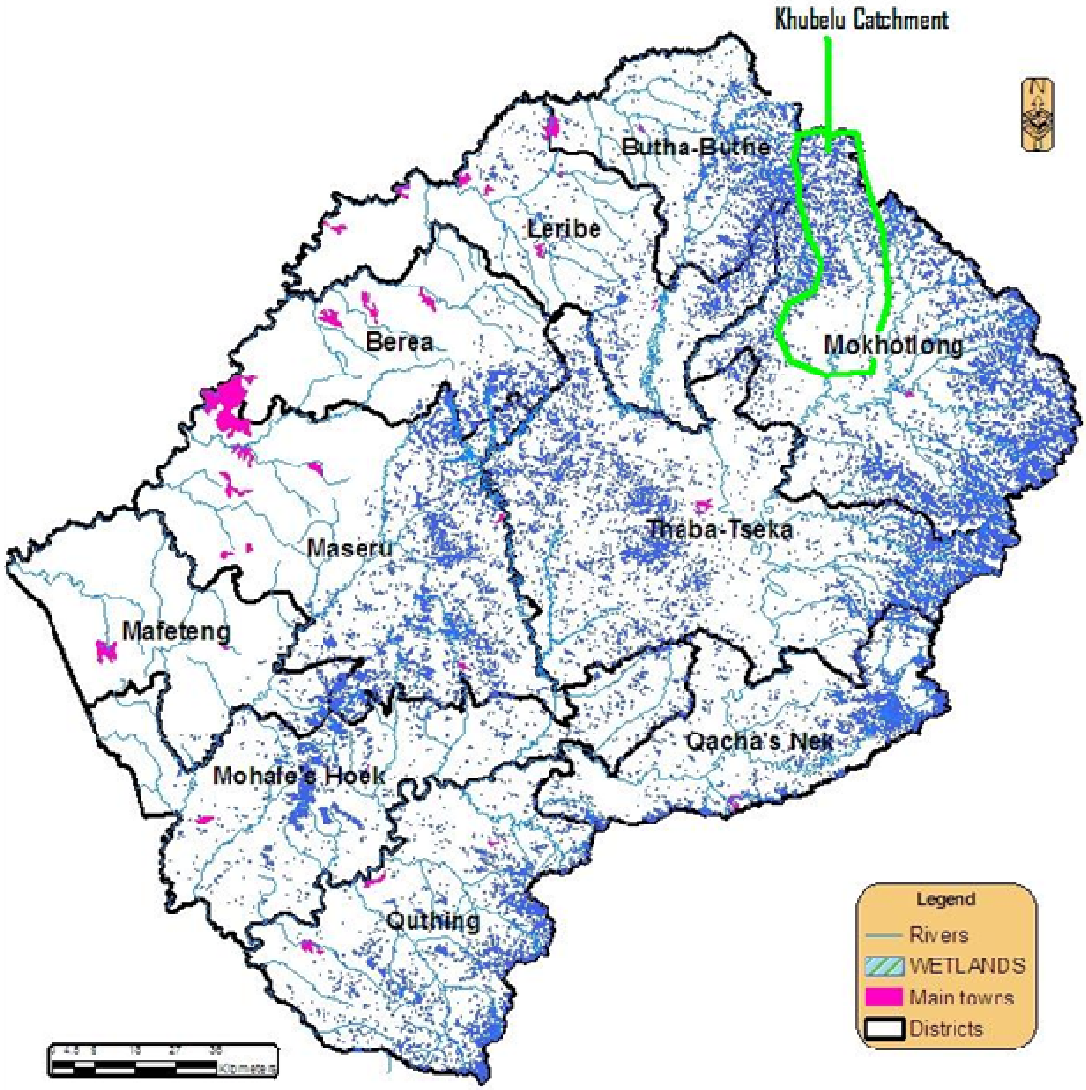
The reporting from the 'Sponges Project' consists of:

- **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): Final Report, September 2008. Accompanying the final report under separate cover are: *'Project Proposal for Pilot Project for Protection of Orange-Senqu River Water Sources'* and *'Brochure'* presenting the results of the Feasibility Study

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



EXECUTIVE SUMMARY

This Inventory Report presents the results of the Inventory Stage for the 'Feasibility Study of the Protection of Orange-Senqu River Water Sources ('Sponges' Project) by the Orange-Senqu River Commission (ORASECOM) funded by the French Global Environmental Facility (FFEM).

The background to the study, the project objectives and the approach and methodology that have been followed in the study are presented in Chapter 1. The findings of the Inventory Phase are presented in Chapter 2. A summary of the findings are outlined below.

Data: the review of the quality of the spatial data on wetlands available to the Department of Water Affairs (DWA) revealed difficulties in overlaying the various themes and importing information from one data source to another due to the use of different geographic projection systems.

The current DWA Geographical Information Systems (GIS)/ Wetlands Information System (WIS) platform, including all the other sources gathered during study and available data, provide only spatial information and lack attributes such as the Why? What? How? which needs to be recorded systematically in the metadata. As an initial step it has been suggested to standardize the Wetlands Inventory Sheet (Annex B) and Socio-Economic Questionnaires (Annex C) and allow for their inclusion as attributes to the corresponding layers.

For the systematic recording and management of the metadata, it is recommended to use the FGDC ESRI[1] especially when DWA is using ArcView 9.2 and its successors for manipulation of data and maps. For meta-data management it is advisable to provide data in decimal degrees preferably in the World Geodetic System (WGS) 1984 projection so that other users could easily project it to the preferred projection. The further development of the GIS WIS must take place through a continuous survey, mapping and classification of wetland ecosystems based on the standardized inventory sheets.

Study Area: The selection of the study area was done in coordination with DWA according to the following parameters and criteria:

- Wetlands falling within the category of Palustrine wetlands
- Wetlands which are sources of a major tributaries to the Orange-Senqu River
- Wetlands under pressure from development plans.
- Wetlands where little or no information is available.
- Wetlands which seem to be vulnerable and are not earmarked for future projects.

Through an exercise of exclusion of wetlands based on the established criteria, the Khubelu Catchment area surfaced as the area complying clearly with all of the criteria.

Wetlands Information: Through the compilation of all available spatial data it became evident that the details and quality of the information available as attributes and the meta-data were limited and hinder an appropriate analysis of the wetlands conditions. The field studies based on standardized inventory sheets proved useful and fairly simple to apply for the appropriate generation of the needed information.

[1] Federal Geographic Data Committee – Environmental Systems Research Institute

To obtain the information on a broader scale this approach would have to be adopted at district and community levels, which would require extensive capacity building at these management levels.

However, there is still a need for more in depth research on crucial aspects such as:

- Hydrological dynamics of wetlands
- Erosion measurement
- Methodological approaches to rehabilitation & restoration of degraded wetlands.
- Approaches to alternative livelihood options for wetland users.

More data analysis is needed to establish the trends in water retention capacity in the wetlands. DWA is in the process of digitising the river gauging stations in the neighbouring areas to Khubelu and when available this data will enable an assessment of trends in water retention.

Status of Wetlands: Although wetlands show signs of erosion, the outflow water quality 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. According to Marneweck and Grundling (1999) cited in National Wetlands Management Programme (2005), the average water loss due to degradation is 36%.

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

Range Management: According to the interviews, few livestock farmers move their livestock to the lower areas (grazing areas B and C) during winter; while others leave their livestock in the highland pastures (grazing area A) all year round despite the risk of disasters such as heavy snowfall that sometimes occur in winter and the problems with cattle thefts. This indicates that the wetlands may not be given appropriate time to regenerate.

The wetlands in Khubelu catchment are used by a majority of interviewees to graze animals and most of the cattle-posts are located around or within the wetlands.

Benefits of wetlands: Perception of the Cost and 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 alternate source.
- Wetlands are sometimes used for traditional rituals and for spiritual purposes. The famous place is Soloane in the Khubelu catchments.

- To assess the current value of the wetlands, it is needed to derive monetary values of the services. However, an estimation of the current value in monitory terms has also proven difficult as this depended on accurate livestock data and the willingness of people to reveal figures for their actual use of the wetlands.

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.

Pilot Project Area: It is proposed to continue the project activities in the Khubelu Catchment Area – focusing on the Upper and Middle Sections for the following reasons:

- no other projects already present
- poor communities
- need for further investigation on wetlands conditions (see above)
- representative in terms of Palustrine wetlands conditions and management issues
- Khubelu is an important or tributary to the Orange-Senqu and catchment for the proposed LHWP Phase II dam.

The Design Phase: The plans for the Design Phase of the project are presented in Chapter 3.

Detailed Information in annexes: technical information on the work done on the Wetlands Geographical Information System is enclosed in Annex A. The survey tools: 'Wetlands Data Sheet' and 'Socio-economic Inventory of the Wetlands' are presented in Annex B and C. Annex D presents information on the Institutional Framework for Wetlands Management and the detailed information on the implementation of the study: list of people consulted, minutes of stakeholder consultation meetings and bibliography are presented in Annex E, F and G.

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ABBREVIATIONS

CC	Community Council
DEM	Digital Elevation Model
DHI	Danish Hydraulic Institute
DO	Dissolved Oxygen
DRWS	Department of Rural Water Supply
DWA	Department of Water Affairs, Lesotho
EIA	Environmental Impact Assessment
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
GOL	Government of Lesotho
IWRM	Integrated Water Resource Management
LHDA	Lesotho Highlands Development Authority
LHWP	Lesotho Highlands Water Project
LSPP	Department of Land Surveys and Physical Planning
LUPD	Land Use Planning Division
M	Maloti (currency of the Kingdom of Lesotho)
MAE mm	Mean Annual Evaporation in mm
MAFS	Ministry of Agriculture and Food Security
MAP mm	Mean Annual Precipitation in mm
MAR	Mean Annual Runoff in mm
m.a.s.l.	Metres above sea level
MCC	Millennium Challenge Corporation (USA)
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
NES	National Environment Secretariat
NGO	Non-Governmental Organizations
NUL	National University of Lesotho
NWC	National Wetlands Committee

ORASECOM	Orange-Senqu River Commission
PEM Consult	People, Environment and Management
PIU	Project Implementation Unit (ORASECOM)
PRS	Poverty Reduction Strategy
PSC	Project Steering Committee (ORASECOM)
RMA	Range Management Area
SADC	Southern African Development Community
SPOT	Satellite images
SPSS	Statistical Package for Social Scientists
TCC	Tsoelopele Consultants & Contractors (Pty) Ltd.
UTM	Universal Transverse Mercator
WASA	Water and Sewerage Authority
WIS	Wetlands Information System
WGS	World Geodetic System

1. INTRODUCTION

This Inventory Report presents the results of the Inventory Stage under the Contract for undertaking the 'Feasibility Study of the Protection of Orange-Senqu River Water Sources ('Sponges' Project) between Orange-Senqu River Commission (ORASECOM) and PEMconsult[2], Denmark in cooperation with DHI[3], Denmark and TCC[4], Lesotho. The Contract commenced on the 5th of November 2007 and has a total duration of eight months.

The Inventory Report presents the results of the detailed field investigations and the remote sensing assessments and collection of the existing wetlands data now incorporated in the Department of Water Affairs (DWA) Geographical Information System (GIS) platform.

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^2, of which 30.690 km^2 forms the Kingdom of Lesotho. 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, storing and releasing rain-water slowly through streams, springs 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 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 Lesotho Highlands Water Project (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 M15 million per month. It is believed that the wetlands play an important role in regulating factors that negatively impact on the water quality and quantity.

In 2000, as a consequence of increased focus on *'up-stream courses – down-stream effects'* in the management of water resources, the countries of Botswana, Lesotho, Namibia and South Africa established the Orange-Senqu River Commission

[2] PEM is the abbreviation of People, Environment and Management.
[3] DHI is the abbreviation for Danish Hydraulic Institute.
[4] TCC is the abbreviation for Tsoelopele Consultants & Contractors (Pty) Ltd.

(ORASECOM) under the SADC Protocol on Shared Watercourses[5] 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[6], the Government of the Kingdom of Lesotho[7] formulated a National Wetlands Management Programme. The main purpose of the 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 is 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 is provided by the French Global Environmental Facility (FFEM).

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.

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 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

[5] SADC 1998, revised 2000
[6] funded by the Norwegian Agency for Development Cooperation (NORAD)
[7] through the Ministry of Natural Resources (MNR), Department of Water Affairs (DWA), Wetland Unit

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 (methodological approach) for the sustainable management of the palustrine wetlands.

The links between the two specific objectives/outputs and the stated objectives are illustrated in Annex 1.

1.3 APPROACH AND METHODOLOGY

The following activities have been undertaken during the Inventory Stage 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 an unify the GIS data on wetlands collected from available sources into the Wetlands Information System (WIS) platform in a common geo-reference system as well as suggest formats and 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 DWA staff in the use and maintenance of the GIS system and the future generation of appropriate information.

A team consisting of a representative from DWA and research assistants[8] has worked together under the supervision of the Consultant[9] for 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 selected study areas in order to:
- Assess the conditions in selected study areas
- Assessment of stakeholder perceptions and training 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. Data entry and analysis was done with the Statistical Package for Social Scientists (SPSS)[10].

Research assistants were trained and supervised for undertaking the work. The questionnaires were administered to herders and household heads or their spouses within

[8] Mr. T. Mefi, DWA and Ms R. Mabote, Research Assistant
[9] Denvertech GIS Specialist, Phomolo Mohapi
[10] SPSS Inc. Headquarters, 233 S. Wacker Drive, Chicago, Illinois 60606

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 as per the Project.

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

- *Central level*: A 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 more questions 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;
- Review of on-going work on soil conservation, protection and rehabilitation of wetlands.

The following sections will present and summarise the key findings of the Inventory Phase.

2. SUMMARY OF INVENTORY PHASE FINDINGS

2.1 ESTABLISHMENT OF THE GIS DATA BASE ON WETLANDS

2.1.1 Existing Wetlands Data

The available data on wetlands was retrieved from DWA. The original projection of the data is Universal Transverse Mercator (UTM) 35S which carries the World Geographic System (WGS) of 1984 and 1984 World Spheroid. As the data has 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[11] 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[12] and analysed in view of the establishment of a common geo-reference system including metadata.

Figure 2: Projection Details

Data Projection:	
Name: WGS_1984_UTM_Zone_35S	
Projection:	Transverse Mercator
False Northing:	10000000
False Easting:	50000
Central Meridian:	27
Scale factor:	1.0
Latitude of Origin:	0.0
Linear Unit:	meter

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 is supplied in ArcShapefile format in UTM35S (WGS84) map projection – details provided in Figure 2.

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.

2.1.2 Digital Data

[11] See Annex A: Technical Report 1: Spatial Data compilation and analysis, Denver Technologies (Pty) Ltd. 2008

[12] 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)

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 and Schwabe & Whyte wetlands,1:250.000, 1993
- 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.

The review of the quality of the spatial data available to the DWA revealed difficulties in overlaying the various themes and importing information from one data source to another due to the use of different geographic projection systems. Furthermore, the operating system of the DWA had some limitations such as the lack of the *Spatial Analyst Extension* and *3D analyst* to assist in the analysis of the suitable area. This limitation has been recognised and DWA is in the process of upgrading the system.

2.1.3 Recommendations on 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 inventory 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 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 (Annex B) and Socio-Economic Questionnaires (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[13] especially when DWA is using ArcView 9.2 and its successors for manipulation of data and maps. In as far as the meta-data management is concerned it is advisable to the users to provide data in decimal degrees preferably in the WGS 1984 projection for other users to easily project it to the preferred projection.

It is recommended that the further development of the GIS WIS must continue by:

[13] Federal Geographic Data Committee – Environmental Systems Research Institute

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.

Continuous production of information materials for wetland management at all levels.

2.2 SELECTION OF STUDY AREAS

2.2.1 Selection Criteria

In coordination with DWA the following parameters or criteria were established in order to select the Inventory Phase study areas:

- Wetlands falling within the category of Palustrine wetlands
- Wetlands which are sources of a major tributaries to the Orange-Senqu River
- Wetlands under pressure from development plans such as an envisaged LHWP Phase II dam below the confluence of Khubelu and Sengu River.
- Wetlands where little or no information is available.
- Wetlands which are not earmarked for future projects.

The area to be selected should be representative in order to apply experiences to other areas.

2.2.2 Selection of Khubelu Catchment

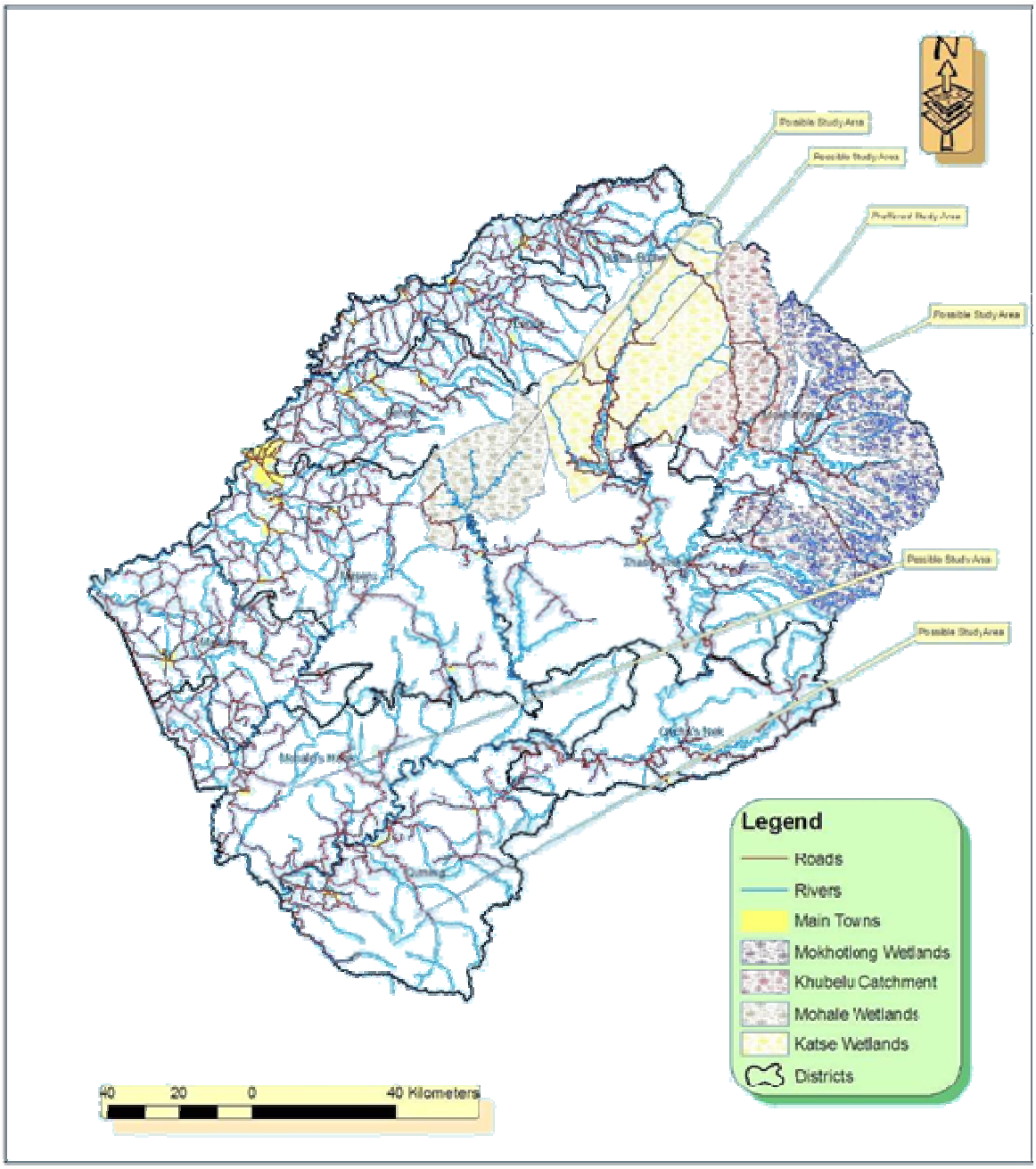
Through an exercise of exclusion of wetlands based on the established criteria, the Khubelu Catchment area surfaced as the area complying with all the criteria. The wetlands in the Khubelu Catchment are of the Palustrine category; the catchment is a major tributary to the Orange-Senqu; it is located immediately up-streams from the proposed LHWP Phase II dam; apart from the satellite mapping of the wetlands there is no data available and it is located in between areas with good data on wetlands: to the west the Katse Dam catchment and to the east the study area for the Mokhotlong Study[14]. There are no projects planned for the conservation of the wetlands in the Khubelu catchment.

The Khubelu catchment covers a total area of 645 km^2 divided into the Upper, Middle and Lower Catchment Area. As the study would not be able to cover the whole catchment area, it was agreed with DWA to concentrate the study on the Upper and Middle Section.

The locations of the Khubelu Catchment and the other study areas that were considered are shown on Figure 3.

[14] • Schwabe & Whyte 1993

Figure 3: Location of Selected Study Areas

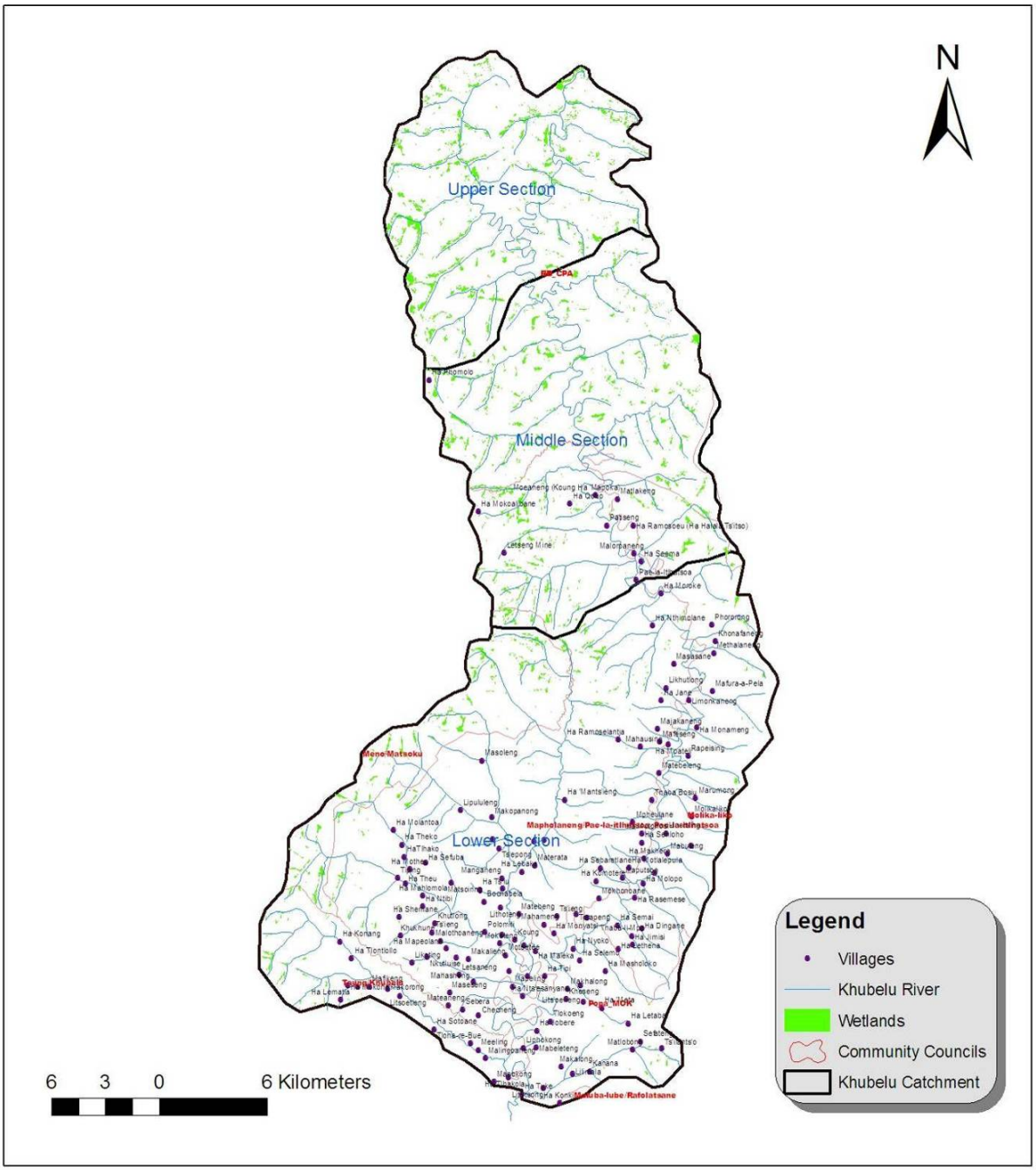


2.3 INVENTORY OF THE KHUBELU WETLANDS

2.3.1 Wetlands in Khubelu

Khubelu catchment is located in Mokhotlong district on the border to Butha-Buthe district.

Figure 4: Khubelu Catchment and its Wetlands Area

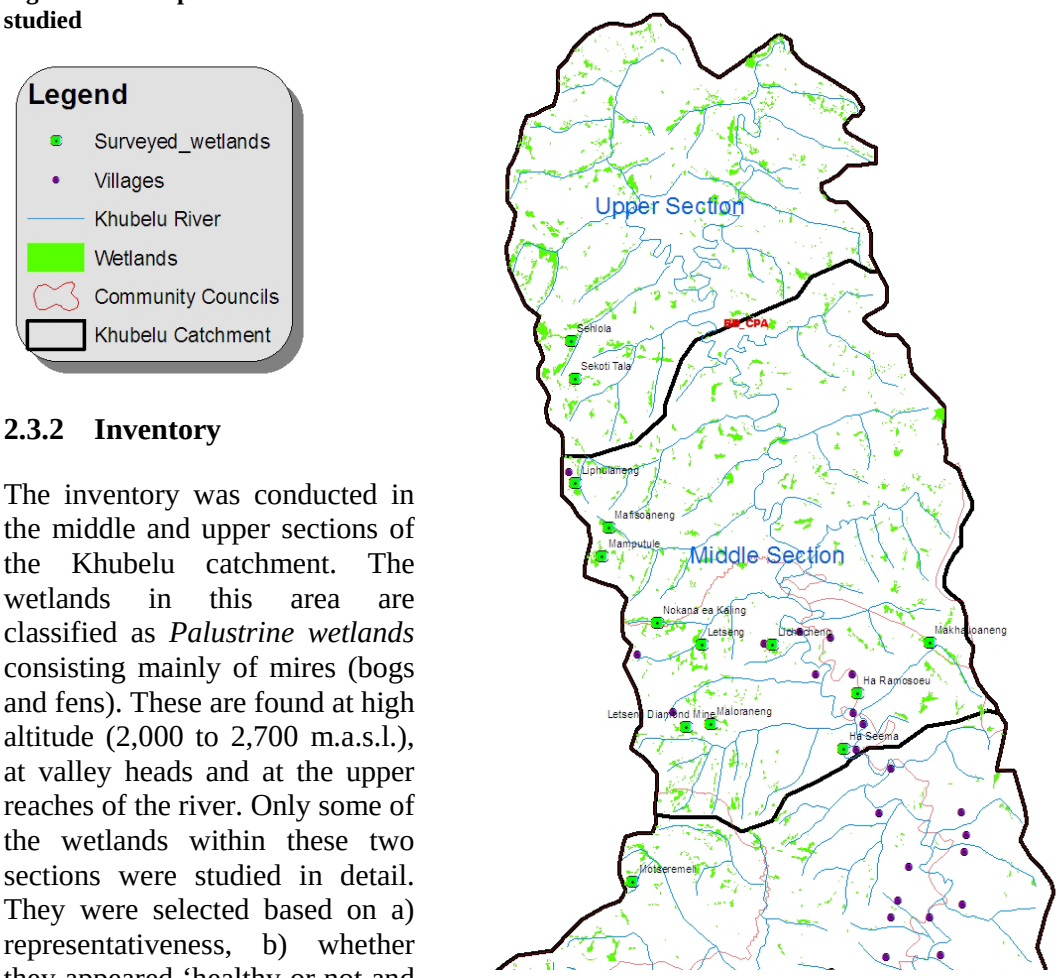


Remote sensing media in the form of SPOT satellite imagery, colour photographs and GIS interpretation were used to obtain a general idea of the status and conditions in the

area and to produce the wetland maps before starting activities in the field. Analysis using remote sensing and GIS may 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.

Letseng la Terai diamond mine is located on the ridge of the Khubelu catchment and draws water from the wetlands.

Figure 5: Map of the Wetlands studied



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. They 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 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^2	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 Resource Data

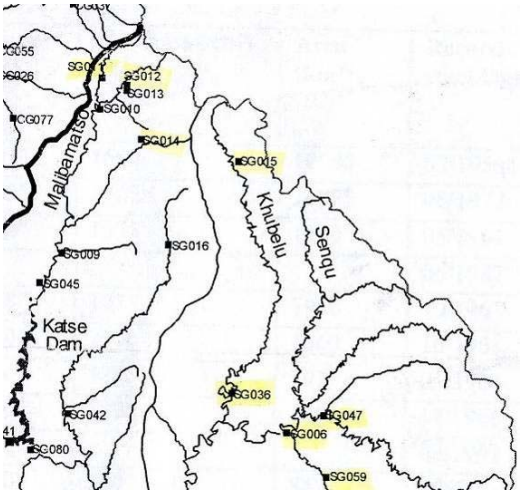
Generally outflow of less than 6 litres/sec have been recorded in the wetlands sampled during the month of February 2008 (fig.6). This once-off measurement of flow does not show any relation between the state of erosion and the average flow per m^2 of wetlands. A thorough analysis of the hydrology of the wetlands would require detailed survey data e.g. corresponding 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.

The available data on runoff and rainfall relevant for the Khubelu catchment (Figure 6) are:

- Lekhalong la Lithunya hydrometric station (SG 15): digital data available from 1961 to 1970 – no other records available
- Motete hydrometric station (SG 14): digital data available from 1981 to 1992, DWA in process of digitising earlier data back to 1962 and the recent data.
- Tsehlanyane hydrometric station (SG 11): digital data available from 1981 to 1992, DWA in process of digitising earlier data back to 1958 and the recent data.

- Khubelu - Tlokoeng hydrometric station (SG 36): digital data from 1981 to 2006, in process of digitising earlier data back to 1968 and the recent data.
- The closest rainfall stations are in Oxbow and Mokhotlong with data covering the period since the early 1940s.

Figure 6: Location of river gauging stations and rainfall stations

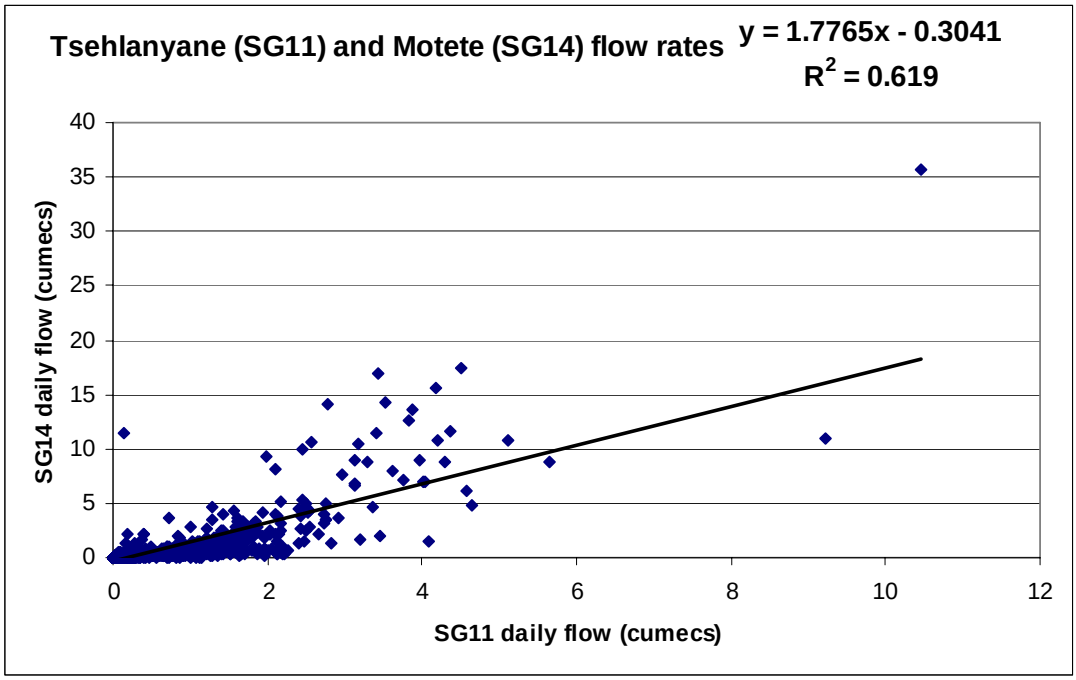


With the digital data available it is not presently possible to establish the runoff relationship between Khubelu at Lekhalong la Lithunya and the neighbouring stations, Tsehlanyane and Motete because this station was closed and data is not available for periods corresponding to the two neighbouring stations. However, the relationship between the two stations Tsehlanyane and Motete has been established with a coefficient of determination of 0.619 (Figure 7).

ain Fall Station

When DWA has digitised the data for the period covered by the Lekhalong la Lithunya, a similar analysis can be made during the design phase of the project.

Figure 7: Tsehlanyane and Motete runoff relationship between 1981 and 1992.



2.3.4 Water Balance

Wetlands surface and ground water dynamics was assessed for the Tsehlanyane 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:

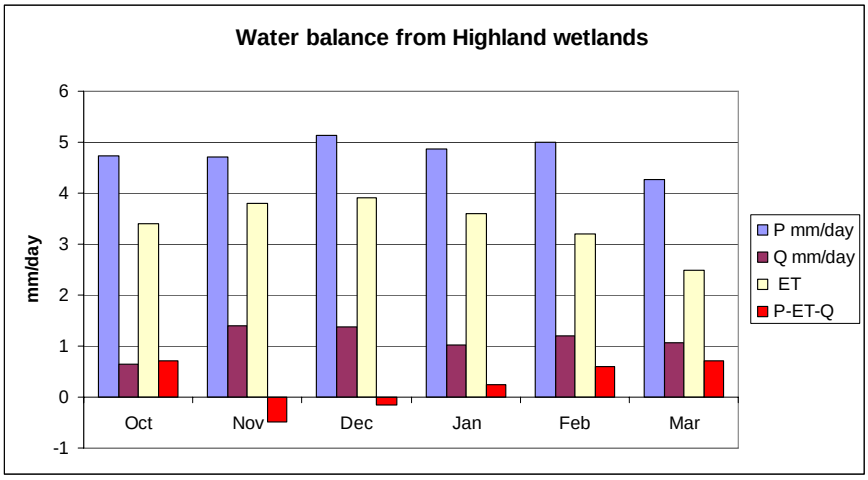
$$Storage = P - ET - R$$

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

Monthly rainfall data from Oxbow from 1981 to 1992 was used together with corresponding flow rate data at Tsehlanyane (SG11). The selection of Tsehlanyane gauging station was based on the fact that it was the closest gauging station to Khubelu catchment with runoff measured from 1981 to 1992. The size of the catchment (57 km^2) was also small enough to represent local conditions of rainfall, runoff and evapotranspiration. Evapotransporation values estimated by the Food and Agriculture Organisation (FAO) during the calibration of crop water requirement (CROPWAT) model for African meteorological stations were used for Oxbow due to lack of actual evapotranspiration data at Oxbow rainfall station.

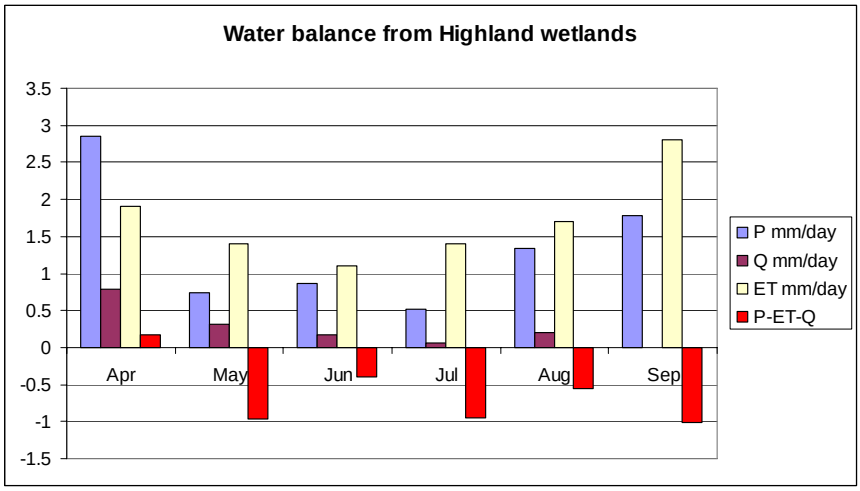
The change in storage during the wet season is different from the dry low flow discharge (Figure 8 and Figure 9).

Figure 8: Wet season water balance of Highlands wetlands.



The change in storage as depicted by water balance during the wet season is positive except for the month of November and December. However, the amount of storage does not coincide with rainfall. It may have been affected by vegetal cover which may not have been well established during the early months of the rainy season or the lack of it throughout the season. Evapotranspiration contributes most of the loss.

Figure 9: Dry season water balance of highlands wetlands



On the other hand, change in storage is negative throughout the dry season except during the month of April. The positive value may have been caused by the residual positive storage during the month of March (Figure 9).

The conclusion one can derive from this analysis may be that since the vegetal cover is not well developed in November/ December and possibly overgrazed, the run-off is high during those months. The vegetal cover therefore 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. Proper range management seems to be a prerequisite for sustainable yield from healthy wetlands.

When the DWA digital data are available over the next few months for a longer period from the early 1960s to present it will be possible to analyse the data in a similar manner for each decade to investigate the effect (or no effect) from the changes in vegetation and erosion in the catchment. This will be done during the next phase of the project.

2.3.5 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 of 12.8 mg/l and 7.5 mg/l are normally considered typical for good quality fresh water for temperatures of 5 ^{o}C and 30 ^{o}C. 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 wetlands seem still to perform their water purification function well although some degree of degradation. 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 and European Union.

Table 2: Quality of water flowing out of surveyed wetlands

Site name	Longitute	Latitude	Salinity	TDS (mg/L)	pH	DO mg/L
Ha Ramosoeu	28.94623	-28.99714	0.1	97	7.31	2.53
Ha Seema	28.94124	-29.01716	0	127.5	7.73	1.05
Lets'eng	28.88116	-28.98073	0.2	203	8	1.72
Lets'eng Diamond Mine	28.87517	-29.01097	0.2	204	8.04	1.71
Lichecheng	28.91116	-28.97998	0.1	103.9	7.34	2.95
Liphulaneng	28.82929	-28.92312	0	25.6	7.45	1.66
Mafisoaneng	28.84286	-28.93807	0	39.5	6.86	3.71
Makhauoaneng	28.97475	-28.97894	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	34	7.92	2.16
Motseremeli	28.85444	-29.06593	0	31.4	7.25	1.35
Nokana ea Kaling	28.86384	-28.97278	0	38.7	7.59	2.36
Sehlola	28.82601	-28.87131	0	26.7	7.66	1.78
Sekoti tala	28.82877	-28.88626	0	23.9	7.22	1.70

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 to gullies with extended soil scouring.

2.3.6 Degradation of Wetlands

Livestock trampling and ice rats and moles may also have such an effect on the rates of erosion and water storage. 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^3 while the current storage is stated to be 522,470m^3 (i.e. 64%). The average water loss due to degradation is put at 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.

It has also been observed that the highly degraded wetlands have scanty vegetal cover and most of those were 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*.

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%), *Scenecio Aspeulus* (28%)[15]	**H**
Letseng	2925	North east	valley bottom	7	*Merxmullera sp* (70%), *Senecio sp*. (5%), *Oxalis sp*. (5%)	**H**
Makhauoaneng	2649	South East	seep	23	Short sedge grass (60%), *Geum capensi*(10%), *Cirsium vilgare* (10%)	**D**
Ha Seema	2340	South west	valley bottom	0	*Scirpus* 90%, *Rorippa sp* (10%)	**H**
Mamputule	3107	East	valley bottom	10	Short sedge grass (50%), *Geum capensi* (40%), *Silaginella caffrorum* (9%)	**D**
Liphulaneng	3140	North	valley bottom	10	*Geum capensi* (70%), Short sedge grass (25%), *Cotula sp. (4%)*	**D**
Tlaeeeng	3051	East	valley bottom	16	*Geum capensi* (70%), Short sedge grass (30%)	**D**
Malroaneng	2711	South West	valley bottom	21	Short sedge grass (30%), *Geum capensi* (20%), *Oxalis sp* (20%), *Helicrysum* (11%)	**Partly D**
Motseremeli	2914	North West	valley bottom	8	*Geum capensi* sp. (70%) *Cotula sp*. (30%),	**D**
Letseng	2877	South West	valley bottom	10	*Merxmullera* (90%), *Senecio sp*. (5%), *Oxalis sp*. (1%), *Geum capens*i sp. (5%)	**H**
Sehlola	2915	South East	valley bottom	8	*Cotula sp.* (30%), *Trifolium sp.* (30%), Moss (30%) *Geum capensi. (5%),*	**Partly H**
Mafisoaneng	2979	South East	valley bottom	13	Short sedge grass (50%), *Oxalis sp*. (25%) *Cotula Sp* (10%) *Festuca* (10%),	**D**
Basali	3074	East	seep	12	*Geum capensi sp*. (80%), Short sedge grass (9%), *Cotula* sp (10%)	**D**
Ha Ramosoeu	2431	South west	seep	24	*Geum capensi* sp. (45%), *Scirpus sp* 25%), Moss sp (30%)	**Partly D**

[15] Remaining % up to 100% indicates bare ground without vegetation

2.4 USES OF THE KHUBELU WETLANDS

2.4.1 Local Government

Within the upper Khubelu catchment there are two Local Government Community Councils (CCs), namely: Paelaitlhatsoa (J04) and Molikaliko (J06). In terms of administration, the villages are split between these two councils although for other services those from Molikaliko CC still get their services from the chief of Paelaitlhatsoa. J04-Paelaitlhatsoa is composed of the following villages: Lichecheng, Patiseng, Maloraneng, Paelaitlhatsoa, Ha Nthimolane, Ha Masasane, Limonkaneng, Mafaneng, Mahausong (Masefeng) Matebeleng and Letseng. J06-Molikaliko is composed of Maropong, Khonofaneng, Ramosoeu, Taung, Libetseng, Ha Monameng, Libetseng, Ha Moroke (Masianokeng) Rapeising and Molikaliko.

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;

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

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 4. These villages are: Paelaitlhatsoa, Ha Seema, Maloraneng, Ha Ramosoeu, Patiseng, Matlakeng, Ha Boraki, Ha Qobo, Lichecheng and Moeaneng (Koung). The remaining settlements are cattle-posts located in the upper section of the catchment area.

2.4.2 Socio-economic Data

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 Local CCs. In the presentation of the survey results, the responses from some of the smallest villages have been included under one representative village name.

Khubelu Catchment Population Size: Efforts were made to get the correct population size for the villages in the Khubelu catchment in order to establish the number of people that are served by the catchment and the wetlands within. At this stage, only the population size per CCs is available since the Bureau of Statistics has only released the preliminary results of the 2006 population census that do not include the details per village. These preliminary results show that Paelaitlhatsoa (J04) has a population of 2,080 (1,005 men and 1,075 women), while Molikaliko (J06) has 6,239 (3,155 men and 3,084 women). During the next phase it will be attempted to acquire more detailed population data.

2.4.3 Rangelands

Although the exact village population will be important to determine the number of people living within the catchment, the population per CCs is also important as the CCs are responsible for the management of the rangelands hence protection of the wetlands in grazing areas closer to the populated areas (area B and C). In area B all villages within the CC including those outside the Khubelu catchment will have access to grazing.

In grazing area C, due to transhumance, the population supported by the Khubelu catchment is further enlarged to the area under the principal chief who provides the grazing permits for area C.

The villages and the CC boundaries are shown on the map included as Figure 4.

Table 4: Villages participating in the Field Inventory

Village	Number of people who participated	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
Paelaitlhatsoa	13	14.1
Total	**91**	**100**

2.4.4 Results of the Inventory

The inventory was carried out 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 men and 51% women. 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. Their household size was on average 6.5 members inclusive of their herders. Household have on average 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, 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.

The household physical assets included fields and trees such as peach, willow and poplar of 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 for those who own them, of about 4 acres. Fewer of the respondents have up to 3 fields ranging from 2-2.5 acres. Table 5 below shows respondents' livestock ownership as analysed from their responses. As the table shows there are more sheep, goats and cattle owned by respondents. However there is a wide disparity among the respondents regarding livestock ownership.

Table 5: 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 a majority of women are less knowledgeable about the importance of the *palustrine wetlands* as they seldom have work so 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 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.

2.4.5 Khubelu catchment as cattle-post area

The terminology used for grazing areas in Lesotho is shown in the text box in 2.4.5 above. A map showing the boundaries of the grazing areas in the Khubelu catchment is

being prepared in cooperation with the Department of Range Management and will be included in the reporting for the next phase of the project.

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.

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 had 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.

During the summer 2006, the Department of Range Management counted the numbers (Table 6) of livestock that went for summer grazing on the pastures in area B of Khubelu catchment. However, the figures should, according to the Range Management Planning Officer, be used with caution because of the difficulties in obtaining exact numbers due to:

Table 6: Summer Grazing in area B of Khubelu

a. Interchanging movement of livestock
b. Some livestock could not be counted because herders were not present hence true numbers no numbers were collected for some;
c. Misleading numbers as herders fear attack by livestock thieves if they reveal that they attend a high number of livestock.

Livestock Type	Livestock Number
Cattle	947
Sheep	6999
Goats	3482
Horses	45
Donkeys	248
Mules	0

or

Table 7 below shows the number of livestock for which the Malingoaneng Principal Chief's office issued permits for 2007/2008 of which the Khubelu catchment is approximately 50%.

Table 7: Cattle-posts and livestock numbers 2007/2008

Area	Cattle	Sheep	Goats	Donkeys	Horses	Total
Khabele	363	4360	88	55	27	4893
Khutlopeli	37	146	112	3	3	301
Motete	238	2323	665	29	9	3264

Area	Cattle	Sheep	Goats	Donkeys	Horses	Total
Tlaeeng	161	2119	251	20	11	2562
Letlapeng	221	3997	1047	52	15	5332
Tsakholo	81	1465	440	19	24	2029
Basali	19	904	71	3	2	999
Mohloling oa Matsoku	41	245	66	2	0	354
Mothae	128	1595	283	20	18	2044
Mothieane	15	88	118	6	0	227
Lekhalo-la-lithunya	82	523	130	12	0	747
Tsikoane	5	75	25	0	0	105
Sehlola	16	46	3	3	1	69
Tsatsamotho	5	140	17	0	0	162
Thaba-ts'ehla	110	665	392	5	2	1174
Kotisephola	20	300	30	3	1	354
Ha Leohla	46	168	94	8	0	316
Ts'eng la mabelete	22	565	110	3	2	702
Ha Mosebi	10	13	1	2	0	26
Leoa-lefubelu	31	215	164	7	0	417
Mothibeli	4	0	0	0	0	4
Thaba-tsepe	22	230	29	2	1	284
Thaba-li-hare	37	368	15	11	6	437
Total	**1714**	**20550**	**4151**	**265**	**122**	**26802**

Source: Malingoaneng Livestock Records, May 2008

2.4.6 Grazing Permits

The interviews with the district officers and the Principal Chief of Malingoaneng in May 2008 indicates that grazing permits have been issued for much larger number of livestock in previous years – the number mentioned for 2006 was in excess of 800,000 for the total grazing area controlled by the Principal Chief of Malingoaneng and this is regarded by the Acting Principal Chief to be representative for the number of livestock in the area. The number of grazing permits for 2008 is thus only 3% of the estimated livestock – and therefore the grazing registration can be regarded as ineffective or non-existing. The reason given by the stakeholders in Mokhotlong for the decline in grazing permits is the lack of clarity of responsibilities for grazing permits after the establishment of the CCs in 2005. The livestock figures will be further investigated in the next phase by digitising the past records in the Principal Chief's Office, so that at least the past figures for grazing in the Khubelu catchment can be established.

The Range Management Department in Mokhotlong does also not have information on the livestock as they depend on the records from the Principal Chief's office as well as the livestock records by the police. The latter are now unreliable/ irrelevant 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 (including livestock) and the Ministry of Forestry of Land Reclamation (including range management) has further segregated the public sector responsibilities for controlling degradation of natural resources.

2.4.7 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 cattleposts are located around or within the wetlands.

2.4.8 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.

2.4.9 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. Local people prefer it. At Khubelu catchment, some of the major wetlands are far away from homes so it is not the case that people use wetland water 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 no springs are available. When asked about availability of alternative 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 an alternate source. It is also an alternate 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 an alternate source of water is not always a problem. This suggests that they can get used to drawing water from the river if needed. Some of the respondents who have donkeys uses them for hauling water especially water for laundry.

2.4.10 Wetlands as a place for performing traditional and spiritual rituals

Wetlands are sometimes used for traditional rituals and for spiritual purposes. Basotho believe in water especially directly from natural resources for performing their traditional and spiritual rituals. Running water is normally preferred because it is believed that it will take away all their misfortunes and they will remain clean. Their alternative source at Khubelu is the river. The famous place for the rituals is Soloane in the Khubelu catchments according to the interviews.

2.4.11 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 was earlier drawn from the wetlands within the Khubelu catchment. Presently the mine is supplied with water from a dam at the top of the catchment close to the mine.

2.4.12 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 however the

proposed LHWP Phase II dam at the confluence of Senqu and Khubelu is likely to generate electricity.

2.4.13 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 introduction of sustainable wetlands management.

The issues raised in 2.4.12 on responsibilities for range management indicate that 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 (Ministry of Agriculture and Food Security, MAFS) advising farmers on livestock, the Range Management Department (Ministry of Forestry and Land Reclamation, MFLR) doing some work on grazing plans[16] as well as the Ministry of Home Affairs/ Police responsible for registering livestock for purposes of controlling stock theft. In addition Grazing Associations are expected to assist in the management of range land however the large livestock owners are boycotting the grazing associations making them ineffective. Stock theft aspects add to the reluctance of livestock owners to register and seek 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 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 Maluti Drakensberg Trans-frontier Project on developing grazing management plans is also not having an impact if the local government (CCs and Principal Chief) do not use the plans when issuing grazing permits. The division of responsibility for grazing permits between the Principal Chiefs (Area A) and CCs (Areas B and C) seems also to be ineffective as the livestock is expected to move between the areas during the year – therefore two different institutions can not effective manage the allocation of grazing.

[16] The Principal Chief is not using any grazing plans when issuing grazing permits.

2.5 THE COST OF DEGRADATION AND POTENTIAL BENEFITS

2.5.1 Wetlands Services

Wetlands benefits/ services can be grouped into four categories: i) Provisioning, ii) Supporting, iii) Regulating and iv) Cultural:

i) Provisioning services consist of resources obtained from the wetlands for direct use by humans and animals (e.g. water);

ii) Wetlands support survival/growth of fish and other aquatic resources. They provide moisture recharge function necessary for growth of vegetation (e.g. grazing and grasses, medicinal plants, wild vegetables, shrubs). These are called supporting services of the wetlands;

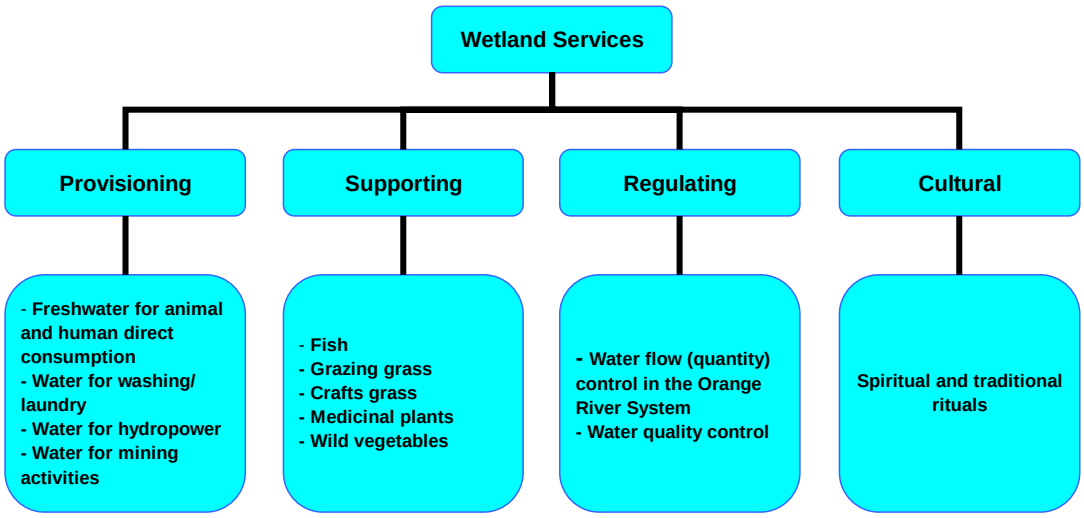
iii) The highlands wetlands also regulate the quantity and quality of water flow of water in the Orange-Senqu River System, hence regulatory services of the wetlands;

iv) Wetlands also provide aesthetic, recreational and cultural values.

2.5.2 Wetlands Benefits

From the socio-economic surveys conducted in the study area, the benefits derived from the Khubelu Wetlands are summarized in Figure 10 below.

Figure 10: Benefits derived from Khubelu Wetlands



During the Inventory Phase an initial assessment of the economic costs of degradation of the wetlands has been attempted. However, as the biophysical inventory has demonstrated (please refer to section 2.4 above) the actual degree of degradation and hence the lack of the ability for the wetlands to provide the optimal services in terms of regulating the water flow, is uncertain, rendering an assessment of the costs of degradation intricate based on the information gathered so far.

To assess the current value of the wetlands, it is necessary to derive monetary values of the services identified in Figure 10, which depends on the status or quantities of the services accessed from the socio-economic and biophysical studies. However, an estimation of the current value in monitory terms has also proven difficult as this depended on the willingness of people to reveal in figures their actual use of the wetlands e.g. how many cattle they allow to graze on the highland pastures; how much water they consume not only from the wetlands but also from the rivers which flows from the wetlands. The highlands wetlands regulate the quantity and quality of water flow of water in the Orange River System. In monetary terms this regulating service of the wetlands is the most important benefit.

The present assessment is therefore incomplete at this stage, however, it is the intention to estimate the values based on the available information combined with more general studies on the matter during the following phase of the project.

2.6 THE MANAGEMENT OF THE KHUBELU WETLANDS

The catchment has been subdivided into three areas based on the location of the wetlands. The map in Figure 4 shows that most of the villages are situated in the lower section that has fewer wetlands in comparison with the middle and higher sections.

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.

2.6.1 Policy Framework

In the absence of a overarching 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.

2.6.2 Central level

At central level it became clear that the Ministry of Agriculture and Food Security (MAFS) no longer was the administrator of the wetlands since livestock registration has been moved to 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 Ministry of Forestry and Land Reclamation (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.

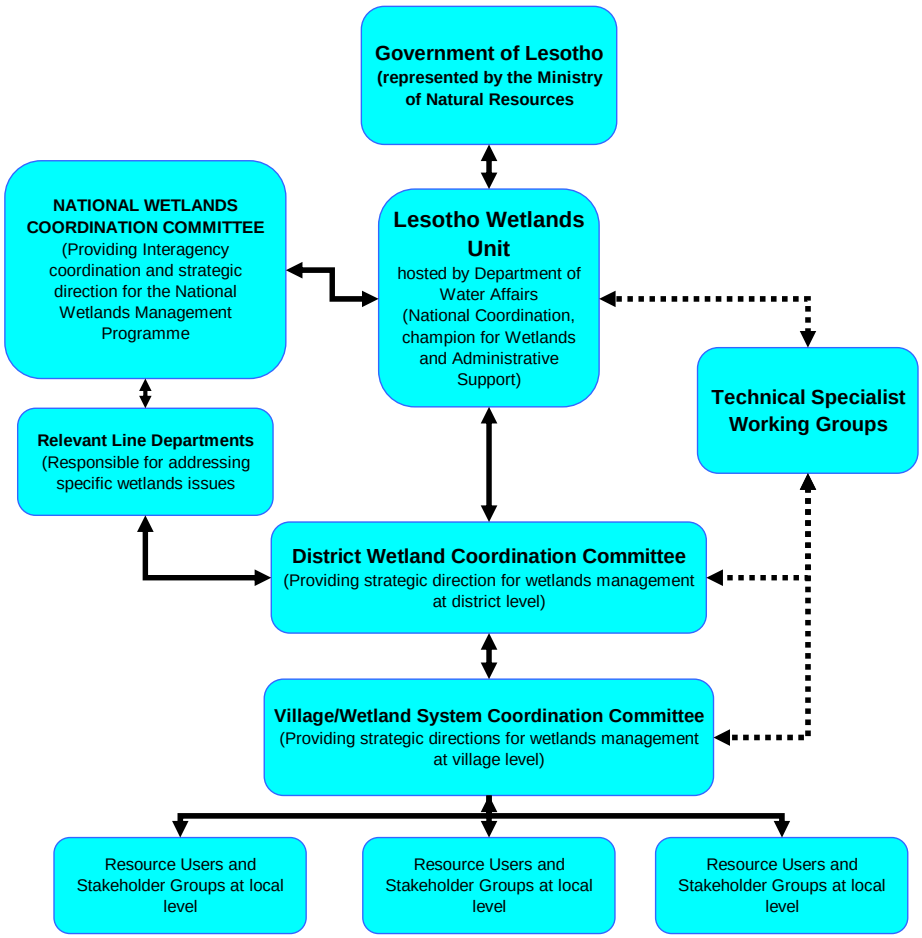
It became evident during the interviews that for a long time, since 1983, the exercise of calculating the stocking rates and the carrying capacity has not been undertaken and livestock owners for varying reasons have been very reluctant to give the correct livestock figures when they are being issued 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 jealous people to see their herd size, some of which could be illegally owned.

Overgrazing in 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 11 below illustrates the proposed institutional framework for wetlands management17.

Figure 11: Proposed Wetlands Management Structure



An initial review of mandates and competencies required in order to fulfil their mandates are included in Annex D. 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.

2.6.3 Management of wetlands by Local Government at District level.

[17] Lesotho National Wetlands Management Programme, March 2005

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

2.6.4 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 and some of the livestock owners have taken advantage and maintain large herds in the highlands.

The mandate for management of grazing lands is not clear in the minds of communities. 47% 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% that 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%[18]) are member of the grazing associations introduced and established by the MDTP. The grazing associations are responsible for policing the rangelands. In 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.

2.6.5 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.

[18] Initial information on grazing associations – need to be investigated further during the next phase of the project as this low % indicates that the grazing associations are not very effective instruments for controlling grazing

2.7 TRAINING NEEDS ASSESSMENT

2.7.1 Training Needs

The following information on training needs have been collected as part of the data collection interviews with stakeholders during the inventory stage. This needs assessment will be further detailed during the next phase and result in a specific capacity building plan. One of the initial 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 flock 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 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 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.

2.7.2 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, Range Management Association has been formed at the same time that they were formed in other areas such as Tlhanyaku Range Management Area (RMA), of the Senqu Sources project by MDTP. The Khubelu RMA 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 very limited and this and the effectiveness of the Khubelu RMA will be further investigated during the next phase of the project.

2.7.3 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 some 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.

2.7.4 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 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.

2.7.5 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.

2.7.6 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 in properly addressed in the curriculum.

The training needs assessment will be further detailed in the next phase and provide input to the capacity building plan that will address capacity building needs in general including the institutional roles and responsibilities and the tools and other resources needed for improving the management of wetlands.

2.8 SUMMARY OF CONCLUSIONS

2.8.1 Wetlands Information

- The review of the quality of the spatial data available to the DWA revealed difficulties in overlaying the various themes and importing information from one data source to another due to the use of different geographic projection systems;
- The current DWA GIS-WIS platform including all the other sources gathered during study and available data provide only spatial information and lack attributes such as the Why? What? How? which needs to be recorded systematically in the metadata. As an initial step it has been suggested to standardize the Wetlands Inventory Sheet (Annex B) and Socio-Economic Questionnaires (Annex C) and allow for their inclusion as attributes to the corresponding layers;
- For the systematic recording and management of the metadata, it is recommended to use the FGDC ESRI especially when DWA is using ArcView 9.2 and its successors for manipulation of data and maps;
- For meta-data management it is advisable to provide data in decimal degrees preferably in the WGS 1984 projection so that other users could easily project it to the preferred projection;
- The further development of the GIS WIS must take place through a continuous survey, mapping and classification of wetland ecosystems based on the standardized inventory sheets.

2.8.2 Selection of Study Area

In coordination with DWA the following parameters and criteria were established to select the Inventory Phase study areas:

- Wetlands falling within the category of Palustrine wetlands
- Wetlands which are sources of a major tributaries to the Orange-Senqu River
- Wetlands under pressure from development plans such as an envisaged LHWP Phase II dam below the confluence of Khubelu and Sengu River.
- Wetlands where little or no information is available.
- Wetlands which seem to be vulnerable and are not earmarked for future projects.

Through an exercise of exclusion of wetlands based on the established criteria, the Khubelu Catchment area surfaced as the area complying clearly with all of the criteria.

2.8.3 Filling Information Gaps and a Strategy for the Generation of Data

Through the compilation of all available spatial data it became evident that the details and quality of the information available as attributes and the meta-data were limited and hinder an appropriate analysis of the wetlands conditions. The field studies based on standardized inventory sheets proved useful and fairly simple to apply for the appropriate generation of the needed information.

To obtain the information on a broader scale this approach would have to be adopted at district and community levels, which would require extensive capacity building at these management levels.

However, there is still a need for more in depth research on crucial aspects such as:

- Hydrological dynamics of wetlands
- Erosion measurement
- Methodological approaches to rehabilitation & restoration of degraded wetlands.
- Approaches to alternative livelihood options for wetland users.

2.8.4 The Status of the Wetlands

- More data analysis is needed to establish the trends in water retention capacity in the wetlands. DWA is in the process of digitising the river gauging stations in the neighbouring areas to Khubelu and when available this data will enable an assessment of trends in water retention.
- Although wetlands show signs of erosion, the outflow water quality was good in terms of total dissolved solids, dissolved oxygen and pH.
- Livestock overgrazing and trampling and ice rats is affecting the rate of erosion of the wetlands. According to Marneweck and Grundling (1999) cited in National Wetlands Management Programme (2005), the average water loss due to degradation is 36%.
- It has been observed that the highly degraded wetlands have scanty vegetal cover and most of those were shrubs, *Oxalis sp., Geum capensi (Geumcapensi)*, short sedge grasses, *Helichrysum chionosphaerum, carex, Festuca and Festuca Caprina* as an indication of degradation. However, healthy wetlands were characterised by abundance of *Carex sp., Scirpus sp.* and *Merxmullera sp*.
- According to the interviews, few 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 such as heavy snowfall that sometimes occur in winter and the problems with cattle thefts. This indicates that the wetlands may not be given appropriate time to regenerate.
- The wetlands in Khubelu catchment are used by a majority of interviewees to graze animals and most of the cattleposts are located around or within the wetlands.

2.8.5 Perception of the Cost and 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 alternate source.
- Wetlands are sometimes used for traditional rituals and for spiritual purposes. The famous place is Soloane in the Khubelu catchments.
- To assess the current value of the wetlands, it is needed to derive monetary values of the services. However, an estimation of the current value in monitory terms has

also proven difficult as this depended on accurate livestock data and the willingness of people to reveal figures for their actual use of the wetlands.

2.8.6 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.

2.8.7 On the selection of a Pilot Project Area

It is proposed to continue the project activities in the Khubelu Catchment Area – focusing on the Upper and Middle Sections for the following reasons:

- no other projects
- poor communities
- need for further investigation on wetlands conditions (see above)
- representative in terms of Palustrine wetlands conditions and management issues
- Khubelu is an important or tributary to the Orange-Senqu and catchment for the proposed LHWP Phase II dam.

The above findings serve to focus the discussions and planning work to be undertaken in the next phase of the project.

3. PLAN FOR DESIGN PHASE

3.1 ACTIVITIES

The Design Phase will include the following activities:

3.1.1 Development of a conservation, rehabilitation and protection programme, as well as impact assessment and the quantification of the returns from rehabilitation of the wetlands

The programme will be based on the data collected on the state and extent of the wetlands, the information collected from stakeholders on the perceptions of the value of the wetlands and information on previous conservation activities in the highlands of Lesotho as well as additional data collection and analysis especially of livestock data, functioning of the grazing associations and the digitised data from DWA on river gauging stations.

This will be combined with an assessment of the methodologies for restoration of wetlands used e.g. by the MDTP and the range management strategies and taking into account the livelihood realities for the population in the mountain areas it will provide input into the development the methodological approach and action plan for sustainable wetlands management.

This will include proposals for:

- Institutional and organisational framework for wetlands management (who will/ should do what?);
- Strategy for coordination between programmes in the area;
- Wetlands in District and Community planning including Environmental Impact Assessment (EIA) of development activities;
- Guidelines/ catalogue for sustainable wetlands management techniques adapted to the Upper Orange-Senqu environment (what can be done to rehabilitate – mitigate?);
- Tools for Rapid Appraisal and Monitoring of wetlands;
- Strategy for generating appropriate information including data management and dissemination of information (central-district level interchange).

3.1.2 Development of a capacity building plan for formal and on the job training of local communities, livestock owners, herders, local councillors and government officials

The success of the protection work on the wetlands will be depending on effective range management regulations and the knowledge and attitudes of the main users of the natural resources in the mountain areas.

The capacity building activities will therefore need to be designed in a way that they target the various stakeholders like livestock owners, herders, local councillors and government officials separately. The development of the capacity building plan will be based on the information collected earlier on the skills and knowledge of the various stakeholders as outlined above.

The development of the capacity building plan is likely also to include review of existing possibilities for training within the country and/or regionally and discussions with the

Ministry of Education to establish how well the protection and use of wetlands is covered in the earlier work on including environmental issues in the school curriculum.

The positive and negative impact of the proposed protection work will be quantified and the Agricultural Economist will quantify the returns from sustainable rehabilitation of the sponges.

3.1.3 Preparation of an action plan for a pilot project and development of a proposal for donor funding

The plans for conservation, rehabilitation and protection of the wetlands integrated with the capacity building plan will be further developed into an action plan for a pilot project for addressing the urgent conservation and rehabilitation needs. The upper and middle Khubelu catchment area has been selected in consultation with the PSC. The plan will be discussed with the 'Reference Group' and other relevant stakeholders like senior officials in the MAFS, MFLR as well as District Authorities to ensure that the proposed measures are in line with the realities of what the Government of Lesotho will be in a position to implement.

The action plan will be developed in a format consistent with the common formats for donor proposals and if specific funding agencies have been identified, the proposal will be structured according to the specific guidelines applicable to these.

3.1.4 Preparation of draft final report and presentation of report and action plan to the Steering Committee, ORASECOM and 'Project Reference Group'

The action plan will be documented in a draft final report and presented to the Steering Committee, ORASECOM and the 'Project Reference Groups' according to arrangements for workshops and meetings as agreed with the Project Steering Committee.

The workshops will be arranged in a participatory manner where the results of the study will be presented and the participants will be able to provide input and comments to the proposed action plans. The presentation to stakeholders will include a draft description and illustrations to be incorporated in a brochure for dissemination of the results of the study in order to get feedback on the content of the brochure.

3.1.5 Preparation of brochure and presentation of study results to stakeholders

Following the presentation of the results of the study and incorporation of the comments from the stakeholders, the brochure will be finalised and after approval by the Steering Committee printed in the required number of copies. The final version of the brochure will be translated to Sesotho to be used in information dissemination to the affected communities

3.1.6 Preparation of final report based on comments to the draft final report and the presentations of results

The final report will be prepared following the presentation to stakeholders and incorporation of comments. The final documentation will include the information from the mid-term report on the inventory as well as the programme for restoration, rehabilitation and protection of the wetlands and the associated capacity building programme. All the data and documentation collected during the study will be made available in electronic format.

3.2 WORKPLAN

The work plan for the remaining part of the assignment is indicated in the time schedule below. The progress of the project is about one month behind schedule mainly due to more that anticipated efforts needed in retrieving the data that is needed for the analysis.

Activities		Time Schedule in Months								
		Dec-07	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08
B	**Inventory Stage**									
B.1	Mobilisation and engagement of a Project Reference Group									
B.2	Location and assessment of all existing GIS data on wetlands and development of GIS tools for mapping and filling gaps in existing data to be included in the MIS/GIS system developed by DWA									
B.3	Interpretation of GIS data (satellite and aerial photos) and in consultation with Project Reference Group, select areas for field assessment (criteria for selection: not addressed by other projects, representation of diffeernt wetlands classes)									
B.4	Detailed field assessment and data collection (rapid appraisal in accordance with RAMSAR Guidelines for Inventory of wetlands) of the wetlands in the selected area									
B.5	Preparation of Mid-term report. Presentation of findings of studies and assessments to the Steering Committee and the Project Reference Group									
C	**Design of Restoration, Rehabilitation and Protection Programme**									
C1	Development of a conservation, rehabilitation and protection programme with mitigating measures and quantification of the returns from sustainable rehabilitation of the wetlands and analysis of positive and negative impacts of protection works									
C2	Development of a capacity building plan for formal and on the job training of local communities livestock owners, herd boys, local councillors and government officials									
C3	Preparation of an action plan for a pilot project and development of a proposal for donor funding									
C4	Preparation of draft final report and presentation of report and action plan to the Steering Committee, ORASECOM and 'Project Reference Group'									
C5	Preparation of brochure and presentation of study results to stakeholders									
C6	Preparation of final report based on comments to the draft final report and the presentations of results									

Planned Timing
Actual Timing

ANNEX A: TECHNICAL REPORT ON GIS

Protection of Orange – Senqu River Water Sources "Sponges"

Technical Report 1

Spatial Data compilation and analysis

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Background

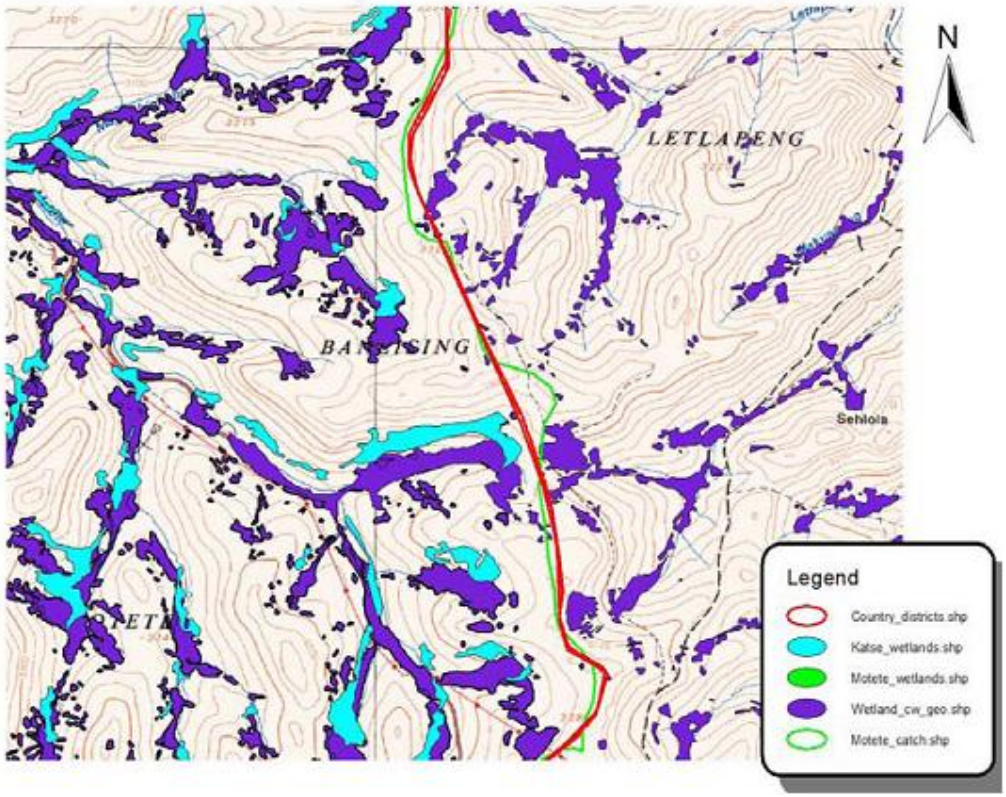
Wetlands of the highlands of Lesotho are classified under Palustrine wetlands, sub-class - alpine mires - which comprises fens and bogs. These alpine mires play a major role in sustaining the water flow of most major rivers in Lesotho as they are mostly found at the valley heads and upper reaches of the rivers. These wetlands, also commonly referred to as sponges, store water within organic and clay soils and release it over a long period of time. The sustained storage and slow release of water into streams maintain the perennial flow of rivers. According to Marneweck and Grundling (1999) cited in National Wetlands Management Programme (2005), studies carried out on wetlands in the highlands region of Lesotho show the potential maximum inferred water storage of highlands wetlands as 817 845m^3 while the current storage is 522 470m^3 (i.e. 64%). The average water loss due to degradation is put at 36%. This percentage will be exceeded if proper and effective wetlands management plan is not initiated.

The wealth of spatial data relevant to sustainable wetlands management is available from a number of sources e.g. Lesotho Highlands Water Project (LHWP), the Maloti Drakensberg Transfrontier Development Project (MDTP), the Department of Water Affairs (DWA), the Ministry of Forestry and Land Reclamation (MFLR), the Ministry of Agriculture and Food Security (MAFS), Department of Land Surveys and Physical Planning and others. Most of these institutions operate GIS-based data platforms based on geo-referenced topographic maps, interpretation of SPOT5 Satellite images and aerial photography.

The review of the quality of the spatial data available to the DWA revealed difficulties in overlaying the various themes and importing information from one data source to another due to the use of different geographic projections systems by the various sources of data. Furthermore, the layers identifying and locating wetlands do not include metadata information, indicating that the system is not used to its full capability. It appears that all the different institutions operating spatial data bases develop their own systems without overall coordination. This is shown by lack of data overlap on the wetlands captured by different geographic projections (figure 1).

Moreover, in the past, numerous resource inventories have been undertaken in Lesotho and these may still be accessed in the form maps and reports, for example, the Land Resources of Lesotho by Carroll and Bawden published in 1968. Binnie and Partners produced a series of reports on water, geology and soil resources in 1971. Extensive studies on ground water resources were carried out by Bonney during 1974 and 1975, and a comprehensive study and mapping of the Lesotho soils was completed by Carroll and his team in 1979 (Schmitz & Rooyani, 1987). Between 1983 and 1986 the Range Division of the Ministry of Agriculture initiated a vegetation survey with a particular focus on the development of Rangeland policy. Information from the study was used for cattle inventory whereby digital capturing and analysis of spatial data was employed in 1989. All of these studies would be able to provide the possibility for analysis over time on the trends of the wetlands environment, needed for the appropriate assessment of actions to be taken. However, today, a great deal of this important information is not readily accessible or may no longer be available.

Figure A1 Undefined data source



PEM Consult and TCC are undertaking an assignment for the Orange-Senqu River Basin Commission (ORASECOM) for protection of the Orange-Senqu river sources – 'Sponges'. As part of that assignment a Consultant was required to avail and compile the GIS data that is available in Lesotho on the 'Sponges'. It was suggested that all spatial and metadata (GIS data) on the wetlands would be fully located and unified from all available sources and provide these inputs to the GIS platform being established by the DWA to allow for the appropriate analysis of the data and providing inputs to the identification of information gaps and research topics during the inventory stage of the project. In addition, the structure of the data to be located, collected, and unified will be made compatible with the Regional MIS established for the Integrated Water Resources management plan of Orange-Senqu.

This activity will, furthermore, provide inputs to the development of a strategy for generating appropriate information and to the formulation of a coordinated strategy between programmes and activities in the area. The GIS Specialist was engaged to *'assist in the establishment of accurate information on the extent and state of the wetlands'*.

The outputs of the consultancy were:

- to consolidate and unify in a common geo-reference system in the DWA WIS the GIS – metadata information on wetlands collected from all available sources.
- to capacitate DWA staff in use and maintenance of the GIS system and generation of appropriate information.

The activities carried out in close cooperation with the DWA staff in the wetlands unit and the PEM-TCC Consultant team to achieve the outputs, were as follows:

- Locate and collect all available spatial data (GIS data) from available sources, as listed in the background;
- Consolidate and unify the GIS data into the WIS platform in a common geo-reference system;
- Assess the GIS data on wetlands in order to:
  - Identify information gaps;
  - Suggest formats and structure for the metadata management;
  - Discuss and agree with DWA on structures for the GIS platform;
- Assist in the interpretation of the GIS data for the selection of areas for detailed field assessment (satellite images – aerial photography);
- Any other activities required to adequately fulfil the objectives and achieve the outputs.

Methodology

A team of three members was assembled which constituted Mr. P. Mohapi (Denvertech GIS Specialist, Mr. T. Mefi (DWA) and Ms. R. Mabote (Research Assistant).

A letter was drafted and signed at DWA to assist the incumbent to collect data from the respective government Ministries and Non-governmental organizations. The research assistant and DWA members joined hands to collect the relevant data from its relevant hosts.

i. Define current projection to all layers for manipulation
ii. Projection of all to layers to a single known projection which also similar to the one that the present wetlands have which is UTM ZONE 35S, to enable layers to overlap
iii. Generation of new layers e.g. general Land use from vegetation map; Slope output from the Digital Elevation Model.

Mapped wetlands

Existing information has revealed that the wetlands which were mapped by different projects are:

1. Katse Wetlands
2. Part of Mokhotlong wetlands
3. Mohale Wetlands
4. MDTP Area Wetlands

MDTP Area Wetlands

Wetlands were mapped using conventional on-screen manual photo-interpretation techniques off (client supplied) 2.5 m resolution, true colour SPOT5 satellite imagery, acquired in 2004. Wetlands were captured using a 1:10,000 screen viewing scale. It is recommended that 1:25,000 scale (or coarser) is used for all subsequent GIS modeling applications. The SPOT5 image data was supplied in a ortho-corrected format, in UTM zone 35, spheroid WGS84, datum WGS84 map projection format. The actual image data consisted of a series of standard image-mosaiced blocks (not original SPOT image tiles). In several cases these individual image-mosaic blocks contained SPOT image data captured from different seasonal periods, as evidenced by clearly definable "cut-lines".

Wetland features were mapped on the basis of visually identifiable vegetation or wet area boundary delineation. All original wetland polygons were cleaned, re-built and finally merged to ensure that each contiguous wetland feature consisted of only a single digital polygon. All wetlands were mapped in the same UTM zone 35 (WGS84) map projection format as the original SPOT5 imagery.

A total of 69,000 wetlands were delineated in this way, but some were later merged into single polygons where they were close enough to be considered one wetland. The wetlands map was compared with previous wetland mapping attempts and field verified. The map was found to be highly accurate for mapping of permanent

wetlands at the scale it was done. A classification system based on wetland position in relation to position in the landscape and climatic variables was applied resulting in seven wetland types. Thereafter, surfaces of probability of occurrence were created for each wetland type which was then used to develop a combined broad wetland type layer and to assign wetland type to the mapped wetlands.

Table 1: Attribute table for MDTP mapped Wetlands

ID	DESCR	WET_TYPE	1_50000	1_250000	90_DEM	ALL_CHNLED	AREA	ACRES	PERIMETER
32253	Wetland	Seep					6750.25	1.668	338.518
68714	Wetland	Valley Bottom	Non-channelled	Non-channelled	Channelled	Channelled	32485.11	8.027	1458.974
68713	Wetland	Seep					6558.146	1.621	371.434
68712	Wetland	Seep					1564.085	0.386	210.011
68711	Wetland	Seep					2171.685	0.537	187.537
68715	Wetland	Seep					100.373	0.025	63.308
68710	Wetland	Seep					1215.211	0.3	139.069
68709	Wetland	Seep					11952.09	2.953	545.237
68715	Wetland	Seep					16638.76	4.111	783.98
68708	Wetland	Seep					4237.526	1.047	265.388
68707	Wetland	Seep					909.451	0.225	154.206
68706	Wetland	Valley Bottom	Non-channelled	Non-channelled	Non-channelled	Non-channelled	5397.84	1.334	379.782
68727	Wetland	Seep					21089.61	5.211	924.456
68726	Wetland	Seep					2254.01	0.557	209.451
68725	Wetland	Seep					1959.995	0.484	206.956
68724	Wetland	Seep					1732.649	0.428	153.999
68723	Wetland	Seep					42171.32	10.421	871.536
68722	Wetland	Seep					1305.354	0.323	137.547
68728	Wetland	Valley Bottom	Non-channelled	Channelled	Channelled	Channelled	122686.9	30.316	3240.194

68721	Wetland	Valley Bottom	Non-channelled	Non-channelled	Non-channelled	Non-channelled	5150.869	1.273	280.935
68720	Wetland	Seep					1395.519	0.345	143.829
68719	Wetland	Valley Bottom	Non-channelled	Non-channelled	Non-channelled	Non-channelled	26205.18	6.475	817.525
68718	Wetland	Valley Bottom	Non-channelled	Non-channelled	Non-channelled	Non-channelled	1795.379	0.444	182.117
68717	Wetland	Seep					1117.197	0.276	131.191
ID	DESCR	WET_TYPE	1_50000	1_250000	90_DEM	ALL_CHNLED	AREA	ACRES	PERIMETER
68702	Wetland	Seep					8659.277	2.14	363.891
68701	Wetland	Seep					768.315	0.19	112.146
68700	Wetland	Valley Bottom	Non-channelled	Non-channelled	Non-channelled	Non-channelled	493.914	0.122	94.437
68699	Wetland	Seep					1340.636	0.331	141.402
68698	Wetland	Seep					493.919	0.122	149.222
68697	Wetland	Seep					823.2	0.203	163.895
68696	Wetland	Seep					2520.552	0.623	206.325
68729	Wetland	Valley Bottom	Non-channelled	Non-channelled	Channelled	Channelled	106540.6	26.326	2995.101
68695	Wetland	Valley Bottom	Channelled	Non-channelled	Non-channelled	Channelled	17146.17	4.237	619.534
68694	Wetland	Seep					1132.888	0.28	136.923
68693	Wetland	Seep					439.037	0.108	84.784
68692	Wetland	Valley Bottom	Non-channelled	Non-channelled	Non-channelled	Non-channelled	10650.65	2.632	698.829
68690	Wetland	Seep					3284.969	0.812	219.834

68691	Wetland	Valley Bottom	Non-channelled	Non-channelled	Channelled	Channelled	3347.664	0.827	218.026
68689	Wetland	Seep					3206.554	0.792	227.858

Mohale and Katse Wetlands

These wetlands were mapped and classified only as wetlands that are degraded, good and very good and their respective map attributes excludes all these parameters as displayed in the hard copies provided. A total of 611 individual wetlands were mapped for Mohale Dam during feasibilities and environmental assessments whilst 683 individual wetlands were mapped for Katse Dam.

Table 2: Attributes for Mohale wetlands

TWet_No	AREA	PERIMETER	WET_SA_	WET_SA_ID	CLASS
1	7474.34	410.307	2	0	Wet
2	9310.875	500.6642	3	0	Wet
3	10807.38	428.389	4	0	Wet
4	7088.674	427.4745	5	0	Wet
5	43533.35	1836.311	6	0	Wet
6	2186.089	218.2413	7	0	Wet
7	16504.27	798.2695	8	0	Wet
8	7565.834	429.7225	9	0	Wet
9	4827.295	301.478	10	0	Wet
10	13404.67	543.6858	11	0	Wet
11	41871.17	1153.692	12	0	Wet
12	12408.56	566.0225	13	0	Wet
13	7083.165	339.9085	14	0	Wet
14	7125.072	590.0096	15	0	Wet
15	10918.85	462.0087	16	0	Wet
16	7990.19	493.4309	17	0	Wet
17	15203.36	1189.755	18	0	Wet
18	6058.438	373.3456	19	0	Wet
19	15003.72	735.6369	20	0	Wet
20	28132.1	1080.657	21	0	Wet
21	9608.219	402.3384	22	0	Wet
22	29866.83	1082.528	23	0	Wet
23	4208.406	362.3264	24	0	Wet
24	7302.897	411.0261	25	0	Wet
25	11024.86	585.9536	26	0	Wet
26	20748.45	807.2537	27	0	Wet

27	6334.979	457.575	28	0	Wet
28	21147.66	704.4728	29	0	Wet
29	8988.541	415.8553	30	0	Wet
30	14701.05	802.7779	31	0	Wet
31	12609.26	635.2624	32	0	Wet
32	3906.835	254.4422	33	0	Wet
33	16654.09	578.0529	34	0	Wet
34	4157.733	309.8658	35	0	Wet
35	7126.02	406.9491	36	0	Wet
36	3667.339	281.3578	37	0	Wet
37	6586.931	422.7746	38	0	Wet
38	10722.24	459.7495	39	0	Wet
39	6006.568	410.9291	40	0	Wet

Table 3: Attributes for Katse wetlands

Wet_No	AREA	PERIMETER	K_WET_	K_WET_ID	CLASS
1	53135.22	1687.951	2	2	Wet
2	48229.49	1490.001	3	3	Wet
3	123514.3	2919.735	4	4	Wet
4	40852.36	958.9628	5	5	Wet
5	20030.83	717.8836	6	6	Wet
6	51351.63	1283.504	7	7	Wet
7	48002.11	1528.834	8	8	Wet
8	22161.79	1033.69	9	9	Wet
9	48955.8	1366.326	10	10	Wet
10	18203.42	642.5499	11	11	Wet
11	29154.91	1184.351	12	12	Wet
12	53694.24	1039.227	13	13	Wet
13	61042.07	1805.574	14	14	Wet
14	7844.545	425.006	15	15	Wet
15	56325.21	1368.521	16	16	Wet
16	18343.83	547.5588	17	17	Wet
17	51119.76	1727.509	18	18	Wet
18	56114.88	1710.81	19	19	Wet
19	11946.55	655.689	20	20	Wet
20	11632.16	619.3369	21	21	Wet
21	17787.43	659.4332	22	22	Wet
22	35989.08	1355.288	23	23	Wet
23	94874.91	1482.621	24	24	Wet
24	43647.78	1163.044	25	25	Wet
25	18255.92	917.912	26	26	Wet
26	74200.18	1516.949	27	27	Wet
27	9083.739	431.2204	28	28	Wet
28	31798.49	823.4859	29	29	Wet
29	133191.3	2997.68	30	30	Wet
30	4313.272	376.0147	31	31	Wet
31	51238.26	1106.8	32	32	Wet
32	117805.6	2444.123	33	33	Wet

33	36012.69	1088.141	34	34	Wet
34	50884.36	1363.433	35	35	Wet
35	52659.58	1157.27	36	36	Wet
36	9882.703	471.3719	37	37	Wet
37	27295.63	924.7957	38	38	Wet
38	7712.607	494.3739	39	39	Wet
39	18903.18	714.1068	40	40	Wet
40	66220.34	1906.947	41	41	Wet
41	21953.06	752.9543	42	42	Wet
42	12034.2	522.6844	43	43	Wet
43	244400.9	5717.416	44	44	Wet
Wet_No	**AREA**	**PERIMETER**	**K_WET_**	**K_WET_ID**	**CLASS**
44	38678.89	1125.377	45	45	Wet
45	47218.07	1713.844	46	46	Wet
46	15712.05	775.2988	47	47	Wet
47	41268.31	1188.666	48	48	Wet
48	27844.47	852.9836	49	49	Wet

Mokhotlong Wetlands

These wetlands were also mapped by Schwabe and Whyte with which a number of parameters were used and a classification made which stipulated as thus: these wetlands were classed as A for Non-wetlands, B for Bogs (sponges), C for River associated Vleis, and D for Associated Bogs and Vleis which made 980 individual wetlands in all. The information also included their spatial reference which is their location.

Table 4 Attributes for Mokhotlong Wetlands

AREA	PERIMETER	TEST_	TEST_ID	CLASS	WETLAND	HECTARES	X_COORD	Y_COORD	NUMPARTS	NUMHOLES
0.186395	27.93512	2	1	A	Non-Wetland	0	29.17138	-29.33004	1	732
0.000353	0.248738	3	979	B	Bogs (Sponges)	0	29.01414	-28.90021	1	4
0.000004	0.012115	4	975	A	Non-Wetland	0	29.0153	-28.89472	1	0
0.000009	0.01179	5	976	A	Non-Wetland	0	29.01333	-28.90259	1	0
0.00001	0.020483	6	977	A	Non-Wetland	0	29.01072	-28.90683	1	0
0.000005	0.012335	7	869	B	Bogs (Sponges)	0	29.03494	-28.90456	1	0
0.000004	0.009075	8	978	A	Non-Wetland	0	29.01553	-28.90944	1	0
0.000008	0.012682	9	924	B	Bogs (Sponges)	0	29.03003	-28.90944	1	0
0.000031	0.036274	10	923	B	Bogs (Sponges)	0	29.02039	-28.9183	1	0
0.000098	0.134756	11	870	B	Bogs (Sponges)	0	29.05932	-28.92512	1	0
0.000005	0.008724	12	868	B	Bogs (Sponges)	0	28.98044	-28.92069	1	0
0.000007	0.019342	13	867	B	Bogs (Sponges)	0	28.98074	-28.92926	1	0
0.000054	0.057853	14	920	C	River Associated Vleis	0	29.01783	-28.93497	1	0
0.000003	0.006537	15	925	B	Bogs (Sponges)	0	29.05005	-28.93253	1	0
0.000009	0.013553	16	907	B	Bogs (Sponges)	0	28.99641	-28.93452	1	0
0.000007	0.011366	17	921	B	Bogs (Sponges)	0	29.01087	-28.93569	1	0
0.000015	0.023823	18	926	B	Bogs (Sponges)	0	29.03447	-28.93731	1	0
0.000005	0.010794	19	922	B	Bogs (Sponges)	0	29.00743	-28.93776	1	0
0.000004	0.008064	20	928	B	Bogs (Sponges)	0	29.05066	-28.93724	1	0
0.000002	0.005935	21	927	B	Bogs (Sponges)	0	29.04106	-28.93979	1	0
0.000008	0.013202	22	908	B	Bogs (Sponges)	0	29.00455	-28.94298	1	0

0.000044	0.026353	23	572	D	Associated Bogs and Vleis	0	29.06671	-28.94591	1	0
0.000006	0.009795	24	906	B	Bogs (Sponges)	0	28.99973	-28.94515	1	0
0.000005	0.009084	25	919	C	River Associated Vleis	0	29.01974	-28.94396	1	0
0.000023	0.034063	26	820	B	Bogs (Sponges)	0	29.08205	-28.94812	1	0
0.000006	0.014537	27	918	B	Bogs (Sponges)	0	29.02923	-28.94501	1	0
0.000009	0.012102	28	573	B	Bogs (Sponges)	0	29.07255	-28.94684	1	0
0.000007	0.012541	29	916	B	Bogs (Sponges)	0	29.04998	-28.94741	1	0

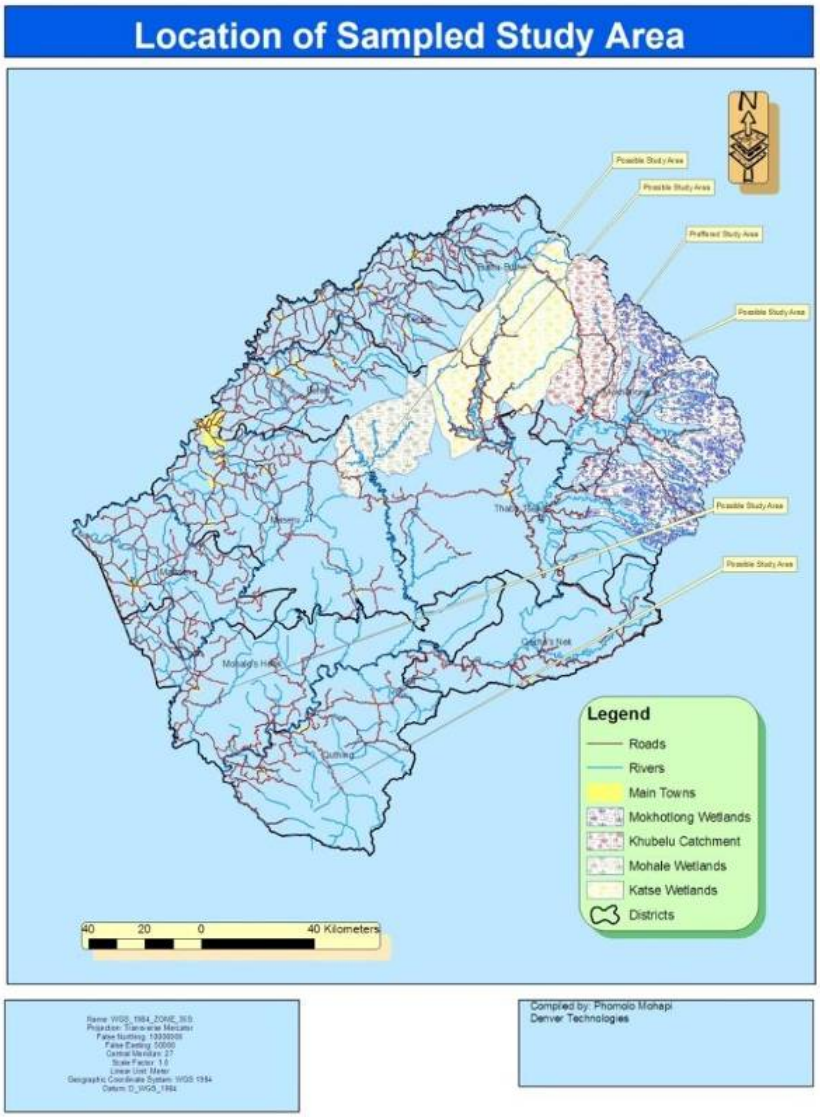
AREA	PERIMETER	TEST_	TEST_ID	CLASS	WETLAND	HECTARES	X_COORD	Y_COORD	NUMPARTS	NUMHOLES
0.000006	0.011866	30	866	B	Bogs (Sponges)	0	28.98732	-28.94818	1	0
0.000016	0.02277	31	917	B	Bogs (Sponges)	0	29.02365	-28.9475	1	0
0.000022	0.026894	32	819	C	River Associated Vleis	0	29.09193	-28.94848	1	0
0.000005	0.010129	33	821	B	Bogs (Sponges)	0	29.07874	-28.94836	1	0
0.000059	0.049034	34	818	D	Associated Bogs and Vleis	0	29.10349	-28.95503	1	0
0.000018	0.026006	35	909	B	Bogs (Sponges)	0	29.02747	-28.95495	1	0
0.000003	0.007691	36	913	B	Bogs (Sponges)	0	29.03222	-28.95066	1	0
0.00002	0.027518	37	822	B	Bogs (Sponges)	0	29.07985	-28.95361	1	0
0.000006	0.01382	38	915	B	Bogs (Sponges)	0	29.04878	-28.95552	1	0
0.00004	0.052619	39	824	B	Bogs (Sponges)	0	29.05655	-28.95913	1	0
0.000003	0.007836	40	911	C	River Associated Vleis	0	29.02479	-28.95401	1	0

Selection of the Project Area

The following parameters were used as the major contributing factors for selecting the preferred area for a study area/project area.

- These wetland have been classified as Palustrine wetlands
- They are sources the major tributaries of the Orange river
- There is an information gap as some studies have been carried out for Mohale, Katse, and Mokhotlong wetlands
- There is a possibility that the study may assist other users especially as a feasibility study has envisaged the construction of a Polihali dam after the confluence of Senqu and Khubelu as part of the Lesotho Highlands Water Project Phase II.

Figure A2 Map of Lesotho indicating mapped, and possible study areas.



There are two other options for an inventory field assessment; these could be Butha Buthe wetlands and Quthing wetlands which one way or the other still drain into Senqu at different locations, although these options do not fall within the Palustrine classification. This study has identified that some studies have been conducted for Mokhotlong, Katse, and Mohale, as shown in figure 2 so a totally new area could assist in learning from previous studies.

The final Deliverables

The final wetland map deliverable consists of a single polygon coverage containing in excess of 69000 individual wetlands, which have been coded according to hydrological landscape position re "valley bottom" (channeled / non-channelled) or "seep". The data is supplied in Arc Shapefile format, in UTM35s (WGS84) map projection). In addition to the mapped wetlands, the following digital datasets are also supplied on the final data DVD.

- Schwabe & Whyte mapped wetlands (Mohale and Katse), 1:250.000, 1993
- Combined SPOT5 and Schwabe & Whyte wetlands,1:250.000, 1993
- 90m 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, 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 Basutoland.
- Rivers, 1:250.000, MDTP, 2006
- Boreholes layer, 1:250.000, DWA constantly upgraded
- Mayor rainfall stations including those bordering Lesotho from RSA, from 1950' to present.

All the layers have been projected to Universal Transverse Mercator (UTM) 35S, this projection is in Meters therefore allows users to measure all types of geometry. That is the user can measure distances and areas. The data is also presented in World Geographic System of 1984.

Name: WGS_1984_UTM_Zone_35S

Projection: Transverse Mercator

False Northing: 10000000

False Easting: 50000

Central Meridian: 27

Scale factor: 1.0

Latitude of Origin: 0.0

Linear Unit: Meter

Geographic Coordinate System: WGS 1984

Datum: D_WGS_1984

During the assessment of available data on wetlands, all the data on wetlands has one source which is the Department of Water Affairs, so as the data was manipulated by different users, it ended up being projected to unknown projection which do not reflect or identify the name and type of projection on the metadata. The data has the original projection of UTM 35S which carries a World Geographic System of 1984 and 1984 world Spheroid.

The other data had a number of origins and the team has projected it to UTM 35S.

In as far as metadata management is concerned it is advisable to users to provide data in decimal degrees preferably in the WGS_1984 projection for other users to easily project it to the preferred projection.

Conclusions

The review of the quality of the spatial data available to the DWA revealed difficulties in overlaying the various themes and importing information from one data source to another due to the use of different geographic projection systems.

The current DWA GIS-WIS platform including all the other sources gathered during study and available data provide only spatial information and lack attributes such as the Why? What? How? which needs to be recorded systematically in the metadata. As an initial step it has been suggested to standardize the Wetlands Inventory Sheet (Annex 3) and Socio-Economic Questionnaires (Annex 4) and allow for their inclusion as attributes to the corresponding layers.

For the systematic recording and management of the metadata, it is recommended to use the FGDC ESRI especially when DWA is using ArcView 9.2 and its successors for manipulation of data and maps.

In as far as metadata management is concerned it is advisable to users to provide data in decimal degrees preferably in the WGS_1984 projection for other users to easily project it to the preferred projection.

As all activities were carried out at DWA with full participation of some members of the department. It was through these exercises that members of staff have benefited by learning from the consultants as part of capacity building. The operating system at the DWA had some limitations such as lack of **spatial analyst extension** and **3D analyst** to assist in the analysis of the suitable area.

ANNEX B: WETLAND DATA SHEET

DISTRICT: ----------

Date: ----------

Name of compiler/s			
Site name (official name of site and catchment)			
Area of wetland catchment			
Area of wetland			
Mean Annual runoff from the main catchment (m^3/s)			
Mean Annual Evaporation			
Precipi-tation	**Mean**		
	Max		
	Min		
Geogra-phic location	**South**		
	East		
Altitude			
Aspect			
Landform Setting			
Slope			
Flora		**Species /genus**	**Abundance (No/m^2)**
Fauna			

Water Quality (Outflow)	**Salinity**		
	TDS		
	Conductivity		
	pH		
	DO		
Water quantity	**Inflow**		
	Outflow		
Erosion extent	**Severity**	%	
		Low	
		Moderate	
		High	
		Very high	
Extent of wetlands using digital camera with coordinates		S:	Direction:
		E:	
Sketch the wetland below			

Observations:

SKETCH MAP

ANNEX C: SOCIO-ECONOMIC INVENTORY OF THE WETLANDS

Tsoelopele Consultants and Contractors in collaboration with PEMConsult have been commissioned by ORASECOM to conduct a study that will inform them about the wetlands. The purpose of this study is to collect information about the wetlands within the Khubelu River catchments. Such information will be used for comparison with the neighbouring wetland areas that have already been surveyed**.**

District: _____

Name of village: _____

Name of Respondent: _____

Respondent's Status: 1. Household head [ ] 2. Spouse [ ]
3. Herder [ ] 4. Chief [ ]
5. Other [ ]

Name of Interviewer: _____

Date of Interview: _____

A. Respondent's Personal Characteristics

1. Gender of respondent: Male ____ Female _____

1b. Age of respondent: _____

2. Number of household members including herder's _____

3. Number of household herders _____

4. Age of household herder _____ Herder 2_____

5. Schooling of household herders _____ Herder 2 _____

B. Household's Assets

6. Number, size and location of fields owned by the household

Fields	Size (acres)	Location	Who allocated you this field?
1			
2			
3			

Location: 1. Along the river 2. On the hillside 3. Flat plain

7a**. Number and type of livestock owned by household**

Livestock type	Livestock size
Cattle	
Sheep	
Goats	
Donkeys	

7b. Where does your livestock graze, at what season?

Livestock type	Grazing land	Season
Cattle		
Sheep		
Goats		
Donkeys		

Season: 1. Summer 2. Winter 3. Spring 4. Autumn

7c. Is there a restricted grazing area where animals are totally not allowed to graze?

_____

7d. If so, where is this area, and why are they restricted? _____

_____

8. Number and type of livestock mafisa'd in from other households

9. Number and type of livestock mafisa'd out to other households

Livestock type	Number Mafisa'd in	Number mafisa'd out
Cattle		
Sheep		
Goats		
Donkeys		

10. Number and type of trees owned by the household?

Tree type	Number

11. Which other assets does your household own?

a._____b.

_____

C. Current Wetland Uses

12. For what purposes is the wetland used?

a. For grazing animal's _____

b. For settlements _____

c. For agriculture _____

d. For extracting medicinal plants _____

e. For harvesting crafts grass _____

f. Tourism activities _____

12b. For what purposes is water from the wetland used?

a. Drinking water for humans _____
b. Drinking water for animals _____
c. Water for laundry _____
d. For irrigation _____

D. Current Wetland Management responsibilities:

13. Who manages the use of the wetland _____?

13b.Who decides on how it has to be used? _____

13c. Are you a member of the grazing association? _____

13d. Are herders involved in the management of wetlands? _____

13e. How are herders involved in the management of wetlands? _____

13f. Are herders given any training on management of wetlands? _____

13g. Who has trained them on wetland management? _____

E. Economic Aspects of the wetland

14. For the following provisioning services from the wetland indicate where the alternative sources are and the mode of transport used to get of the service

Service	**Alternate source**	**Time taken to reach alternate source**	**Mode of transport to alternative source**
Water for direct human consumption			
Water for washing purposes			
Water for livestock			
Other			

14 b. For the following supporting services, indicate for how much you have bought or sold them in the informal market and the unit of measurement.

Resources supported by wetlands	**Price of resource when sold in informal markets**	**Price of resource when bought**	**Unit of measurement (Lefupu, plastic bag,**
Fish			
Medicinal plants (specify)			
Wild vegetables (specify)			
Shrubs and trees (specify)			
Grazing grass			
Thatch grass			
Craft grass (e.g. Mosea)			
Other (specify			

14c. For the following cultural/ spiritual / recreational services, indicate whether there is an alternative service source and how long it takes to get there and the mode of transport normally used.

Service	**Alternative service source**	**Distance to the alternative source**	**Time taken to get to alternative source**	**Mode of transport normally used**
Baptism				
Ritual swimming				
Ritual cleansing				
Recreational swimming				
Fishing				

14d.Which of the services above have reduced, and which disease outbreaks resulted from reduction of their availability?

Service	**Disease outbreak**

F. Identification of Benefits

15. What specific benefits do you get from the wetland?_____

_____

_____

15b. Are the benefits that you are getting still the same as before? _____

15c. What has caused the change, if any?

_____

_____

15c. Which threats to the benefits do you envisage?

a. _____
b. _____
c. _____

15d. Have the benefits from the wetland reduced within the past few years and if so, what has reduced them?

_____

_____

G. Assessment of the impact of the Use of the wetlands

16. From your observation, what is the condition of the wetlands in your area?

a. in good condition _____

b. Have eroded _____

c. have been overgrazed _____

16b. What has caused that condition?

_____

_____

16c. How can the condition be improved/reversed? _____

16d. Which of the following benefits have changed and how have they changed?

Benefits	**Whether changed**	**How they have changed**
Fish		
Medicinal plants (specify)		
Wild vegetables (specify)		
Shrubs and trees (specify)		
Grazing grass		
Thatch grass		
Craft grass (e.g. Mosea)		
Other (specify		

Medicinal plants	**Wild vegetables**	**Shrubs and trees**	**Craft grasses**

Thank you very much

ANNEX D: INSTITUTIONAL FRAMEWORK FOR WETLANDS MANAGEMENT

Institutional Level	Responsibilities	Tasks/Activities	Competency Required	Capacity Gap	Proposed Capacity Development	Modality
Ministry of Natural Resources	Promote and ensure wise conservation of wetlands; Host the Lesotho Wetland Unit and overseeing its programmes	Provide enabling environment for effective wetland conservation and wise use through policy direction, appropriate legal frameworks, resourcing and staffing of Lesotho Wetlands Unit	Policy formulation and analysis; ability to write effective proposal and socially constructing the wetlands problems; Public participation Planning			
National Wetland Coordination Committee	Interagency body responsible for interagency coordination and provision of strategic direction at the national level. To advise the Lesotho Wetland Unit	Hold meetings twice a year to oversee the coordination and implementation of the national wetlands programme	Specialist in wetland management; Environmental specialists; Water specialists			
Lesotho Wetlands Unit	Oversees the implementation of the National Wetlands Management Programme	Programming Wetlands Management Planning Budgeting Coordination Facilitation Reporting Monitoring				
Technical Specialist Working Group	To facilitate scientific research on wetlands and provide technical backstopping to the Lesotho Wetlands Unit					
Relevant Line Departments	Work on wetland issues that are unique to their own departments					

Institutional Level	Responsibilities	Tasks/Activities	Competency Required	Capacity Gap	Proposed Capacity Development	Modality
Ministry of Forestry and Land Reclamation	Should continue to work with the Ministry of Natural Resources and Ministry of Local Government on rehabilitation of Wetlands; Should continue to train herders on proper wetland management; Continue rehabilitation and conservation programmes					
Ministry of Local Government	Overall management of natural resources at district and community levels; District planning and implementation of programmes; formation of district wetland coordination committee					
District Wetland Coordination Committee	To provide interagency coordination and strategic direction ; Facilitate the process of formulating relevant regulations and bylaws, compiling inventory and assessment of wetlands at district level, law enforcement and monitoring compliance, and the implementation of wetland management plans and guidelines. To work with District Community Council on issues related to management					
Village/ wetland System Coordination	Coordination of the National Wetlands Programme at community level; provision of	Coordinate implementation of activities at the village level and report				

Institutional Level	Responsibilities	Tasks/Activities	Competency Required	Capacity Gap	Proposed Capacity Development	Modality
Committee	strategic direction for the programme at this level;	accordingly;				
Herders and other resource users	Ensure protection of wetlands;	Rehabilitate wetlands through re-seeding; continue good grazing practices; maintain recommended stocking rates				

ANNEX E: LIST OF PEOPLE CONSULTED

Stakeholders at Central level Contacted in 2008

NAME	DEPARTMENT/MINISTRY	POSITION	TELEPHONE	MOBILE PHONE	ADDRESS
DEPARTMENT OF WATER AFFAIRS					
Mr. S. Lerotholi	DWA				
Ms. L. Motanya	DWA				
Mr. Mefi	DWA				
MINISTRY OF WORKS					
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	
MINISTRY OF AGRICULTURE AND FOOD SECURITY					
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			
MINISTRY OF TOURISM, ENVIRONMENT AND CULTURE					
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
MINISTRY OF FORESTRY AND LAND RECLAMATION					
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			
NATIONAL WETLANDS COMMITTEE					
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
LERIBE					
Mr. Malefetsane Nthimo	Forestry and Land Reclamation	District Coordinator	58953551	maljinthimo@yahoo.com	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	vwss@leo.co.ls	Box 498. Maputsoe 350
Ms. N. Mohapeloa	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		
BUTHA-BUTHE					
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

NAME	DEPARTMENT/MINISTRY	POSITION	TELEPHONE	E-MAIL	ADDRESS
Mr. T. Bokaako	Agriculture and Food Security	District Irrigation Officer	22460490/ 215 58765079	Thoso_bokaako@yahoo.com	Box 15, Botha-Bothe
Mr. T. Lethunya	Ag4riculture and Food Security	District Animal Production Officer	22460490 63143674		P.O. Box 15 Botha-Bothe 400
MOKHOTLONG					
Ms. Makhothatso Tsita	Local Government	District Administrator	22920202/291 58974992	makhothatsot@yahoo.com	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	rws@leo.co.ls	Box 110 Mokhotlong, 500
Mr. Chesetsi Ntsiki	Agriculture and Food Security	District Extension Officer	22920211		Box 11 Mokhotlong, 500

ANNEX F: MINUTES OF STAKEHOLDER CONSULTATIONS

Meeting with the Ministry of Tourism, Culture and Environment Secretariat held on March 27, 2008 at NES

Present

- NES facilitated the implementation of the RAMSAR Convention in Lesotho which they passed to Natural Resources – Wetlands Unit.
- As Ministry of Environment, they can source funds for projects that deal with the environment.
- GEF projects should be developed by experts from Lesotho but Lesotho has delayed submissions. Only four have been submitted.
- EIA is being conducted by the projects that apply for the developments. EIS are required with regard to different projects. However law enforcement still seems to be a problem. Normally projects are expected to provide EIA and EIS especially around the wetlands.
- The environmental audit is being done but issues are not enforced because there is a bill but it has not been enacted. Note that the bill 2000 was repealed. We expect that the act will be 2007 Act.
- Wetlands and rangelands are always a concern. Environmental Act of 2001 was repealed. We are looking forward to 2007 Environment Act which is being discussed.
- In the absence of the legal imperative, researchers are bound by professionalism and ethics to conduct EIA although it is costly. Some do consult with the Ministry of Environment although others do not.
- The Ministry banks on cooperation of other ministries. There is need for proper collaboration among government ministries,
- There is need for training and integrating environmental staff within the line ministries.
- There is a plan by the Ministry of Environment to conduct training in the other ministries to make them aware of the environmental issues.
- Each district has got an environmental officer. Their role is to make people aware of the environmental issues.

- Outreach programmes operate countrywide. There are environmental officers in all districts. They work with environmental education and awareness. They are also expected to participate in district planning that includes environmental concerns.
- Strategic Environmental Assessment was done by MDTP around Senqu Sources through Protected Area concept. Report is with the director. It is difficult to change people's mindset. It involves controlled range management. What is important is good rapport with communities. The theme is to intensify the management of the areas. Good relations and understanding of people act as effective management. Community Conservation forums were formed to coordinate grazing. Such forums are assisted to make bylaws which are hoped to be part of the Local Government Act as amended – Local Government Act Number 6 of 1997 as amended.
- Environmental Policy of 1998 is still the same. It has not been amended

Meeting with Principal Secretary Ministry of Works held on March 25, 2008
Mr. L. Phooko

- Roads does environmental and social studies
- Rural Roads takes precautions on impacting issues as they build roads.
- It is binding to conduct EIA
- The consultants have in their teams environmental consultants
- The documents are available but they will be made available from the environmental officer
- Department of Rural Roads have construction methods and documentation which they will make available
- Department of Rural Roads involve the communities in construction and maintenance of roads. This enables them to integrate with communities and educate them.
- Name of Environmentalist: Ms. Ntaoleng Mochaba -22327449 cell 58592016

Meeting with PS Ministry of Agriculture and Food Security
on March 27, 2008

Present:

Mr. Mohale Sekoto, Principal Secretary,

Mrs Seipati Mofolo- Principal Livestock Development Officer, Fisheries

Dr. Marosi Molomo- Director Livestock

Mr. Seriti Phate

Dr. Motlatsi Mokhothu

Mrs. Thope Matobo

- Ministry of Agriculture is mandated to assist the farmers to rear successfully the livestock and vegetables
- The ministry is not responsible for land tenure administration
- Local Government structures have taken over the issues of land administration. Like others the ministry has its manpower working under the Local Government in the districts.
- The Ministry is concerned with feeding and livelihoods of animals
- The ministry always advises the farmers to balance their livestock with grazing lands. Currently, Range Management also has a role to play in the guiding of farmers to take care of their animals.
- The animal registration is under the Ministry of Home Affairs under the Livestock Registrar. It is no longer under the Ministry of Agriculture.
- Livestock Department provides recommendations for improving livestock in terms of breeds and disease control.
- The Range Management will know about the animals which are said to be wild but reality is that such animals are owned by certain individuals who just leave them roaming around in the sponges. They know their number. Range Management Area Programme (RMA) used to be effective in controlling grazing as rotational grazing used to be done properly.
- Currently Local Government Structures are the ones that are mandated to manage rangelands.
- Currently the Agric staff in the districts is undergoing a transition towards decentralisation. This involves moving staff at district level from Public Service Commission to Local Government Service Commission. District Agricultural Officer, is under the District Administrator, although he represents central government at district level.
- Range management Department is the coordinator of rangelands and wetlands working together with Department of Water Affairs.
- Local Government is the engineer who is supposed to coordinate different Government ministries.

Meeting with PS Ministry of Forestry and Land Reclamation held on April 08, 2008 at MFLR

Present

1. Dr. Motlatsi Mokhothu
2. Mr. Seriti Phate
3. Mr. Halefele Matsipa
4. Mrs. Nkareng Mahlompho Mota PS, MFLR
5. Mrs. Majosease Thulo
6. Mrs. Thope Matobo

The meeting was held in the absence of the Director, Soil Conservation because they a workshop on-going.

Mr. Seriti Phate introduced the purpose of the meeting and PS Ministry of Forestry and Reclamation welcomed the team.

The Principal Secretary confirmed the fact the wetlands are the responsibility of the Ministry of Natural Resources. However, the Ministry of Forestry and Land Reclamation and the Ministry of Local Government work together as a team in the rehabilitation and protection of the rangelands and the wetlands.

The Ministry of Forestry and Land Reclamation, has started the rehabilitation of the wetlands in collaboration with the herders. They used to train herders since they are recognised as the main stakeholders in rehabilitation and protection of the wetlands. Their training and engagement seems to have yielded positive results. Such training has been held for herders all over Mokhotlong. Herders have been engaged in reseeding the rangelands. They have been trained on protecting the rangelands that include the sources of Khubelu and the wetlands. The Maluti Drakensberg Transfrontier Project has been very intrumnetal in training herders.

The Ministry finds it important that Local Government and DWA meet with them regularly.

The presence of the traditional leadership especially some of the key ones has worked positively since people now have begun to understand the importance of observing the boundaries for the different rangeland zones. The chiefs are also important to lead in the rehabilitation and maintenance of wetlands. This has also facilitated the planning process.

The Ministry of Forestry and Land Reclamation's responsibility is to provide the technical know-how for land reclamation and rehabilitation of rangelands. The Ministry of Natural Resources have the funds and they assist the MFLR for them to train and supervise the reclamation. Range Management Department provides technical advice on the stocking rates and assessment of the rangelands. They also monitor the rangelands but have no powers of removing livestock extra livestock on that has exceeded the areas carrying capacity. They can only approach the authorities that have allocated the rangeland and provide advice.

They have also train the Local Government Councillors and other stakeholders in the management of natural resources. Such training has facilitated good working relations between the councils and the chiefs. However, those who have not received similar training still have problems. It is therefore important that all get training and given a chance to go to the rangelands so that they can acknowledge the different grazing zones.

According to the interviews there many cattleposts within the wetlands which is a sign of poor understanding and maybe inefficiency of some of the councillors contributes to improper allocation of cattleposts. They do not give themselves a chance to visit the rangelands so that they could make proper allocations of the cattleposts.

There is a policy on range management and it is currently being updated. The update has sections on the protection of wetlands which was lacking in the original document.

It is necessary to formulate the policy which eventually will be gazetted into an act.

This policy should stipulate the protection and management of wetlands. It should also identify different responsibilities.

Range Management is forming grazing associations which follow up established plans that include protection of the grazing areas. Wetlands will be demarcated and stocking rates established within each wetland. Already there is a document showing the stocking rates within Khubelu catchment which can be used as a benchmark. However there is a need to come up with a policy that will govern grazing distance away from the wetlands. Such a policy should also determine the length of time and intervals at which the area could be let to rest. Livestock cannot be removed totally from the wetlands as nature calls non-removal but controlled grazing. However because of the degraded situation of the wetlands at Khubelu catchment, there is need to let it rest for a while in order to rehabilitate.

For grazing control to be effective, there should be continued training of farmers especially livestock owners and herders and follow-ups established. The Khubelu area has not received this training in the past year, 2007/2008. It should also be noted that there are different Principal Chiefs involved at Khubelu.

The livestock that is found at the cattlepost all year round even at the time when they are supposed to have moved to a different zone should be impounded by grazing associations and Community Local Government Councils. The problem is that at present the law allows impounded stock to be paid for, but unfortunately the trespassers pay and return their livestock to the same area where their livestock were impounded. It becomes difficult for people to continue impounding the same livestock each time since they are afraid of being attacked and even killed by livestock owners who carry dangerous weapons. This worsens degradation of the wetlands.

It should be noted that within Khubelu catchment, people's livelihoods depend more on livestock rearing than crop production, hence the reason why they keep many livestock. There are so many cattle posts set on the wetlands contrary to the past whereby positioning of catleposts was done at a distance away from the wetlands.

The physical inspection by chiefs has helped a great deal since they allocate the grazing permits knowing the status of the areas concerned.

There is a policy governing grazing and times of relocation to various areas. Farmers are also encouraged to plant fodder and the Ministry has seeds for free.

The ministry advice the farmers and local government on the capacity of grazing area in terms of type and numbers fit to graze the area without causing degradation. The local government have to mange the implementation. Funds for district programs are supposed to be in the districts but there is no capacity at district level.

Meeting held at the Department of Water Affairs (DWA) on January 03, 2008 at 2:30pm

Present

Mr. S. Lerotholi

Mr. S. L. Phate

Dr. M. N. Mokhothu

Ms. L. Motanya

Mrs. T. Matobo

Agenda

1. Office Space
2. Capacity Building
3. Area Selection for the inventory study
4. Reference Group/ National Wetlands Committee
5. Revised Inception Report

1. Office Space

The office space for the consultant has been earmarked but not yet confirmed with the director. Access to the office is still a problem as result. January 04, 2008 is supposed to be the date for completing the allocation process. This will be finalised between Mr. Phate and Mr. Lerotholi.

2. Capacity Building

In order to capacity build DWA staff, the agreement is that DWA will provide at least two people who will work with the consultants. Three aspects were discussed with respect to capacity building:

a. There is a communication person who can be attached to the sociologist and communications specialist
b. Clear duties for the counterpart personnel should be provided
c. Qualifications of staff to be attached versus those of the assistants

To facilitate the process of selection of staff, Mr. Phate will provide DWA with the work plan by Friday 4th January, 2008.

3. Area selection for the inventory

For selecting the area for the inventory, the consultants have to ensure that there is no duplication of efforts or overlap with other projects. The following projects are either running already or proposed:

a. MCC has proposed work at Lekhalong la Lithunya, Letseng la Letsie and Sani;
b. MDTP is already working at Senqu Sources with the Protected Area Project.
c. Motete wetland is within Lekhalong la Lithunya despite that there were discussions about its possibility for selection and that it is seriously disturbed.

It was agreed that the wetlands to be selected should be palustrine and at close proximity to Senqu Sources. Mokhotlong Sources sounded like a possible option. However a final conclusion will be reached after Dr. Mokhothu has looked into inflow statistics in consultation with DWA.

4. Reference Group / National Wetlands Committee

According to Mr. Lerotholi, NWC is made up of institutions that are involved with wetlands. They include government departments, Non- governmental Organisations and University. The committee was formed as a response to RAMSAR Convention. The committee holds ad hoc meetings and provides an advisory role as well as share ideas on wetland management. Mr. Lerotholi will provide the full list of institutions that form the NWC. It was agreed that because of its nature and roles, NWC will be involved at the second level for advisory and monitoring purposes.

The Reference Group will be identified once the area has been selected. It is important for the consultants to come up with possible offices that will be involved and not necessarily people's names.

Proposed date of the next meeting will be Thursday January 10, 2008 at 2:30pm at DWA.

The meeting closed at 4:00pm.

Stakeholder Meeting Held on April 29, 2008 at Paela-itlhatsoa Local Community Council (JO4)

Address: Paelaitlhatsoa Local Community Council

Box 193, Mokhotlong 500

Present

Ms Panana Moahi- Clerical Assistant (Cell Number: 63259483)

Ms Ntsoaki Lesefa- Accounts Clerk (Cell NO. 63184576)

Mr. Moiseraele Sekonyela – Messenger (Cell: 63146569)

Mr. Thoriso Setebe – Deputy Chief

Dr. Motlatsi Mokhothu

Mrs Thope Matobo

The meeting was started with the introductions. Dr. Mokhothu went on to explain the purpose of the meeting whose intention was to meet with the Chair of the Local Community Council and members of the council. Unfortunately all were not present. He went on to introduce the project and our reason for being there which was to discuss the differences observed in the Khubelu catchments and training needs.

According to those present, JO4 Local Community Council is made up of the following villages:

1. Lichecheng
2. Limonkaneng
3. Patiseng
4. Maloraneng
5. Mahausing (Masefeng)
6. Pailaitlhatsoa
7. Ha Nthimolane
8. Matebeleng
9. Ha Masasane
10. Lets'eng

According to the discussions, some of the villages that are within the Khubelu Catchment belong to Molikaliko Local Community Council (JO6) which is made up of the following villages:

1. Maropong
2. Khonofaneng
3. Ramosoeu
4. Taung
5. Libetseng
6. Ha Monameng

7. Ha Moroke (Masianokeng)
8. Rapeising
9. Molikaliko

Each Local Community Councillor makes development plans together with the chiefs and villagers concerned in their own village. They decide on the timing of restricted areas and how they should be observed. The plans are kept by the Local Community Council.

Within JO4, there are two gazetted chiefs, namely that of Paelaitlhatsoa and that of Limonkaneng who are representing all the chiefs and headmen in the area within the council.

Normally, restrictions on grazing resume in October up to July in the low lying areas in the C zone. Animals are allowed to graze after harvest. During the restricted period animals go to the cattleposts at Tseng-la- Senqu and at Tlaeeng which are Zone A. In these areas, the principal chiefs are the ones who are responsible for allocating grazing areas and cattleposts to different livestock owners. They issue permits for grazing there. Principal Chief of Malingoaneng issues permits to all Batlokoa to graze at these places.

Animals are supposed to move to Zone B which is between A and C which can be considered as the foothills in April. Sheep remain at Zone B until they return to Zone A in October. Cattle normally move down to Zone C during end of May.

Grazing associations are supposed to work with the Local Community Councils. According to the discussions, so far in JO4, a pitso was held for chiefs and associations where the Local Councillor had called them about the protection of the grazing areas. Grazing associations are supposed to ensure proper movement of livestock to different zones. Included in this meeting also were livestock owners and not the herders. The reason for the meeting was that there was observed rampant burning of the grass which was done not only by herders but by livestock owners as well. The meeting took place in September, 2007.

On the question of how grazing restrictions are done for Zone A, it appeared that the Principal Chief of Malingoaneng normally calls a Pitso at Malingoaneng where the restricted areas (Maboella) get discussed. The chief also announces those grazing areas that have been opened for grazing.

Livestock Numbers

In July livestock get counted by councillors and chiefs. This allows for the issuing of permits at different zones. There are two types of permits:

For Zone A, it is the Principal Chief of Malingoaneng who issues it

For Zone B, they are issued by the Local Community Councils.

Chiefs and representative of the principal chief sometimes tour the grazing areas before they could allocate them for grazing.

- At Tlaeeng, grazing is combined with those from Leribe and Motete
- JO4 graze at Khabele and Tseng la Senqu (all Batlokoa). Here they have never been joined by livestock from Butha-Buthe
- At Letlapeng, Batlokoa and Butha-Buthe graze together. Except for livestock theft, there have never been conflicts over grazing lands
- Wetlands around villages are no longer in good condition due to overcrowding since animals go and come back all at once. Also there is less rain

According to the discussions, it is not only the herders who burn grazing areas, but grown ups as well. They do it intentionally especially because they get chased away in order to let the grasses to regenerate.

There is need for training workshops despite the fact that the chiefs and the Local Community councils give them feedback all the time when they return from the workshops. The Local Community Councils have not yet been fully accepted by the communities as the ones who are responsible for natural resources. They still have problems in this area. On the other hand people still look up to the chiefs for the management of natural resources and they are still respected. It is alleged that the chiefs are the ones who are influencing people to the extent that they have not accepted the local councils.

There are chiefs within the council who represent chiefs' interests since they have been appointed with that intention. However, there are other chiefs who are still problematic.

Development activities in the catchment

The following developments are either ongoing or have been completed:

1. A health Post (clinic) at Maloraneng- currently undergoing construction
2. Lodge- built by Letseng Diamond Mine by the Alluvial Ventures Company. This was started before the establishment of the local councils. However it was build with the purposes of assisting the villagers within the Tlokoeng ward (Malinoaneng) The agreement was that the company would deduct its incurred expenses then the lodge could then be taken over by the villagers who would receive the benefits for the loss of grazing land as a result of the mine. The following villages were included in the plan:
    a. Lichecheng
    b. Patiseng
    c. Maloraneng
    d. Paelaitlhatsoa
    e. Ha Nthimolane
    f. Ha Masasane
    g. Ha Moroke
    h. Libetseng
    i. Ha Ramosoeu

j. Maropong

3. Tree planting and construction of walls (metseletsele) by the Ministry of Forestry and Land Reclamation. These have been done at Limonkaneng. They are also planting grasses which will prevent soil erosion and improve grazing for the livestock.
4. Water supply which was done by Letseng Diamond Mine for Maloraneng whereas for Paelaitlhatsoa and other villages it was done by Rural Water Supply of the Department of Water Affairs. At Mahausing, water supply will be expanded to those who do not have water with the funds from JO4 Local Community Council. Normally funding for the council and its activities comes from the District Council.
5. Community gardens have been established by JO4 at Matebeleng

Reference Group

The following offices and groups were suggested for the formation of the Reference Group:

a. Grazing Association
b. MDTP rangers
c. Representatives of JO4 and JO6
d. Principal Chief
e. District Council Secretary
f. District Administrator
g. Ministry of Forestry and Land Reclamation
h. Ministry of Agriculture

Regarding the uses of the wetlands, it was reiterated that there are medicinal plants that are found in the wetlands which are used by the villagers. They mentioned herbs like khapumpu, sehlehle and lekhala (spiral aloe) which they get from the wetlands. Such herbs are used for curing people and animals. They also get different grasses for making handicrafts such as baskets and sweeping brooms. However, they do not sell them. People from outside the catchment have to ask the chief for harvesting the herbs and pay a certain amount. But it is difficult to say how much for what. What was confirmed was that much as natural resources are a prerogative of the Local Community Councils, they are slow to come up with prices for selling hence why people still go to the chiefs. Harvesting is not yet controlled.

The meeting was ended with a summary of the days discussions which also emphasised for information that Khubelu Catchment has been approved as the study site for the improvement and protection of the wetlands.

ANNEX G: 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, Malibamatso 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, (2007).	Lesotho Water and Sanitation Policy. Maseru, Lesotho
Ministry of Natural Resources (2007 draft)	Draft IWRM Strategy for Lesotho
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, Pietermarizberg