Makgadikgadi Framework Management Plan

Volume one:
Main report

November 2010

Republic of Botswana

Report details

This report is volume one of the Makgadikgadi Framework Management Plan prepared for the government by the Department of Environmental Affairs, Ministry of Environment, Wildlife and Tourism in partnership with the Centre for Applied Research.

Volume one is the main plan for the Makgadikgadi area. Volume two contains detailed findings of specialist and component studies prepared during 2009/2010.

Acknowledgements

The MFMP project team is indebted to a large number of institutions, companies, persons and communities that have actively contributed to the projects through: 1. participation in various focus group discussions, project workshops/ meetings and kgotla meetings; 2. being interviewed for the livelihood survey or as a resource person; the provision of data and feedback on draft reports. We sincerely hope that the implementation of the plan will offer a 'reward' for these efforts and the time spent on the project.

Citation:

Department of Environmental Affairs and Centre for Applied Research, 2010. The Makgadikgadi Framework Management Plan. Government of Botswana, Gaborone.

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Abbreviations

APU	Anti Poaching Unit
ATP	Area with Tourism Potential
AWP	Artificial Water Point
BDF	Botswana Defence Force
BEDIA	Botswana Entrepreneurial Development & Information Agency
BLDC	Botswana Livestock Development Corporation
BOBS	Botswana Bureau of Standards
Botash	Botswana Ash
CAR	Centre for Applied Research
CBNRM	Community-Based Natural Resources Management
CBO	Community Based Organisation
CDC	Central District Council
CEDA	Citizen Economic Development Agency
CHA	Controlled Hunting Area
CITES	Convention on International Trade in Endangered Species
CKGR	Central Kalahari Game Reserve
CPPP	Community-Public-Private sector Partnership
CPP	Community-Private sector Partnership
CSO	Central Statistics Office
CT	Central
DCC	District Conservation Committee
DDC	District Development Committee
DDP	District Development Plan
DEA	Department of Environmental Affairs
DFRR	Department of Forestry and Range Resources
DLUPU	District Land Use Planning Unit
DNMM	Department of National Museum and Monuments
DWNP	Department of Wildlife & National Parks
DPCWM	Department of Pollution Control & Waste Management
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
GEF	Global Environmental Facility
GR	Game Reserve
HIES	Household Income and Expenditure Survey
IBA	Important Bird Area
ICCROM	International Centre for the Study of the Preservation and Restoration of Cultural Property
IDMC	Interministerial Drought Monitoring Committee
IKS	Indigenous Knowledge System
IPA	Important Plant Area
ISPAAD	Integrated Support for Arable Agriculture Development
IU	Implementation Unit
FMD	Foot-and-mouth disease
KAZA	Kavango & Zambezi Transfrontier Conservation Area
KTP	Kgalagadi Transfrontier Park
LAC	Limits of Acceptable Change
LIMID	Livestock Management and Infrastructure Development
LEA	Local Entrepreneurial Agency
LSU	Livestock Unit
LWDP	Livestock water Development Programmes
MCA	Multi-Criteria Analysis
MCM	Million Cubic Metre
MEWT	Ministry of Environment, Wildlife & Tourism
MFDP	Ministry of Finance & Development Planning
MFMP	Makgadikgadi Framework Management Plan

MIMP	Makgadikgadi Integrated Management Plan
MNPNP	Makgadikgadi & Nxai Pan National Park
NAMPAADD	National Agricultural Master Plan for Arable Agriculture and Dairy Development
NDB	National Development Bank
NG	Ngamiland
NMPWWS	National Master Plan for wastewater and Sanitation
NDP	National Development Plan
NDC	Ngamiland District Council
NGO	Non-Government Organisation
NP	National Park
ODMP	Okavango Development Management Plan
PA	Protected Area
PDL	Poverty Datum Line
POP	Persistent Organic Pollutant
PPP	Polluter-Pays-Principle and Public-Private sector Partnership
PSC	Project Steering Committee
RDC	Rural Development Council
SADC	Southern African Development Community
SLOCA	Support for Livestock Owners in Communal Areas (Programme)
SST	Sea Surface Temperature
STC	Sowa Town Council
SWOT	Strengths, Weaknesses, Opportunities and Threats Analysis
TEV	Total Economic Value
TFCF	Tropical Forest Conservation Fund
TGLP	Tribal Grazing Land Policy
UN	United Nations
UNCBD	United Nations Convention on Biodiversity
UNCCD	United Nations Convention to Combat Desertification
UNCED	United Nations Conference on Environment & Development
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNFCCC	United Nations Framework Convention on Climate Change
UPP	User-pays-principle
VDC	Village Development Committee
VET	Village Extension Team
WAB	Water Apportionment Board
WCED `	World Commission on Environment & Development
WMA	Wildlife Management Area
WSSD	World Summit on Sustainable Development

1. Introduction

This chapter provides the background to the framework management plan introduces the Makgadikgadi Pans and states the plan's objectives and the activities that have been undertaken in order to prepare the plan.

1.1. Background

The Makgadikgadi Pan area is of national and international importance, particularly for birdlife, as it is one of the rare breeding areas for the flamingos. The area is dry for most of the year and receives its water from rainfall and inflows from ephemeral rivers.

The area is characterised by different land tenure regimes, sectoral policies and administrative districts and plans, and the use and management of its natural resources is largely sectoral and insufficiently coordinated. A holistic and integrated planning is imperative to conserve the integrity of the wetland system and to optimise the sustainable utilisation of its resources.

The Ministry of Environment, Wildlife and Tourism (MEWT) through the Department of Environmental Affairs (DEA) has taken the initiative to develop a Makgadikgadi Framework Management Plan (MFMP). The MFMP will be followed by implementation of on the ground activities and recommendations for further planning and work, which will lead to Makgadikgadi Integrated Management Plan (MIMP), similar to the Okavango Delta Management Plan (ODMP). This initiative is an integral part of the implementation of the Draft Botswana Wetland Policy and Strategy, and government's drive towards economic diversification and sustainable development, which is recognised within the context of the District and National Development Planning processes.

As a step towards the plan preparation, the government carried out a baseline inventory of the resources (Eco-logical Services, 2002) and a project formulation mission (Centre for Applied Research, 2004) which resulted in the development of a project memorandum (Department of Environmental Affairs, 2005).

This report **is volume 1 of the MFMP** and describes the people and their resources in the area (chapter 3), current land use (chapter 4), the economic value of the area (chapter 5), tourism and heritage (chapter 6), consultations (chapter 7) and the policy environment (chapter 8). A range of possible management scenarios are evaluated in chapter 9. The approach and methodology is briefly outlined in chapter 2. Appendix 1 summarises the proposed MFMP implementation activities with institutional responsibilities and indicative costs. Appendix 2 shows additional maps that have been developed for the project. Appendix 3 has a detailed monitoring plan.

Volume 2 is published separately and has detailed reports on ecology, hydrology, wildlife, economic valuation, tourism and the policy environment. Volume 2 is particularly relevant for those, who are responsible for implementation and those who consider starting projects in the area as well as for communities, NGOs, planners and researchers. In addition, an update of the Site Inventory for the area was conducted during this study, which outlines our current knowledge on the status of, and trends in the physical and biological characteristics of the system. This document can be availed to interested parties by the DEA.

1.2. The location of the Makgadikgadi Pans

The Makgadikgadi Pans are located in north-eastern Botswana, south east of the Okavango Delta and south of the Chobe River front, both of which are major tourism centres in northern Botswana. The Makgadikgadi Framework Management (MFMP) area is located entirely within Botswana. The *catchment area* of the Makgadikgadi Pans is larger and extends into Zimbabwe in the east and north through the Nata River system. It is also linked to the Okavango system on the north-western side through the Boteti River. The wetland area is divided into the eastern Sua Pan and western Ntwetwe Pan. Each pan has a different catchment area, and they are both covered under the SADC Shared Water Courses Protocol. Figure 1 shows the location of the Makgadikgadi Pans in Botswana and southern Africa.

The eastern Sua Pan catchment receives inflows from the Nata River and the Mosetse, Semowane, Lepashe and Mosupe Rivers in the east of the Makgadikgadi Basin. The Boteti River, which is part of the main Okavango River drainage system, drains into the western Ntwetwe Pan (Eco-logic Support Services, 2002). The Boteti River has been dry since the 1980s but has been in flood this year. Water has gone beyond Rakops, and has reached Lake Xau, an event that has not happened since 1981.

Figure 1: Location of the Makgadikgadi Pans in Botswana and southern Africa.

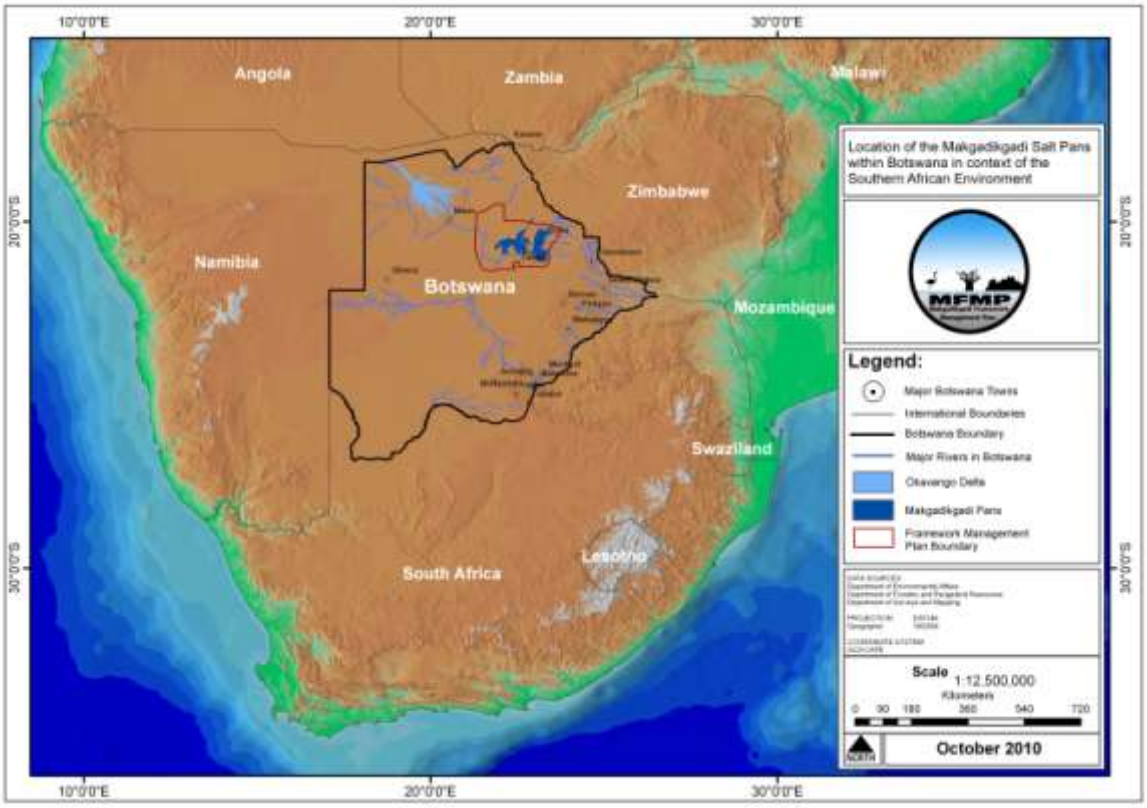


Figure 2: The river head of the Boteti River (September 2010).

Source: NASA.

Source: field trip

Several mines are found around the area, including one of the two major diamond mines (Orapa-Letlhakane) and a Soda Ash mine at Sowa in the east. Mineral exploration occurs in a large part of the area. Wildlife and biodiversity is conserved in the Makgadikgadi and Nxai Pan National Park (MNPNP) and a number of Wildlife Management Areas (WMAs). A string of villages are located around the Pans, partly attracted by the Boteti River. Subsistence livestock and crop production and gathering occur around villages. A large number of heritage archaeological sites are found in the area, particularly in the south eastern part and along the Boteti River.

1.3. Makgadikgadi Framework Management Plan

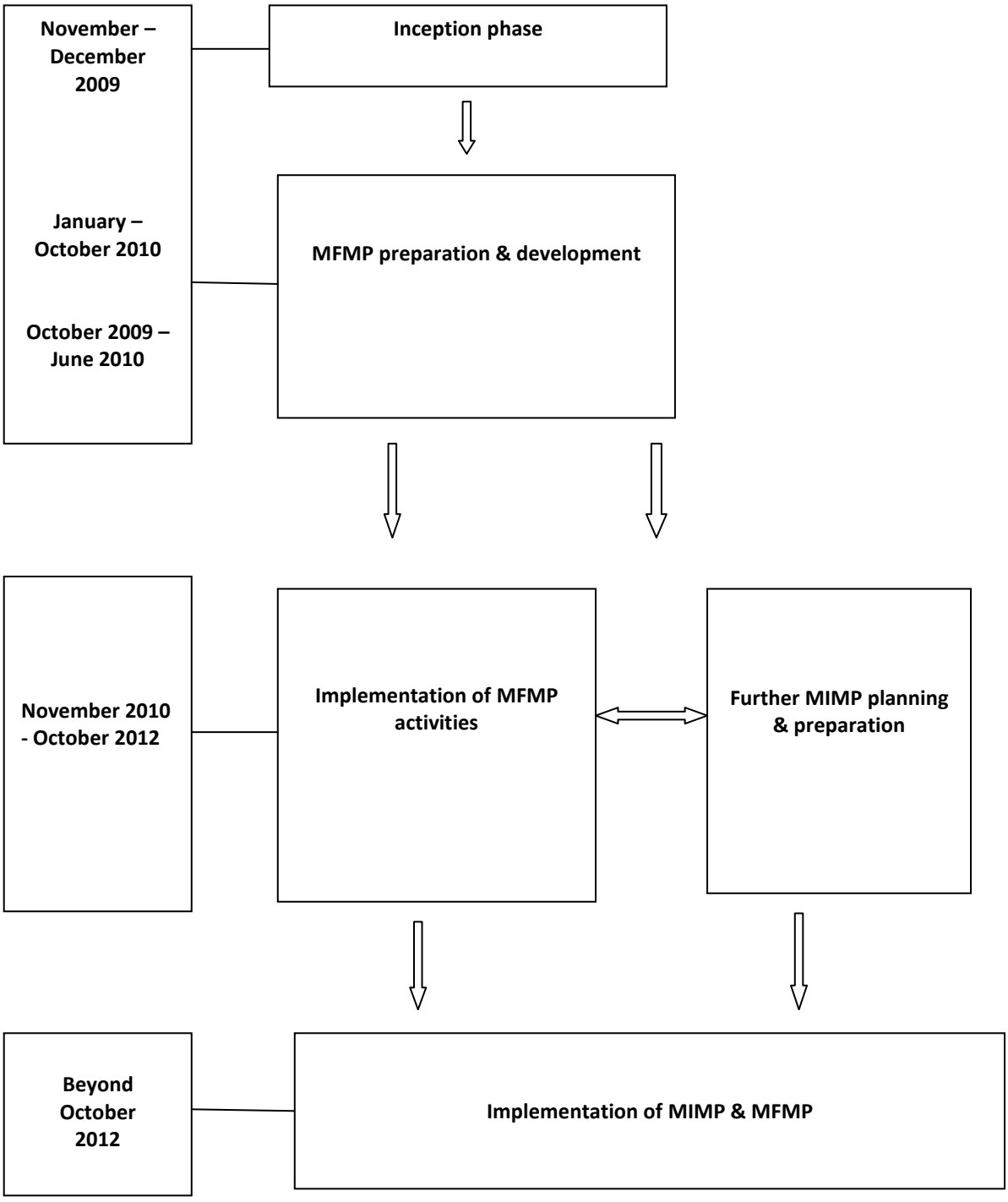
The project consisted of three phases: inception (November – December 2009); analysis and component development (January – July 2010); synthesis and plan development (August – October 2010). After the inception phase, further analysis and studies were undertaken to develop the MFMP, which will be the basis for the subsequent development of the MIMP. The MFMP would identify priorities for development, management and conservation activities and indicate which additional work needs to be done as follow ups.

The overall objective of the Makgadikgadi Framework Management Plan (MFMP) was to provide a starting point for implementation of activities after one year and recommendations for further work under the Makgadikgadi Integrated Management Plan (MIMP). The MIMP implementation will take several years and will require further financial resources. These resources will be made available by government if the MFMP process provides sufficient justification for the need of a comprehensive MIMP beyond the MFMP.

The overall aim of the MIMP (and MFMP) is: "*to improve people's livelihoods through wise use of the wetland's natural resources".* The MFMP is premised on several guiding principles:

- Holistic planning must prevail over largely sectoral planning, which causes many conflicts;
- Development must benefit rural livelihoods and the environment;
- Special attention is needed for vulnerable groups;
- Local stakeholders should be involved in the preparation, planning and plan implementation;
- The local population must develop a sense of 'ownership' of the MFMP and MIMP;
- Implementation is the shared responsibility of the government, private sector and civil society; and
- Resource conservation and management benefits long term development opportunities and livelihoods.

Figure 3: Time plan and linkages between MFMP and MIMP preparation and implementation

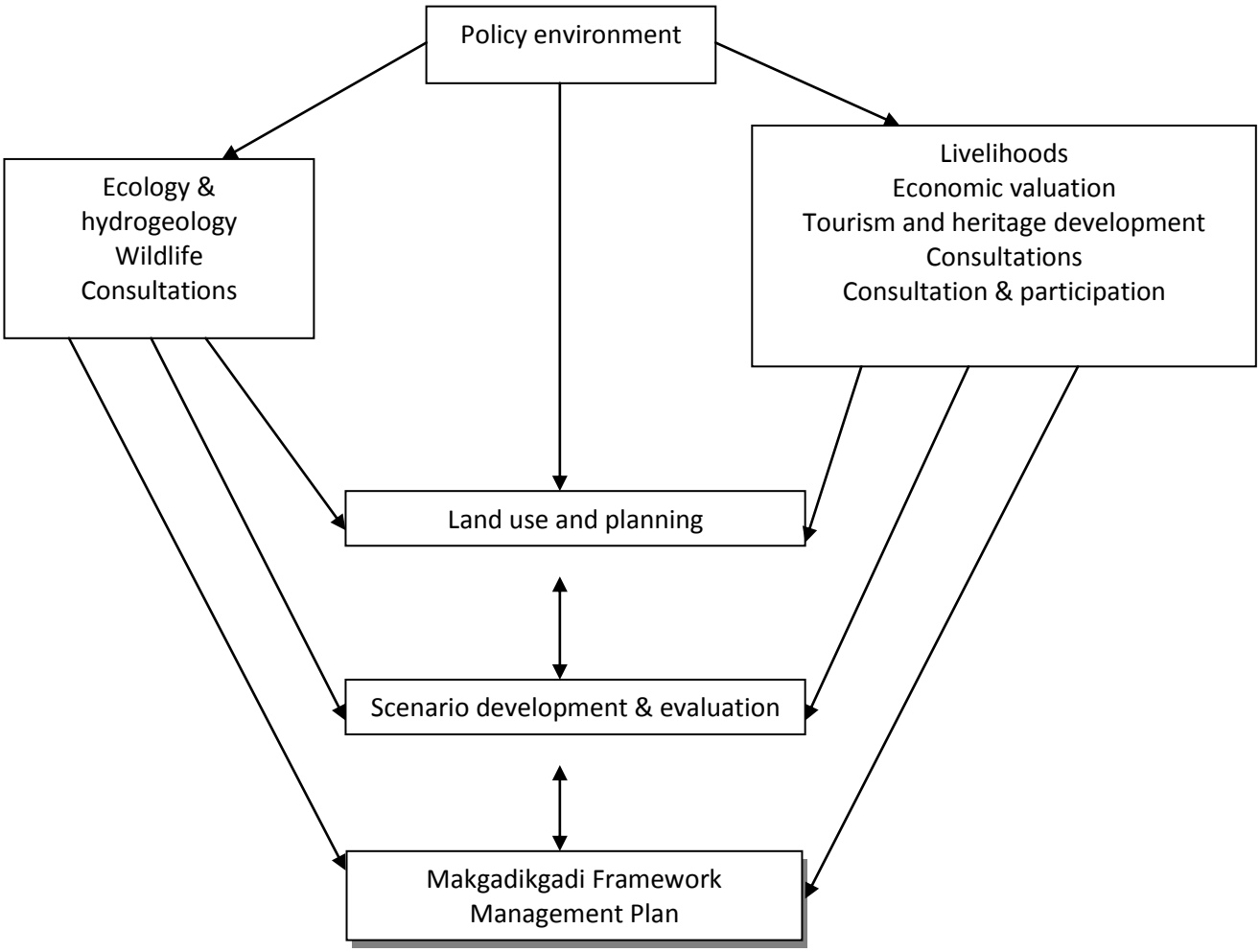


In order to ensure rapid results and continuity, the following priority components were addressed during the MFMP phase (November 2009 – October 2010); the other components will be addressed during the MIMP preparation after November 2010:

- Ecology and hydrogeology;
- Wildlife resources;
- Livelihood assessment;
- Resource use and economic valuation;
- Tourism and heritage development;
- Policy environment assessment;
- Scenario development and analysis; and
- Land use assessment and evaluation.

The MFMP components and their linkages are summarised in figure 4.

Figure 4: MFMP structure and components



2. Approach and methodology

This chapter explains the approach adopted in the preparation of the MFMP (section 2.1). In addition, the concepts and key terms used in the plan are described in section 2.2., and the plan's area is discussed in some detail in section 2.3.

2.1. Approach

The MFMP approach required a clear prioritization and focus up front. MFMP activities have focused on what could be achieved in one year. For example, during the MFMP, many biodiversity hotspots, wet spots, heritage and archaeological sites, and tourism development areas were identified. The spots were prioritized through a multi-criteria analysis and subsequently MFMP work focused on the 'top ten' spots. Lower ranked spots will be dealt with under the MIMP. While choices had to be made, they have been made systematically and in a transparent manner through multi-criteria assessment.

The approach has been integrated and multidisciplinary. During the inception phase, a common environment-development approach (see section 2.2) was adopted. Subsequently, work was subdivided into disciplinary components, before it was synthesized and integrated back into the integrated framework and scenario evaluation. This approach ensured that components are fully linked and together create a comprehensive analysis. The analysis required a range of disciplines, including economics, ecology, land use, hydrogeology, climatology, sociology and archaeology.

The project was developed through a public-private sector partnership. The Department of Environmental Affairs worked together with the Centre for Applied Research on the project. Each institution had its own responsibilities and tasks and close collaboration ensured progress of the project. Unlike in many other projects, government staff carried out part of the work programme itself, including livelihood analysis, policy environment assessment and consultations. This led to cost savings and prepares the DEA to carry out similar work in future by itself.

Stakeholders have regularly participated in workshops in Letlhakane, and Sowa and communities have been widely consulted. The MFMP has benefited from stakeholder views (chapter 6) and it is essential that participation and consultation will continue during the MFMP implementation.

2.2. Leading concepts

The activities were guided by a combination of the sustainable development and livelihood approach as well as the ecosystems approach.

Sustainable development and livelihoods

The concept of sustainable development is widely accepted as a guiding principle for development planning and natural resource management. For example, two global conferences have been devoted to sustainable development (1987 UNCED in Brazil and 2002 WSSD in Johannesburg). Sustainable development is "development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs" (WCED, 1987, p. 43). Given the poverty levels in the MFMP area, sustainable development must focus on economic growth and livelihood improvements in balance with resource conservation. Where trade-offs exists between growth and conservation, informed

decision have to be made and where possible options should be pursued where conservation can be combined with growth and development (win-win situation). Four aspects of sustainability are commonly distinguished:

- Ecological sustainability;
- Economic sustainability;
- Social sustainability; and
- Institutional sustainability.

Some important aspects of sustainable development need further elaboration.

Firstly, some environmental change is inevitable during the development process. The question is which change is acceptable and which is not. Generally, where natural capital can be replaced by human and physical capital, development can be sustained (so-called weak sustainable development). Where natural capital cannot be substituted by other forms of capital, development cannot be sustained and the integrity of the ecosystem is at risk. The MFMP needs to recognise critical natural capital (where substitution does not work) and irreversible environmental changes. MFMP activities need therefore to ensure that critical natural capital is not lost and that irreversible environmental change is avoided.

Secondly, sustainable development requires the investigation of resource use efficiency. The desired economic growth will put more pressure on natural resources unless resources are more efficiently used. In other words, economic growth and natural resource pressure need to be decoupled! The efficiency challenge requires that the MFMP identifies underutilised resource based activities and that it recommends, where necessary, technological and management changes to reduce resource pressure. The efficiency debate needs to be closely linked with the challenge of benefit distribution.

Thirdly, sustainable development requires recognition of spatial mobility and interaction between the local, district, national and international levels. Wildlife mobility and rivers originating away from the project area are examples of physical interactions. National, SADC and global policies and strategies also influence resource management and economic activities. Resource threats, biodiversity values and drivers operate at different spatial levels and these interactions need to be incorporated into the analysis. For example, the pans are critical areas for several globally threatened migratory bird species. Global climate change and potential upstream water abstractions could have a major impact on the pans. These factors need therefore to be considered in the analysis.

Fourthly, approach has to be multidisciplinary. Sustainable development is more than economics, sociology and ecology. Institutional and governance aspects are critical to the successful implementation of the MFMP and were taken on board from the onset. Moreover, stakeholders were engaged throughout the project to ensure that they contribute to understanding the meaning of sustainable development in the area. The question arising is, whose sustainable development? Participation was also used to look for consensus among different economic sectors and communities.

Table 1 contains a preliminary list of the core issues under each category.

Table 1: List of core sustainability issues

Aspects of sustainability	Core issues
Institutional sustainability	Level of decentralisation of planning & management Harmonisation of plans of individual districts Harmonisation of and compliance with district, national and international plans Clear management responsibilities and capacity through local institution (s) with multidisciplinary skills & experience Development of comprehensive area specific plan Use of all kinds of information, data, lessons, benchmarks etc., including indigenous knowledge.
Ecology sustainability	Conservation of biodiversity Maintaining the integrity of the pan's ecosystem Recognition & maintenance of spatial and temporal variability within the ecosystem Maintaining migratory links between pans and other major ecosystems Ensuring that use of renewable resources does not exceed their regeneration Ensuring that pollution remains within the natural absorption capacity or pollution abatement measures
Social sustainability	Ensuring improvements in rural livelihoods Poverty reduction Participation and empowerment of local population, incl. women and youth Buy in of stakeholders (communities, local authorities, commercial sector)
Economic sustainability	Increasing production and direct use value Minimisation of resource conflicts, external effects and opportunity costs Increasing resource productivity Balance BD use and conservation
General	Use of precautionary principle where impacts cannot easily be assessed or are suspected to be irreversible

Ecosystem approach

The ecosystem approach may be viewed as a version of sustainable development that focuses more explicitly on resource conservation, especially wildlife. It is adopted in global conventions such as the United Nations Convention on Biodiversity (UNCBD) and in Botswana policies and strategies such as ODMP and the wetlands strategy. The guiding principles of the ecosystems approach are summarised in Table 2.

Description of key terms used in the MFMP

Archaeological and heritages sites are sites with archaeological and/or heritage values, and they include national monuments, sites with archaeological and heritage features and remnants.

Areas with Tourism Potential are sites within the MFMP area that possess the greatest set of positive attributes within which tourism products and facilities can be developed and where a myriad of tourism activities can be offered. If provided with the right management and utilization within limits of acceptable change, they may significantly contribute to tourism growth in the MFMP and national economy at large.

Table 2: Principles of the ecosystem approach

Principle 1: *The objectives of management of land, water and living resources are a matter of societal choices.*

Principle 2: *Management should be decentralized to the lowest appropriate level.*

Principle 3: *Ecosystem managers should consider the effects (actual or potential) of their activities on adjacent and other ecosystems.*

Principle 4: *Recognizing potential gains from management, there is usually a need to understand and manage the ecosystem in an economic context. Any such ecosystem-management programme should reduce those market distortions that adversely affect biological diversity; align incentives to promote biodiversity conservation and sustainable use; and internalize costs and benefits in the given ecosystem to the extent feasible.*

Principle 5: *Conservation of ecosystem structure and functioning, in order to maintain ecosystem services, should be a priority target of the ecosystem approach.*

Principle 6*: Ecosystem must be managed within the limits of their functioning.*

Principle 7: *The ecosystem approach should be undertaken at the appropriate spatial and temporal scales*.

Principle 8: *Recognizing the varying temporal scales and lag-effects that characterize ecosystem processes, objectives for ecosystem management should be set for the long term.*.

Principle 9: *Management must recognize the change is inevitable.*

Principle 10: *The ecosystem approach should seek the appropriate balance between, and integration of, conservation and use of biological diversity.*

Principle 11: *The ecosystem approach should consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices*.

Principle 12: *The ecosystem approach should involve all relevant sectors of society and scientific disciplines*.

Biodiversity hotspots are areas of the highest conservation priority and direct limited management and conservation resources in a strategic manner to help address the protection of biodiversity and ecosystem functioning from unsustainable development, its associated threats and other challenges to biological diversity. As well as providing direct protection to species, site conservation can also reduce the loss of natural habitats, the main cause of extinctions. BD hotspots also provide ideal reference sites for monitoring the state of biodiversity within the system in effective monitoring programs.

Conflict areas are areas with frequent and significant conflicts between different forms of land uses and human activities. The conflicts include human wildlife conflicts (e.g. predation, damage and diseases) and livestock crop conflicts.

The Makgadikgadi Wetland System (MWS) is delineated by the watershed boundary of the river catchments to the east, including the Nata River catchment in Zimbabwe, which encapsulates the principal input of surface water into the salt pan complex. On the western side, the connection to the Okavango basin, via the Boteti River, is a component of the system, while the hydrological connectivity along fossil drainage lines extending the basin into the Kalahari, Namibia, and the Chobe district are also recognised as part of the greater hydrological basin of Ntwetwe Pan.

Note: This description identifies the 945m contour, which defines the palaeolake boundary/basin surrounding Ntwetwe and Sua Pan, as a realistic and manageable physical boundary. The biological connections are also important to include in the MWS description, which include the mammal migration corridors to the wetlands in the north (Chobe, Linyanti and Okavango wetlands), and the CKGR system to the south.

Tourism nodes are settlements that are meant to support ATP development with facilities and infrastructure. Each tourism node supports several ATPs.

Wet spots are pan surface areas, which have the potential to support an ephemeral wetland. These areas gradually grade into wet mud, hydrated salts and during dry cycles may be reduced entirely to a bare, moisture free, pan surface. Wet spots are produced by direct rain contributions to the pan surface, water runoff from adjacent river catchments and the discharge of shallow groundwater.

Note: The extent of these features is highly variable and the exact surface area, depth and water volume of wet spots is difficult to ascertain, as shallow pan water bodies may also be filled with sediment and algae. Current identification of wet spots is based on the 10 year observation record from the MODIS sensor. Follow up instruments are to be deployed on the Joint Polar Satellite System (JPSS). Systematic space borne monitoring also needs to be accompanied by dedicated, ground-based validation, including water edge detection, pan bathymetry and limnological characterisation.

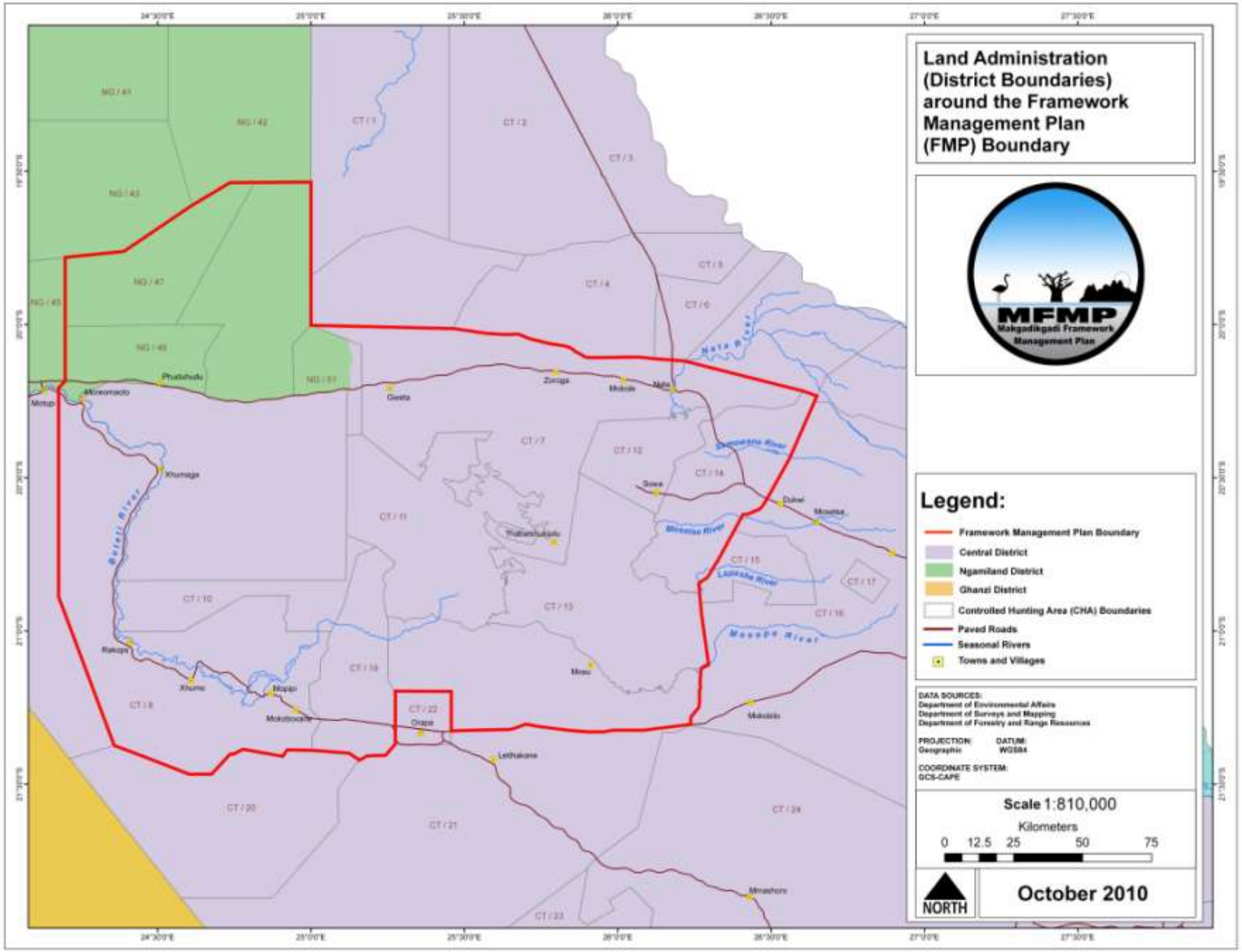
2.3. The MFMP area

Several proposals have been made in the past regarding the boundaries of the area for the Makgadikgadi Integrated Management Plan (MIMP). The areas vary in size from 12 500 km^2 to around 60 000 km^2. During the inception phase, the proposals have been reviewed and considered using the following criteria for the MFMP phase:

- ✓ The size of the area must be such that it can be properly analysed and covered in the available time (one year) and budget;
- ✓ The area must cover the 'core' of the Makgadikgadi wetlands, i.e. salt pans and immediate surroundings;
- ✓ As much as possible the boundary should recognise and follow environmental as well as socioeconomic systems/ zones (e.g. roads, veterinary fences and administrative boundaries);
- ✓ Incorporation of key ecological areas that need to be conserved and that face; and
- ✓ Potential compliance with Ramsar sites' guidelines during the MFMP and MIMP.

Based on these criteria, a 36 000 km^2 area was identified in consultation with the Project Steering Committee (PSC) in December 2009. The area is shown in Figure 5.

Figure 5: Boundaries of the MFMP area



The boundaries for the MFMP project are clearly delineated around the 'core pan and its villages' area. The proposed boundary takes into account the contour lines, physical boundaries such as roads, veterinary fences etc.

The MFMP area excludes linkages with the CKGR, the Okavango, the upstream river basins and the Chobe ecosystem. Development in and conservation requirements of these areas will be reviewed during the MFMP but treated as exogenous factor and processes. It was agreed that the MFMP will recommend refined boundaries of the MIMP area and recommend development and environmental recommendations and requirements for the four areas listed above based on the precautionary principle regarding the maintenance of the integrity of the core parts of the Makgadikgadi wetlands. The four areas will be more fully investigated and planned during the MIMP.

A brief description of the area's boundaries is as follows. The 945m contour boundary around the Makgadikgadi Wetland System was used as a guide to ensure the project area encapsulates the majority of the ecological and hydrological features. While this contour is recognised as a physical perimeter around the wetlands it is not always distinctly visible and can be hard to differentiate with the naked eye while on the ground. To help clearly define the boundary of the MFMP and to ensure that there is effective implementation of the plan, the boundary was also, where possible, aligned with administrative boundaries close to the 945m contour, or with physical features such as roads or fences. The proposed boundary covers an area of 36 452km^2. To the east of the project area the MFMP boundary follows the eastern alignment of the CT14 boundary, running south along the Dukwi veterinary cordon fence, which continues south west towards the southern edge of Sua Pan as far as the corner with CT21 / CT24, where the veterinary cordon fence splits at the Thalamabele gate. From the Thalamabele gate the MFMP boundary follows the main Francistown-Orapa road westwards, passing to the north of the Orapa mine complex and then along the north of the Setata Quarantine Camp's veterinary cordon fence, past Kedia Hill to the Gidikwe Ridge. The Gidikwe Ridge, which runs to the west of the Boteti River through the middle of CT8, is one of the most visually distinct parts of the 945m contour. The MFMP boundary is aligned with this part of the contour north towards Motopi.

From close to Motopi the MFMP boundary is aligned to the east of the Makalamabedi BLDC ranches, then following the northern boundary of the CHA NG47 to the northern and subsequently the north-eastern border of the Nxai Pan National Park. Broadly following the 945m contour the MFMP boundary is aligned to the east of Nxai Pan National Park towards the southern, fenced border of the Nata Ranches. From the south-eastern edge of the Nata Ranches a line is taken to the fenced north east corner of CT14 and the Dukwi veterinary cordon fence.

The MWS, therefore, differs somewhat from the MFMP area. The report routinely refers to the MFMP area and mentions explicitly when reference is made to the MWS area.

3. The Makgadikgadi framework management plan area

3.1. Introduction

This chapter provides an overview of the main socio-economic and environmental characteristics of the MFMP area. Population and livelihood features and processes are discussed in section 3.2. The ecology and hydrology of the area is described in 3.3, followed by a description of the wildlife resources.

3.2. People and their livelihoods

3.2.1. Introduction

The MFMP area is sparsely populated with people from different backgrounds and cultures. However, the livelihood challenges are similar. Households depend on a number of livelihood sources the major one being agriculture which is undertaken primarily for subsistence purposes. Government's social welfare programmes provide a social safety net but unfortunately reliance on government hand-outs has increased over time. Collection of natural resources such as thatching grass, firewood, mophane worms and wild fruits are also important livelihood activities.

Poverty is widespread in the MFMP area. Nation-wide in 2002/3 (HIES data), the Poverty Datum Line (PDL) stood at P 571.65/ month and 30.6% of the population lived below the poverty datum line with a poverty gap of 11.7 (i.e. shortfall of consumption as compared to the PDL). Poverty in the north eastern region, which includes the MFMP area, is above average poverty: 38.5% of the population lives in poverty with a 14.1 poverty gap. While poverty may have decreased since 2002/3, rural poverty has proven to be persistent and difficult to resolve.

The MFMP area includes the Sowa Township, which has a population of 2 879 with a projection of 3 318 people in 2011. The township is built for employees of the Botash mine and it has good infrastructure. All Sowa households have good sanitary facilities, electrified houses, access to educational and recreational facilities and a reliably supply of water. Furthermore, solid waste is regularly collected.

A household survey was undertaken in eight villages to determine and assess the livelihood strategies of the people living in the MFMP area. Based on a 90% level of confidence, a total of 628 households were interviewed (see Table 3).

Table 3: Sample size

Village	Number of households (2001)	Number of households interviewed
Xhumaga	186	49
Rakops	958	86
Mopipi	665	76
Mosu	274	72
Mmatshumo	190	65
Gweta	966	90
Zoroga	202	57
Nata	923	133
Total		***628***

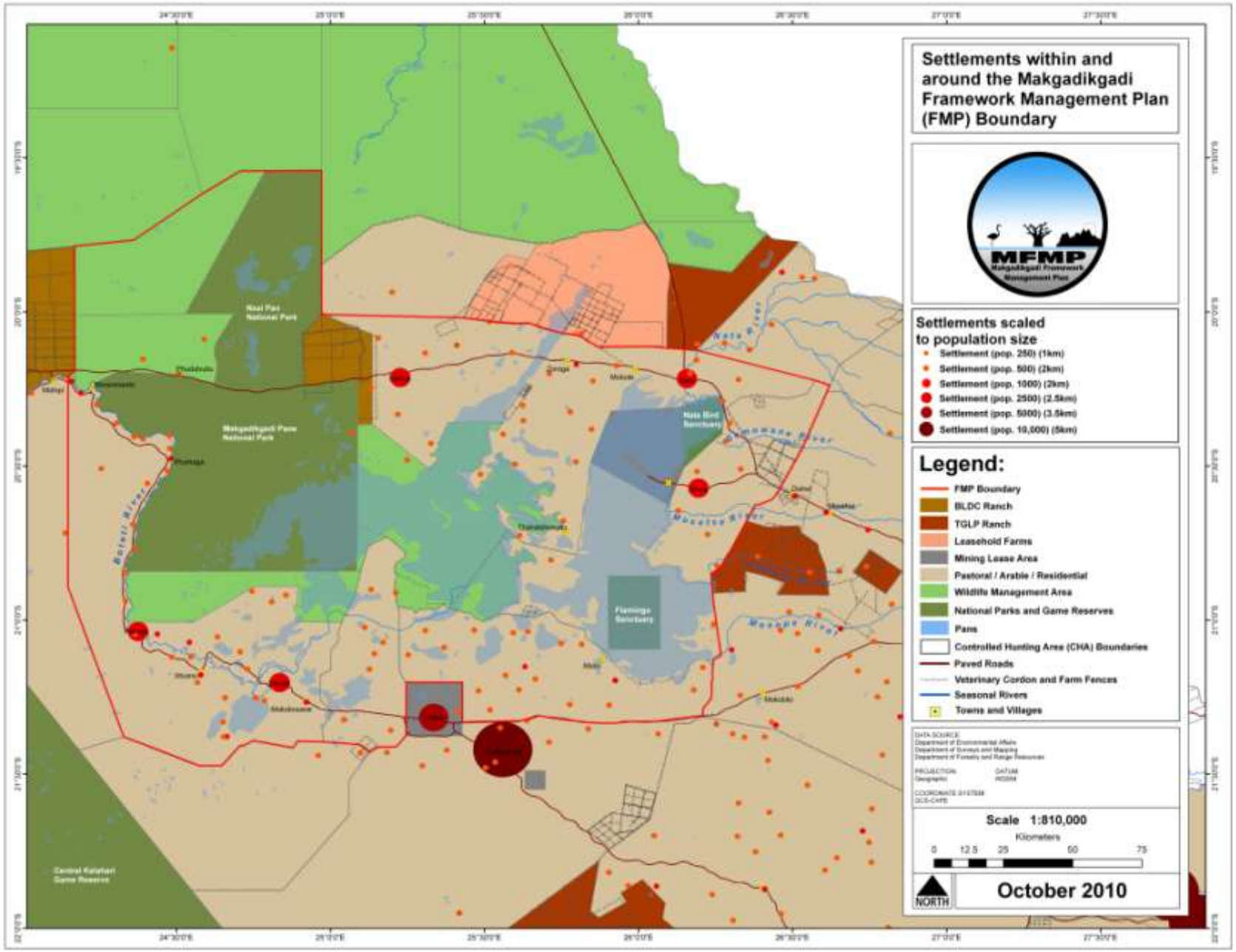
In addition to the household survey, key informants in the selected various villages were interviewed derive their views regarding the livelihoods strategies in the MFMP area. These included: Dikgosi, village elders, Village Development Committees (VDCs), Social Welfare Office, Department of Wildlife and National Parks (DWNP), Community Trust, Land Boards, Department of Crops, Department of Veterinary, Department of Tourism, Botswana Tourism Organisation (BTO), and tourism operators.

3.2.2. Socio-economic environment

Population and settlements

The population of the MFMP area was estimated to be 51 131 in the 2001 Population Census, with an estimated population of 57 118 in 2011 (CSO, 2005). The largest village is Rakops with a population of 4 555. The second largest village is Nata (4 150), followed by Gweta (4 055), Mopipi (3 066), Sowa (2 879) and Xhumo (1 591) (Figure 6). Other villages are smaller.

Figure 6: Settlement distribution and population size of settlements



Source: data from 2001 Population Census

Figure 7: Unemployment rate

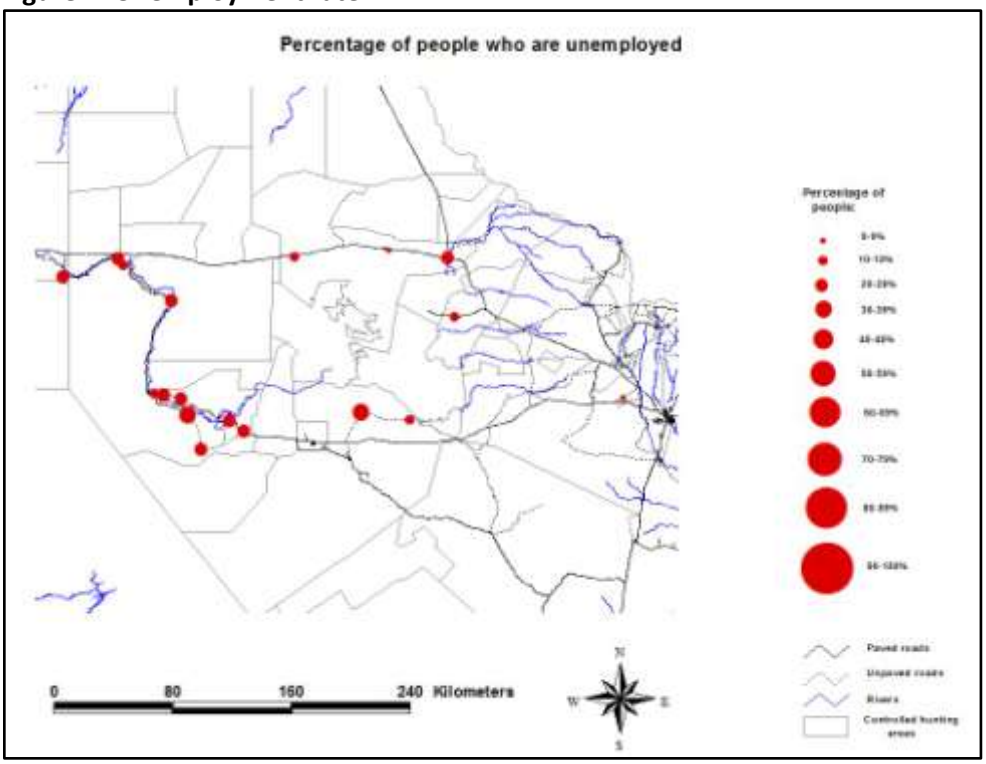
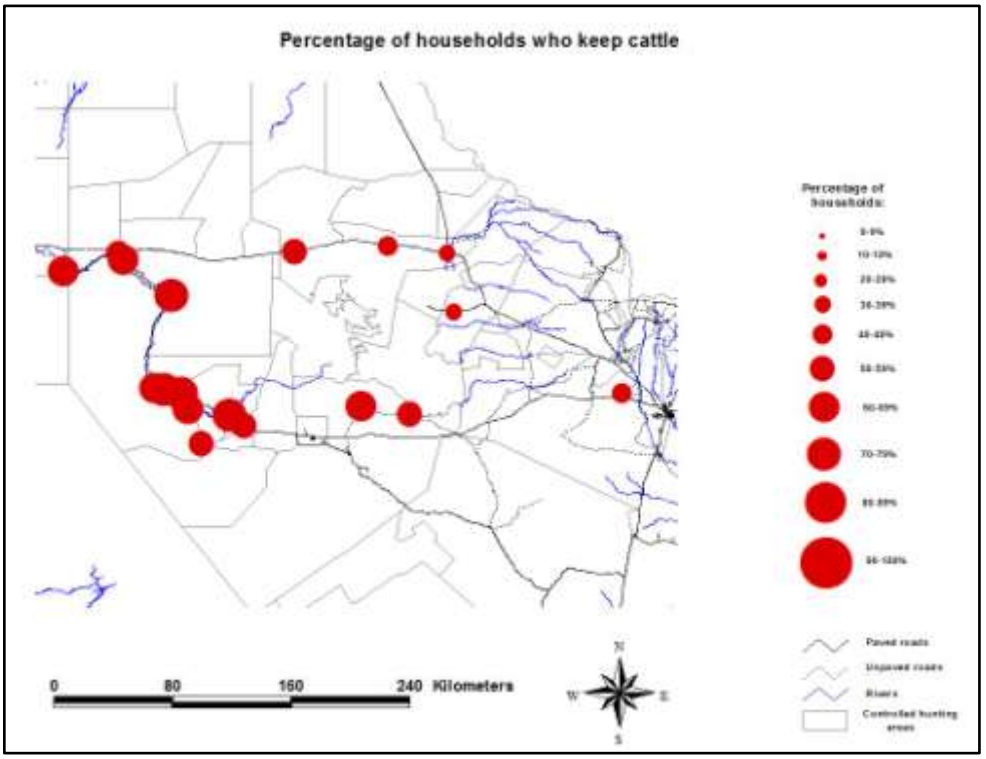
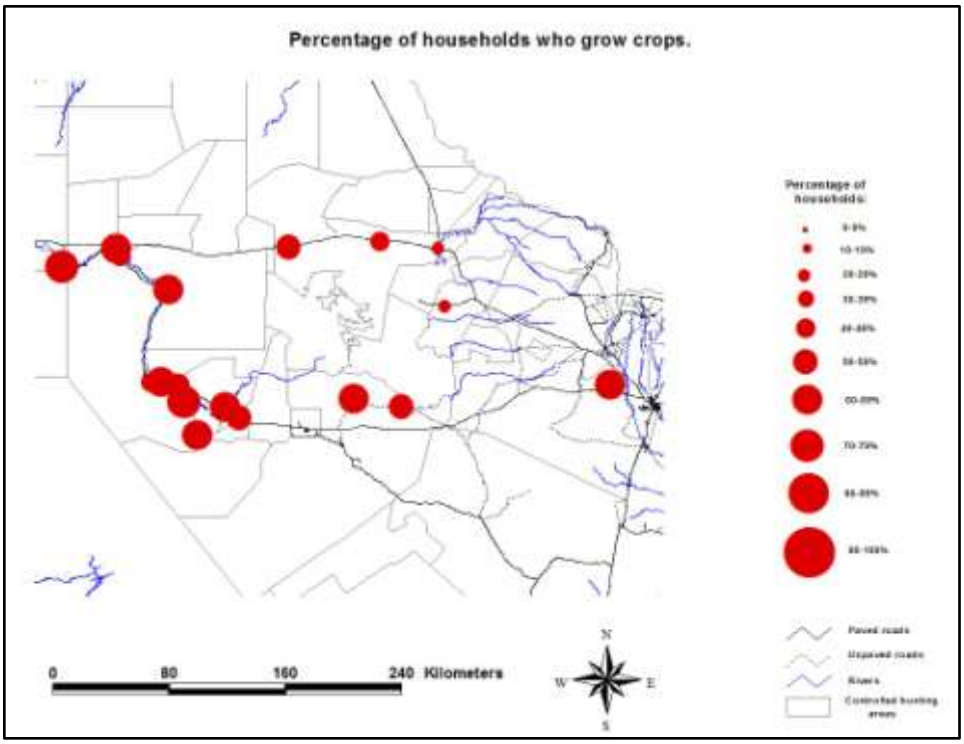


Figure 8: Cattle ownership



Source: data from 2001 Population Census

Figure 9: Participation in crop production (2001)



Source: data from 2001 Population Census

Unemployment rate is shown in Figure 7, while Figures 8 and 9 show the participation rates in crop and livestock production.

Education

Most household heads have very limited education, which adversely affects household decision making. Just under half (48%) of the household heads have never attended school before. Lack of formal education is especially common in Rakops, Mmatshumo and Zoroga with 52%, 56% and 53% respectively. Only twenty and seven percent of the household heads have junior and secondary school qualification while 2% have obtained tertiary education. Non-schooling is higher among female headed households as compared to males.

Lack of formal education is an indicator of poor human development and thus can prompt poverty and social ills such as crime. If the head of household is uneducated, there's greater chance of insufficient knowledge about government support opportunities and lower participation in productive activities such as formal employment and participation in community organizations and committees that would otherwise help in improving the livelihoods of the household members. Reasons for low levels of education do not only rest with poor performance at primary school and JSC but also with the fact that institutes of higher learning are remote with only one senior secondary school in the area (Letlhakane Senior Secondary school).

Water and sanitation

Village households have good access to drinking water from village water reticulation systems (Table 4). Half of the households use public standpipes; the use of public standpipes is mostly common in Zoroga with about 83% of households using these facilities. Over 40% of the households have connections in their yards while 7.2% use water from their

neighbours. In Nata, Mmatshumo, Gweta, Rakops and Mosu, 40 to 49% of the households have yard connections. A minute number of households (0.8%) use wells and rivers as sources of water for drinking purposes. Notably, in-door piped connections are also limited.

When compared with the findings of the national household income and expenditure survey (CSO, 2004) which indicate that 5.1% of rural households have house reticulation, the MFMP area is still below this average.

There is need to further improve access and ensure provision of good quality water and as such achieve the nation's Vision 2016 and the UN's Millennium Development Goals (MDGs). The abolishment of public standpipes should not adversely affect household access to water.

Table 4: Access to drinking water by source (as % of households)

Source	Xhumaga	Rakops	Mopipi	Mmatshumo	Mosu	Gweta	Zoroga	Nata	TOTAL
Stand pipe in yard	36.7	46.5	35.8	48.3	43	40	10.5	48.9	40.6
House reticulation	0	2.2	1.5	0	0	3.3	1.75	0	1.1
Stand pipe (public)	63.3	37.2	59.7	48.3	48.6	44.4	82.4	41.2	50.3
Well/pond	0	0	0	0	0	0	5.3	1.5	0.8
Stand pipe (neighbour's yard)	0	13.9	3	3.2	8.3	12.2	0	8.4	7.2

Source: MFMP socio-economic survey, 2009

Sanitation facilities

Access to proper sanitation is poorer that access to drinking water. Over a quarter of the households (25.9%) have no toilet facility (Table 5). Zoroga has the highest percentage (61.1%) of households without toilet facility followed by Xhumaga (38.8%). On average, 13.7% of households use neighbours' pit latrine. The percentage of households who still rely on neighbours' toilets as well as bushes is a health concern. The latter is unhygienic and increases vulnerability to diseases. Wide usage of pit latrines is largely influenced by its low maintenance costs, and unlike flush toilets, it does not require a sustainable availability of water, a resource which is available but quite unreliable and costly.

The main toilet facilities used in the MFMP area is the pit latrine with average of 57% of households using their own pit latrine. Gweta, Nata and Rakops have the highest percentage (70.5%, 63.3% and 62.7%, respectively) of households owning pit latrines. In Zoroga, only a third of the households have their own pit latrines. Fewer households own a flush toilet with an average of 3.6% owning such a facility.

Table 5: Access to sanitary facilities (% of households)

Facility	Xhumaga	Rakops	Mopipi	Mmatshumo	Mosu	Gweta	Zoroga	Nata	TOTAL
Own flush toilet	2.0	4.8	2.7	4.8	0.0	8.0	1.9	3.1	3.6
Own pit latrine toilet	42.9	62.7	48.6	54.0	59.7	70.5	33.3	63.3	56.8
Neighbours' pit latrine or toilet	16.3	20.5	20.3	14.3	8.3	11.4	3.7	13.3	13.7
No facility (bush)	38.8	12.0	28.4	27.0	31.9	10.2	61.1	20.3	25.9

Source: MFMP socio-economic survey, 2009

Energy sources
As in most rural areas in the country, firewood forms a very important source of energy especially for cooking. At national level, this accounts for 77% of rural households (CSO, 2006). On average, almost 90% of households use firewood for cooking while 10% and 3% use gas and electricity respectively. High reliance on firewood is facilitated by the fact that the resource is inexpensive to access. In terms of lighting of households, 67% of households use paraffin lamps, and the highest number of users is prominent in Zoroga at 78.6% while the lowest is Gweta at 57.8%. The use of electricity stands at 17.2% with Gweta accounting for the highest users at 32.2%. Current rural electrification schemes will increase the access to electricity.

Land
Access to land is important for household livelihoods as many households in the MFMP area are dependent on agriculture. Residential land ownership is most common. A total of 75% of all households own residential land. Ownership of residential land ranges from 60% to 87% in the villages. Ownership of arable land is surprisingly low at an average of 16.6% of all households. This figure is low considering that arable farming is the most common source of livelihood among households. Fields are shared with those that do not own land, where they plough a piece of the land for livelihood sustenance. While this offers livelihood contributions for several households, those who do not own the field have an insecure livelihood source. It is possible that households do not see the need to apply for ownership of a field as the returns are low and they are currently able to borrow land. Only 5.3% of households have indicated to 'own' communal pastoral land ownership. This means that they own a water point, giving effective custodianship over the land surrounding the water-point.

3.2.3. Sources of livelihood

Like in most rural areas, the main source of livelihood in the MFMP area is agriculture. Cattle production remains an important factor in the rural economy as a source of income, employment and investment opportunities (BEDIA, 2006). It also has strong linkages with the rest of the economy as a supplier of inputs for meat processing, leather and other industries (CSO, 2006). Similarly, the arable sector remains important as most households have access to land and arable production requires limited inputs.

Table 6 shows the main sources of livelihoods in the MFMP area. In the MFMP area, arable farming is most important with 71.8% of the total households benefiting from the activity. The second most common source of livelihood is livestock farming at 56.2% of the households. Agriculture, in the form of arable and livestock farming is common largely because it is traditional and it is easy to manage as the livestock and crops are not engaging resource wise in both time and money. The third and fourth common source of livelihood is government welfare and informal employment with 33% and 23.7% of the total households respectively. Communities benefit from government welfare programmes such as the provision of food rations and the old age pension while informal employment includes casual work in construction and on fields as well as the selling of veldt products. Formal employment is limited and therefore fewer households benefit (18.8%).

Differences between villages exist but the overall livelihood sources pattern is very similar. Nata has limited agriculture (livestock and crops), informal employment is highest in Zoroga, while Rakops and Gweta benefit most from formal employment. Government support is

most common in Gweta, Zoroga and Rakops while Ipelegeng benefits more livelihoods in Mosu and Mmatshumo.

Table 6: Main sources of livelihood (% of households)

	Livestock production	Arable production	Informal employment	Formal employment	Ipelegeng	Government support	Remittances	Other
Xhumaga	49.0	65.3	14.3	18.4	10.2	22.4	10.2	2.0
Rakops	69.8	96.5	25.6	24.4	12.8	38.4	10.5	1.2
Mopipi	67.1	93.4	18.4	14.5	15.8	25.0	13.2	1.3
Mmatshumo	67.7	86.2	27.7	15.4	24.6	30.8	20.0	1.5
Mosu	76.4	76.4	20.8	18.1	29.2	33.3	15.3	1.4
Gweta	70.0	81.1	25.6	23.3	13.3	45.6	22.2	2.2
Zoroga	31.6	54.4	49.1	12.3	14.0	45.6	12.3	10.5
Nata	28.6	37.6	16.5	19.5	2.3	24.8	12.0	10.5
Total	56.2	71.8	23.7	18.8	14.0	33.0	14.5	4.3

Source: MFMP socio-economic survey, 2009

The above picture reflects several major livelihood concerns. The first livelihood concern is the dominant role of crop production, which has low livelihood benefits, and the importance of government support, which creates dependency and is not sustainable. The second livelihood concern is the shortage of formal employment opportunities. While formal employment is a reliable and secure livelihood source, opportunities are limited, and mostly found in the public sector. Public sector employment is unlikely to increase and there is therefore need for private sector employment and for gainful self employment. Below, we briefly review the most common livelihood sources.

Arable farming

Arable farming in the area is characterised by the growing of traditional crops such as sorghum, maize meal, water melons and sweet reeds mainly for subsistence purposes. In Rakops, 96.5% of households depend on arable farming for their livelihoods. Of these households, 95.2% use arable farming for subsistence purposes and only 4.8% use it to earn cash. In Mopipi, 93.4% of households depend on arable farming with 84.3% of these households using arable farming for subsistence purposes and only 15.7% of the households earning cash from arable farming. Arable farming in the area is significantly assisted by government through the provision of farm implements, seeds and technical advice.

Livestock farming

In Gweta, 70% of households depend on livestock farming. Of these households, 79.4% use livestock for subsistence purposes and only 20.6% use it to earn cash for the household. In Mosu, 76.4% of households depend on livestock for their livelihood. Of these households, 92.7% use livestock for subsistence purposes while only 7.3% use it to earn cash. The same trend is also found in arable farming in all the villages.

Government support

Government is also a major source of livelihood for households in the FMP area. In Zoroga and Gweta a total of 45.6% of households depend on government for their livelihood. Government provides old age pension, food rations and money to the orphaned and the

disabled. Social welfare assistance from government is meant to offer temporary assistance to those in need.

Informal employment
Informal employment covers a wide range of piece jobs and informal sector employment (e.g. traditional beer brewing, construction, sale of veld products). This sector is important for almost a quarter of the households in the area. It can be viewed as an adaptation to the limited formal employment opportunities.

3.2.4. Livelihood security

Households simultaneously engage in multiple sources of livelihood to improve their livelihood security and to cope with various forms of shocks (e.g. job losses, HIV/AIDs and droughts). Livelihood security is a serious concern in the MFMP area as evidenced by the limited number of livelihood sources and the inability of many households to cope with shocks.

Multiple livelihood sources
Households in Rakops, Mmatshumo and Mosu have on average three livelihood sources per household, while Nata and Xhumaga have the least number of livelihood sources per household at two. Dependence on multiple livelihood sources is important as it increases household resilience to tragedies that may befall a household. However, these sources must be of better value as it is of no importance to have multiple sources of livelihood which are of low value. On the positive side, the number of livelihood sources has increased over the last decade, suggesting greater resilience and less dependence on a particular livelihood source.

Most livelihood sources are dependent on rainfall (e.g. agriculture and collection of veld products) and hence highly variable. Livestock and arable farming, which are the main sources of livelihood, are susceptible to drought, pests, and diseases, destruction by wildlife and birds, as well as climate change. Despite its importance to local livelihoods, arable production has low yields and is unable to provide food security. Therefore, though a number of households depend on agriculture, it is an insecure source of livelihood hence there is need to explore and fully utilise non-agricultural sources of livelihood.

Coping with shocks
Family death and wildlife destruction are the major shocks experienced by households in the area (Table 7). Drought and illiteracy are of secondary importance. Wildlife damage to crops and predation is one the shocks that have been experienced. In Mosu and Xhumaga, 57.8% and 50% of households had property destroyed by wildlife. This shock is less prevalent in Zoroga where 5% of households experienced wildlife destruction. The death of a family breadwinner has been highlighted as a major shock; in Mmatshumo, 46.7% of households have lost a breadwinner[1]. Drought is also seen as a shock especially to households in Mopipi and Rakops. Surprisingly, HIV/AIDS is only listed by 7.2% of the households as a shock. Clearly, provision of HIV/AIDs treatment has limited the 'shock' impacts of the disease.

1 A breadwinner is a person who is the main source of income for the households and death of a breadwinner often leaves the family poorer.

Table 7: Major shocks experienced

Major shock	Xhumaga	Rakops	Mopipi	Mmatshumo	Mosu	Gweta	Zoroga	Nata	TOTAL
Recurrent drought	17.6	32.0	34.1	16.7	15.6	6.4	5.0	5.6	14.9
HIV/AIDS	2.9	4.0	9.8	5.0	12.5	6.4	12.5	5.6	7.2
Wildlife destruction	50.0	10.0	12.2	11.7	57.8	33.3	5.0	10.1	23.7
Family deaths & loss of breadwinners	5.9	22.0	24.4	46.7	4.7	28.2	15.0	34.8	24.8
Job losses	0.0	16.0	7.3	3.3	0.0	2.6	2.5	23.6	8.1
Family illiteracy	20.6	16.0	2.4	16.7	9.4	19.2	47.5	14.6	17.3
Other	2.9	0.0	9.8	0.0	0.0	3.8	12.5	5.6	3.9

Source: MFMP socio-economic survey 2009.

A third of the households was unable to adapt at all to a shock and are presumably left poorer as a result. Others use several mitigation strategies have been used. The major response has been to turn to government through Ipelegeng, social welfare programmes and apply for wildlife damage compensation; only six percent of the households found employment to minimize the impact of their lost or eroded source of livelihood. It becomes clear that households cannot cope themselves with shocks without social welfare. This is indicative of livelihood vulnerability and insecurity. Cessation of government welfare programmes would have serious adverse short-term impact on livelihoods.

3.2.5. Livelihoods and natural resource utilisation

Natural resources are vital to the livelihoods in the area. Livestock production, arable production and collection of natural resources are all important livelihood sources that depend on the local environment. In this section, the importance of veld products and CBNRM are discussed in more detail.

Veld products

Firewood, grass and wild fruits/berries are frequently used as they are widely available within the area. A total of 86.5% of all households use wood for purposes of cooking and lighting, and it is also highly used during the winter season largely for warming purposes. With the exception of Nata, where 57.8% households use firewood, in other villages, firewood usage ranges from 88.7% to 100% of the households. The reliance on firewood may however lead to resource depletion around villages, which would negatively impact on people's livelihoods. The second most common natural resource is grass which is used by 70.2% of the households. Households in Zoroga and Xhumaga are the highest users of grass at 96.3% and 85% respectively. Grass is easily accessible and is often sold to buyers from outside the area. The selling of grass is a challenge to the community as there is no reliable market for them to sell it. Most households state that it is no longer viable to harvest grass under the current marketing situation. Households also augment their income through the sale of wild fruits. Almost forty percent of households harvest veld products including wild fruits like moseme, moretlwa, and morula as well as mophane worms. The mophane worm is the most valuable of the veld products as it is used for subsistence purposes, and is also commercialised. Despite its abundance, as is the case with grass, the major challenge for households is to find a reliable market with good prices.

Veld products are currently mostly used for subsistence purposes. Their depletion would therefore negatively affect livelihoods. For the time being, there remains however, a potential to increase their commercial use.

Community Based Natural Resources Management
Community Trusts are vehicles through which communities can augment their livelihoods and in the process develop their villages. In the MFMP area, only three CBOs are operational: The Gaing 'O Community Trust, the Nata Sanctuary Community Trust and Xhwauxhatubi Trust. The Gaing 'O Community Trust manages the listed archaeological heritage site of the Lekhubu Island where they operate tour guides, photographic safaris and campsites. CBOs in other villages are still in the process of registration and some being resuscitated after they had collapsed. For example, the Gwezotshaa Community Trust, which covers the villages of Gweta, Zoroga and Tshokotshaa, is being resuscitated after it had collapsed.

Knowledge about the CBOs varies from CBO to CBO but generally people feel that they do not benefit much from CBNRM projects at the moment. A few however, acknowledge that CBOs create employment and deliver some community services.

The above shows that the livelihood benefits of CBOs and CBNRM projects must be enhanced. CBOs need however, to be supported to operate better and deliver more benefits.

Environmental conditions
When asked about the state of the natural resources in their locality, people were most concerned about deterioration of firewood, grasses and timber resources, which had negative impacts on their livelihoods. For example, they now have to travel long distances to collect firewood. In some villages, the distance is significant and unsafe especially for women. Thus, people buy from those with donkey carts or vehicles. In contrast, some areas experience an increase in wild resources and human-wildlife conflicts. Further to that, some destruction by wild animals is not compensated for by DWNP thus affecting some livelihoods. There has however, been an improved state of edible veld products and this has led to improved livelihood through selling of these products.

3.2.6. Livelihood constraints and opportunities

The population is experiencing a number of challenges to their livelihoods, key among them being lack of employment and financial resources. A total of 44.7% of all households in the FMP area are constrained by financial problems and unemployment. This is due to the fact that gainful employment opportunities within the area are quite limited. Xhumaga had 54.2% households constrained by unemployment, and Gweta was the lowest at 37.8% of the households. The absence and unreliability of rainfall was indicated as the second major constraint at 15.1% of the total households. Mosu and Nata had almost 30% of the households constrained by the unreliability of rainfall. The issue of old age and disability was the third most constraint at 8.8% of the total number of households with Gweta being the highest at 14.4% of the households. Wildlife destruction was highly noted as a major constraint to livelihood in the village of Gweta at 22.2%. Wildlife in this area is destructive to people's farming activities hence there are high incidences of human wildlife conflicts.

Despite these challenges, a number of opportunities for improving livelihoods have been identified by households. Fifty five percent of the households indicate that agricultural

activities in the form of horticulture and commercial farming are the most opportune. Informal businesses are the second most important opportunity as it accounted for 31.4% of the households. Only 4.7% of the households identified tourism development as an available opportunity. Therefore, tourism development will require extensive awareness raising and popular participation to show tangible benefits and opportunities.

3.2.7. MFMP expectations

The respondents came up with several suggestions on how the MFMP could contribute to improvement of livelihoods. All surveyed villages suggested that the MFMP should create employment opportunities, bring development (all except Gweta), lead to sustainable utilisation of natural resources (all except Mmatshumo), provide more land for arable production (all except Mopipi, Zoroga and Gweta), and contribute to tourism development (all except Rakops, Zoroga and Gweta). Other suggestions for the MFMP included: protection of rivers and pans and proper land management, support for business opportunities, agriculture and CBNRM as well as more public participation.

There are many existing government programmes that are meant to improve local livelihoods but some households do not utilise these programmes. The main reason for not utilising these programmes is lack of information about the programmes and how they could be utilised. There is need to disseminate information about the programmes especially to rural areas to improve accessibility. Some people however, do not use programmes because either they do not meet the programmes' requirements or the application forms are too difficult to fill in. Furthermore, there are few government officers to assist local people to better utilize the programmes. Some cited general lack of interest, shortage of land, lack of finance for down payment and lack of work commitment as reasons for not utilizing the government assistance programmes.

3.3. The ecology

This section is based on two reports dealing with ecology and hydrogeology respectively. These reports appear in volume 2 and contain more detailed analysis and description of main findings.

The MFMP area and the Makgadikgadi Wetland System (MWS) itself comprise a unique combination of physical, chemical and hydrological characteristics, determined by its overriding climatic and geomorphologic 'drivers'. Ecosystem processes and functions are influenced to a large degree by the highly variable and unpredictable flood regime of the system that maintains its biodiversity and system integrity as a whole. For example, the rich biodiversity, which according to the Biodiversity Strategy Action Plan makes the Makgadikgadi one of the country's biodiversity hotspots, comprises a biological community that is well adapted to the unique and often extreme conditions of this saline and highly variable wetland system. In some instances, this has led to endemism and, in others it has resulted in remarkable physiological and behavioural adaptations.

Migration is one such important behavioral adaptation. The ability to move in and out of the system to take advantage of a bountiful food source during the wet season and leave during drought, when conditions render survival almost impossible, is a key life history trait that sustains much of the system's faunal biodiversity. Maintaining connectivity to other nearby systems, and in the case of birds, to an extensive network of habitats that span the region, and which connects global populations, is, therefore, one of the most important challenges

facing the conservation and effective management of the MWS' biodiversity and ecosystem integrity.

Another remarkable life history trait among aquatic assemblages is the existence of a torpor stage in the life cycle of many aquatic plants and animals. This can manifest in the form of dormant ametobolic eggs or cysts, or a state of hibernation, which enable creatures to survive long periods without water, emerging on the return of rains and wetland flooding.

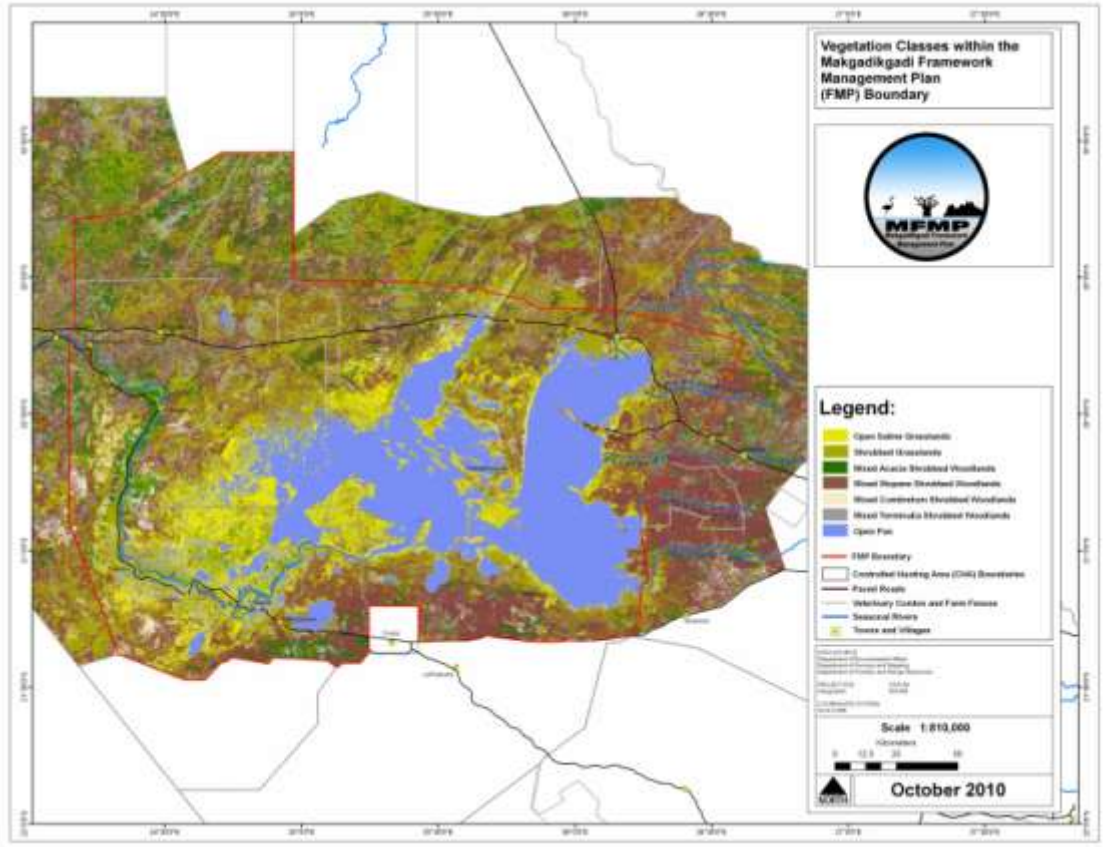
The ephemeral aquatic habitat on the main pan and surrounding smaller pans during the flood periods is a highly productive component of the MFMP AREA and, internationally, hugely important to the diverse and abundant birdlife that migrates to the pans every year. As one of the most productive aquatic ecosystems in the world, Sua Pan provides a bountiful food supply for many invertebrates and bird species, in the form of algae and small invertebrates. Almost as soon as the floods arrive on the pan surface, countless microscopic algae, cyanobacteria and diatoms emerge from their dormant stages, on and just beneath the pan surface. High concentrations and large fluctuations in the salinity of surface water result in relatively low species diversity, but owing to an abundance of nutrients brought in by the rivers and accumulated in the sediment, combined with high temperatures and lots of light, conditions are suitable for very high productivity.

3.3.1. Rangeland ecology

Away from the aquatic wetland habitat, the habitat changes from open savanna and grassland to variable extents of shrub and tree woodland, where vegetation type and species vary primarily with soil depth, salinity, groundwater depth and clay percentage. Grassland dominates on shallow soils, clays and saline soils, with stands ('islands') of Mokolowane palms. With increasing sand depth and decreasing salinity, the grassland becomes more species rich giving way to shrubs and eventually trees, as one travels away from the main pans. Here the rangeland is seasonally very productive and supports large migrations of large herbivores, as well as providing many natural resources like grass and wood that sustain rural livelihoods. Carrying capacities are generally 16.5ha per livestock unit (LSU), which limits the potential of year round livestock grazing. The key to the existence of large populations of herbivores is mobility that enables the primary production that follows highly stochastic rainfall and fire events.

Based on focused field sampling and GIS analysis of Landsat images, a broad vegetation classification developed and mapped for the MFMP area (Figure 10) identifies the spatial extent of six main vegetation types: saline grasslands, shrubbed grasslands, mixed mophane shrubbed woodland, mixed acacia shrubbed woodlands, mixed terminalia shrubbed woodlands, and mixed combretum shrubbed woodlands.

Figure 10: Vegetation types for the MFMP area



Source: MFMP vegetation study.

Based on substantial evidence of a decrease in sweet (palatable) and perennial grass types, and an increase in bush encroachment, almost every livestock related study conducted over the past forty years has pointed to the ecological deterioration of the rangeland resource as a direct consequence of keeping excessive numbers of domestic stock. Stocking rate estimates, made independently from a diverse array of authors, all indicate that the rangelands are marginal for livestock keeping due to poor forage on halomorphic soils and dominantly saline groundwater. This is compounded by the fact that fenced ranches are under-developed, private bore-holes conflict with communal grazing land, which renders improved community rangeland management almost impossible and by the lack of real benefits accruing to the communities from wildlife in protected areas and CBNRM projects.

3.3.2. Biodiversity hotspots

The concept of 'biodiversity hotspots' was used to identify the areas of highest conservation priority. The MFMP purpose is to direct limited management and conservation resources in a strategic manner to help address the protection of biodiversity from unsustainable development. Based on a review of global, regional and local conservation planning approaches a set of criteria was identified together with their associated thresholds most suitable for the identification of ecological hotspots. Of the criteria, species endemism (restricted-range species), threatened species, species richness and representation were the most frequently used criteria. Target sites, including all 'wet spots', mammal 'core' areas, important plant areas and area of hydrological importance and/or ecological functioning were then systematically assessed against the criteria.

The highest ranked ten Biodiversity hotspots, identified through the MCA analysis are listed in Table 8: the Boteti River, The MNPNP, Nata Sanctuary, Nxai & Kudiakam Pan, Nata River, Boteti Delta, NG47, Lake Xau, Mosu and Rysana Pan (Figure 11). Hotspots inside the MNPNP are already protected. However, several sites are currently unprotected and should be covered under the MFMP:

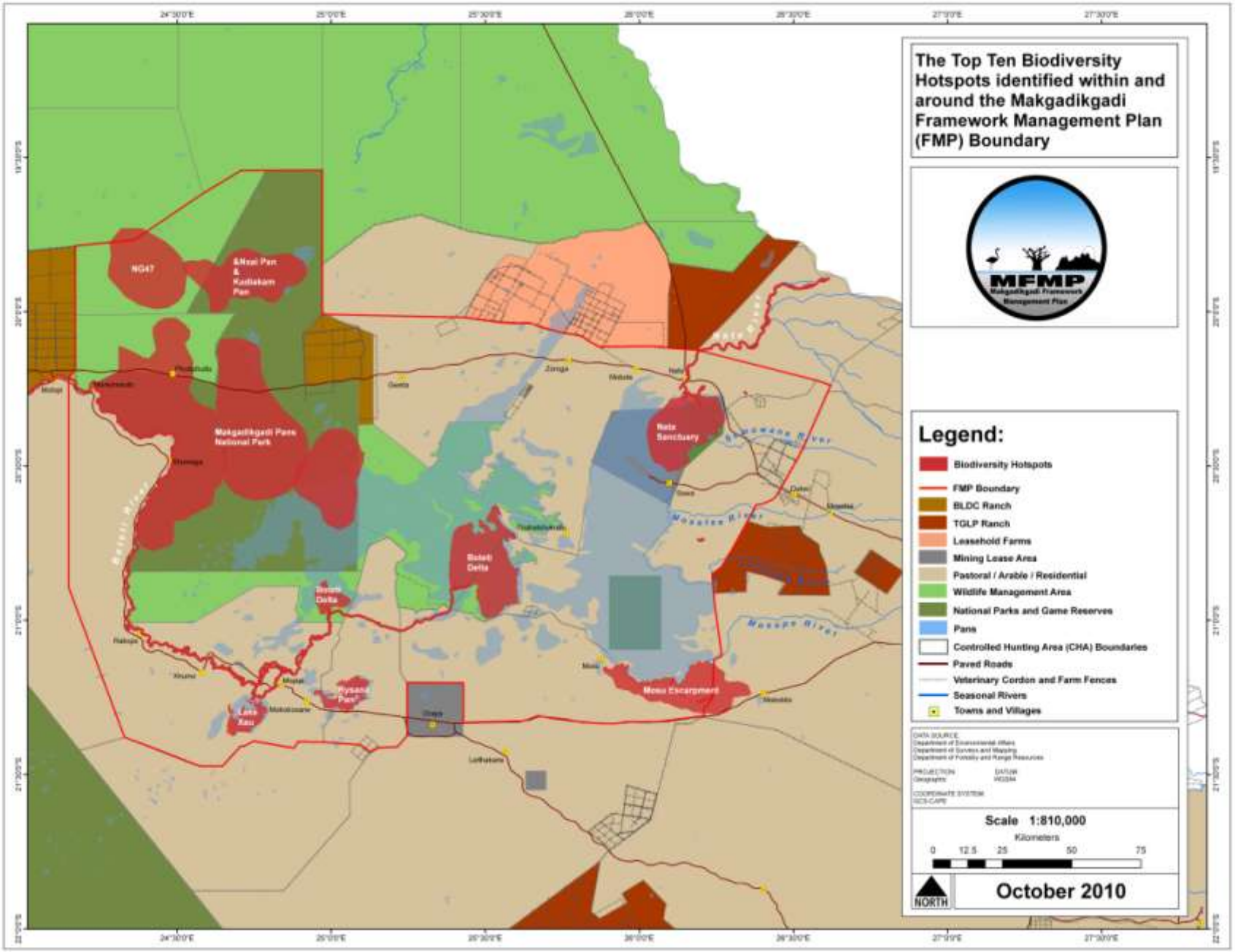
- Western side of the Boteti River;
- Nata River;
- Lake Xau;
- Mosu escarpment area; and
- Rysana Pan.

Biodiversity hotspots need to be placed in the correct management context of the area. While the identification of hotspots contributes to land use zoning and spatial biodiversity conservation and planning, the approach needs to be linked to ecosystem-based objectives, whereby they are seen also as providing locations used to monitor change; including as reference sites and indicators representing the broader ecosystem integrity. In addition, there needs to be an 'ecologically coherent network' of conservation hotspots to ensure connectivity and robustness.

Table 8: Most important biodiversity hotspots in and outside protected areas

HOTSPOT MCA RESULTS		
Rank	**Overall Top Ten Sites**	**Protected/Unprotected sites**
1	Boteti River	Partially – Fence divide
2	MPNP	Protected
3	Nata Sanctuary	Protected
4	Nxai & Kudiakam Pan	Protected
5	Nata River	Unprotected
6	Boteti Delta	Protected
7	NG 47	Protected
8	Lake Xau	Unprotected
9	Mosu	Unprotected
10	Rysana Pan	Unprotected

Figure 11: Ten highest ranked biodiversity hotspots



Source: MFMP ecological & hydrological analysis.

3.3.3. Ecosystem functioning

Maintaining the functional integrity of an ecosystem and using the goods and services provided by the system is a central requirement for sustainable use of a wetland. Each habitat comprises unique 'hydrological and geomorphologic conditions' that determine the ecosystem process and functions that maintain ecosystem integrity. An assessment of the land systems of uniform physical, chemical and biological character and of their respective ecological character and processes was conducted in this study, in order to establish the main ecological functions that maintain ecosystem integrity as a whole.

The overriding ecosystem function that maintains the ephemeral wetland nature of the MWS is the hydrological regime of surface and groundwater input. The amount and extent of flooding is controlled by rainfall and the flood period is also influenced by temperature and evaporation rates. This main function has many sub functions, which include groundwater recharge via palaeolake 'proto pans', groundwater and capillary fringe control of pan surface deflation and chemical/mineral dissolution and leaching. Fault lines and fossil drainage provide important groundwater recharge foci. In addition, river discharge from the Okavango system is also a very important hydrological function, particularly, in light of the recent recurrence of the Boteti's surface discharge to Lake Xau. Seasonal differences in flood regimes between these river systems and MWS, contribute to important seasonal variation in resource availability. For large mammal populations' sustainability, an important connection exists among the wetlands of the north.

The origin and geomorphology of the Makgadikgadi's closed basin drainage system provides the mineral salts and nutrients that control the biological component of the system. A unique chemical composition and high nutrient contents from the catchment provides for a unique biological species composition and a highly productive aquatic system. These conditions also control the prevalence of grasslands surrounding the pans and the seasonal productivity that supports and maintains large herbivore populations and their associated predators and scavengers.

Aeolean erosion and transport of soils influence soil structure and sensitivity in the Kalahari sandveld. These also provide salts and nutrients in the surrounding grasslands and contribute to salinity in groundwater downwind of the pans. Furthermore, they play a major role in the Aeolian deflation of the pan surface and shaping of the system's topography.

Anthropogenic factors lead to ecosystem degradation when thresholds are exceeded; for example, over grazing has increased rangeland and soil degradation; an increase in the number of fires has reduced woodland and impacts grazing potential and associated carrying capacities, and excess brine extraction from beneath the pan has led to groundwater drawdown and an apparent increase in nebka dune formation and grass encroachment.

The functions and processes of the MFMP area can be categorised into different ecosystem services that are provided by or derived from the wetland and which support rural livelihoods and improve the indirect values of the system (Table 9).

Table 9: Ecosystem services provided by the MFMP area

Category	Specific service	Services provided
Production	Food	Rangeland & woodland provides wild game, vegetables, fruits, and grains Rivers provide fish
	Fresh water	Surface water in rivers and small pans is an important freshwater resource both seasonally, and in the case of the Boteti annually; Storage and retention of water in the groundwater table provides an important fresh water resource for domestic, industrial, and agricultural use; Karstic formations in the palaeolake floors provide both important freshwater sources and groundwater recharge foci
	Fibre and fuel	Woodlands provide logs, fuel wood, and fodder for livestock; Rangelands provide an important source of thatching grass
	Biochemical	Deepwater brines under Sua Pan provide the raw material for the production of soda ash and salt, and sustaining a local economy; Salt mineral precipitation on the pan surface provides salt for salt licks and domestic use
	Genetic materials	Unique biological assemblage provides genes important in evolutionary as well as population viability; Potential for biotechnology development and resistance to plant/animal pathogens etc. Flamingos and Zebra are keystone and flagship species
	Medicines	Area provides traditional medicines
Regulation	Climate regulation	Rangelands and Woodlands in particular are a carbon sink for greenhouse gases; Area also influences local and regional temperature, precipitation, and other climatic processes
	Water regulation (hydrological flows)	Groundwater recharge/discharge is an important process in controlling the hydrology Pan flood extent and flood period is influenced by surface drainage and groundwater input;
	Water purification and waste treatment	Retention, recovery, and removal of excess nutrients and other pollutants occurs along ephemeral rivers, mainly in the deltas and associated reed beds, and with movement through sand;
	Erosion regulation	Grass and woody vegetation cover contributes to retention of fine lacustrine soils and sediments; Riverine habitat is particularly prone to erosion by sheet wash, if undercover is removed; Groundwater level and capillary fringe maintains pan surface erosion/deposition equilibrium
	Natural hazard regulation	Wetland vegetation and riverine woodland contributes flood control, storm protection
	Pollination	Area provides a varied habitat for pollinators
Cultural	Spiritual and inspirational	Source of inspiration for scientists, and entrepreneurs; Cultural and spiritual attachment to some of its features, e.g. Kubu Island Religious values to aspects of wetland ecosystems, e.g. freshwater pools and springs at Mea & Mosu, respectively
	Recreational	Opportunities for recreational activities on the pan are abundant
	Aesthetic	Many people find beauty or aesthetic value in the MFMP AREA's unique vista and environment
	Educational	Opportunities for formal and informal education and training are abundant
Support	Soil formation	Sediment retention and accumulation of organic matter occurs at the fluvial deltas, the river floodplains, and on the main pan surfaces
	Nutrient cycling	On the pans, seasonal flooding and drying contributes a cycle of storage (in sediment), unlocking (mixed with water and O_2), recycling though the primary producers (algae) and their grazers (e.g. flamingos), processing (secondary productivity, e.g. flamingo chicks), and acquisition of nutrients (from the catchment) Wind deposition provides sediment and nutrients to the grasslands downwind of the pans; Termites are important recyclers of nutrient from the saline grasses back into the soil;

3.3.4. Indicators

Understanding how wetlands respond to anthropogenic pressures and how this affects their value to all stakeholders is essential in order to implement sustainable development. By using variables considered important in conservation and/or development terms, and referred to as indicators, changes in the health of a wetland, its attributes, functions, and the goods and services that it generates can be identified. The most important indicators are those that relate to climate and hydrology. Besides some of the obvious rainfall and discharge variables worth monitoring, some biological indicators can also be used to indicate long-term ecosystem integrity.

Table 10 summarises indicators for the state of the ecosystem. Birds are valuable bio-indicators of ecosystem functioning and integrity and the success of key 'trigger' species, particularly when breeding, can prove very useful in monitoring programmes. The Lesser Flamingo has been identified by Birdlife Botswana as the trigger species for monitoring the integrity of the MFMP AREA. For the past twelve years, a monitoring programme indicates that significant breeding success occurs only during years of average to above average rainfall. Lesser Flamingo breeding success is therefore a great indicator of hydrological variability and vice versa, and indicates a balanced ecosystem.

Other indicators can be used to identify changes to the hydrological regime, pollution and other anthropogenic impacts that threaten the system and its biodiversity. Here too biological indicators can be used to provide 'tools' in rapid assessment monitoring techniques. Algae are good indicators to pollution and eutrophication of wetlands and respond very quickly to any changes as a result of waste water pollution or chemical pollutants from mining effluent. Changes in water chemistry as a result, for example, of brine extraction and effluent disposal on the pan surface could be detected using the community of crustacean that exists in the lake waters. This community is made up of a number of species (12 in all) each with different tolerances to varying salinities and chemical composition. Sampling this community can flag chemical variations in the system outside the normal variations with reliable significance. A reduction in sweet perennial grass species and an increase in species associated with bush encroachment like *Acacia mellifera* and *Dicrastachys cineria* are good indicators of rangeland degradation.

Table 10: Ecosystem indicators

MONITORING GOAL	INDICATOR	USE / METHOD
Altered Ecosystem integrity: Through impacts on main ecosystem functions – Hydrological input, Groundwater recharge, Groundwater table level and pan surface equilibrium and grassland-woodland interface Physico-chemical controls, Physico—chemical impact on biological community, Trophic level links, Migration and movements around MFMP area and between MFMP area and other systems, Hydrological variability in maintaining species diversity,	Keystone indicator species – Zebra, Elephant, Flamingo, Pelicans, crustacean community, Borehole Water Chemistry and draw-down level at key well point sites, e.g. BotAsh Aquatic community composition (algae & invertebrates), Daily rainfall – river hydrology - flood extent relationships.	Key stone species population counts Borehole level monitoring & strategic peizometer readings, using Conductivity, pH, turbidity meter, Strategic sampling of algae and invertebrate community in rapid assessment techniques of pollution & chemical changes, Daily rainfall events analysis and modeling, MODIS image analysis of flood extent in relation to daily rainfall events and river discharge,
Altered morphology (terrestrial and pan)	Topographical pattern changes around or on the pans, e.g. open cast mining, new sumps or altered pan surface water hydrology	GIS remote sensing analysis, Ground observations
Altered hydrologic regime	Flow magnitude, timing, duration, frequency in relation to rainfall Pan dusts increase from pan Borehole level drawdown, on pan and surrounding rangeland, municipal and mining boreholes, Daily Rainfall data and temperatures Salt bush (*Suaeda merxmuelleri*) encroachment on pan surface, with nebka dune formation	GIS remote sensing (MODIS) analysis of flood extent and period, and dams, GIS analysis of MODIS derived flood extent and period in relation to rainfall and river discharge River Discharge, Borehole levels and recharge Strategically placed Peizometers Remote Sensing of dust emissions Daily Rainfall & Temperature analysis, plus Climate change modeling on daily rainfall,
Altered chemistry in water and/or soil	Lake Conductivity and pH, and crustacean community composition; River conductivity & pH, Groundwater/borehole conductivity and pH,	Conductivity meter readings of river, pan surface water and borehole, Invertebrate sampling methodology and microscopy at strategic sites
Degraded water quality	Water Chemistry, Phytoplankton Rapid assessors	GIS analysis of MODIS satellite imagery & ground observations; Strategic targeted Chemical tests at impact sites,

	Invertebrate (Crustaceans & Odonata) rapid assessors Bird numbers and diversity – during wetlands bi-annual waterfowl counts	Rapid assessment tests of phytoplankton and invertebrates at target impact sites & key functioning hotspots. BLB waterfowl counts
Altered sediment regime	Turbidity and total suspended solids Benthic community (algae & invertebrate) community composition	GIS analysis of remote sensing data & ground observations of new developments Turbidity and TDS rapid testing kits Annual sampling of algae and invertebrate community
Biodiversity Loss	Aquatic species assemblages Threatened and protected species, e.g. Wattled Crane, Flamingo, Chestnut banded Plovers, Vultures species, Lion and Brown Hyaena	Monitoring key indicator species at biodiversity hotspots, and assessing threat from habitat loss, pollution and other disturbances
Rangeland degradation	Increase in 'Increaser' grass species, forbs and bush encroachment along on both sides of fence – wildlife & livestock impacts Exotic species, e.g. castor oil plant Vegetation recovery analysis through NDVI/EVI remote sensing Fire and Dust emissions through remote sensing	Conduct Ground observations – key strategic observation/reference sites in affected & unaffected areas that should be identified and monitored regularly, Conduct NDVI/EVI GIS analysis bi-annually, Ground observation of wildlife movements and distributions (DWNP & Tourism camps), GIS analysis of remote sensing data on dust & fire, and NDVI/EVI
Loss of Wildlife migration routes	Zebra & Wildebeest mortalities Waterbird mortalities	GIS analysis, Migration studies, Strategic surveys of fences and power lines
Reduction in veld products	Dead trees standing, Tree felling, Thatching grass harvest levels, Rangeland quality-changes	Strategic surveys in high impact areas with implementation of harvest thresholds and timing, Survey key harvesting sites, NDVI/EVI analysis of rangeland

3.4. Hydrogeology

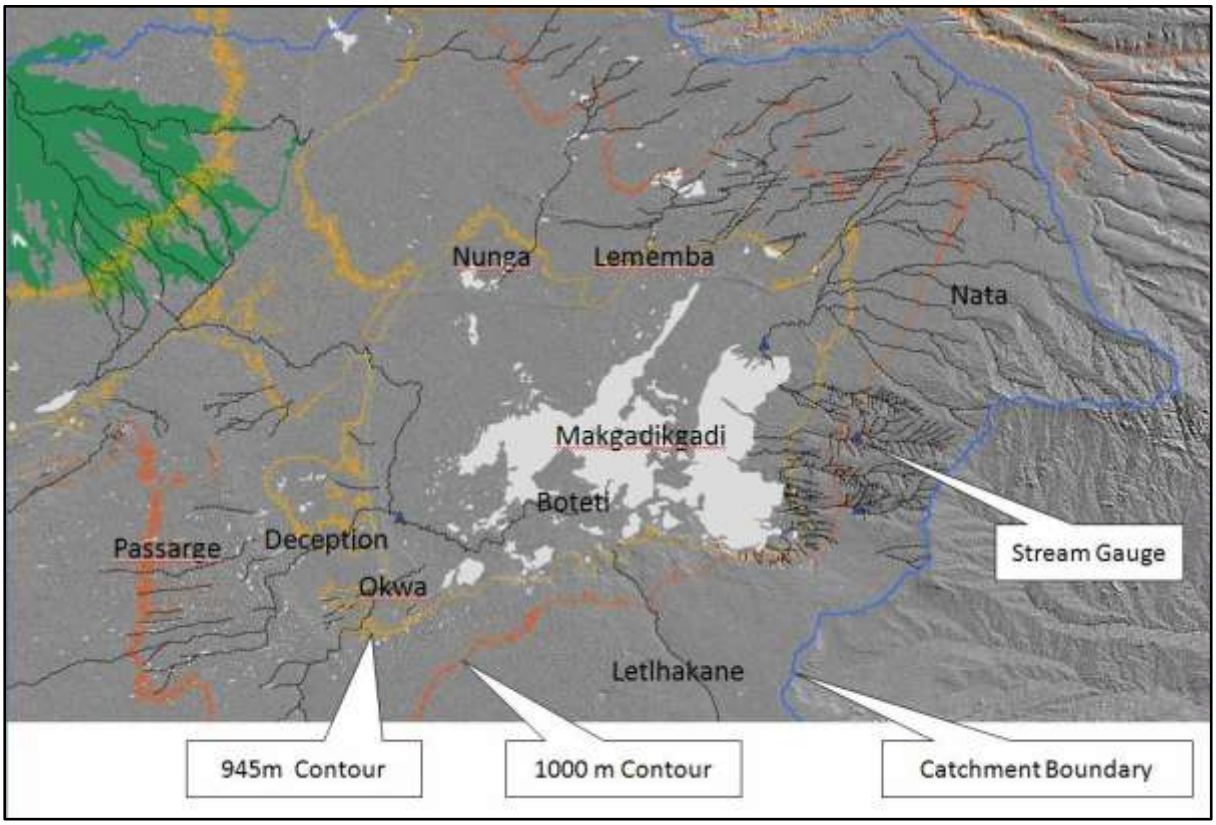
According to the Ramsar Conventions' classification system, the predominant wetland type is **R** - *Seasonal/intermittent saline/brackish/alkaline lakes and flats* (Ramsar Wise Use Handbook 14). When described in more detail, the MFMP area comprises an ephemeral saline wetland system that forms the hydrological terminus of a large endorheic (closed) basin, where climate (rainfall and evaporation) is of major importance to its ephemeral hydrological regime and saline nature.
There are, however, four other wetland types, listed in the Ramsar classification, that occur within the Makgadikgadi Basin: **Ss** - *Seasonal/intermittent saline/brackish/alkaline marshes/pools*, e.g. Boteti River Pools; **N** - *Seasonal/intermittent/irregular rivers/streams/creeks*, e.g. Nata River and others; **5** - *Salt Exploitation sites; salt pans, salines,* e.g. Botswana Ash Solar Ponds, and; **8** - *Wastewater treatment areas; sewage farms, settling ponds, oxidation basins*, e.g. Botswana Ash sewage ponds.

3.4.1. Hydromorphology

The contemporary pans of Ntwetwe and Sua, and the numerous smaller pans that surround them are relics of immense palaeolakes that once covered much of northern Botswana. Today, the area represents the lowest point in the Okavango catchment basin with the Boteti River forming the hydrological link with the Okavango system. Establishing the exact surface as well as groundwater sources for a basin this size is, however, very difficult.

Numerous drainage lines enter the basin but many of these are considered fossil stream features and have not contributed surface water during modern times. A range of surface features such as the former palaeolake shores to the north and west act as topographic watershed boundaries but may not have an impact on the movement of groundwater. Drainage features in general, are, however, very subdued with the exception of the five main rivers to the east of Sua Pan; Nata, Semowane, Mosetse, Lepashe and Mosupe, where watershed boundaries are well defined and rivers appear most active (Figure 12).

Figure 12: Overview of surface water catchment and topographic setting



Note: not all rivers reach the pan and note pronounced incision of eastern catchments. Contours are indicative old lake floor which may now facilitate infiltration and pan groundwater recharge. Stream Gauges are covered in section 3.4.

Mapping drainage lines, in particular to the east of the Pans, margin highlights two distinct drainage patterns or zones. Above the 1 000m contour most of the rivers are well incised and portray a dendritic surface pattern. Below the 1 000m contour the Semowane, Mosetse, Lepashe, and Mosope Rivers follow narrow floodplains as they enter the terrain of the former lake floor, which has a higher infiltration potential due to its calcareous and silica karst morphology. The watersheds between these rivers below the 1000 m contour are wide and flat and may act as direct recharge zones to the Pan basin. The channel flood plains widen towards the Pan and shallow discharge supports a host of riparian wetlands and delta systems.

This observation stresses the importance of the eastern margin in sustaining the hydrological integrity of the pan and also the potentially significant groundwater recharge from much of the pan margin. Runoff may add directly and relatively swiftly to lacustrine conditions whereas groundwater flow has a delayed function, which may discharge through the pan floor to promote water bodies all over the Makgadikgadi sump.

SRTM data also depicts many of the smaller surrounding pans as elevated yet sunk into the margin of the raised perimeter of the pan (Figure 9). These smaller pans nested in the karstic terrain of the older palaeolake floors, below the 1 000m and 945m contours, may act as important elevated recharge points to the Makgadikgadi area. Their hydrological function has yet not been fully explored but these 'proto–pans' include (area km^2 in brackets): Dzibui Pan (19), Xhorodomo Pan (30), Lake Xau (145) Tsokotsa Pan (33), Rysana Pan (93), Guquago Pan (28), Nkokwane Pan (76), Tshitsane Pan (29) Ntsokotso Pan (46), Mea Pan (3), Makopela Pan (3), and many other smaller pans.

In addition recent tectonic activity to the north has resulted in fault controlled topography, and produced the potential for "channeled" groundwater flow in a number of ill-defined channels such as the Nunga and Lememba (Figure 9). Fossil rivers such as the Okwa and Passarge to the west, Letlhakane to the south, and the Nunga and Lememba to the north are bound to make undetermined hydrological contribution to Ntwetwe Pan. Rates and direction of groundwater flow are, however, not known. Their channels lose definition as they enter the karstic terrain of the former palaeolake margin highlighting the importance of groundwater recharge.

3.4.2. Climate

The average annual rainfall is around 450mm, but annual averages range from 359mm in Rakops to 545mm in Maitengwe, along a southwest – northeast rainfall gradient. Significant inter-annual rainfall oscillations occur at a decadal as well as a 2-3 year time scale. Inter-annual variability is, therefore, highly pronounced, with significant deviation around the mean all over the MFMP area. Highest mean monthly rainfall is in January and February, and July and August are the driest months, with average evapotranspiration rates exceeding 2 500mm per year.

Heavy rainfall events in the Makgadikgadi basin are strongly linked to ENSO (El Ninõ Southern Oscillation) cycles in the Pacific and SST (Sea Surface Temperature) anomalies in the Indian Ocean. Records for the 1980-2000 time series, for example, showed a strong correlation between wet season rain (December - February) in the Nata River Catchment and the Subtropical Indian Ocean dipole (SIOD) values for January - March of the same year. In addition, extreme rainfall events are linked to the landfall of tropical cyclones during periods of La Nina conditions and associated anomalous low-level moisture flux into eastern southern Africa. Further analysis of daily rainfall records would shed more light on the correlation between individual rain events of the past and short-lived synoptic scenarios in the atmosphere (Table 11).

Table 11: Annual rainfall in and around the MFMP area

Months	Motopi	Rakops	Letlhakane	Sua	Nata	Dukwe	Lepashe	Tutume	Maitengwe	Sebina
August	0	1	0	0	0	0	0	0	0	1
September	3	3	3	4	3	2	2	5	5	7
October	21	16	12	14	20	12	16	20	23	20
November	62	44	56	56	53	69	67	69	78	75
December	60	61	77	79	83	84	89	95	131	87
January	121	93	93	123	112	133	111	116	120	109
February	87	66	87	87	96	73	72	84	93	83
March	48	49	58	53	55	58	39	68	62	44
April	12	21	11	6	25	6	11	25	26	21
May	4	3	5	5	4	7	10	4	5	3
June	0	3	3	5	1	3	12	2	3	1
July	1	0	0	2	1	0	4	0	0	0
Total	**419**	**359**	**405**	**435**	**453**	**448**	**433**	**488**	**545**	**452**

Source: DMS data**.**

3.4.3. Surface hydrology

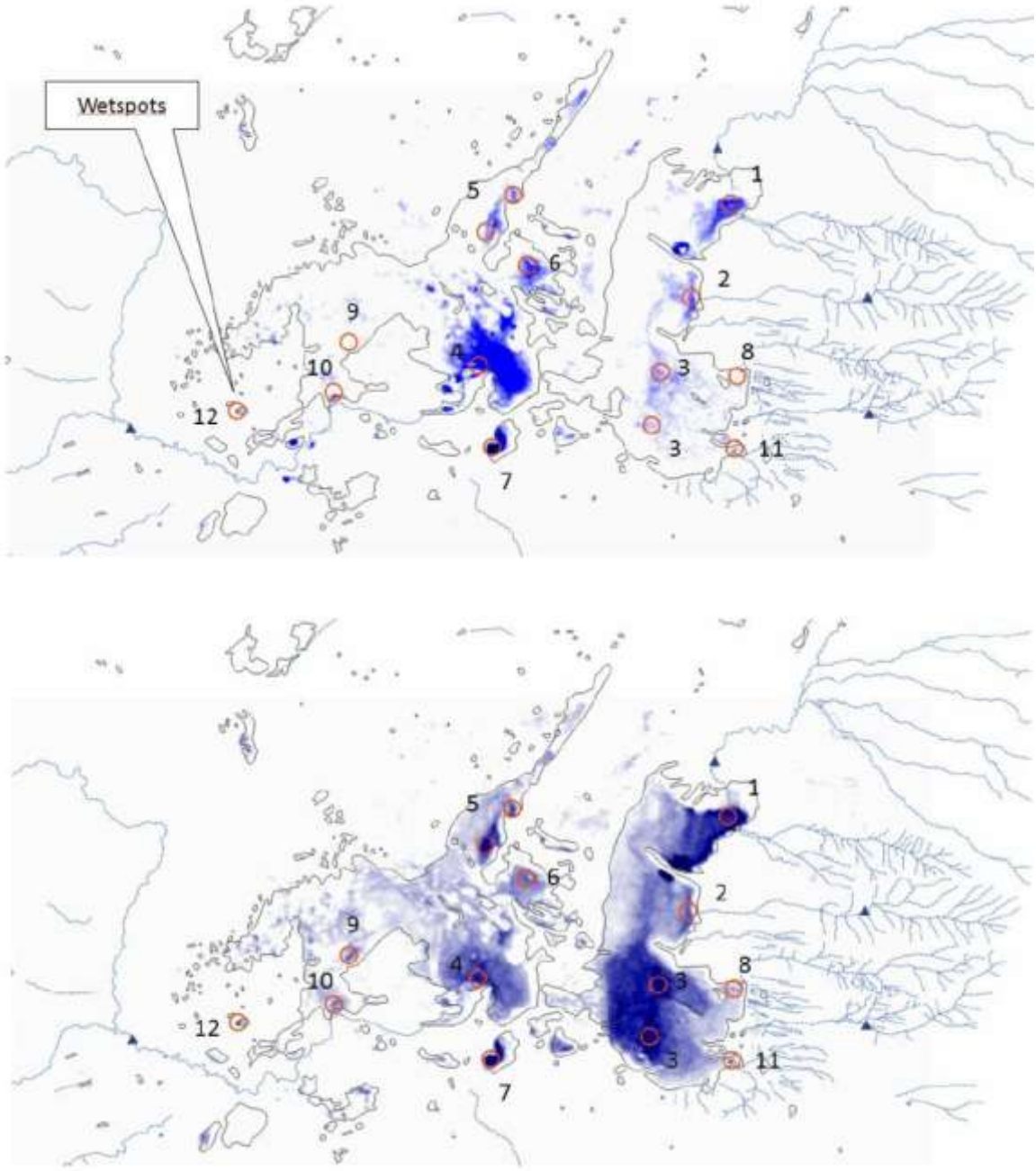
In general, the surface hydrology experiences a negative water balance for most of the year due to marginal inputs combined with excessive losses in the form of evaporation and water infiltration. A combination of input from rivers, direct rainfall, and local runoff, during the rainy season, contributes annual flooding of the pan surface to form extensive saline lakes.

During the period 1971-1999 the Nata River discharged most water in total (4 471MCM), with the Mosetse (688MCM) and Mosope (208MCM) Rivers discharging much less. When the Boteti River last discharged in the mid 1970's, its annual discharge past the Rakops gauge, was 3 274MCM, and peaked in September as its floodwaters originated from the Okavango Delta. In this river, flood periods may extend over many months with noted variations being gradual. The eastern river floods, on the other hand, are typically of ephemeral river flows in the region; short and sharply peaked floods, and synchronized with rains with peak flow usually in January and February. Flow is, however, highly variable and all months recorded zero flow over the years in all rivers.

Since the Boteti River stopped flowing, analysis of their surface water indicates dynamic, with "wet spots" that appear seasonal and persistent. These must all be fed by groundwater with its origin in the calcareous recharge zone and associated proto-pans as well as the ponding of direct rainwater additions to the pan floor. In fact, detailed analysis of daily MODIS sensor imagery since 2000 was used to produce the lacustrine history of the entire Makgadikgadi basin. The analysis has identified areas indicative of pronounced surface water presence, worthy of further examination and consideration, which have been called "wet spots" (Figure 13). While some of these "wet spots" are directly linked to surface water inputs, most of them may well show a response to short-lived groundwater pulses and/or rainwater ponding depending on pan topography. Southern and central Sua Pan appear to host larger water bodies than the northern section, which occurs mostly in the pan centers and is not closely associated with the pan margin inputs. This is surprising when taking into account the relative size of eastern catchments and observed discharge in particular from the Mosetse, Lepashe and Mosope streams. This may suggest increased groundwater and direct rainfall influences in these two pan basins. In addition, numerous pans on the southern margin of the Makgadikgadi, some of which often appear to host surface water, in particular, Dzibui Pan (12) and Nkokwane Pan (7), suggest strong groundwater influence.

While insight in some of the yields from deep brines and boreholes from municipal well fields is satisfactory, shallow groundwater flow that sustains surface wet lands is not adequately captured. As a result we simply do not fully understand the shallow groundwater level and its dynamics, which is the single most important factor determining the character and behavior of the Pan and its surface. This is one of the biggest knowledge gaps in the functioning of Makgadikgadi and its wetlands.

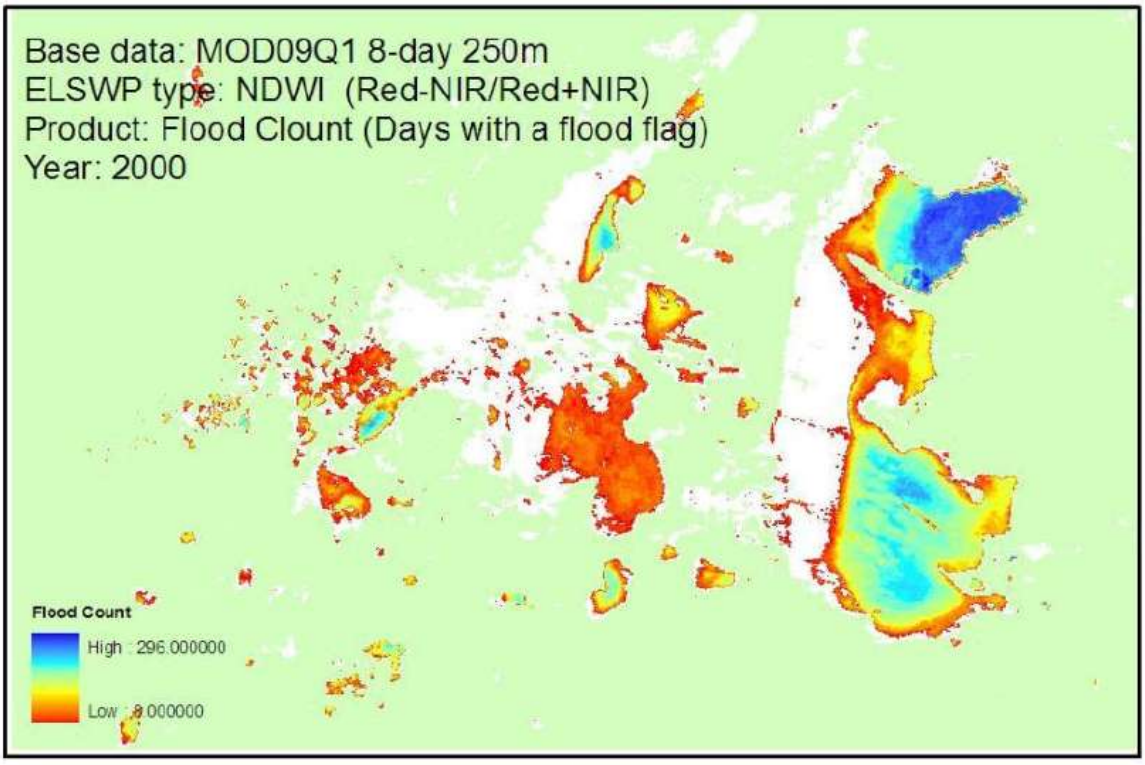
Figure 13: Wet spots in the MFMP area (2000-09)



Note: relative pan wetness of the MFMP AREA, as depicted in NIR (top) and MIR (Bottom) (Note over- and under-estimate) MODIS imagery analysis for the 2000-2009 period, identifying the systems surface water 'Wet spots'.

In general, the total surface water accumulation on the pan surfaces varies from less than 100km^2, to 1 000km^2 in the year 2000 (Figure 14). There is, however, the potential to host up to 2 000km^2 of water. Volume estimates for the amount of water on the pan, however, still remains difficult to estimate as there is an absence of water depth records and micro bathymetry of the pan floor.

Figure 14: Example of MODIS derived Flood Count Map for Year 2000



3.4.3. Water mass balance

At an annual rainfall amount of 500mm, the pans receive 3600MCM from direct rainfall. The combined average annual input from the five rivers entering Sua Pan is 166MCM. An evaporation rate of 2500mm per annum over the pan surface (7 200km^2) equates to 18 000 MCM/annum. On average 94km^2 (47MCM, assuming average depth of 50cm) is flooded each year, but can be as much as 1 000km^2. This is small compared to the combined input from rainfall and potential inflow from the catchment. Water depth, pan bathymetry and surface-groundwater movement rates are, however, absent.

The Nata basin alone can cover 300km^2 and assuming an average depth of 50cm, can hold 150MCM, which is comparable to the average annual flow of the Nata River of 136MCM. Based on the size of the Nata River catchment and on an annual rainfall level of 500mm, the Nata River may receive 10 081MCM, of which 136MCM reaches the pan and the rest is lost to evaporation and infiltration. The exact losses to groundwater in the eastern catchment and elsewhere in the MFMP area, are however unknown.

3.4.4. Water off-take conflicts

The Mosetse Dam is expected to store 50MCM, with significant losses to the middle pan runoff regime and recharge of groundwater through the karstic margins of the pan slope. The EIA of Mosetse Dam shows no clear impact on the resulting ecology of the pan as a result of this surface discharge loss. Groundwater extraction at current levels in Dukwi Well field is unsustainable and likely to decrease groundwater input into Sua Pan, while the Letlhakane, Orapa and Gweta well

fields have the potential to impact upon Ntwetwe Pan. Groundwater quality for potable water supply is also likely to be impacted and further degraded, as is already the case at Orapa.

The pan holds an estimated 8 013MCM of deep fossil brine. Botswana Ash pumps from over 90 well points in the north basin of Sua Pan and aim to expand south of their current well field. The current pump rate is at about 2 400m^3 per hour and rates of 3 500m^3 are considered feasible with the expansion. A drop in the brine water level of up to 7m is to be expected with an increase in brine extraction. This is to be accompanied by a drawdown of the shallow groundwater of up to 5m in the south of the current well field, and diminishing evapotranspiration at the surface of the Pan. This trend has indeed been manifested in all monitoring wells with modeled and observed drawdown currently centered to the north west of the spit at (lat -20.38° lon +25.99°). Although pumping has taken place for two decades now, it is largely unknown how the system, in particular the lacustrine environment, will respond to drawdown. There is an urgent need for more monitoring.

Since 1984, the Orapa mine has become wholly dependent on groundwater and the greater Orapa area has seen the development of new well fields and extensions to existing well fields to meet Orapa's increase in water demand. Continued mining of this groundwater at current rates may not only reduce the long-term water supply to the mine but also affect supply of other uses (e.g. domestic water in Letlhakane and surrounding villages and the numerous cattle posts in and around the mine well fields); moreover it may eventually lead to ingress of saline water especially from the north as regional groundwater flow gradients are changed.

The total annual abstraction from the six operating well fields, and the three pit dewatering systems for the 2008 monitoring period was 11.8 MCM, with a monthly average of 982 558m^3. Water levels data indicate a continued decline in water levels around the Orapa and Letlhakane well fields. Well field 6, which provides potable drinking water, has fallen to Class II (BOS 32: 2000) in terms of its drinking water quality. In addition, recent groundwater modeling suggests that continued and increased abstraction from boreholes in well fields 2, 3 and 5 will result in the breaching of a 50% drawdown constraint (50% of Ntane /Mosolotsane aquifer dewatered). Simulated impacts on the DWA well field at Letlhakane showed a 25m drawdown over the 20-year period (2024).

Currently, estimated water abstraction rates at Dukwi well field are estimated at around 6 600m^3 per day; a combination of 1 200m^3, 1 700m^3 and 3 700m^3 per day from, respectively, Chidumela, Botswana Ash and the Dukwi boreholes. Current abstraction exceeds recharge, estimated to be 600m^3/day. While predictions indicate that pumping at these high rates can be supported up to at least 2020, no indication is given to the implications of continued unsustainable extraction of this well field on the aquifers' future detriment, that of the surrounding water table, or the pan groundwater and recharge.

3.5. Wildlife resources

3.5.1. Introduction

As stated earlier, the MFMP area has been identified as important in the country's Biodiversity Strategy Action Plan. The community of wildlife species is well adapted to the unique and often extreme conditions of this saline and highly variable wetland system. The conservation of both wildlife and bird resources is crucial.

The wetlands are an 'Important bird area' (IBA), forming one of the most significant breeding grounds for flamingos and pelicans within Africa and a migratory destination for tens of thousands of other water birds. The majority of the area covered by open pan is unprotected, leaving vital

breeding and important feeding areas for migratory wetland birds vulnerable to degradation and disturbance. The region is also home to the largest migration of medium sized herbivores in southern Africa and one of the largest remaining on the continent. The migration of zebra and wildebeest that move annually across the Makgadikgadi forms a keystone within the ecological dynamics of the system and offers opportunities for eco-tourism.

A total of 14 Orders, 32 Families, and 91 species of mammal are recorded as occurring in the Makgadikgadi wetlands. Of these, nine are listed on the IUCN Red Data List; Wild Dog, Lion, Leopard, Cheetah, Elephant, Hippopotamus, White Rhino, Brown Hyena and the Black-footed Cat. Forty-two, out of a total number of seventy three mammal species recorded in the MNPNP, were small mammal species. One hundred and four water bird species, thirty two of which breed locally, migrate to the pans each rainy season to feed and breed, augmenting the resident terrestrial birds to give a total bird count for the area of 385 species. Some of these are globally threatened and/or of particular conservation importance, eighteen in all, including Wattled Crane, Grey Crowned Crane, Chestnut-banded Plover, Black-winged Pratincole as well as Greater and Lesser Flamingo.

Large numbers of birds are regularly counted at Nata Sanctuary, Mea Pan, the Sua spit area and at Rysana Pan. Extreme variation in annual flooding, among and within seasons, however, makes it very difficult to identify trends in the water bird populations. Nonetheless, the mean annual total number of birds in the MFMP is in excess of 30 000 water birds. Barbel fish and bream survive and breed in the deep waters of Sua Pan in years of exceptional rainfall and flooding. Reptiles and amphibians are important components of the ecosystem and are of value to the remote-area communities in Botswana. Eighteen species of amphibian and fourteen families and seventy one species of reptiles have been identified in the MFMP area, with collections from Xhumaga, along the Boteti, Nata Sanctuary and some of the other smaller pan wetland areas showing the greatest species diversity. One species is endemic; the Makgadikgadi Spiny Agama (Agama makarikarica), while the Rock Python (Python sebae natalensis) and the Nile Crocodile (Crocodylus niloticus) are listed as protected.

Human-wildlife conflict is a concern in many parts of western and northern Botswana. Human-wildlife conflict is most prevalent around protected areas (PAs), where wildlife populations are greatest, and between protected areas where migratory corridors cross unprotected community land. While there are many ecological factors that regulate the levels of conflict, the intensity of conflict is primarily affected by land use zoning and management. High intensities of conflicting land uses in close proximity lead to direct conflict. Human wildlife conflict is therefore in many regards a form of land use conflict.

3.5.2. Mammals

Herbivores

Herbivore species form a vital component of the Makgadikgadi wetlands dynamics. They help regulate the composition and structure of grasslands, provide a food base for the regions predators and provide a significant contribution towards the economic productivity of the region through sustainable consumptive tourism. Aerial census data is however not available for all species, due to their size and cryptic nature. There are no estimates of numbers or distribution available for bushbuck, hippo and rhino. The herbivore populations within the MFMP area have shown a varied response to ecological variability and human development over the past decade; with some populations showing a significant increase within the region, some a significant declining population and others with a stable population.

Carnivores

There exists a poor and patchy record of carnivore population occurrence and density within the MFMP. As one of the principal points of human-wildlife conflict within the region, there is a need to improve our understanding of these species. The Makgadikgadi is known to host lions, leopard, cheetah, caracal, wildcat, black-footed cats, spotted and brown hyena and wild dogs. The core range of most of these species, especially the lions and cheetah is within the MNPNP, while the other species can be found to a lesser or greater extent across the MFMP area.

The lion population within the MNPNP was estimated at between 28-59 individuals or a low density of one lion per 125km^2 (Hemson, 2001). The spatial distribution of lions within the MFMP area is limited to the MNPNP and surrounding wildlife management areas (WMAs). There is no evidence of lions in the south of the area or around Sua Pan. Lion conflicts with farmers remain a large management problem both in terms of lion population viability and economic loss to farmers. In the 1999-2000 wet season ten lions alone were killed (Hemson, 2001), while further extensive mortalities have been recorded in more recent years, with six lions reported killed in 2009 along the Boteti.

The trend in wildlife numbers is shown in Table 12 (1996 – 2006). Elephants, buffalo, ostrich and gemsbok are increasing while eland, giraffe, kudu, springbok and red hartebeest are in decline. The key species of wildebeest and zebra, with over a third of the national herd located in the MFMP area, are stable.

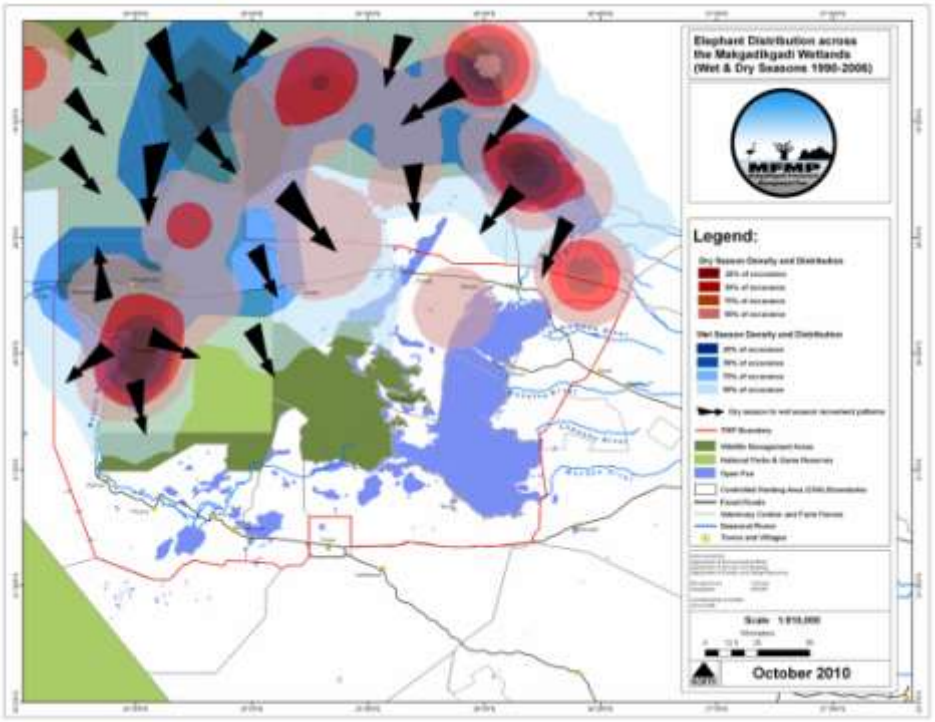
Table 12: Current population estimates for wildlife species within the MFMP area

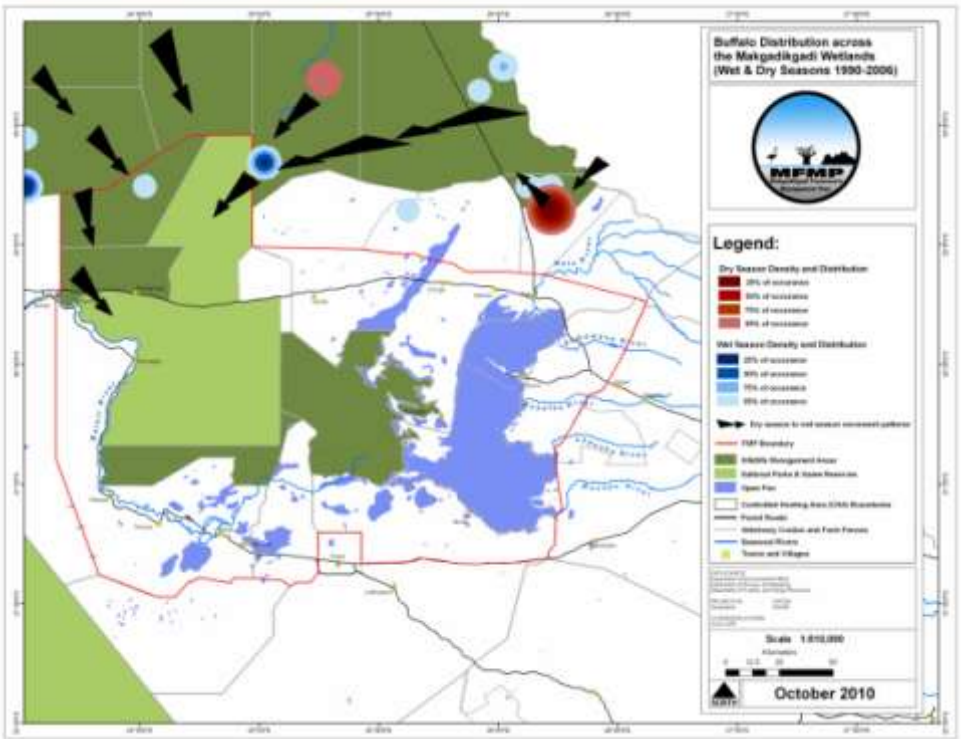
	1996	1999	2001	2002	2003	2004	2006	Trend	% of national herd
African elephant	323	1 023	728	355	904	1 305	1 561	↑	1.2
Blue wildebeest	3 391	19 605	3 949	10 314	8 009	3 071	10 843	→	31.9**
Burchell's zebra	12 124	29 123	15 974	13 766	13 519	20 137	18 249	→	42.6**
Cape buffalo							92	↑	0.2
Common duiker	170	217	220	232	417	115	104	→	1.7
Eland		96		124	34	10	43	↓	0.2
Gemsbok	1 311	1 571	1 657	2 186	1 842	2 398	3 148	↑	3.7
Giraffe	1 209	1 597	657	697	411	913	1 139	↓	10.6**
Greater kudu	3 539	1 909	2 187	1 604	1 500	1 525	1 166	↓	4.7
Impala			292	941	1 001		245	↓	0.5
Red hartebeest	1 994	754	349	1 377	513	189	339	↓	0.9
Roan							11	↑	1.8
Sable	133							↓	0.0
Springbok	6 170	2 214	8 096	332	2 141	1 764	3 938	↓	11.1**
Steenbok	1 467	2 409	827	1 846	1 406	368	767	↓	2.3
*Ostrich	4 869	4 046	5 526	7 119	4 689	3 089	6 625	↑	12.8**

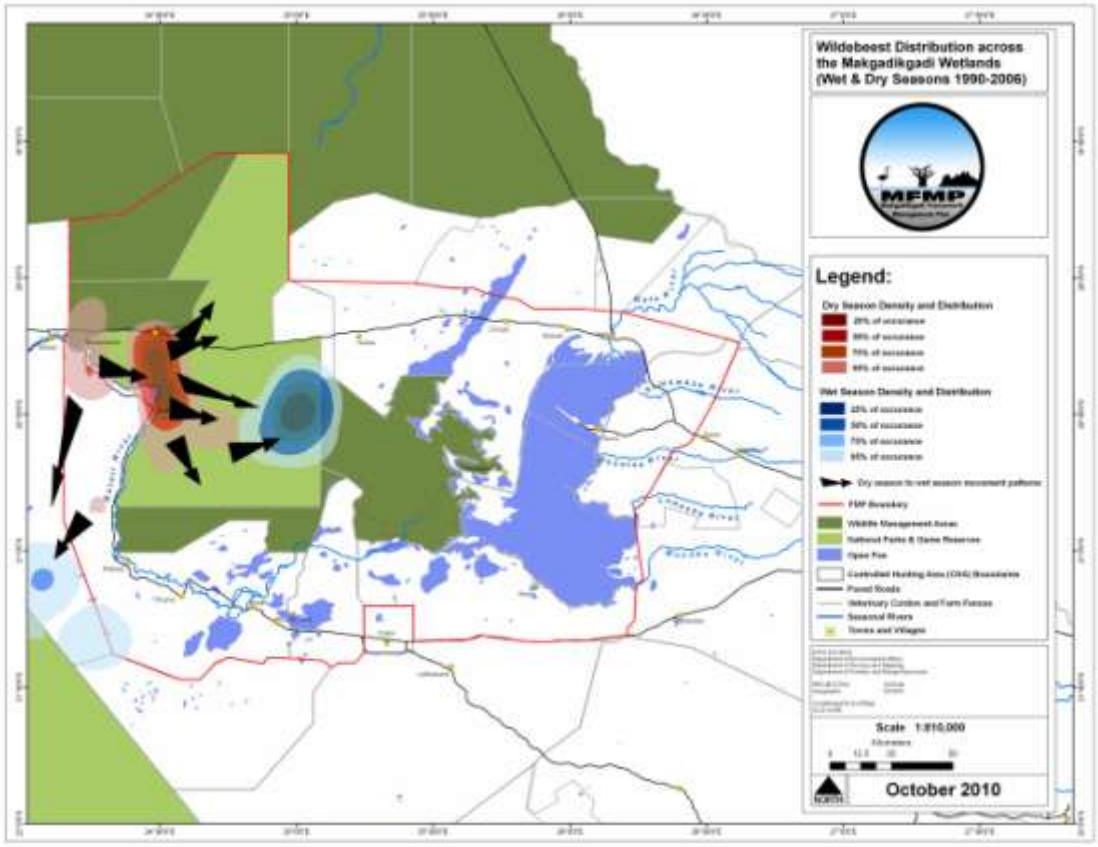
Notes: * Included within this table as a medium-to-large sized herbivore; ** wildlife populations with close to or more than 10% of the Botswana national population.

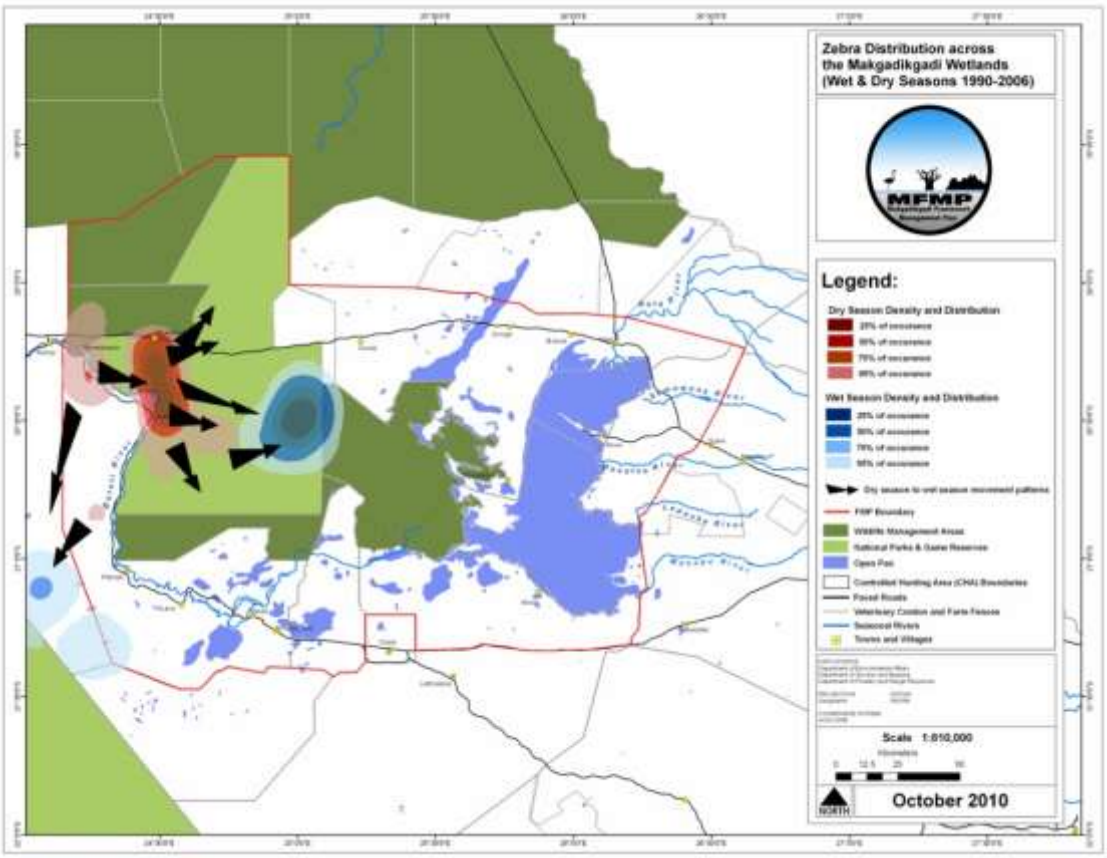
Source: DWNP data

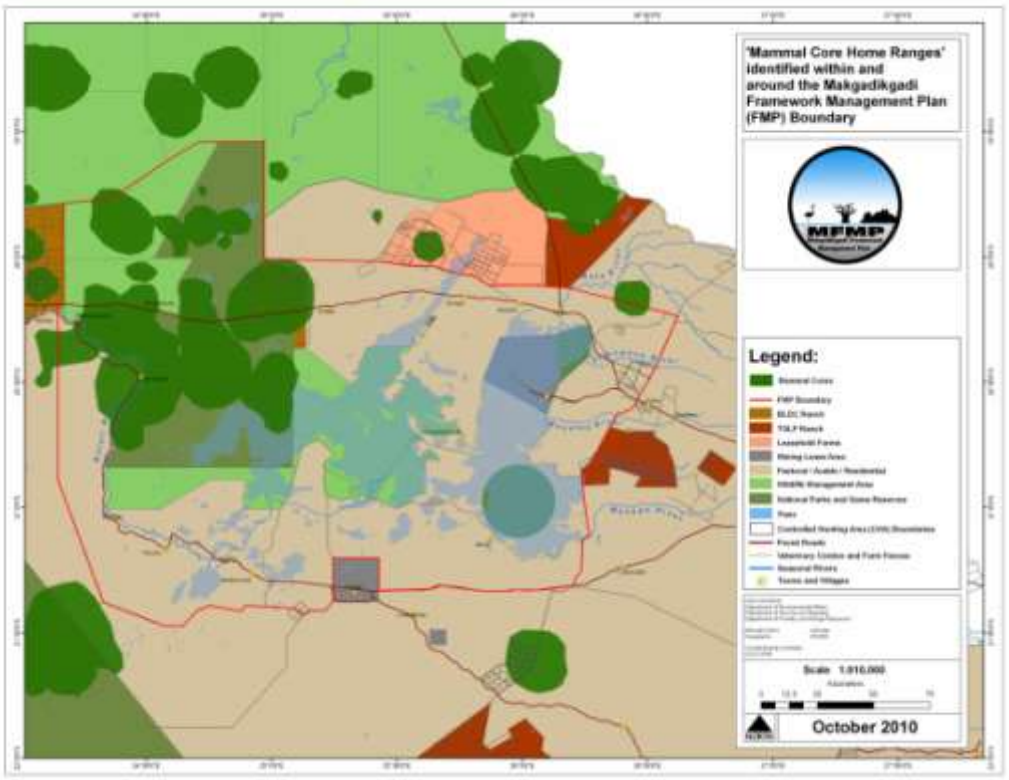
Figure 15: Kernel density and distribution patterns of key wildlife species in the MFMP area and the mammal cores






Wildebeest Distribution across
the Makgadikgadi Wetlands
(Wet & Dry Seasons 1990-2006)
MFMP
Legend:
Dry Season Density and Distribution
Wet Season Density and Distribution
Scale 1:810,000
October 2010


Zebra Distribution across
the Makgadikgadi Wetlands
(Wet & Dry Seasons 1990-2006)
MFMP
Legend:
Dry Season Density and Distribution
Wet Season Density and Distribution
Scale 1:810,000
October 2010



3.5.3. Amphibians, reptiles and fish

Reptiles and amphibians are important components of the ecosystem and are of value to the remote-area communities in Botswana. For instance, land tortoises, turtles, monitor lizards and their eggs, pythons and a variety of small lizards are used as food, or their by-products are fashioned into curios. Similarly, many reptiles and amphibian derivatives are valued greatly by herbalists and traditional healers. However, the role these reptiles and amphibians play in the Pans ecosystem is relatively unknown. Reports of endemic frog species could not be confirmed. There is need for studies aimed at gaining more knowledge about the reptiles and amphibians of the Pans.

3.5.4. Birds

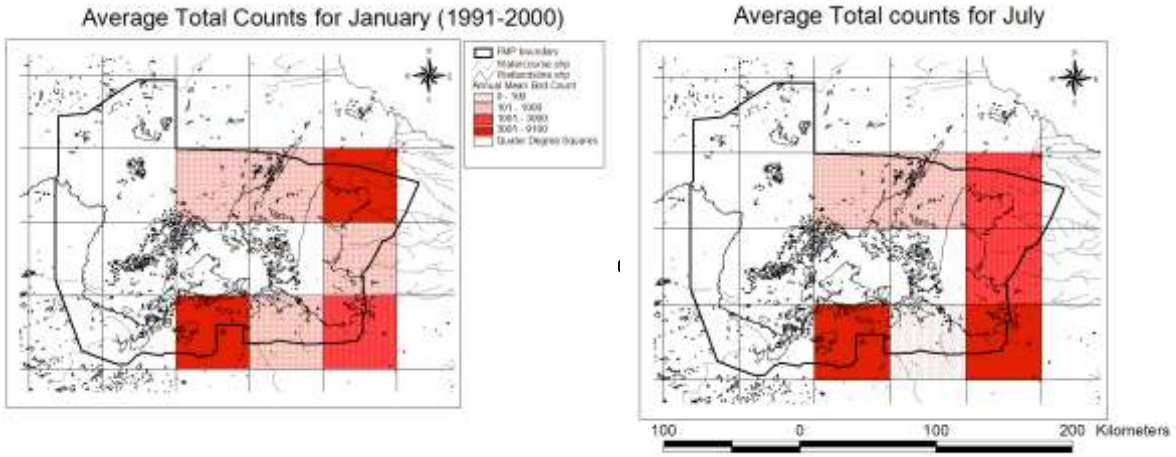
The MFMP area supports over 20 000 water birds on a regular basis, with more than 1% of entire global populations of bird species seasonally. Both these facts form key birdlife criteria for ensuring the Makgadikgadi gains elevated status as a RAMSAR site. The Makgadikgadi wetlands are, for similar reasons, designated as an Important Bird Area (IBA) by Birdlife Botswana (Tyler, 2001). When flooded, the MFMP area attracts a wide variety of water birds, including several Globally Threatened Birds, with many thousands of Palearctic migrant waders migrating to its shores in the wet season to take advantage of an abundance of food (Tyler, 2001).

A recent species list, compiled by McCulloch & Tyler, records a total of 385 bird species in the MFMP area. One hundred and four of these species are water bird species, and thirty two of them breed locally. The list also indicates those species that are rare: thirty nine species are listed as B rarities (uncommon to rare) and seven are listed as A rarities (very rare). The area supports a considerable number of threatened species too: seven species are listed as 'Vulnerable' and eleven are listed as 'Near Threatened' (IUCN Red Data List Website, 2009). In an attempt to help focus/prioritise bird related research and conservation efforts, Birdlife Botswana has identifying twenty species of

national concern, requiring special attention because of their population status and/or the importance of the Botswana in sustaining the total global population. The MFMP area supports nineteen of these species. These and other bird groups are also listed as protected under the Wildlife and National Park Act, 2002.

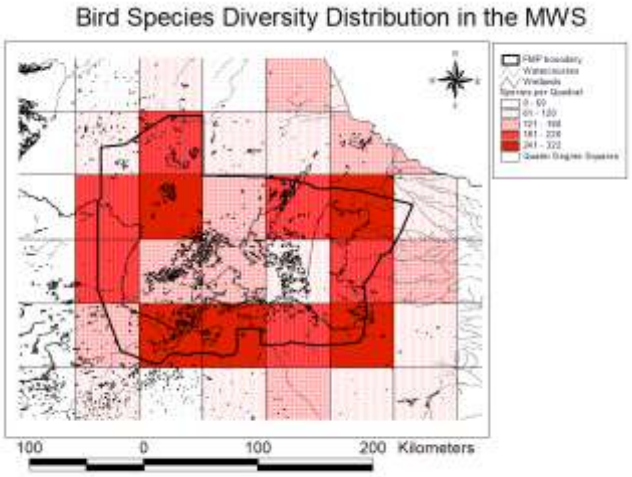
Large numbers of birds migrate to the pans each year, with numbers varying from year to year depending on the extent of annual flooding and corresponding habitat availability. Tyler (2001) provides a review of a decade of bi-annual water bird counts (between 1991 and 2000), conducted in January and July each year at wetlands throughout Botswana for Wetlands International (Figure 16). Bi-annual counts have been sparse since January 2001, by comparison, and include the drought years of 2002 and 2003, when the pan was completely dry for much of the year and very few birds were counted. A record high during this period of 203 577 birds was, however, counted in July 2001, at the end of a two-year continuous flood period, when total numbers were confined to the last remaining floodwater in the Nata Sanctuary. Most of these birds comprised flamingos (170 000 Lesser Flamingo and 30 000 Greater Flamingo) counted by McCulloch (Simmons *et al.,* 2001, McCulloch, 2003) during an aerial survey of the species that month. It also included 1 700 Great White Pelicans.

Figure 16: Water bird densities at seven sites (1991-2000).



Areas with high bird densities include Nata River Delta and the north basin of Sua Pan, the Boteti River, Lake Xau, the lower Boteti and Mopipi's surrounding pans, Rysana Pan and nearby pans, and Mea pan and its surrounding pans (Figure 17). High species diversity at these sites could be attributed to wetland bird species augmenting the large numbers of woodland and grassland species adjacent to them, particularly where wetland occurs adjacent to a diverse number of terrestrial vegetative habitats, e.g. the diverse woodland and nearby grassland habitats on the edge of the Nata and Boteti Rivers.

Figure 17: Spatial distribution maps of species diversity



Large variation in annual breeding attempts and success for both species of flamingo has been observed. Although breeding may occur on an annual basis, the success of the chicks fledging depends on the period of flooding on the pan, which is closely correlated with rainfall. Estimates for the number of fledged chicks each year assumed that all those chicks counted in the crèches fledged and made it to the feeding grounds. This number, of course varies from year to year according to flooding in the south basin of Sua Pan and the associated variation in predator pressure and mortalities as a result of physiological stress.

There appears to be a rainfall threshold of approximately 450mm (the annual average rainfall for Sua Pan), below which the pan dries up before the chicks fledge and dramatically reduces overall breeding success (McCulloch, in prep). However, poor breeding results may also occur at times of extreme account (eggs were lost due to flooding in 2000) and good results may occur during low rainfall years that experience continuous flooding from the previous wet season rainfall (e.g. 2004-05 wet season, when 278mm fell, but the pan still held flood water from heavy rains the previous March).

Little is known about the movement patterns and seasonal migration of the many water bird species that visit Makgadikgadi. Some studies, conducted by the Max Plank Institute of Ornithology, have identified some of the flyways followed by White Stork from their breeding grounds in northern Europe. Important regional movements and identification of wetland networks that are linked to the Makgadikgadi system and are crucial for sustaining the regional populations of these birds, is however scanty.

3.5.5. Human wildlife conflicts

The causes of human wildlife conflict are related to habitat and resource factors, land use and human activities. Human wildlife conflict occurs when the requirements of wildlife populations for land and resources overlap with those of human populations, creating costs to both the human residents and the wild animals (IUCN World Park Congress, 2003; Lamarque *et al.* 2008).

1. <u>Habitat and resource induced factors</u>
   a) Limited good grazing potential – poor quality sandy soils and fragile saline soils, while the area is susceptible to variable rainfall patterns. While carrying capacity is quite good on the

saline soils (5-8 ha/lsu), the soils are fragile and susceptible to erosion and rangeland degradation;

b) Expanding elephant population – Increased rainfall over the past five years, plus an expanding elephant population in Chobe District are causing movement of more elephants down into the Makgadikgadi region, intensifying levels of human-elephant conflict;

c) Predators – Large seasonal movements of wildlife and permeable PA boundaries have resulted in livestock predation, especially with lions along the Boteti River and in CT11. However there are also severe problems associated with smaller predators such as black-backed jackals and hyenas; it is estimated that more than one third of the livestock losses to predators are caused by these smaller species;

2. Land use induced factors
   a) Lack of land use buffers - The drying of the Boteti River in the early 1990s created a hard edge between wildlife within the MNPNP and cattle and people in CT8;
3. Human induced factors
   a) Poor management of the communal grazing areas – An expanding livestock population and evidence of rangeland degradation in the region has highlighted issues of poor management of communal land;
   b) Disputed use and settlement of the WMA wildlife buffer zones – the state lands of CT10 and CT11 have limited on-the-ground management, which has enabled settlement of people and use of the area for cattle.
   c) Livestock and arable conflict – The poor soil quality and variable rainfall patters limit the potential areas for good arable land. The areas with the best soils are also utilised by pastoral farmers with limited zoning between pastoral and arable farming.

Human wildlife conflicts lead to crop damage, predation, disease problems and injuries to humans. These include:

1. Crop raiding - Principal point of concern relates to elephants, but damage is also done by livestock. There is limited assistance for farmers, who have not been trained in modern mitigation strategies, while there is no planning in field development.
2. Predation on domestic stock - Hemson (2005) estimated that each cattle post within the vicinity of the MNPNP lost $168 per annum to lions alone, with Meynell & Parry (2002) suggesting that lions were responsible for 50% of wildlife associated damage. The cost of human wildlife conflict at the household level in the vicinity of the Makgadikgadi Pans National Park is therefore estimated at $336 per annum. This forms a significant portion of an individual's annual income within this part of the Makgadikgadi.
3. Disease transmission - There have been no outbreaks of foot-and-mouth disease (FMD) within the Makgadikgadi region since 1977. The last outbreaks in close vicinity to the Makgadikgadi were in Chobe District in 2005 and in Francistown in 2001.

Table 13: Settlements and wildlife compensation paid

Villages	Compensation paid from 1998-2008 (in Pula)
Rakops	311 935
Xhumaga	200 197
Makalamabedi	136 890
Moreomaoto	112 880
Letlhakane	65 895
Mopipi	20 110
Motopi	14 891
Xhumo	4 450
Mosu	3 390
Kedia	2 800

4. Current land use patterns and issues

This chapter deals with overall land use patterns in the Makgadikgadi (4.1.) and with the different land uses (4.4–4.7) and land use administration and plans (4.2-4.3) in more detail.

4.1. Overall land use

The key feature of the MFMP area is the Makgadikgadi salt pans, which is encircled by the Maun-Nata road, the Nata – Francistown road and the road from Francistown past Orapa and Rakops to Motopi. The salt pans lie at the centre of the study area for the MFMP, which covers an area of 36 452km^2. As a percentage of land use within MFMP area Tribal Land is most prominent (56%), as compared to State Land (44%); there is no Freehold Land (Table 14). The most prominent forms of land use are:

1. Land used for communal grazing, arable and residential development – primarily Tribal Land): 19 454km^2 (53.1%)
2. Land for wildlife conservation: WMAs, Sanctuaries and Protected Areas – primarily State land, apart from the Nata Sanctuary): 16 366km^2 (44.7%)
3. Mining Lease Areas (Botash): 763km^2 (2.1%)
4. Botswana Livestock Development Corporation (BLDC) Ranches: 359 km^2 (1%)
5. Quarantine Camps: 134km^2 (0.4%)

The most prevalent land use is pastoral/arable and residential, this land being mostly under tribal/communal land-tenure, within which agriculture is the principal form of land use. Livestock production is widespread across the region, with arable development more spatially confined. Further land for pastoral development exists in the form of the Botswana Livestock Development Corporation (BLDC) ranches and quarantine camps. Around the periphery of the MFMP area, significant proportions of land are allocated TGLP leasehold ranches with further land identified for fencing component ranches in CT20 in the review of the National Map (2009). There are no ranching developments currently within the MFMP area, although fencing component ranches have been proposed in the south of CT19 and the north of CT14, within the Review of the National Land Use Map (2009 (Figure 18).

Figure 18: Current land use in the MFMP area

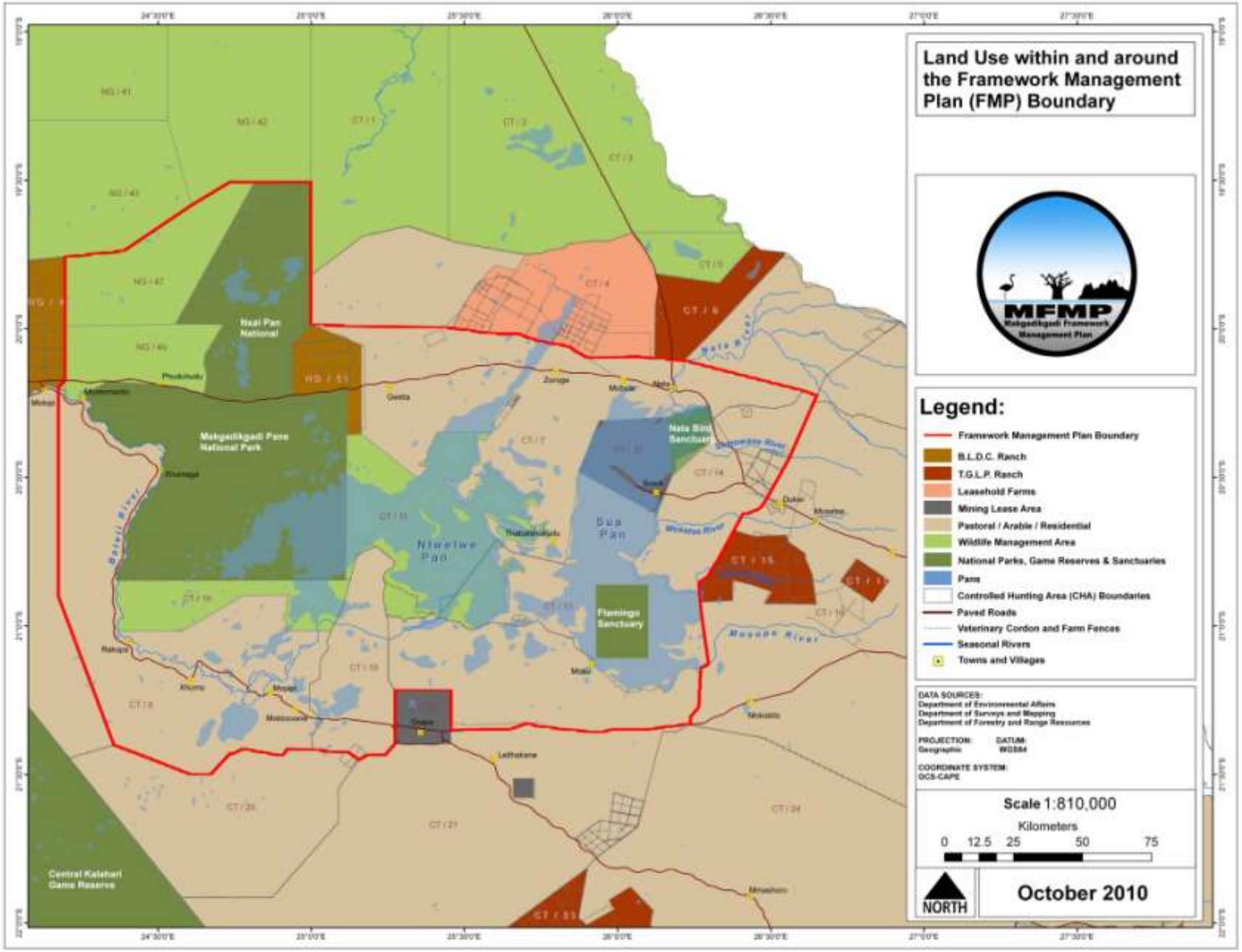


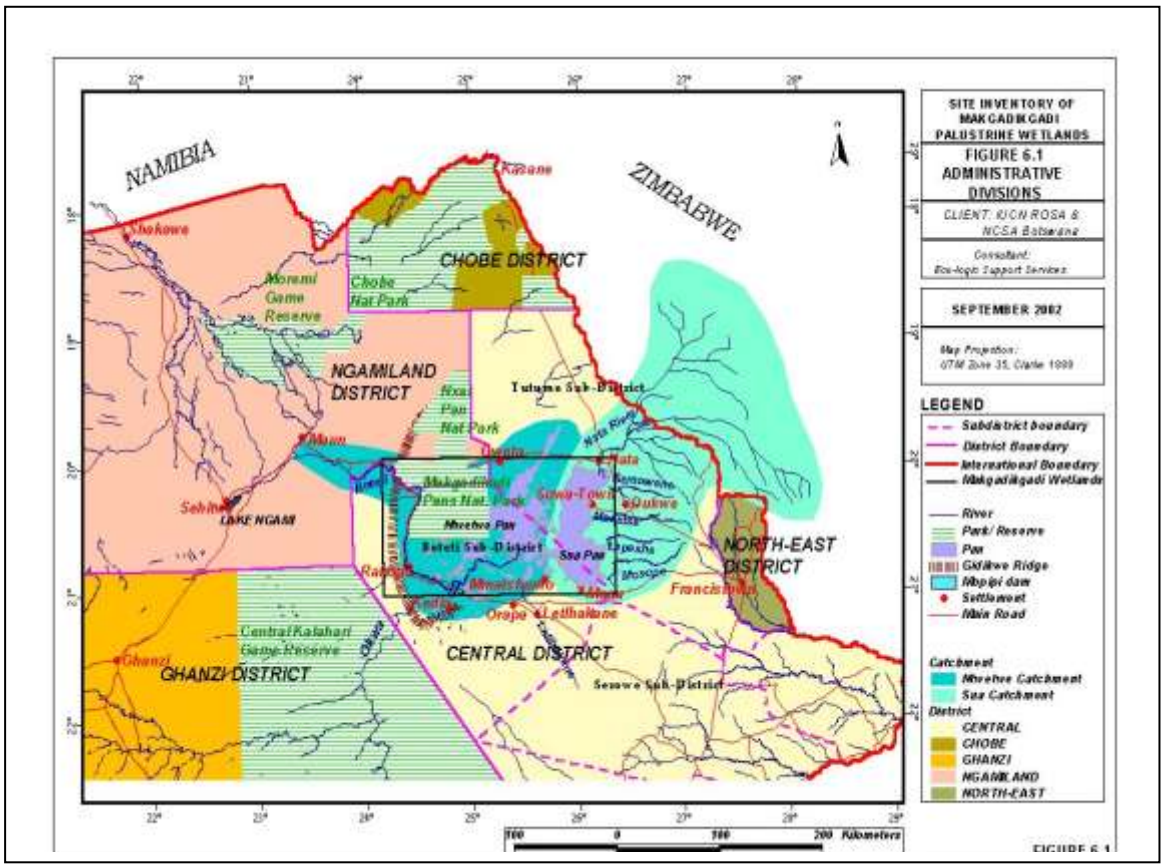
Table 14: Land use designation within the MFMP area

Number	District	Sub-District	Land Use	CHA Type	Land tenure	Area (km^2)	% inside project area	Area inside MFMP area
NG/47	Ngamiland	NA	Wildlife Management Area (Gazetted)	Commercial wildlife utilisation (leasehold)	State	1,689	100%	1,689
NG/48	Ngamiland	NA	National Park	Nxai Pan National Park	State	2,490	100%	2,490
NG/49	Ngamiland	NA	Wildlife Management Area (Gazetted)	Community wildlife utilisation (leasehold) WMA	State	1,128	100%	1,128
NG/51	Ngamiland	NA	BLDC Ranch (and WMA)	BLDC Ranch	State	565	100%	565
NG/52	Ngamiland	NA	National Park	Makgadikgadi Pans National Park	State	1,524	100%	1,524
CT/7	Central	Tutume	Pasture/Arable/ Residential	Communal area	Tribal	7,871	57.9%	5,225
CT/7	Central	Tutume	Wildlife Management Area (Gazetted)	Communal area	State	1,143	18.4%	211
CT/8	Central	Boteti	Pastoral/Arable/ Residential	Communal area	Tribal	9,095	59.6%	5,426
CT/8	Central	Boteti	Wildlife Management Area (Gazetted)	Communal area	State	304.5	100%	304.5
CT/9	Central	Boteti	National Park	Makgadikgadi Pans National Park	State	3,535	100%	3,535
CT/10	Central	Boteti	Wildlife Management Area (Un-gazetted)	Wildlife Management Area	State	1,151	100%	1,151
CT/11	Central	Boteti /Tutume	Wildlife Management Area(Un-gazetted)	Wildlife Management Area	State	2,984	100%	2,984
CT/12	Central	Tutume	SAB + Nata Sanctuary	Soda Ash Botswana + Nata Sanctuary	Tribal	966	100%	966
CT/13	Central	Tutume /Boteti	Pastoral/Arable/ Residential	Communal area	Tribal	2,954	100%	2,954
CT/14	Central	Tutume	Pastoral/Arable/ Residential	Communal area	Tribal	2,061	100%	2,061
CT/19	Central	Boteti	Pasture/Arable/ Residential	Communal area	Tribal	1,515	100%	1,515
CT/21	Central	Boteti /Tutume	Pastoral/Arable/ Residential	Communal area	Tribal	12,266	23.5%	2,882

4.2. Land resources and administrative boundaries

The Makgadikgadi region is administered by two Districts (Ngamiland and Central District), with two sub-districts within Central District (Tutume and Boteti; Figure 19). This fractured administration has created a fragmented planning approach with different land tenure regimes, sectoral policies and districts plans, with the use and management of the MFMP's natural resources insufficiently coordinated. Uncoordinated planning has failed to ensure that the area fragile natural resources are appropriately protected through an integrated approach, while remote and poorly managed state lands (CT7, CT8, CT10 &CT11) have witnessed the proliferation of disputed settlements and inappropriate land use, such as the exploitation of natural resources and over grazing. Some of these issues have recently been tackled by Government following a Cabinet Directive to allocate land within the state lands of CT6, CT7, CT10 & CT11, following the development of CHA specific management plans and applications to lease plots of land for various appropriate land use activities.

Figure 19: District land use boundaries across the MFMP area



The administration of the MFMP area is further confused by segmented responsibility for the implementation and enforcement of various land use planning systems spread out among various institutions. Agricultural District zones and Veterinary District zones partition the region yet further (Fig. 17 & Fig. 18). The main administrative centres are not located within the MFMP boundary (Letlhakane & Tutume), although Rakops and Nata are to become new sub-district administrative centres. They will operate under devolved and delegated powers from the district council.

The MFMP area is bisected by a series of veterinary cordon fences (Fig. 22) that divide the northern FMD 'red' zone from the southern and easterly FMD free zones. These zones do not however follow those of the above veterinary district zones, which are administrative zones, but those of the FMD zones (Fig. 23). Some of these fences currently do not serve a functional purpose following changes in the FMD designated status and therefore a comprehensive review of the fences in the region is required. Quarantine camps are located at strategic locations on the boundaries of these zones, namely at Odiakwe in NG51 and south west of Orapa in CT19 and CT20 (Fig. 18).

4.3. Current land use plans

The existing relevant plans were reviewed at the inception of the MFMP. The review included proposed zoning and land use recommendations, defined land use conflicts and proposed mitigation strategies, which were assessed and where applicable incorporated into the MFMP approach. The relevant plans reviewed for the MFMP process included: Review of the National Land Use Map (2009) National Development Plan 10 (2010), District Development Plan 7 (2009), Central District Integrated Land Use Plan (2001), Ngamiland District Integrated Land Use Plan (2009), Proposed Land

Use Plan for the Makgadikgadi Region (1989), Proposed Land Use Plan for the Ngamiland State lands (1987), MNPNP Management Plan (2006), Nata Sanctuary Business and Management Plan (2003) as well as Mokopi Community Land Use Management Plan (2006).

Many of these plans have failed to fully incorporate livelihood issues and therefore do not necessarily reflect community needs. One of the principal objectives of the MFMP is to improve livelihoods. The region is comparatively poor and under developed, with small scale agriculture and natural resource collection as the principal economic generators.

Figure 20: Agricultural District Zones across the MFMP area

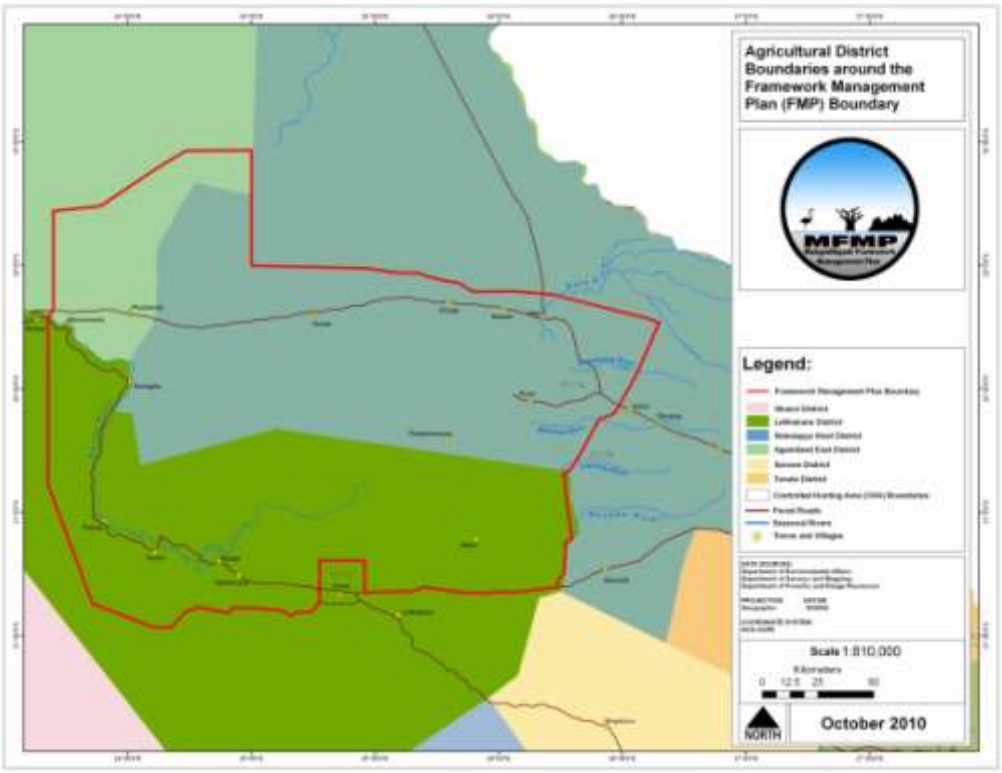


Figure 21: Veterinary District Zones across the MFMP area

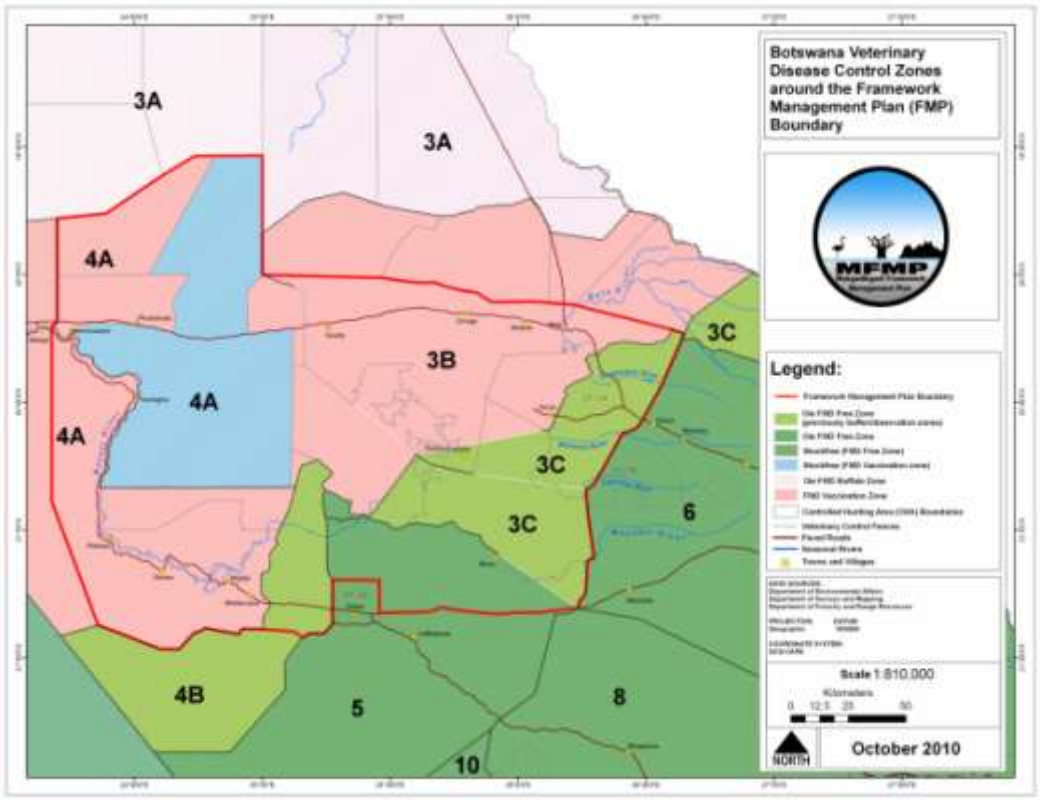


Figure 22: FMD zones in Botswana

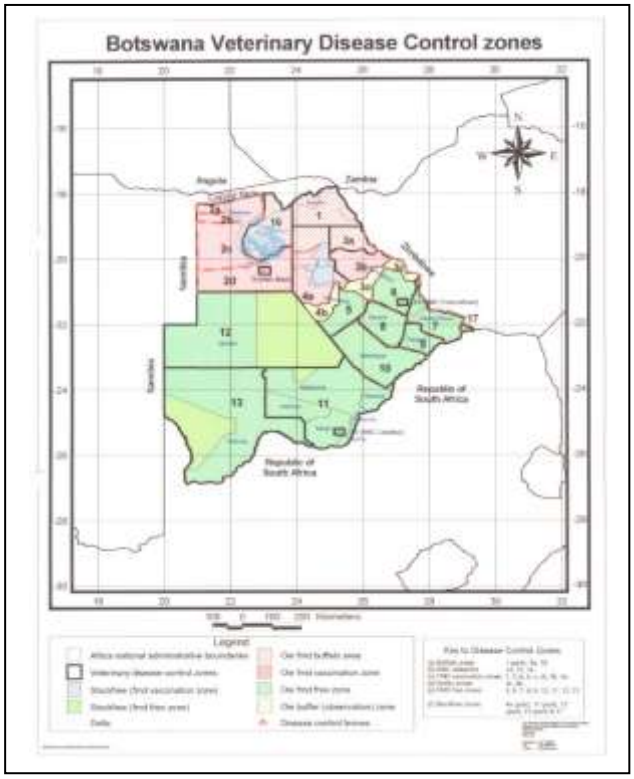


Figure 23: Fence alignments in the MFMP area

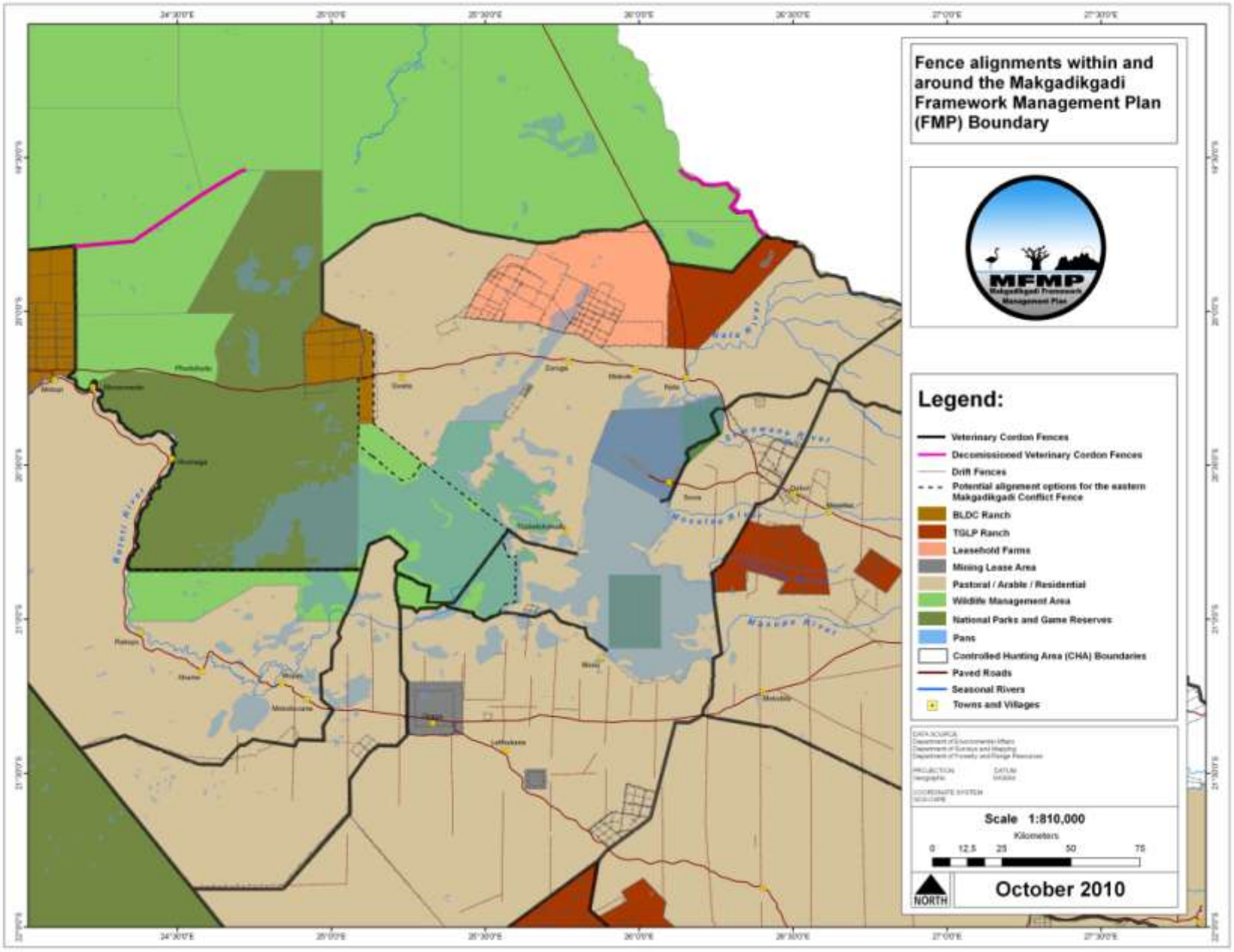


Figure 24: Borehole development in the MFMP area

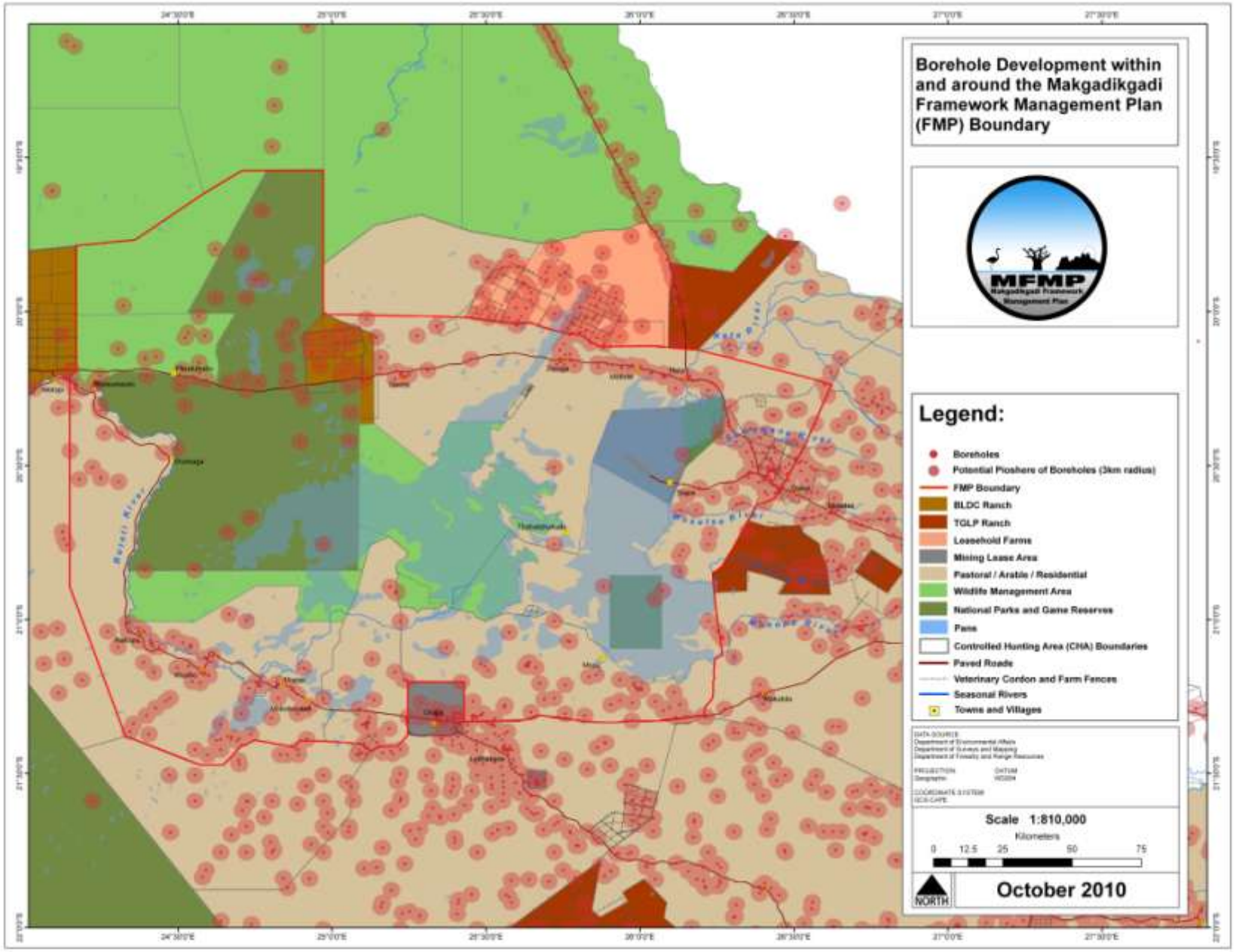


Figure 25: Cattle density and distribution patterns in the MFMP area

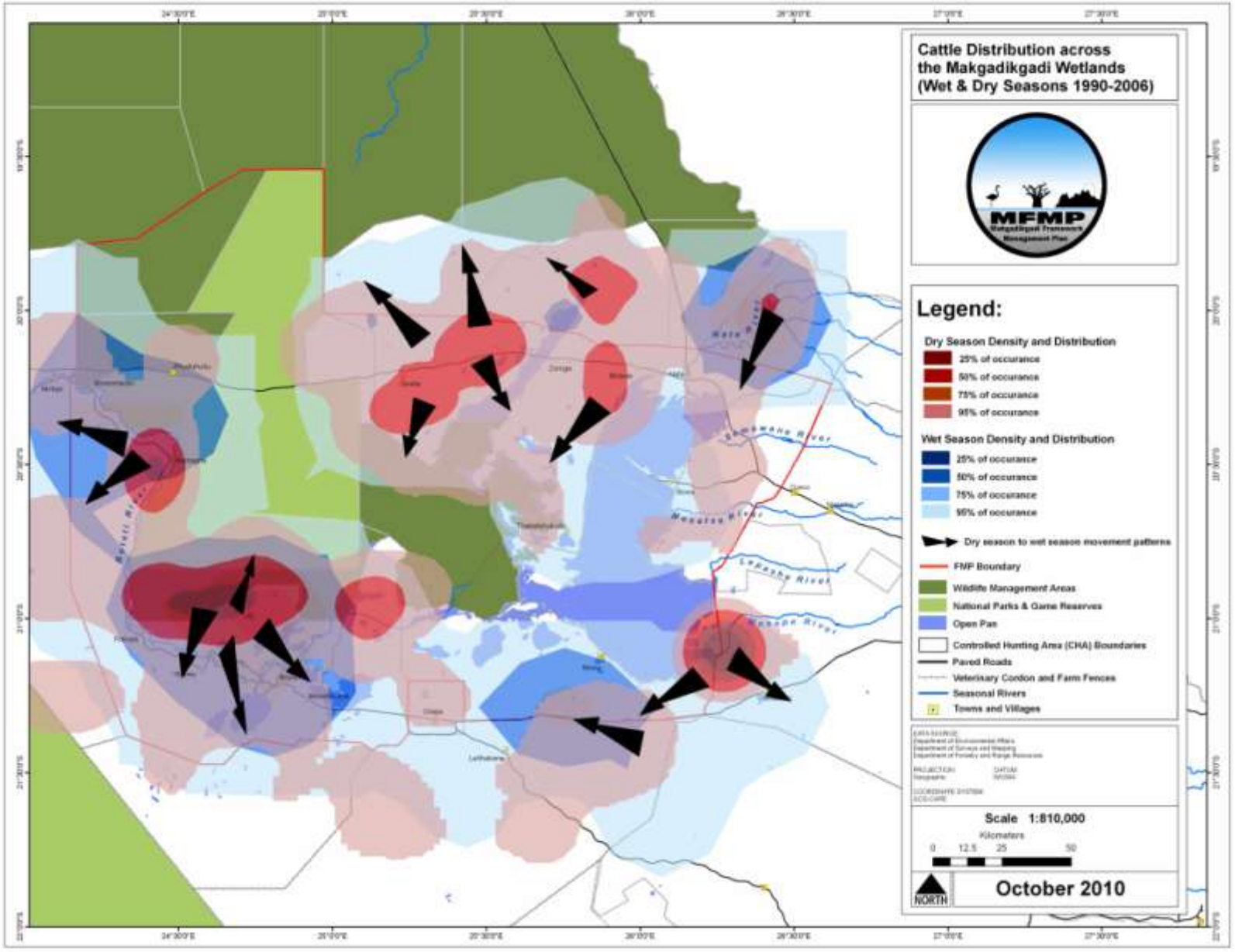
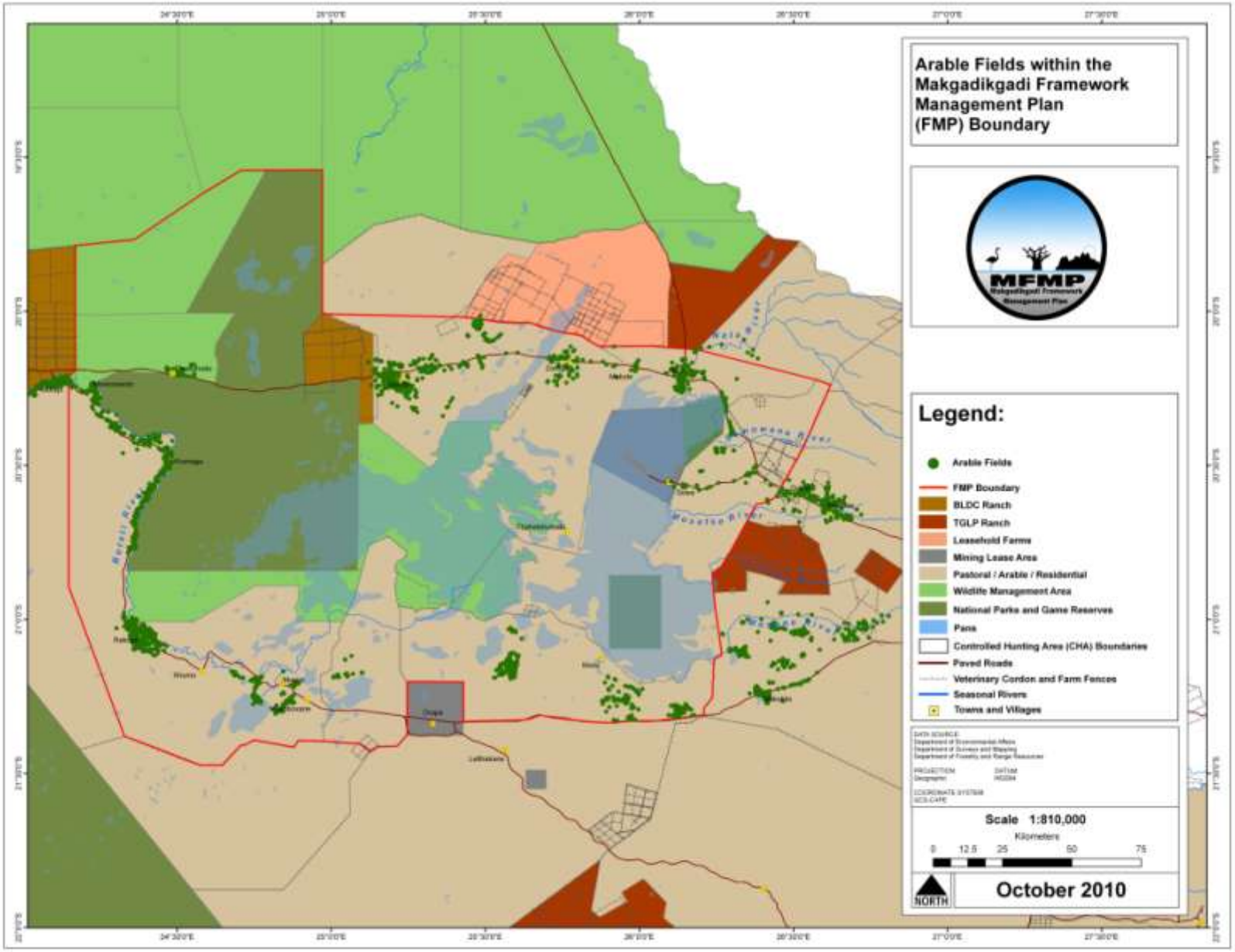


Figure 26: Arable fields within the MFMP area



4.4. Land use and agriculture

One of the primary factors controlling the population distribution is the availability of potable surface and ground water. These factors also dictate the density and distribution of cattle, which are, in the most part clustered around boreholes (Figures 24 & 25). Arable production (Figure 26), while linked with more fertile soils is more closely associated with settlement distribution with most arable development being rain fed dry land farming with a small amount of molapo farming within the Boteti River, especially around Rakops and Mopipi. However, arable development is constrained by saline and sandy soils, excessive wind erosion and primarily low and erratic rainfall. The vast majority of arable production is undertaken as part of the rural subsistence livelihood strategy.

Rangeland degradation is a concern across much of the MFMP area, with over grazing caused by high densities of cattle being one of the principal causes. Land use conflicts between pastoral and arable production are evident and caused in part by limited surface water availability, high soil fertility and also poor communal land management. Proposals within the Review of the National Land Use Map 2009 called for the development of Community Land Management Associations, similar to current CBNRM Trusts to take responsibility for the sustainable use of natural resources while maximising agricultural and livestock production. Fires are also a significant problem, with extensive firebreaks aligned across the area, with further firebreaks planned by the Department of Forestry and Rangeland Resources (DFRR).

4.5. Land use and wildlife conservation

A significant proportion of the MFMP area is set aside for wildlife conservation, within which a small, but growing tourism industry is focused. The core of this land use sector is the MNPNP (7 300km^2), with both gazetted (NG47 & NG49) and ungazetted (CT10 & CT11) wildlife management areas (WMAs) surrounding the protected area to the north, east and south; while on the western side, the park is bordered by the Boteti River and communal land beyond. This hard edge between wildlife and people/livestock on the western side of the Park is one of the principal causes for the high incidence of human-wildlife conflict in this area. Although land designated for conservation is predominant across the region, several biodiversity hotspots are not protected and at risk of degradation and disturbance.

The majority of the wildlife conservation area is State Land, the Nata Sanctuary being the largest exception. A new wildlife Flamingo Sanctuary (408km^2) has been proclaimed within the southern part of Sua Pan (in CT 13) through section 14 of the Wildlife Conservation and National Parks Act through Cabinet Memo 170 (Pres. Directive CAB 34 (B)/2009). To the north of the MFMP area, WMAs form a continuous link with the Chobe National Park and the Moremi Game Reserve (Fig.27), thereby highlighting the importance of the Makgadikgadi protected areas for ecosystem connectivity and wildlife movement. To the southwest lies the Central Kalahari Game Reserve (CKGR) to which a wildlife corridor has been proposed in previous management plans.

4.6. Land use, tourism and CBNRM

Tourism in the MFMP area is primarily undertaken through the private sector with small to medium sized safari camps and serviced motels dominating the industry. Some land is allocated to communities for community based natural resource management (NG49: Xhauxhwatubi Development Trust; Nata Sanctuary: Nata Conservation Trust; and Lekhubu: Gaing-O Community

Trust) (Fig. 25). The land allocated to communities is, however, low in view of the number of Community Based Trusts (most are not yet operational), prevalence of unallocated WMAs (CT10, & CT11) and the high intensity of human-wildlife conflicts.

There are current proposals to allocate portions of CT11 to the Gwezotsha Natural Resources Trust or to tender it out to a private tourism operator, while the Nata Conservation Trust has applied for the lease for CT 5, to the north east of the MFMP study area, and has recently submitted a management plan for the area to the Department of Lands. Some work led by Birdlife Botswana has also proposed the land allocation in the south of CT13 around the new flamingo sanctuary to the joint management of the Mokubilo, Mmatshumo, Mosu and Mea communities. Diversification of the tourism industry within the MFMP area would enable tourism development to occur away from the existing protected areas to take advantage of the historic and cultural resources of the region. However, water restrictions and shortage of serviced land restrict development.

Figure 27: Ecosystem linkages of MFMP area with the Moremi GR and Chobe NP

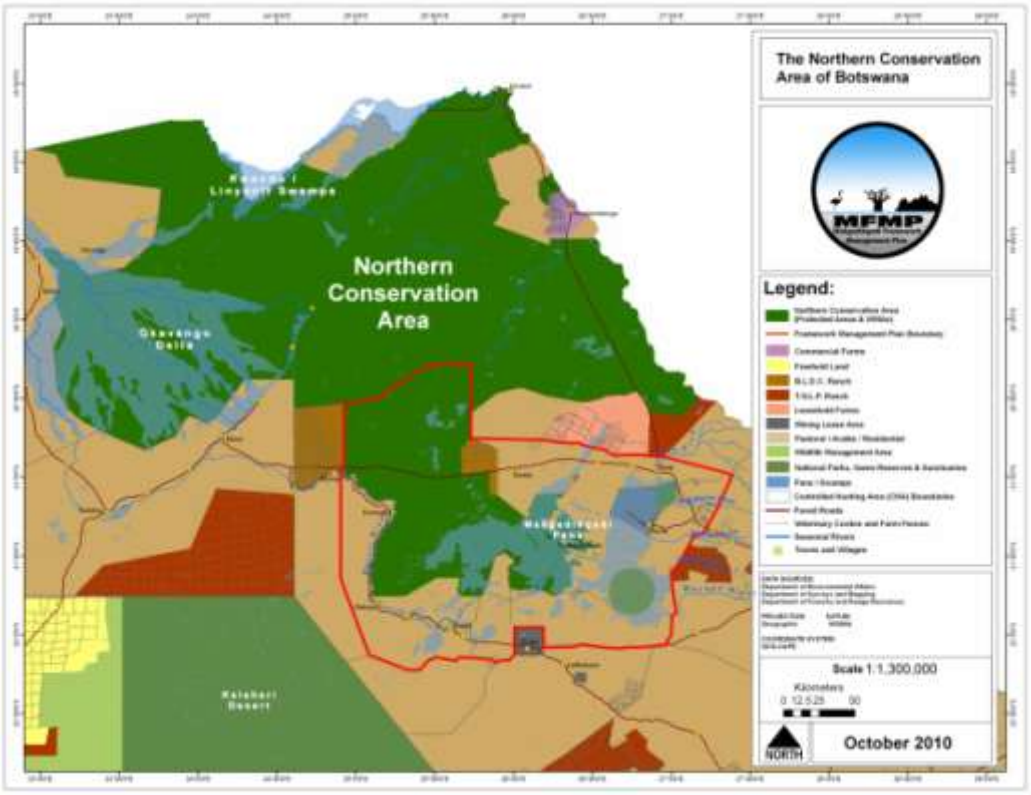
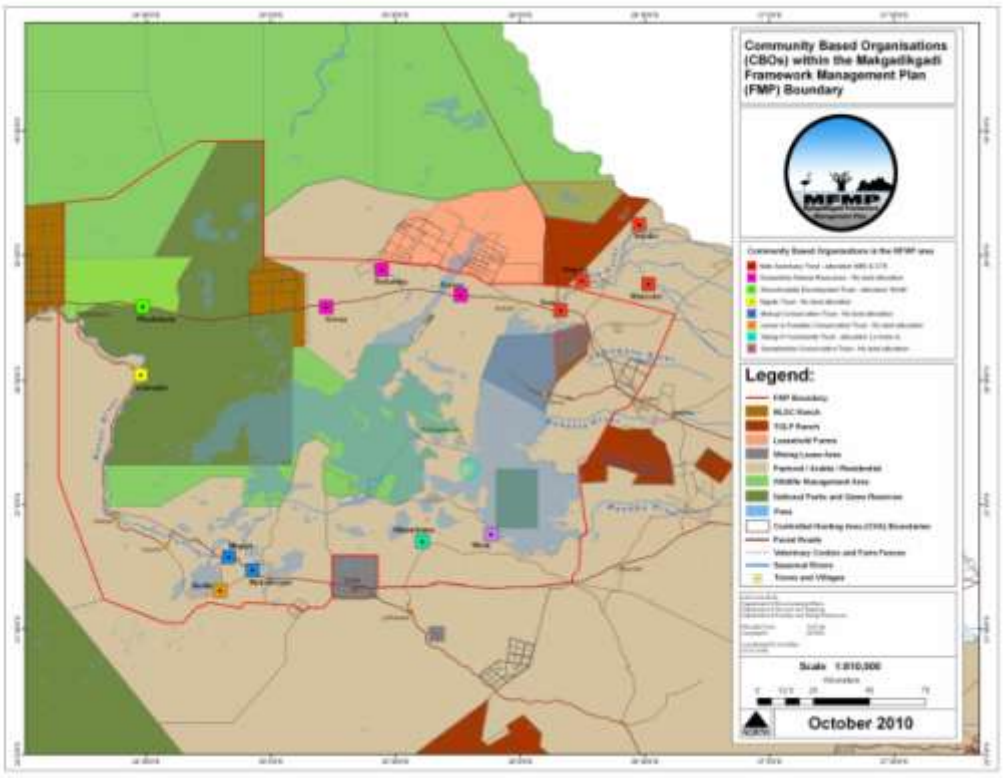


Figure 28: Community based trusts and land allocation for community management



4.7. Land use and mining

A few mines are found inside the MFMP area with some large ones just outside. Although mines form a small proportion of the MFMP area, they significantly contribute to the area and Botswana's economic profile (see chapter 5). Just outside of the MFMP area are the Dukwi copper mine and the Orapa diamond mine, with the smaller and currently inactive Damtshaa mine, the soda ash mine at Sowa and a small granite quarry at Xhumo being the only mines within the MFMP boundary. While the spatial footprint of the mines is limited, all three mines have an impact on the MFMP area, through having some of their well fields inside the MFMP area. The potential for mining expansion within the MFMP is evident from the extensive prospecting that is currently underway within the region. Prospecting licenses are currently held for precious stones (diamonds), coal and coal bed methane, base and precious metals, uranium and radioactive minerals. When these prospecting licenses are assessed on the basis of the number of their relative renewals (Figures 29 & 30), it is clear that the south and eastern regions of the MFMP study area could be more significantly affected by future mining activity. However due to the prospective nature of mining and the unknown location, the impacts of these potential developments are hard to plan for.

Figure 29: Prospecting license renewals for precious stones

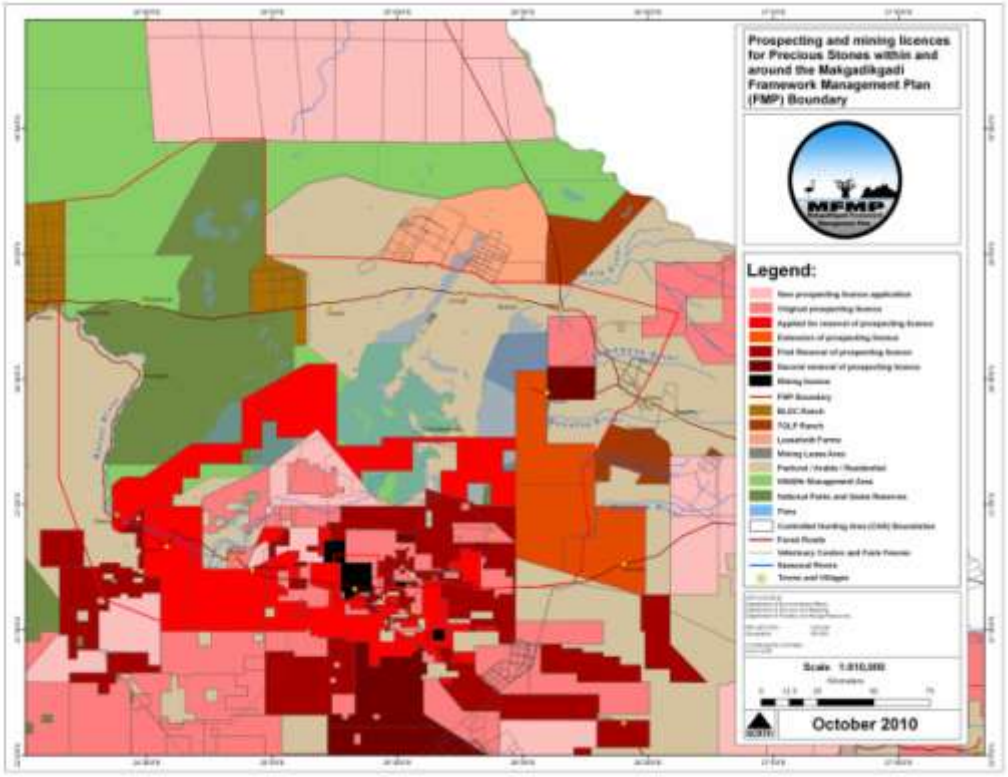
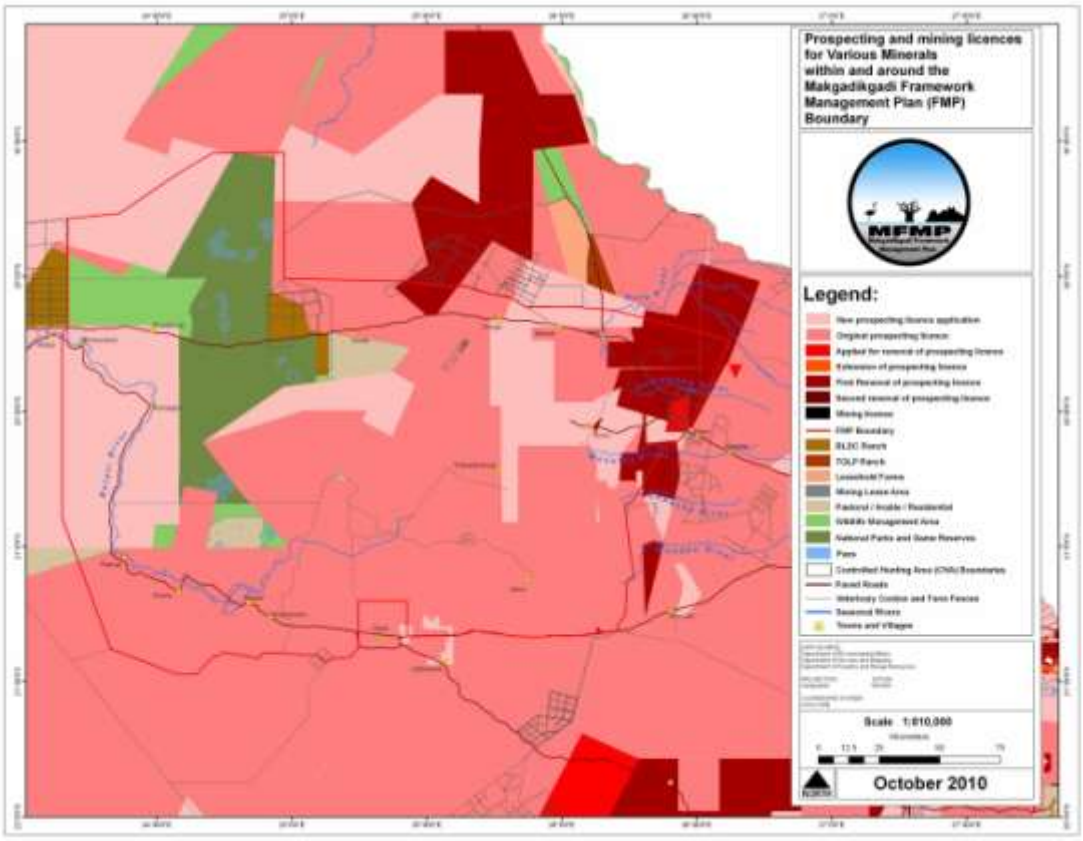
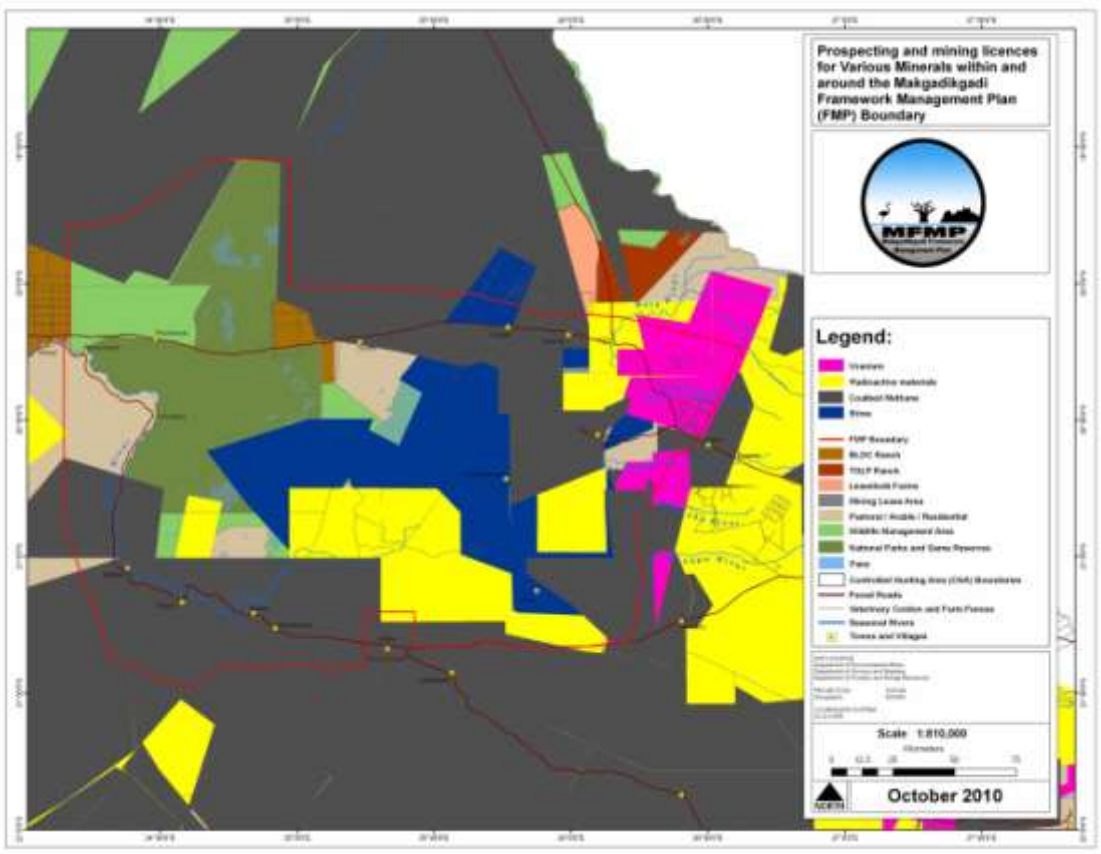


Figure 30: Prospecting license renewals and location of prospecting activity for various minerals





The development of a dam for water provision to the eastern portion of the MFMP region has been proposed with the damming of the Mosetse River 10km downstream from Mosetse village, with a catchment area of 1 360km^2 and an eventual reservoir covering 14.2km^2. The reservoir would flood land currently used for communal livestock grazing and arable production and have a significant impact on hydrological flow into Sua Pan, resulting in a potential 5% drop in the long-term breeding success of the flamingo population.

4.8. Land use and other physical developments

Other currently proposed physical developments within the MFMP area include: upgraded bitumen roads to Mmatshumo and Mosu/ Kedia/ Rakops new road fencing between Nata and Makalamabedi and to Sowa Town, new primary hospital facilities in Rakops and new DWNP facilities in Gweta.

5. The economic value of the Makgadikgadi

5.1. Introduction

The MFMP area provides a range of goods and services to the community and Botswana at large. However, their total value and the importance of individual goods and services were hitherto not fully understood. Therefore, a valuation study was undertaken of the economic value of the wetland and associated areas. This chapter reports the main findings for the direct uses value (5.3), the indirect use value (5.4) and the option value (5.5). The approach and methods used are discussed first (section 5.2).

5.2. Approach and methods

The concept of the Total Economic Valuation was used to assess the economic value of the MFMP area. This concept looks at the use and non-use values of the wetland system. The 'use' component refers to direct and indirect use values while the non-use refers to the option value (possible future uses) and existence value (independent from any use). The following use values were estimated:

- Direct uses: livestock and crop production, harvesting of natural resources, tourism and mining;
- Indirect uses: carbon sequestration, wildlife refuge, groundwater recharge, science and education and water purification.

The use values were quantified. The option value was explored qualitatively. Due to logistical constraints, no attempt was made to estimate the existence value.

Data were obtained from statistics, documents, in-depth interviews and focus group discussions (direct use values). Financial and economic enterprise models were developed to estimate the direct use values based on models of Barnes (1998, 2001), Barnes *et al.,* (2002) and Turpie *et al.,* (2006). The models are based on empirical data and assumptions brought together through interviews, focus group discussions and past valuation studies. The models depicted the livelihood values derived by the communities from income generating activities within the Makgadikgadi as well as income accruing to government and contribution to the national income.

For the direct use values (agriculture and natural resource use), the study area was divided into two categories: Zone 1 for the north and Zone 2 for the south. These zones correspond to both the veterinary and agricultural zonation of the area. Zone 1 has a smaller population and average household size than the southern zone. The southern zone, which also wraps around to the west of the pans, has more settlements, particularly in the south-west. Both zones contain a portion of pans and associated grassland areas.

The study assessed several types of values, private and economic as well as gross and net. The differences between the values are indicated in Table 15. Financial values refer to values for farmers, tourist operators or mining houses. Economic values or value added refer to contributions to the national economy.

Table 15: Explanation of the types of value described in this study

Measure of value	Explanation
Gross private value	The market value of the total output per year (quantity of production multiplied by market price) for a farmer, tourist operator or mining company
Net private value	Gross private value less the annual cost of capital, labour and other fixed and variable input costs; with own (household) labour valued at the minimum wage rate (P600/month)
Gross output	Gross private value, slightly adjusted through shadow pricing, so that it reflects opportunity cost to the economy
Direct gross value added	Direct contribution to gross national income (GNI), calculated as gross output less inputs from outside the enterprise, leaving income earned by internal factors. It reflects opportunity costs to the economy and includes shadow pricing adjustments to account for market distortions, taxes and subsidies
Total gross value added	Direct plus indirect contribution to gross national income, calculated as direct gross value added plus an estimate of the indirect value added as a result of multiplier effects

5.3. Direct use value

The direct use values largely depend on the number of people involved in the particular direct use, the amount harvested or produced and its value. Values can be determined for subsistence and commercial purposes.

5.3.1. Livestock production

Livestock is an important component of rural livelihoods as it provides cash income, meat, milk, draught power, source of wealth, and prestige. Large herds of livestock are usually kept at the cattle posts while small herds are kept in the village area. Spatially, livestock farming is more pronounced in the south-western part of the Makgadikgadi area (Zone 2). The surveys indicate that about 65% of households in this zone keep livestock compared to 54% of households in Zone 1 (Table 16).

Table 16: Average numbers, rates of off-take for consumption and sale per household and reported prices

Livestock	Zone 1 – North	Zone 2 – South
Cattle	35	29
% consumed	1.3	0.9
% sold	4.7	5.1
Average price in Pula	2875	2250
Small stock (goats & sheep)	20	45
% consumed	3	4.5
% sold	4	4
Average price in Pula	550	375
Donkeys	7	7
% consumed	0	0
% sold	0	0
Average price in Pula	250	300

In terms of value, livestock production has a gross private value of P 53million and a net private value of P15.4 million per year (Table 17). Of the gross income, 60% is realised as cash income while 40% is consumed by the producer households. The aggregate value of livestock per producer

household is relatively higher in Zone 2 than Zone 1 primarily due to the greater proportion of households that are engaged in livestock production in the former.

Table 17: Estimated value of livestock production

Livestock	% households*	Produced (LSU)	Sold (LSU)	Ave Price	Gross private value	Net private value	Gross value added
Zone 1							
Per livestock household	54	2	2	2 918	8 288	2 754	1 776
Total zone 1		5 567	4 241		19 978 577	6 637 750	4 282 371
Zone 2							
Per producer household	65	2	2	2 337	7 489	1 959	1 428
Total zone 2		10 704	8 019		33 423 067	8 742 787	6 374 370
TOTAL (P)		16 271	12 261		53 401 644	15 380 537	10 656 741

5.3.2. Crop production

Dry land farming is the most common form of crop farming in the MFMP area but households in areas like Rakops and Xhumaga practise floodplain (*molapo*) farming in areas that are seasonally flooded. The average size of fields is 3.8 ha and the crops grown include maize, sorghum, millet, beans and melons among others. However, in a good year, farmers can plough as much as five hectares. The produce is mostly utilised for household consumption and sold locally, and to a lesser extent to Botswana Agricultural Marketing Board (BAMB).

The average production of crops per household and crop prices, are much higher in the north than in the south (Table 18). Arable farming has a net private value of P19 million directly to farmers while it contributes P14.7 million to the national income (Table 19). This is mostly attributed to dry land farming as molapo farming is marginal.

Table 18: Average production per ha of the main crops grown each season in each zone

Dry land crop	Unit	Approx. price per unit (P)Zone 1	Approx. price per unit (P) Zone 2	Production per ha Zone 1	Production per ha Zone 2
Maize	Kg	7	5	375	282
Millet	Kg	6.5	6.5	250	29
Sorghum	Kg	3.5	2	313	286
Beans	Kg	12	13.5	86	29
Sweet Reeds	Each	2	2	125	179
Melon	Each	20	20	15	15

Table 19: Estimated value of crop production

Crops	% of households	Net private value	Gross value added
Zone 1			
Per producer household	76	4 481	3 897
Total		15 346 366	13 344 658
Zone 2			
Per producer household	83	678	239
Total		3 863 087	1 362 955
TOTAL		**19 209 452**	**14 707 613**

5.3.3. Collection of veld products

Local people collect and utilise a wide range of veld products. The area is endowed with a variety of veld products including grass, *imbrasia belina* (mophane worms) wild fruits and vegetables, firewood, medicinal plants, honey, salt, palm leaves, timber, poles and wild birds. The extent to which local communities are involved in the harvesting of these products differ spatially. For instance, harvesting of grass is common across all the zones while fishing is more common in Zone 1.

Grass
Grasses are used extensively in the area mainly for thatching, making traditional brooms and on a limited scale, for building of fences. A large proportion of households to the northeast at Nata village, to the south at Mmatshumo village, and to a lesser extent in the north at Gweta village are engaged in collecting grass. Households in Rakops village to the southwest only collect grass for thatching when needed and do not collect grass to sell. Overall some 45% of the grass harvested is sold mainly to the outsiders. Grass harvesting is worth approximately P29 million in terms of net private value to households, and just over P33 million in terms of gross value added to national income.

Wild fruits and medicines
Wild foods and medicines are harvested by the majority of the households, especially the poor households. Ninety percent of the households in the north collect wild foods compared to about 50% in the south. An estimated P900-950 per household in cash income can be realised from selling these products and a total net private value of P3 950 per annum is realised. In aggregate, the collection of wild foods is estimated to be worth about P29 million in terms of net private income, and P36 million in terms of gross value added. Women are more engaged in the collection of wild foods while medicinal plants are mostly harvested by men. These are collected for both subsistence and commercial purposes, while it is estimated that 18% of the products collected are sold.

Wood resources
Wood resources are used for cooking, heating and lighting, but wood also provides poles and timber for house and fence construction as well as for the production of wooden products such as mortar, pestle and furniture. Eighty five percent of households in the north are dependent upon firewood (89% for Zone 2). Firewood is mostly collected for subsistence utilisation and on a limited scale, for commercial purposes. It is estimated that a total of 950 000 head loads of fuel wood is harvested each year, with more being harvested in Zone 2 than Zone 1. The total harvest of fuel wood in the

study area is worth a net total of some P2.7 million to households and a gross value added of P3.6 million.

Mophane worms
Mophane worms are collected in large quantities in December and April. The worms are consumed by the collectors but also sold. Mophane worms are mostly available in the northern and north eastern parts of the Makgadikgadi wetland area. Overall, some 80%, of the harvest is sold. Estimates indicate that mophane worms are worth P3 000 to a user household with an aggregate net private value of P9.9 million of which 58.6% is contributed by harvesters in the northern zone. The total gross value added is slightly higher (P11 million per annum).

Other natural resources
There are other several natural resources which are utilized by the communities. However, collection and utilization of these products is practiced in small amounts or very irregularly that their contribution to household income is minute. Salt is commonly collected in the villages of Mmatshumo and Nata and it is mostly used as supplementary feeds for livestock, in cooking and has medicinal value as well. Fishing and hunting are other direct benefits attained from the wetland. Fishing takes place mainly along the Nata River, and is practiced all year round, but particularly after heavy rains. Unlike areas around the Okavango Delta, harvesting of palm leaves is minimal in the Makgadikgadi area. Where available, they are used for basket weaving and making other crafts.

The total annual private use values and direct value added derived from agriculture and natural resources in the study area are summarised in Table 20.

Table 20: Net private values and economic values associated with natural resource use (in Pula millions per year)

	North: Zone 1		South: Zone 2		TOTAL	
	Net Private Value	Direct Value added	Net Private Value	Direct Value added	Net Private Value	Direct Value added
Grasses	7.2	9.1	24.8	24.5	32.0	33.6
Wild Fruits	14.0	18.1	15.1	17.5	29.1	35.7
Firewood	1.0	1.3	1.7	2.3	2.7	3.6
Mophane worms	5.8	6.6	4.0	4.4	9.9	11.0
TOTAL	***61.3***	***51.9***	***79.4***	***55.1***	***140.8***	***106.9***

5.3.4. Tourism

Tourism occurs primarily as nature-based activities based in accommodation facilities, including serviced hotels/motels, wildlife viewing lodges/camps, some safari hunting operations and campsites. Using financial rates of 10% and 15%, wildlife viewing lodges/camps and safari hunting enterprises can be financially attractive as investments. A lodge can therefore contribute about P400 000 per annum to a community trust or a district authority while the hunting safaris can contribute some P1 million to the community trusts or other land holders. The most attractive hunting safaris are those with elephant bulls in the quotas.

Tourism in the MFMP area directly contributes about P55 million to the national income of which 65% of this is generated by game lodges and camps, 22% by safari hunting operations while 13% is contributed by serviced hotels and motels in the area (Table 21).

Table 21: Direct economic use values for tourism (Pula, 2010)

Category	Gross Output*	Gross value added*
Serviced hotels/motels		
Upper to mid market	16 016 600	6 486 000
Mid market	1 485 800	601 700
Subtotal	**17 502 400**	**7 087 700**
Game lodges/camps		
Upper market	56 733 800	22 974 600
Upper to mid market	17 292 900	7 002 800
Mid market	15 768 400	6 385 500
Subtotal	**89 795 100**	**36 362 900**
Other tourism activities		
Campsites	204 500	82 800
Mobile operations	14 816 200	5 999 900
Safari hunting operations	14 131 600	5 807 700
Subtotal	**29 152 300**	**11 890 400**
TOTAL	**136 449 800**	**55 341 000**

*per annum

When considering the effects of lateral and backward linkages from tourism activities in the area, a total of P227 million is generated as a contribution to Botswana's economy. This is four times higher than the P55 million generated directly by accommodation facilities in the area, hence the importance of linkages is clearly portrayed. Therefore, by and large, the MFMP tourism activities represent accommodation for tourists attracted to or using the attributes in the area. In terms of employment, tourism activities within the MFMP area result in an estimated 350 full time jobs, as well as annual salaries and wages payments of some P22 million. As a result of lateral and backward linkages, local tourism generates about 1 400 jobs in the Botswana economy with salaries of P90 million. In addition, the total direct contribution of tourism to local livelihoods is estimated to be P15 million per annum.

Communities also directly utilise the wetland's resource through the CBNRM programme and currently eight of such projects exist but only three are actively functioning. The main activities are photographic tourism, biodiversity management and to a lesser extent hunting through joint venture partnerships with private companies. These activities are expected to ensure increased investments in the natural asset base and to ensure sustainable management of these resources. A CBO in the Makgadikgadi area can generate a ten year financial internal rate of return of 10% on overall investment. The communities only benefit more if the subsidies from donors and government are considered. Community net income in the form of livelihoods from a CBO is about P270 000 per annum, made up as net income from activities such as campsites, salaries and wages from CBO employment, and net income from the rentals and royalties received from joint venture partners.

Conversely, the direct value added to the national economy is about P990 000 and taking into consideration the backward linkages, CBNRM generates an added value of P1.8 million to the

economy. This signifies that CBOs are economically viable and therefore require support from all relevant stakeholders for their development.

5.3.5. Mining

Soda ash mining in the area generates a direct value of P190 million (Table 22) to the gross national income and some 440 people are employed, with a wage bill of some P99 million. Employment in the mining industry is therefore relatively highly paid compared with that in tourism and even more so compared with that in agriculture. With a multiplier factor of 2.46 as well as the backward linkages, the value of mining activities on the national income is estimated at P467 million.

Table 22: Direct economic values for mining (Pula million/annum, 2010)

Category	Capital investment	Gross output	Gross value added
Mining (soda ash & salt)	458,000,000	528,500,000	190,000,000

5.4. Indirect use value

The indirect use values are related to the ecological functions or services of the wetland. These maintain and protect natural and human systems through services such as carbon sequestration, wildlife refuge, water purification, sediment retention, waste assimilation and flood attenuation, among others. The functions of the system are also related to information such as scientific research and education. The indirect use values are critical to future benefits generated by ecosystems and maintenance of their integrity. These values are discussed in this section for the MFMP area.

5.4.1. Carbon sequestration

The Makgadikgadi wetland has a carbon sink function as it contributes to the reduction of carbon in the atmosphere. Sequestration is highly determined by vegetation types, land use changes, management practices, agricultural practices and fires. Carbon sequestration rates were estimated for different vegetation zones based on expert opinions and literature (Table 23). Two alternatives were considered in sensitivity analyses.

Table 23: Assumed carbon sink rates by vegetation zones

Vegetation zones	Size in ha	Net sink (T/ha/annum)	Alternative 1: low net sink 2 (T/ha/yr)	Alternative 2: high net sink 3
Open water	78 528	0	0	0
Open grassland (saline)	436 365	1	0.5	1.5
Open pan (salt)	711 946	0	0	0
Shrubbed grassland	860 861	2	1.75	2.25
Woodland	1 554 681	3	2.75	3.25
Industrial use	1 701	0.25	0	0.5
Total	3 644 082			

There has been an increase in the value of carbon over the years and between 2005 and 2009, a ton of carbon was valued at US$21 on average (from carbon trading markets). For the project area, the indirect value of carbon sequestration was estimated using the price of US$20/t.

5.4.2. Wildlife refuge

The Makgadikgadi wetland acts as a habitat for migratory wildlife and birds, which create value outside the MFMP area itself. There is a variety of wildlife and bird species and the Makgadikgadi is regarded as an Important Bird Area. Furthermore, the Makgadikgadi wetland is part of the KAZA Transfrontier Conservation Area (TFCA).

In this regard, hunting and ecotourism data are therefore considered in determining the economic value of wildlife refuge. Hunting quotas in the area have generally declined but the elephant quotas for valuable species such as elephants have increased. Due to this trend, the value of hunting has increased. Between the period 1997 and 2010, the value of hunting increased from P0.6 million to P3.1 million considering elephant, buffalo and wildebeest. In regards to ecotourism, the value is estimated to be P2.8 million per annum.

5.4.3. Water purification

The MFMP area has a number of settlements, one operational mine, and tourism camps, which are potential sources of pollution in the area. There is only one wastewater treatment plant in the area (Sowa Town). Furthermore, there is irregular collection of solid waste in most of the settlements. Tourism camps have septic tanks and (some) practice re-use and recycling of solid waste. The soda ash mine has an operational water treatment plant. Bearing this in mind, there are therefore no major sources of water pollution in the area and therefore the wetlands role in purifying water is insignificant.

5.4.4. Groundwater recharge

This value reflects the natural replenishment of ground water, which is used for sustainable abstraction. Groundwater is used by livestock, people and economic sectors in settlements, mining, and a little by wildlife (artificial water point in the MNPNP). For mining, the study considered a portion of the Orapa diamond mines which derive some of the water from the Orapa well fields that are within the Makgadikgadi Framework Management Plan project boundary. In regards to the Botswana Soda Ash mine, water abstraction is for potable water supply, brackish water and brine. Given the per capita water demand figures stipulated by the Ministry of Local Government, the total annual groundwater abstraction for the settlements is estimated at 0.76Mm^3 for 2009. In light of these estimates, the recharge is estimated to be 0.5Mm^3 per annum. This constitutes at least 65 % of the total abstraction for the settlements.

Using the cattle crush and agricultural statistics data, livestock water consumption estimates indicate that recharge from this sector amounts to 1.7 Mm^3 per annum assuming that livestock drink from a groundwater resource for nine months and use surface water for one quarter.

In regards to wildlife in the parks, the hourly water abstractions from the boreholes is 53.88 m^3 and assuming that the boreholes pump water at least four hours a day, the total annual water abstractions are estimated at 78 645 m^3.

The MFMP area is estimated to give a groundwater recharge service of P10.25 million as indicated in Table 24 using P2.75/m^3 as the value of groundwater. The livestock sector is the largest water user

followed by the mining sector. Together these sectors account for over eighty percent of groundwater consumption.

Table 24: Groundwater recharge value

Consumption/recharge by sector - m^3 (2009)	**Consumption**
Domestic	495833
Livestock	2 313 515
Wildlife	78 665
Mining	837 642
Total consumption (Mm^3)	**3.73**
Total groundwater recharge value (Pula million)	**10.25**

5.4.5. Scientific and educational value (S&E)

This value is related to the value of scientific research, filming and educational activities associated with the wetland. This increases the knowledge base and understanding of wetlands and could lead to better management. There have been a number of research projects and films to document Makgadikagdi wetland. An inventory of all activities was made and information was collected about the project budgets. Based on the collected information, the S & E value is estimated to be P3 million.

5.4.6. Aggregate indirect use value

The overall indirect use value of the Makgadikgadi is estimated at P155.4 million with a minimum-maximum range from P73.6 million to P253.4 million (Table 25). Carbon sequestration takes a significant chunk of the overall indirect use values of the wetland (86%). Given the large number of assumptions that had to be made, low and high estimates have been added.

Table 25: Estimated indirect use value of the MFMP area (Pula)

	Category	**Best estimate**	**Low estimate**	**High estimate**
1	Wildlife refuge			
	1.a hunting	3 070 200	1 541 600	4 598 800
	1.b ecotourism	2 849 000	712 300	6 410 300
2	Carbon sequestration	136 451 100	60 000 600	229 351 500
3	Science & education	2 256 900	2 256 900	2 256 900
4	Water purification	0	0	0
5	Groundwater recharge	10 800 000	9 100 000	10 800 000
	Total indirect use value	**155 427 200**	**73 611 400**	**253 417 441**

5.5. Option value

The option value is the value of wetland as potential *future* direct or indirect use. This value is expressed in terms of the people's willingness to pay to have the resource retained for a particular

option. However, due to insufficient data, this value could not be estimated. Nonetheless it is clear that the option value of the MFMP area is significant due to:

- Widespread mineral explorations in the area which clearly signifies the option value for minerals;
- Investments in the national parks which were particularly aimed at maintaining the natural resource base in these parks;
- Scope for tourism expansion;
- CBNRM projects in the area with the ultimate aim of sustainable utilisation and community joint management of the natural resources;
- Possible role of the pans can play in reducing climate change;
- As a unique wetland system, the option to do more research and education work will be important in future; and
- Restricted future use value of groundwater as a result of excessive exploitation.

5.6. Conclusions

The direct and indirect use values of the MFMP area are both significant. The indirect use value is estimated to be P155 million per annum. The direct use value is P197 million in terms of livelihood contributions, P 354 million in terms of direct economic benefits and P880 million in terms of direct and indirect economic benefits (Table 26).

Table 26: Summary of direct use values

Direct uses	Livelihood value (private value)	Direct economic value	Direct & indirect economic values
Livestock production	15 380 537	10 656 741	20 780 645
Crop production	19 209 452	14 707 613	28 679 846
Use of veld products	73 570 663	83 777 571	137 395 218
Tourism	14 732 000	55 341 000	226 718 400
Mining	74 250 000	190 000 000	467 000 000
Total	**197 142 653**	**354 482 926**	**880 574 108**

For livelihoods, mining and use of natural resources are most the important direct use values followed by crop and livestock production. Assuming that the MFMP area has around 7 000 households, the monthly livelihood/ household is estimated to be around P 2 347. This includes cash and in kind livelihood sources.

For the economy at large, mining tourism and use of natural resources are the most important direct use values. Due to the greater backward and forward linkages, tourism generates more direct and indirect benefits to the national economy, while natural resource use creates more direct economic benefits. Mining accounts for a larger portion of the direct use values. It is the biggest contributor to the economy with P190 million and P476 million in gross value added and in total respectively.

Agriculture and tourism clearly represent different values. While livestock and crop production together account for 18% of the livelihoods, their economic value is 6 - 7%. This is among others due to the government subsidies and low wages in the sector. Clearly, agriculture is primarily a subsistence sector in the MFMP. When government can no longer afford the current level of subsidies, livelihoods will be adversely affected unless farmers increase their productivity. The economic effects of reduced subsidies would be modest. In contrast to agriculture, the tourism sector contributes an estimated 7% to local livelihoods, while generating 16 - 26% of the economic value. Thus any tourism development should contribute to a greater livelihood contribution of the

sector. The sectors of natural resource use and mining have a more even value distribution. Use of natural resources contributes 37% to local livelihoods and 16-24% to economic values. Mining contributes virtually the same to local livelihoods (38%) but over half of the economic value.

The indirect use value is significant at 43% of the direct economic use value and 78% of the livelihood value. This finding warrants enhanced natural resource management aimed at sustaining the natural resource base as well as improving livelihoods. Unsustainable resource management would threaten the future use of natural resources, tourism and agriculture, thus posing a significant long term livelihood threat. The indirect use value of carbon sequestration accounts for 86% of the total indirect use value of the wetland system and is therefore the most valuable ecological service of the wetland. Wildlife (and bird) refuge and groundwater recharge value are also important, secondary indirect uses.

Although not quantified, the option value of the wetland system is significant as indicated by the ongoing efforts to manage and conserve the ecosystem as well as the potential future threats on the wetland, such as climate change and groundwater mining.

6. Tourism and heritage

This chapter reviews the tourism and heritage sector in the MFMP area. It assesses current tourism trends (6.1), current tourism facilities, archaeological and heritage sites as well as areas with tourism potential (6.3), market trends and potential (6.4), tourism management models (6.5.) and outlines a proposed tourism strategy for the MFMP area (6.7).

6.1. Introduction

The MFMP area is suitably located for tourism en route to the Okavango Delta and the Chobe. It has beautiful scenery with expansive landscapes and vistas enhanced by pans, palms, baobabs and wildlife; it is also rich in archaeological and heritage sites. The MNPNP is the nexus and anchor of wildlife conservation in the area.

The park has recorded a steady growth in tourists and the number of tourism facilities has increased. However, tourism in the MFMP area is underdeveloped and does not contribute much to local livelihoods. The area has the potential to offer a wide range of tourism products and to distribute tourism more evenly over the country, away from the Delta and Chobe River front. Most of the tourism establishments in the Makgadikgadi comprise of medium-scale lodges and camps which offer services such as game drives, bird-watching, walking safaris, historical tours, horseback riding, quad-bike riding, and use of restaurant, pool, craft shop and bar facilities. Camping sites and hunting camps offering guided big game trophy hunting are also present.

The global and regional tourism market is expected to grow significantly in future, offering opportunities to boost tourism and development of the MFMP area. This chapter discusses the tourism potential of the MFMP area in the context of sustainable development and ecosystem approach. Furthermore, it assesses the market potential of the identified sites and possible activities that can make the area competitive with other tourism areas in the country and elsewhere in the region.

6.2. Approach

Four activities were undertaken as part of the tourism work for the MFMP:

- Inventory and assessment of tourism development potential (with a focus on the ten most valued tourism development sites);
- Inventory and assessment of archaeological and heritage sites;
- Review of tourism management models; and
- Assessment of tourism marketing and branding.

Tourism potential sites were identified and reviewed based on attractiveness in terms of being destinations offering scenery and nature-based experiences whilst also considering archaeological importance and ecological value. These were assessed in terms of their use potential, ecological sensitivity, management needs and other requirements, which were subjected to a multi criteria analysis. Furthermore, the tourism market in the MFMP area was reviewed as well as the market potential of the pans. From this, a market strategy was therefore developed so as to tap this potential. Desk top studies, document review and consultations with stakeholders was undertaken to enhance this process. In addition, GIS mapping was carried out to identify the potential sites as well as zone the different areas and highlight sites with tourism potential.

6.3. Tourism development potential assessment

6.3.1. Current tourism facilities

Some thirty five tourism operations have been established in the area in response to emerging tourism opportunities, almost equally divided between lodges/camps, motels and camp sites (Table 27). Examples of this have been the development of a small camp in the village of Gweta in the late 1990s, along with Jack's Camp and Camp Kalahari along the eastern boundary of the MNPNP in CT11. Moreover, due to the location of Nata as a gate way to the Okavango Delta and Chobe tourism centres, and the existence of the Nata Sanctuary, facilities around the Nata area emerged over time. This includes Nata Lodge, North Gate lodge and Maya lodge. The lodges offer accommodation and wildlife watching experiences, especially those relating to the significant populations of seasonal birds only in the sanctuary. In addition, in the south eastern part of the MFMP, the Mmatshumo community has developed a community campsite at Kubu Island centred on its attractive, wide salt pan landscapes coupled with the mystique of the granite outcrops housing a large number of baobab trees. Traditionally, the island has an ancestral and cultural value and is thus very important to the local community as it is utilised by some segments of the society for performing rituals and prayers. There are ruins, granite rocks, fossils of lion footprints, Stone Age tools and huge baobab trees, all of which enhance the attractiveness of the site.

Below is a list of notable infrastructure developments in the MFMP area:

- Lodges of Meno-a- Kwena and Leroo-la-Tau on the western boundary of the MNPNP on the Boteti River;
- Lodge and campsite of Planet Baobab east of Gweta village on the Maun-Nata road;
- A number of motel-cum-lodges at the Nata village junction, including:
    - Northgate Lodge and Campsite;
    - Nata Guest Lodge; and
    - Maya Guest Inn.
- Nxai Pan Camp in the MNPNP; and
- A number of motels and guest house complexes in Rakops and Letlhakane.

Table 27: Breakdown of accommodation facilities in the MFMP area

Type of facility	No. of facilities	No. of rooms	No. of beds	Max possible occupancy	Average potential Annual occupancy	Annual revenue generated (P million)
Lodges and camps	12	145	597	130 305	7-66%	78.7
Hotels and motels	11	157	225	82 125	40-60%	16.5
Camp sites and camping grounds	11	43	415	151 475	2-25%	1.6
Mobile safaris	1	10	20	7 300	75%	5.2
Total	**35**	**355**	**1257**	**371 205**		**102.1**

The tourism facilities generated over P100 million in gross revenues, mostly from lodges and camps.

6.3.2. Areas with Potential for Tourism (ATP)

The tourism assessment shows a significant potential for tourism expansion given the extensive and diverse range of attractions (e.g. scenery, wildlife, birdlife, palms, vastness/ wilderness landscape, star watching and adventure tourism).

In total, nineteen areas were identified with tourism potential. As the MFMP focuses on the ten most valuable areas, a multi-criteria analysis (MCA) was carried out to identify ten areas with the greatest set of positive attributes where a variety of facilities and tourism products could be developed. Ideally the potential sites and the mix of proposed activities and facilities should be attractive to investors, be ecologically friendly, and should contribute substantially to local livelihoods while boosting the national economy. The results of the MCA are presented in Table 28. Further investigations of the other areas with tourism potential need to be carried out in the future as part of the MIMP. The highest ranked areas include some existing areas with tourism developments, including the MNPNP, the Nata area and the Xhumaga area. There are also areas with new tourism opportunities identified in the Sua mine area and near Mopipi and Mokoboxane (where a community trust already exists).

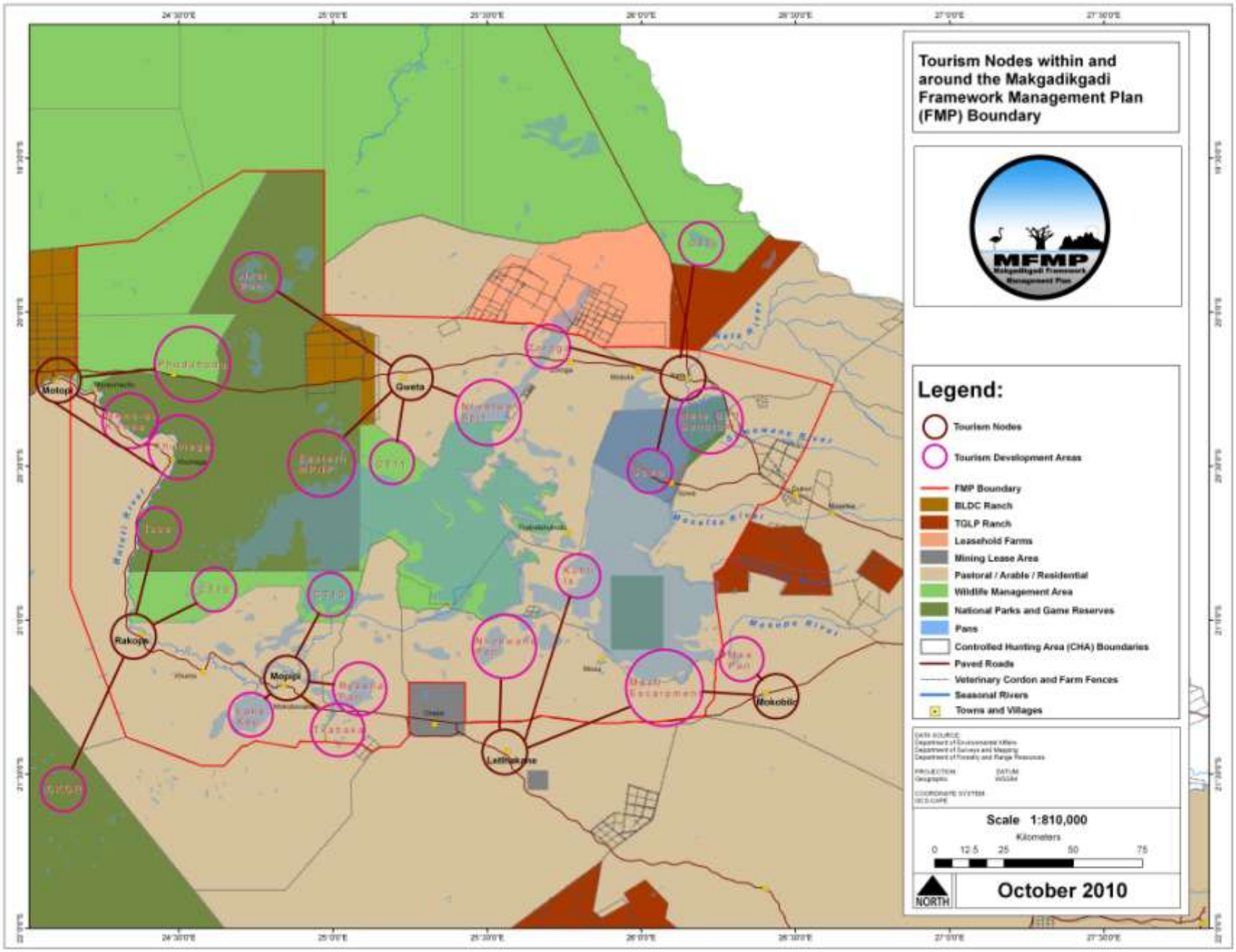
Table 28: Area with tourism potential in the MFMP area

	Areas of Tourism Potential	Character of ATPs	Scores
1	Nata	Nature & Birding	110
2	M/NPs NPs & CT11	Wildlife, Nature & Landscapes	93
3	Sua	Salt Mine	92
4	Gweta	Nature	92
5	Xhumaga-Meno-Leroo	Wildlife	87
6	Kubu-Mosu-Mea-Nkokwane	Wildness, Landscape & Nature	84
7	Phuduhudu	Wildlife	68
8	Rysana/Xau/Txabaka	Adventure on Pans	64
9	Tsoe/CT10/Tamtiga	Nature & Wildness	61
10	Zoroga-Ntwetwe Spit-CT7	Nature & Birding	55

While the MNPNP already is a tourism attraction, it is underutilised and fails to act as core attraction stimulating and driving tourism growth in the entire MFMP area. This is caused by current government park management practices and poor marketing due to poor infrastructure and development in the parks. The protected areas possess a high potential to be the major attractions in the area given their proximity to the Okavango Delta and CKGR. This could be an incentive for tour operators to offer more attractive packages into the MFMP area in conjunction with the Delta and the CKGR. With this in consideration, the visitor numbers to the MNPNP could rise beyond 30 000 per annum by the year 2028.

The locations of the ATPs and the tourism nodes or settlements that would support the ATPs are shown in Figure 31.

Figure 31: Areas of potential tourism and tourism nodes



6.3.3. Archaeological and heritage sites

The MFMP area is of national importance for its archaeology and heritage. There are ten National Monuments in the area and ten sites which are on the list of '100 sites for development'. Most sites are found in the south-eastern part of the MFMP area and along the Boteti River. Since the 1940's, geomorphologic and archaeological studies have been undertaken on the Palaeo-lake Makgadikgadi to determine how the Makgadikgadi pans evolved. In addition, the Ntwetwe Pan area is believed to have played a role in the evolution of modern humans in southern Africa. The Mosu escarpment in the south of Sowa Pan is also regarded as one of the most important archaeologically sensitive areas in the MFMP area. A list of archaeological areas with a high tourism potential are presented in Table 29, and their locations are shown in Figure 32. These sites are also national monuments as per National Museum regulations.

Table 29: Archaeological sites in the MFMP area with a high tourism potential

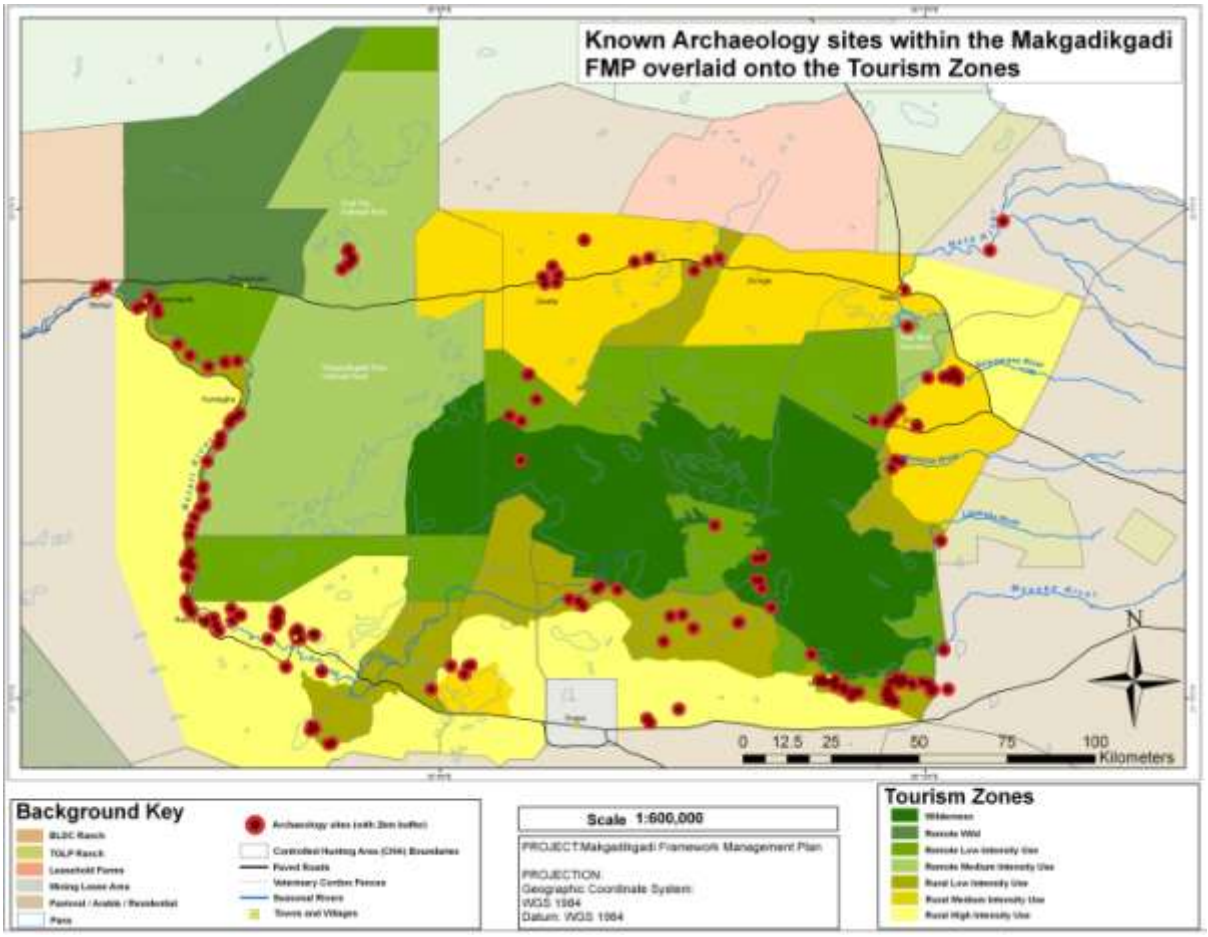
Site no.	Name	Period + type	Especially sensitive	Development potential
04-B2-1	Baines' Baobabs	Historic grove of trees		Already in guide books; in MNPNP (Nxai Pan)
05-A3-3	Green's Baobab	Historic tree and landmark		Already in guidebooks
05-D3-1	Thitaba	LK walled site 900-1000 AD	Yes	In Lekhubu Management area; only public after extensive research
05-D4-1	Lekhubu	LK-Zimbabwe walled site complex	Parts	Already a tourist attraction. In Lekhubu Management area; requires excavation
05-A2-2	Ngcaezini Pan	ESA+fossil deposits, MSA, LSA	Yes	Requires extensive research. Only then should controlled access be granted
15-A1-2	Xanikaga	Animal prints of Plio-Pleistocene?	Yes	Yes, but controlled access
15-B2-6	Khama Ruin	Zimbabwe elite site 1250-1400?		Yes, but requires more excavation.
16-A1-2	Kayishe	Zhizo-LK with wall	Yes	Only after more extensive research
16-A1-39	Unikai water spring	Spring		Possibly stop on historic trail; mainly of importance to the community

Most sites are very sensitive and in need of preservation, protection and salvaging of material. There is also however, need for preservation and protection measures to be fully integrated in the tourism development plan for the MFMP area. A number of sites have potential for development as public sites, both for educational visits for the Botswana public and for tourism for the purpose of generating income for local communities. The DNMM has an agreement with the Gaing-O Community Trust for the management of the Lekhubu area. The Toranju Ruin, Tshwane Game trap and Khama Ruins are fenced off and the first two have a sign informing the public that these are protected sites. Xanikaga, the Marula Grove at the Sowa Town golf course, Unikai Spring as well as Green's Baobab were fenced and had a sign put up more than ten years ago, but these have not been properly maintained (Gabadirwe, letter 30/3/2010 NM6/6/24I(9)). The Baines' Baobabs site also has a sign or notice, but the sign only states that a site is protected, and gives little explanation of the site. This seems to be the extent of site 'management'.

The Department for National Monuments and Musea (DNMM) has a "National Tentative List", for sites and areas under consideration for application to UNESCO for declaration as World Heritage

sites. This includes the "Makgadikgadi Cultural Landscape". While it was expected that this would be the rich archaeological landscape of the Mosu Escarpment on the south side of Sowa Pan, the current brief site description only refers to Lekhubu Island and Thitaba (see archaeology report, volume 2). The identified sites could be important for education and research, scenery, commercially viable projects that benefit local livelihoods.

Figure 32: Location of most important archaeological and heritage sites



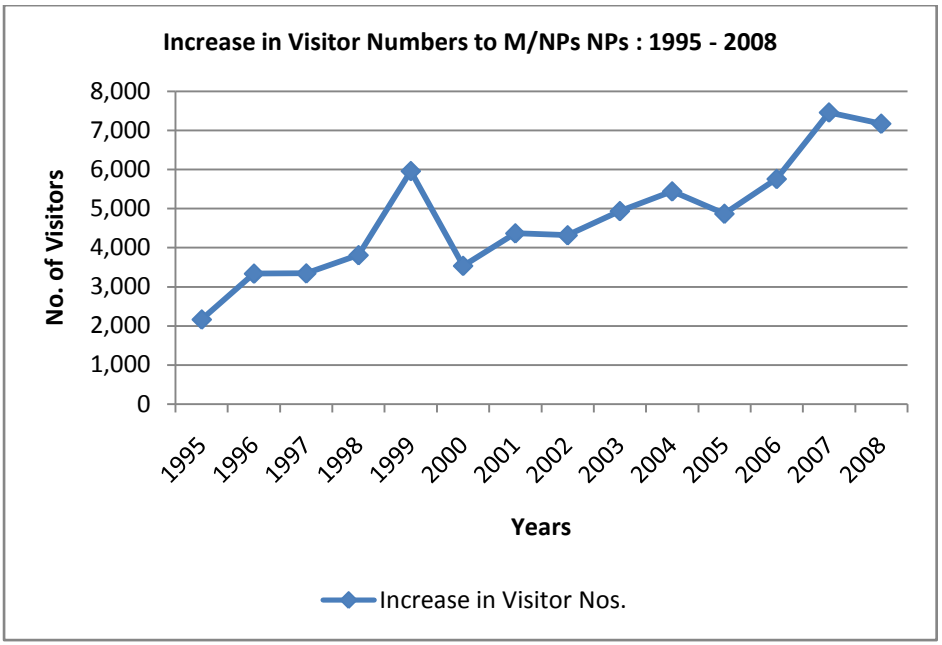
6.4. Market analysis

Botswana offers high-cost, low-volume wildlife adventurous markets and the tourism product mostly relates to a 'unique African wildlife experience'. Most tourism takes place in and around the National Parks and Game Reserves in northern Botswana. As a percentage of total visitor numbers to all Protected Areas in Botswana from 2000 to 2005 the MNPNP rated as 3% in every year. As a percentage of total visitor revenues earned in each year from 2000 to 2005, MNPNP averaged 3% across the years with variations of 4% in 2003 and 2% in 2004. As a percentage of total Private Visitor numbers in all Protected Areas, MNPNP averaged around 8%, with 2002 being 6%, 2003 being 9%, and 2005 being 6%. As a percentage of total Mobile Operator clients in all Protected Areas MNPNP averaged around 3.5% with years 2000-2003 being 3% and 2004-2005 increasing to 4%. Figure 33 indicates the trend in visitor numbers to the MNPNP.

While the Okavango Delta and Chobe region are known for wildlife-based tourism, the MFMP area has additional tourism products which are largely undeveloped. Such products include the vast

landscapes of the salt pans, huge seasonal populations of flamingoes[2] and pelicans, local culture and crafts.

Figure 33: Trend in visitor numbers to the MNPNP



Source: DWNP data

Five tourism market segments of visitors have been identified for the area:

1. 4x4 Self-drive adventure regional tourists fitting into the medium expenditure bracket, with much of this visitation being tourists originating their journeys in South Africa. These visitors have the Okavango Delta as their primary destination, and only using the MFMP AREA as a convenient *en route* overnight stopping point.
2. 4x4 Self-drive adventure overseas tourists who hire completely fitted out 4x4 vehicles in South Africa, Namibia, Zambia or more recently in Gaborone. These visitors tend to spend a few more nights in the area. These visitors want to experience true African attractions such as wildlife, landscape and culture among others.
3. Fly-in Safaris (International mostly up market): These are visitors who are on specially designed package trips who fly into high-end lodges or camps for at least two to six days, seeking superior nature-based (primarily wildlife) adventure experiences in aesthetically styled, luxurious lodge accommodation with superior cuisine and service.
4. Adventure tourists – Local and regional: They mostly originate their journeys in South Africa and their primary destination being the Makgadikgadi Pans where they will undertake various adventure experiences ranging from quad-biking and self-propelled para-gliding.
5. Bird-watchers: Although not a highly developed market segment, this group is relatively flexible about accommodation requirements, although a segment of it often requires staying in luxury lodges overnight.

[2] The huge flamingo populations in the MWS represent the second most important breeding colony of flamingos in Africa.

6.5. Tourism management assessment

An assessment was made of a variety of single institution management models and multiple management models or partnerships. The single institution management models comprise: individual management by government, community or the private sector alone. Partnerships are forms of management where multiple institutions are jointly involved, working in collaboration under some form of agreement for mutual benefit. Examples of such partnerships (or alliances) include: public[3]-private, public-community, community-private and public-community-private partnerships.

Single institution management models:

- Government-led management, where Government operates camps and Parks. In the case of the MFMP area, DWNP can manage campsites within the MNPNP. Government retains any 'profits' or revenue accrued from such operations. All major management decisions are made by the government.
- Community-based tourism management, where tourism concession areas are leased out to communities so that they participate in conservation and tourism development. Communities usually form a Community Based Organisation (CBO) that has a Board of Trustees that is democratically elected to represent the community's interests. Ideally, communities retain all of the financial and other benefits (crops, meat, social or cultural elements etc.), which are then equitably shared amongst community members. All major management decisions are made by the community. Through CBTM, tourism can improve livelihoods and increase livelihood security;
- The private sector investment and operation model is the most common model, where individuals or enterprises use their own money, borrowed money or money from share capital they raise to take risks in developing enterprises and consequently retain the whole profit. All major management decisions are made by the owners of the firm.

Multiple institution management models (partnerships)

- Government-community partnerships exist in wildlife areas considered buffer zones between protected areas and human settlements. In the MFMP area, the community of Xhauxhwatubi annually receive a hunting quota from the DWNP for community hunting in this concession. However, the community enters into joint venture agreements with the private sector to utilise the hunting quota. A key aspect of such partnerships is that by agreement various benefits accrue to each of the parties in the partnership; i.e. by working with government to protect wildlife species in the buffer zone, communities are allowed to retain the financial benefits that accrue from the sale of the hunting quota. All management decisions are agreed to by both parties according to stipulated rules that both parties have adhere to.
- Community-private sector partnerships, where communities sub lease tourism and hunting rights to private sector operators (e.g. Phuduhudu and Nata Sanctuary with Hedgerow) under a shareholder agreement in which both parties bring in equity; for example communities may value their concession at P1million as an opportunity to build a Lodge upon it; they may also value the game viewing possibilities at P1.5 million (a total of P2.5 million equity) whilst the private sector business partner may bring P2.5 million in cash to build the lodge. The total capital of the partnership would be P5 million with each partner having a 50% shareholding. The joint venture agreement usually provide for community

[3] Public in such instances is taken to mean the government or one of its Ministries, Departments or agencies.

payment in dividends, employment creation and other community benefits by the private operator in exchange for the rights to operate a tourism venture on community land.

- In the case of a community-public-private partnership (CPPP), all three parties are involved in the agreement, including associated obligations and benefits from the partnership. In most cases, the government will provide convening power to bring the community and private sector together and all three sign a joint agreement. Usually, communities receive money or goods from the operation; the private sector earns a financial profit, and the government improves protection of natural resources or similar benefits.

The results of a SWOT analysis (Table 30) show that government tourism management is undesirable because it is globally recognized that governments perform less than optimally when operating 'real' business ventures due to built-in constraints to rapid decision making, optimising productivity from workers, managing finances and poor marketing, service delivery and maintenance. While private sector may be able to invest more, operate more efficiently and to market better, the risk exists that profit is put before environmental management concerns. Benefits to the local population are also uncertain. Communities have capacity constraints and internal conflicts, but they have the ability to generate benefits in compensation for human wildlife conflicts and costs, and bring in cultural and other forms of tourism, but like governments, communities are risk averse.

Table 30: SWOT of tourism management models

	Communities management	**Private sector management**	**Government management**
Strengths	Community participation in and benefits from tourism (e.g. MNPNP) Participation in the decision-making process of natural resource management by communities (e.g. around MNPNP). Increased community benefits in the form of employment and income generation	Large investment potential (subject to profitability) and ability to meet demands of growing tourism. Efficient in service delivery. Key services in a private sector investment area are often provided which would otherwise not be provided (e.g. airports, roads etc), communication system etc. Efficient marketing of tourism product both nationally and internationally. Skill development within a limited time scale to suit its demands and needs.	Can meet its mandate of resource protection (without hunting) State land suitable for tourism development
Weaknesses	Lack of tourism business skills (i.e. entrepreneurship skills, marketing and management skills). Internal community conflicts affect performance.	Enclave tourism Revenue leakage to other countries. Weak linkages with other sector of domestic economy. Profit maximization prioritized over environmental management. Limited benefits such as tax revenue and related fees accruing to Botswana.	Inefficient in running the tourism business e.g. the failure to effectively manage campsite in national parks and game reserves. Poor marketing strategy Poor service delivery and maintenance of infrastructure. Government's preservation approach to resource management in protected areas often cause antagonistic relations with surrounding communities. Human resources and logistical constraints
Opportunities	The MFMP AREA has a diversity of tourism product which may benefit communities. The MFMP area is centrally located where transport is better. Reductions of human-wildlife conflicts as communities begin to realize socio-economic benefits	Area's product differs from the Okavango Delta and Chobe regions. Good road network and en route location. Considerable tourism development opportunities. Unique scenery and environment e.g. pans, baobab trees, flamingo birds etc.	Government controls natural resources and can sustainably manage them in the Makgadikgadi area. Government access and control of all the natural resources including tourism products Wildlife products in the MNPNP

	from wildlife resources around them through tourism development.	MFMP AREA is well situated to meet the Botswana Government desire to diversify tourism from reliance on wilderness products	can be packaged with other products in the surroundings to maximize economic returns e.g. local culture.
Threats	Risk of mismanagement and misappropriation of funds. Communities may start to rely on tourism and it is risky, seasonal and depends on global market trends	Resentment against enclave tourism in the MFMP area. Environmental mismanagement to boost profits. More human-wildlife conflicts Economic down turn affects investment capability of private sector	Poor in customer service in tourism development (e.g. management of campsites in protected areas). Poor product marketing and development

The conclusion of the SWOT analysis is that generally partnerships are the best way of mitigating weaknesses of government, communities and the private sector as well as the best way of reducing conflicts and generating more local benefits. The SWOT analysis of each model has led to the management recommendations for the ten selected sites (Table 31).

Table 31: Tourism sites and tourism models for the MFMP area

Proposed Tourism Site	Rank	Recommended Tourism Model
Nata (e.g. Nata Sanctuary, Zoroga Area, CT 5, Southern Sua Pan Area)	1	Nata Tourism Area – Any model Nata Sanctuary Area • CBNRM Tourism Model • Community Public Private Partnership
Gweta (e.g. Gweta Area, CT 7, CT 11)	2	CBNRM Tourism Model in CT11 area Community Public Partnership
Xhumaga, Meno a Kwena, Leruo la Tau (Boteti)	3	CBNRM Tourism Model Private sector model for up-market tourism Community Public Private Partnership
Mosu Escarpment	4	CBNRM Tourism Model
Nxai National park	5	Government Private Sector Partnership Private sector model for up-market Government Campsite Model
Uncharted	6	CBNRM Tourism Model
Mea Pan, Mokobilo Area	7	Community Public Private Partnership
Kubu Islands, Nkokhwane Pan	8	Community Public Private Partnership
Makgadikgadi National Park	9	Government Private Sector Model High-end/up-market model Government Campsite Model
Rysana Pan, Txzbaka, CT 10, Lake Xau	10	Community Public Private Partnership

6.6. Tourism strategy

A tourism strategy is needed to diversify tourism products of the area, expand the tourism sector and to conserve natural, archaeological and heritage resources. In addition, the strategy should ensure that employment and income opportunities are created for the local population. Although the core of the tourism product in Botswana is wildlife, there is substantial room for further growth and diversification of the tourism product, particularly in the MFMP area. The area is therefore well placed to tap on this potential through the MFMP, and as such alleviate poverty and manage natural resource use in the area. Tourism areas have thus been zoned and brief marketing and branding tools have been put in place to enhance tourism development in the Makgadikgadi area.

6.6.1. Tourism zones

Based on the ranking of the areas with tourism potential (ATP), a framework of zoning for tourism activities was developed. This adopted similar principles to those used in the Kgalagadi Transfrontier Park (KTP), Okavango Delta and South African Parks. This framework allows for levels of tourism use to be assigned to particular areas according to their various biodiversity and ecological sensitivity attributes, weighed against the type and level of tourism activity that may be permitted. The purpose of zoning is to ensure that an optimal visitor experience is achieved whilst also protecting ecologically sensitive areas or sites. The proposed zones are illustrated in Figure 34. Each zone has attributes that clearly provide a description of what the tourist could experience, the types of access to be managed, types and levels of interaction between tourists, the types of activities allowed, and how the zones should be managed. The remote zones (wilderness, low density and medium density) are in Protected Areas while the rural zones imply co-existence of traditional livelihood activities with tourism opportunities.

6.6.2. Marketing and branding

The MFMP area has a range of characteristics and desirable conditions that make it a favourable and preferred tourism destination. These include:

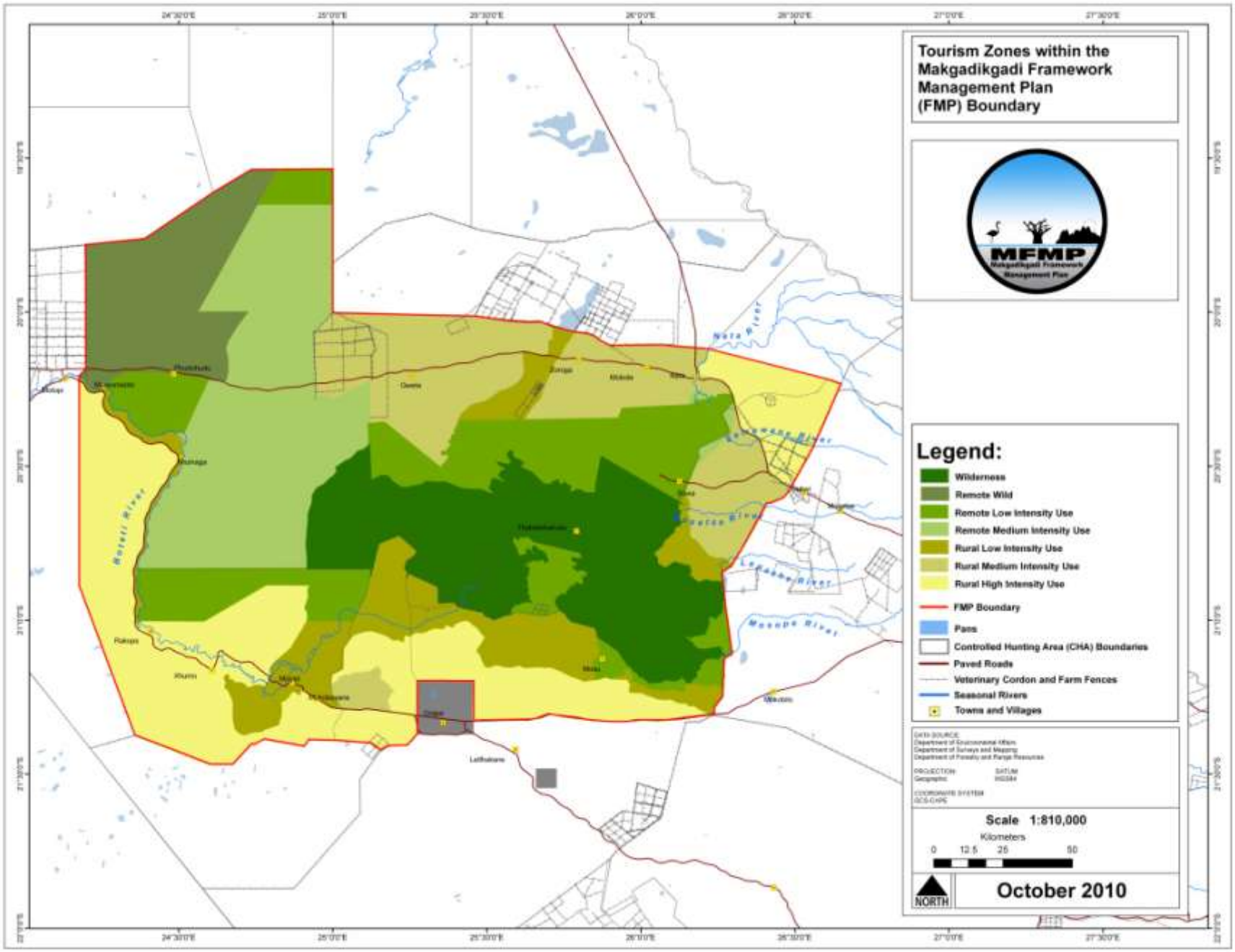
- The inherent attractions, such as game viewing, archaeology and adventure activities;
- Its accessibility and location en route to the Delta;
- The price range of tourism opportunities, accommodation and activities;
- Being a relatively safe and secure destination in terms of crime and violence;
- Having acceptable levels of emergency medical response and treatment within close proximity e.g. Maun, Francistown, Gaborone and even Johannesburg.
- Generally pleasant and acceptable weather. However, although conditions in the central pan area may be harsh and inhospitable, it may actually attract adventure tourists.

Even though less favourable features like extreme temperatures, mosquitoes and the risks of getting stuck in the pans during the wet season may attract adventure tourists, there is need for tourists to be made aware of these conditions. Given these characteristics and the proposed potential tourism sites, efforts are required to market the MFMP area.

In line with the identified area characteristics, tourism branding is important and necessary as it describes the overarching character of the area. Therefore five major Tourism Branding Areas (TBAs) have been recognised. These describe the preferred type of tourism attractions that should be implemented in the area so as to bring a degree of conformity and create harmony to the area, as well as to market a ‘common special identity’ and experience. The suggested areas are:

1. The MNPNP with its wildlife and special migrations;
2. The Nata Sanctuary area with its magnificent bird-watching, in particular flamingos and pelicans;
3. The south eastern area around Mea with its archaeological sites;
4. The south western area around Rakops where adventure tourism on the salt pans could become a major attraction; and
5. The core central ‘wilderness’ or ‘wild’ area where solitude and open spaces predominate.

Figure 34: Proposed tourism zones



6.7. Conclusions

The MFMP area has potential to expand the national tourism product and attract more tourists by offering new destinations adjacent to the existing primary destinations of the Okavango Delta and Chobe National Park. The area offers a range of new and diverse tourism opportunities based around the existing MNPNP, which needs to be upgraded and developed more intensively; optimising on the wild, wide-open landscapes of the salt-pans; focusing on tourism related to flamingos and pelican populations; and the archaeology of the area.

There is, however, need to ensure that more communities and local residents are involved in the emerging tourism ventures as a means of enhancing and diversifying their livelihoods. By having the local communities as true shareholders in the resulting increased wealth generated, they will be more inclined to support conservation measures that protect biodiversity hot spots that are so important in the area. It is also necessary to ensure that the priceless archaeological assets are well protected and managed, whilst also allowing some areas to be made available to tourist where possible. Archaeology is an emerging tourism segment and some of the sites can be used to boost tourism, especially in areas such as Kubu Island.

Of all the destinations in the country, the area has the greatest diversity of tourism opportunities. Developing the right products is critical as a means of being able to offer tourist a number of exciting, different experiences all in one trip. Given that the MNPNP has the potential to become the driver of tourism and to make the area an emerging, self-standing destination of choice, it will be necessary to ensure that the Park facilities and tourism opportunities are upgraded and maintained, without degrading the inherent ecological and biological elements of the parks. Park management should become more use oriented, adaptive and participatory to make it a tourism growth engine.

Tourism in Botswana is concentrated in the northern part of the country mostly benefiting the parks and reserves in that area. Furthermore, the sector is highly reliant upon African wildlife experience while other products are minimal if not nonexistent. In the MFMP area, tourism is underdeveloped but the potential for further development is high. Currently there is the MNPNP with close proximity to the Okavango Delta and CKGR. There have been a number of developments in regards to tourism facilities including camps and lodges as well as a limited number of CBNRM tourism projects. Furthermore, the area has notable tourism products such as the Nata Sanctuary as well as the pans, which are home to a number bird species and support migration of some of these birds.

The Makgadikgadi offers considerable tourism opportunities. Areas of potential sites have been identified taking heed of ecological and archaeological sensitivity as well as local livelihoods' benefits and possible participation by relevant stakeholders. These areas fall within tourism zones that allow for levels of tourism use to be assigned to particular sites in accordance with their sensitivity characteristics and weighed against the type and level of tourism activity that may be permitted within that area.

Zoning aims to optimize visitors' experience, while protecting the natural resource base. Zoning could enable stakeholders to manage and control the allowed carrying capacities of the various activities and the developments that may be allowed in these particular areas.

To tap on the potential of tourism in the area, marketing and branding are equally important. The MFMP area has features and characteristics, which can make it a preferred destination for tourists. As it is still relatively unknown, marketing of its tourism attractions is critical.

7. Stakeholder views and consultations

This chapter describes the main consultation activities carried out under the MFMP preparation and the main views expressed during the consultations. These views have been fully incorporated into the MFMP (chapter 10).

7.1. Introduction and scope

Work on the development of the MFMP started in 2002 and this involved an inventory of the Makgadikgadi Wetland System resources. This was subsequently followed by the development of a project proposal towards the MIMP development and this was done in consultation with all relevant stakeholders, including communities. In order to take views and/or interests of stakeholders on board in the MFMP, it was deemed necessary by the DEA to engage stakeholders at the commencement stage of the MFMP development. The DEA team tasked with the coordination of the development of the MFMP visited Tutume and Boteti Sub-district from the April/May and August/September respectively to consult stakeholders on the commencement of the project. During these visits, district stakeholders including Sub District Land Use Planning committee (sub-DLUPU) members and local communities were briefed on the planned development of the MFMP. Stakeholders were also updated on the approach to be adopted in the plan development since several options had been previously presented during earlier consultative meetings. These meetings were a follow-up to previous meetings held during the project's conceptualisation phase in 2005/6, whereby stakeholders were sensitised on the need to develop an integrated management approach. At the same time, these meetings updated stakeholders on the progress of the MFMP, including the components findings reports.

The objectives of the consultations were to:

1. Inform stakeholders on progress/developments towards the formulation of MFMP;
2. Establish contacts with relevant stakeholders and solicit input as well as get buy-in on the plan;
3. Understand the communities' perspectives on policies, strategies and plans that are driven by different government departments;
4. Understand other relevant dynamics (socio-economic, environmental and otherwise) within the MFMP area; and
5. Provide updates on the MFMP findings.

To achieve these objectives information materials have been developed in Setswana and English, including logo, brochures, banners and posters.

Internal communications were held through: Project Steering Committee (PSC) with PowerPoint presentations, dissemination or distribution of progress updates and quarterly meetings; Project Management Committees (Boteti and Tutume sub DLUPUs) with scheduled meetings, progress updates; Project Team with weekly meetings, emails, cell phones, progress report; DEA management and staff meetings.

External communications involved kgotla meetings, briefing sessions, project reports, field trips, article in the DEA newsletter, workshops, website, publications and other publicity materials. Table 32 lists the consultations carried out during the MFMP preparation.

Table 32: Consultations and stakeholder participation during the MFMP process

Target	No. of consultations	Type of consultation	Output	Period of consultation
Departments Directors	2	Breakfast meeting One-on-one interviews	Minutes of the meeting	During inception (2008) After inception (2009)
PSC	5	Quarterly meetings	Minutes of the meetings	During inception (2009) After inception (2010)
Boteti and Tutume SUB DLUPU	Bi-monthly	Meeting	Minutes of the meetings	During inception (2009) After inception (2010)
Communities	3	Kgotla meetings Workshop for community leaders	Consultation reports	During inception (2009) After inception (2010)
Full Council (Central, Sowa)	2	Meeting	Minutes of the meeting	During inception (2009) After inception (2010)
Central District Development Committee	2	Meeting	Minutes of the meeting	During inception (2009) After inception (2010)

7.2. Stakeholders' views

7.2.1. General views

Communities within the MFMP area welcomed the consultations at the start of the project. The general feeling among members of the public is that there is lack of consultations with the communities when plans and programmes are developed for the area. During the public (Kgotla) meetings, individuals and the general community leadership expressed dissatisfaction with the way some of the development projects in their area were undertaken. The general feeling was that the local community is informed on the projects at a late stage when projects are at an implementation stage. This makes them feel that their role is just to rubber-stamp what has already been decided behind closed door, and this has led to lack of appreciation of developments brought in their area.

Communities observed that most projects implemented without their involvement had detrimental effects on the environment. A case in point was the allocation of land and boreholes by the Land Board which culminated in congestion of livestock certain areas thus leading to degradation. They indicated that they needed to be informed at the project initiation stage to enable them to have an input into the planning process (active participation) and also enhance a feeling of ownership of the projects.

The District Land Use Planning Unit (DLUPU) and the Project Steering Committee (PSC) provide technical information and advice on all the components of the MFMP. Thus they are actively involved in almost every step of the project and advice accordingly. Their main concern was maximization of benefits from natural resources found in the MFMP area. Some of the other issues included:

- Identifying and raising awareness on biodiversity hot spots and tourism potential benefits;
- Identifying conflict areas and collaborating with relevant technical departments to temporarily suspend allocation of rights in those areas until the MFMP is completed; and
- Conduct scenario analysis to review possible future pathways for development and conservation in the MFMP.

The MFMP area straddles two sub-districts being Tutume and Boteti which are under Central District Council. Within the MFMP area there is Sowa Town Council, thus bringing the number of local authorities in the MFMP to three. These were consulted during the MFMP developmental phase and they commended the initiative as they considered it as a way of diversifying economy in the area, especially in Sowa Town. They called for collaboration of DEA with local authorities for effective implementation of the MFMP.

7.2.2. Stakeholder views by issue and sector

Policies
Communities expressed lack of knowledge of some policies and legislation that govern use of resources in general. They indicated that although some of the resources are extracted from within their area, they were unable to monitor the resource situation since they were not aware of the procedures for allocation of permits, and their role in the monitoring resources is not defined. Examples include fuel wood collection in the area, sand extraction and even cutting down of live trees in large quantities.

There are many development projects in the area by different government departments which are seemingly not coordinated. It is apparent that each department draws and implements its development agenda without necessarily involving or liaising with other departments. This fragmented development approach has resulted in communities getting conflicting messages from these departments, thus creating confusion and lack of interest.

Wildlife resources management/Land use planning and zoning
Communities highlighted human-wildlife conflict as the main problem in the area. They called on the government to utilize indigenous knowledge when they attempt to resolve such conflicts. They also recommend land re-allocation to address some of the land shortage problems they have in their area. There is general resentment of wildlife by the communities due to strict conservation measures that the government has put in place (National Parks, WMAs and CHAs). There is shortage of land as much of the land is unsuitable for habitation and agriculture while the most suitable land is zoned as National Park.

Socio-economic and livelihoods
Community livelihoods depend mainly on agriculture. However there has been little output from this sector due to poor rains and soils, and shortage of land. Apart from agriculture, communities depend on natural resources to diversify their livelihood strategies. A general observation on livelihoods is that communities in the MFMP area have limited livelihood strategies and activities. In an attempt to address the problem of limited livelihood strategies, communities suggested that they be given rights to access some natural resources in protected areas. Moreover, they pleaded for decentralised management of natural resources through Village Development Committees (VDCs).

Tourism and heritage development
The MFMP area has a tourism potential which when tapped into could benefit the local community. Nevertheless studies reveal that communities neither have capacity nor resources to pursue this sector. Communities thus advocated for education and awareness raising in tourism development. They further proposed that government should consider shortening the bureaucratic route of acquiring land for tourism development. Moreover, forms should be simple and understandable.

7.3. Conclusion

The roll-out of the MFMP initiation and development phase begun in November 2009 and is expected to continue during the MFMP implementation. Consultative meetings have been held with different stakeholders in order to get their views as well as update them on the progress of the project. The general feeling about the MFMP was one of appreciation and commendation. Stakeholders highly commended DEA for ensuring that they are actively involved in the plan development. They also wish to actively participate in the plan implementation. Since improving livelihoods is the key concern, the MFMP objective is endorsed by the stakeholders. Furthermore, since tourism development should involve and benefit communities, the need for supporting tourism development is recognised.

8 Policy and legislative environment

This chapter discusses the main aspects of the policy and legislative framework assessment within which the MFMP has been developed and will be implemented. In section 8.2, the general policy environment is outlined at the national, regional and global level. This is followed by the analysis of the environmental and resource management (8.3) and the key economic sectors of agriculture, tourism and mining (8.4). Implementation and enforcement is discussed in 8.5 while policy evolution and development is addressed in section 8.6. A detailed policy framework assessment is part of volume 2.

8.1 Introduction

Holistic, integrated planning is imperative to conserve the integrity of the MFMP area, to improve livelihoods, and to optimize the sustainable use of the area's natural resources. The MFMP area falls within the administrative jurisdiction of two district councils. As a result, decision making and implementation of plans and projects in the area becomes complicated. There is no comprehensive, integrated management plan for the MFMP area, and the initiative by the Ministry of Environment, Wildlife and Tourism (MEWT) through the DEA to prepare this MFMP is important. It needs to be noted that the Central District Integrated Land Use Plan of 2000 marked an important move towards integrated planning in the district, and focused on sustainable land management and reduced land use conflicts.

The MFMP is defined within the framework of national policies, legislation and development plans; regional protocols; and international conventions. The need to review policies during the development of the MFMP is vital in understanding how the current and even future policy environment can influence the goods and services provided by the MFMP area as well as livelihoods within the MFMP area. Policies and laws may be often conflicting and, in some instances, may not provide the right incentives for development and resource management due to overlaps, inconsistencies and gaps. Inadequate monitoring and evaluation of policies make it impossible to assess their impact on the environment and livelihoods.

The main objective of the policy assessment is to identify (dis-)incentives for sustainable resource utilisation and conservation, to ensure that the MFMP conforms to the prevailing policy and legislative environment, and where appropriate to recommend policy improvements, both at district and national level.

8.2. The policy and legislative environment

8.2.1. Botswana

Several policies and legislative instruments were reviewed within the context of the MFMP's objective of "*conservation of natural resources and improving people's livelihoods through wise use of the wetlands natural resources*'. The review focused on identifying incentives and disincentives that current policy and legislation frameworks offer for sustainable management of natural resources within the MFMP area and highlighting existing and potential opportunities for the implementation of the MFMP.

Some of the key policies and legislation that have been reviewed include: Mines and Minerals Act of 1999, Forest Act of 1978, Herbage Preservation (Fire Prevention) Act of 1977, Agricultural Resources Conservation Act of 1974, Tribal Land Act of 1970 and its subsequent amendments, National Policy on Land Tenure of 1985, Water Act of 1968, Wildlife Conservation Policy of 1986, Wildlife

Conservation and National Parks Act of 1992, National Policy on Agricultural Development of 1991, Tourism Policy of 1990, Ecotourism Strategy of 2002, Botswana Tourism Organization Act of 2009, Botswana Tourism Organization Regulations of 2010, Community Based Natural Resources Management Policy of 2007, Environmental Impact Assessment Act of 2005, Monument and Relics Act of 2001, Waste Management Act of 1998, Revised National Biodiversity Strategy and Action Plan of 2006, Tourism Master Plan of 2000, Revised National Action Programme (NAP) to Combat Desertification of 2007, National Water Master Plan Review of 2006, Wetlands Policy and Strategy (Draft) of 2008 and the Central Integrated Land Use Plan of 2000.

8.2.2. Southern Africa

The entire wetland system and river basins cover an area extending beyond the Botswana boarders. The system extends into Zimbabwe through the Nata River catchment and it is linked to the Okavango system through the Boteti River. Botswana is party to a number of regional agreements within the SADC region, including:

- Permanent Okavango River Basin Agreement 1994 (Angola, Botswana and Namibia);
- SADC Protocol on Shared Watercourse Systems 2001;
- SADC Regional water Policy 2006;
- SADC Protocol on Development of Tourism Entered 2002;
- SADC Protocol on Wildlife Conservation and Law Enforcement 2003; and
- SADC Protocol on Mining.

There is therefore need for MFMP to comply with these instruments.

8.2.3. Global

Likewise, Botswana has signed and ratified several multi-lateral environmental agreements that have been developed under the auspices of the United Nations and other institutions. The MFMP needs to be developed in line with these agreements. The following environmental agreements have been identified as the most relevant instruments that present, opportunities for improving the management of natural resources within the MFMP area. These are:

- The Convention on Wetlands of International Importance (Ramsar Convention) focuses on the conservation and wise use of all wetlands through local and national actions and international cooperation;
- The United Nations Convention on Biological Diversity (UNCBD) aims to conserve biological diversity, promote the sustainable use of biodiversity components, and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources;
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) that aims to prevent extinction of endangered species by controlling international trade in the endangered species and their by-products;
- United Nations Convention on Combating Desertification (UNCCD) intends to combat desertification and mitigate the effects of drought in countries experiencing serious drought and/or desertification, particularly in Africa; and
- United Nations Framework for Convention on Climate Change (UNFCCC) aims to stabilize atmospheric concentrations of green house gases at levels that would prevent dangerous anthropogenic (human-induced) interference with the climate system.

8.3. Policy environment and resource sectors

8.3.1. Environmental management

Environmental management is based on a number of principles. These include sustainable development, precautionary principle, the user and polluter pays principle, public participation and integration. The MFMP is based on these principles to guide the development planning processes and management of natural resources. Global, regional and national policies and development plans present opportunities to integrate environmental management principles in the MFMP; but the MFMP also needs to comply with their requirements. The National Development Plan 10, the Central District Development Plan 7 and the Central District Integrated Land Use plan will be the main planning tools to be used for integration of environmental management issues identified within the MFMP during their mid-term review.

8.3.2. Natural resources

Land

Land use management is guided by the Tribal Land Act of 1970 and its subsequent amendments, National Policy on Land Tenure (1985) and the Central District Land Use plan. The purpose of the Central District Integrated Land Use Plan is to guide and shape the future growth of the District. It is the planning framework for the entire District and its Sub-districts. The plan utilises different approaches to provide for a platform integrated planning such as capability analysis, suitability analysis, multiple land uses and intensity of use. The plan has not yet been gazette; gazettement will ensure compliance, making it easier for the land boards to monitor the development. The Tribal Land Act was amended in 1993 to grant land boards powers to change use of land and transfers, collect royalties of allocated rights, and develop management plans. The Ministry of Lands and Housing has already initiated the review of the Tribal Land Act and the development of a National Land Policy to guide future land administration and improve access to land.

The recent guidelines (2010) on the management of rural State Land provide for changes in land use of some CHAs within the Central District. Cabinet directed that there be a conversion of land use in the CHAs in Central District (CT 6, CT 7, CT 10 and portions of CT 11) from wildlife use to farming and other economically viable uses by the adjacent communities and other deserving persons, on condition that the areas remain State Land. According to the guidelines there has been a gradual movement into these areas on more permanent basis, with a number of cattle-posts and boreholes being established in the areas around Toromoja in the Boteti sub-district. Around Gweta, there has been a continuous infiltration into state land by local farmers to graze their livestock, and some have actually drilled boreholes in these areas. This has been attributed to lack of clear guidelines for access of these areas by local farmers; hence the establishment of the 2010 Guidelines on the Management of Rural State Lands.

Water

Water resources in Botswana belong to, and are controlled by the state. The state has the final responsibility for allocating water rights through the Water Apportionment Board (WAB), whose powers are drawn from the Water Act of 1968. The main body of water resources legislation comprises four Acts, some of which have been modified by brief amendments: Water Act (1968); Boreholes Act (1956); Waterworks (1962) and Water-works amendment Act (1983); and Water Utilities Corporation Act (1970) and WUC Amendment Act (1978).

The Water Act provides opportunities for the protection of the scarce underground water resources within the MFMP area from pollution. Policies and strategies to meet national water demands in the

future need to be directed toward improving allocative efficiency and enhancing technological developments to improve water stewardship and demand management. This will be achieved through among other strategies the integrated Water Resources Management. As a result of water sector reforms, the Water Utilities Corporation will become responsible for water supply and waste water treatment in all villages in Botswana, including the MFMP area. The Department of Water Affairs will become responsible for water resource management and a new institution will be created to regulate the water and electricity sectors.

Wildlife

Policies relevant to wildlife management include the Wildlife Conservation Policy, the Wildlife Conservation and National Parks Act and the Community Based Natural Resources Management Policy. A number of issues have been identified relating to wildlife resources:

- The zoning and protection of wildlife areas, land use planning and zoning for wildlife and with the protection of wildlife migration;
- Human-wildlife conflicts become manifest in the destruction of crops in parts in Makgadikgadi (both in the Tutume and Boteti sub-districts) and livestock predation by wildlife;
- Competition for grazing and water between livestock and wildlife; and
- Involvement of farmers in the predator-livestock conflict is necessary to ensure that the strategies undertaken are feasible, economic and ecologically acceptable.

Natural resources use

The Veld Products Regulations of 2006 should be implemented in order to protect the over-harvesting of veld products such as wood, wild fruits/berries, grass, mophane worms and morula fruits within the MFMP. There are several recommendations that can be explored to improve the management of veld products in the area. The Department of Forestry and Range Resources (DFRR) is reviewing and consolidating the Herbage Preservation (Fire Prevention) Act of 1977, Forest Act of 1978 and Agricultural Resources Conservation Act of 1974 to improve the management of natural resources. The DFRR is also developing a Fire Management Strategy to guide the management of fires, which includes efficient construction of firebreaks. Fire management provides opportunities to protect natural resources, biodiversity and its habitat, arable fields, veld products and the grazing capacity of the area. Important initiative to improve the management of veld products includes:

- Education and awareness on policies and legislation on the control of the use of veld products. This initiative is critical especially for communities and local authorities within the MFMP area;
- Implementation of the permit system for export, dealers and harvesters for sustainable utilisation of the resources; and
- Use of the District Conservation Committees (DCC) for monitoring the use of natural resources in the MFMP area;

The Energy Affairs Department is currently developing a Biomass Energy Strategy to establish a coordinated framework of short, medium and long-term interventions for sustainable management of biomass energy resources, particularly fuel wood. The strategy is meant to provide better energy services to Batswana. Energy efficient technologies such as stoves reduce the amount of fuel wood used and the adoption of energy efficient measures is essential.

8.4. Waste and pollution

The management of waste should ensure protection of the environment through education, awareness and enforcement of relevant legislation. Sensitisation to good practices, and the enforcement of key legislations such as the Waste Management Act of 1998 and the Atmospheric Pollution Prevention Act of 1971 must be strengthened within the MFMP. The Waste Management Strategy of 1998 states that waste management will be carried out in a manner that protects human health and the environment, and that ensures prudent use of natural resources. It captures the principles of prevention, the polluter pays, and the principle of cooperation. The strategy adopts an internationally acceptable waste management hierarchy of waste reuse and recycling, treatment and finally disposal.

There is need to involve communities in the development and implementation of waste management plans within the MFMP. Non-governmental Organisations (NGOs), the Green Scorpions, the police, Local Authorities (Boteti & Tutume Sub-districts) and Department of Waste Management and Pollution Control are other key stakeholders in waste management of in the MFMP area. Though most villages within the MFMP area have dumpsites, there is still a problem of indiscriminate dumping. Abandoned burrow pits turn into waste dumps. The absence of a District Waste Management Strategy exacerbates the problem.

Furthermore, there is inadequate monitoring to ensure that the contractors decommission the burrow pits at the end of the project as per Environmental Management Plans. The Department of Waste Management and Pollution Control under the Ministry of Environment, Wildlife and Tourism has been mandated to ensure that the environment is protected through prudent waste management practices. This means that waste management practices should be commensurate with economic, social and political concerns of the people of Botswana as well as being consistent with the principles of sustainable development.

8.4. Sectors

8.4.1. Agriculture

According to the MFMP livelihoods report (see section 3.2), agriculture has been identified as a major source of livelihood within the FMP area. Specific attention should be given into how communities can benefit more from this important source of their livelihood. The agriculture sector' policy objective to diversify agricultural production into non-traditional areas is relevant for the MFMP area and is consistent with the economy-wide objective to reduce economic dependence on mining. This objective is partly supported by current efforts to commercialise the sector. A number of programmes could be explored for the benefit of the people.

Cluster fencing, which involves the construction of animal proof fences for fields within a particular area, will help protect farmer's fields from damage by livestock and some wildlife species. The opportunity by Integrated Support for Arable Agriculture Development (ISPAAD) to provide assistance for drilling and equipping boreholes at cluster level will assist low income farmers. The farm cluster model is similar to what was originally intended under the National Agricultural Master Plan for Arable Agriculture and Dairy Development (NAMPAADD), and emanates from the observation that farmers in Botswana are fragmented and that clustering would enhance competitiveness through improved economies of scale from collective action. The other ISPAAD-specific innovation is the facilitation of access to credit through the National Development Bank (NDB). Under this facility, government will establish a fund for providing operating capital (seasonal loans) to farmers at prime rates of interest.

The Livestock Management and Infrastructure Development (LIMID) programme was recently established to promote improved food security. The main components of LIMID include: support for animal husbandry and fodder production (which were covered under SLOCA); borehole drilling and borehole/well equipping (which were covered under LWDP); support for reticulation and purchase of boreholes and wells (water reticulation was covered under LWDP); support for the development of cooperative poultry abattoirs (new component); support for guinea fowl production (new component); and support for Tswana chickens and small-stock production (new component). This will be more suitable for areas within the MFMP area where livestock farming presents more opportunities and is the most suitable land use.

8.4.3. Tourism

The National Tourism Policy recognizes the tourism sector as a possible generator of significant economic activity that should benefit Batswana in many parts of the economy and country and hence contribute to a sustainable national development. Chapter 6 of this plan and the MFMP tourism report (volume 2) recognizes the area's tourism potential. This potential will require government support in terms of enabling policies. The MFMP area has the potential to drive the tourism product diversification beyond its current narrow reliance on wildlife based tourism. Opportunities also exist in building on and linking up with existing markets of the northern parks in the Okavango and Chobe areas. Existing tourism operations within the area present growth opportunities for the tourism industry (see chapter 6). The "high value-low volume" strategy has however been found to be restrictive. The Tourism Master Plan recommended a modified "high volume-mixed price" strategy. This strategy would enable potential tourists to choose from a wider variety of affordable tourism products within the country

The recent enactment of the Tourism Act of 2009, the Botswana Tourism Organization Act of 2009 and the Botswana Tourism Organization Regulations of 2010, is a sign of government commitment to improve the regulation and management of the sector. The Tourism Act of 2009 provides for the establishment of the tourism Industry Licensing Committee, licensing and classification of tourist enterprises, reservation of certain tourism licenses for citizens, safety and sanitation. The Botswana Tourism Organization Act of 2009 focuses on the implementation of tourism marketing and promotion strategies, funding opportunities for CBNRM, conducting tourism awareness campaigns and tourism research, marketing and promoting the establishment of enterprise ventures between citizen and foreign investor.

8.4.3. Mining

Mining creates significant value and is of national importance. The strategy towards the mining sector should be to implement proper environmental management plans and mitigation measures through EIAs, and to increase backward and forward linkages with the local economy to increase livelihood benefits in the MFMP. This should be guided by the Mines and Minerals Act of 1999 which provides for the granting, renewal and termination of mineral concessions and payment of royalties.

The Department of Mines within the MMEWR is the lead implementer of the Act, which is currently under review. The main issues for the review include the procedural and technical constraints with regards to permits and licensing, illegal mining, especially of sand and gravel, and sustainable mining. Several mines are found around the MFMP area, including the two major diamond mines (Orapa-Letlhakane) and Soda Ash at Sowa.

The following issues have been identified as of major concern in mining that need to be addressed:

- Inadequate site visits and monitoring particularly the sand gravel extractions due to the fact that they are not covered in the Act;
- Inadequate education especially for the local government authorities;
- Inadequate financial auditing of mining companies to establish compliance with regards to royalties;
- Inefficient use of penalties and or disincentives;
- Policy conflicts such as EIA Act of 2005 and Land board Act with regards to issues of surface rights vis-a-vis mining rights and approval procedures by these sectoral legislations; and
- Citizen partnership not fully realized due to the fact that locals get licenses and in turn sell to foreign investors thereby reducing their potential benefit from the industry.

The mining sector needs to improve the social corporate responsibility through community development projects and programmes, especially communities near the mining areas.

8.5. Policy implementation and enforcement

The main policy issue is the current multiplicity of sectoral policies, programmes, legislations and regulations that guide the use of land and natural resources. The situation is exacerbated by poor coordination both at the national and district level. The responsibility for these policies, regulations and programmes is spread across a broad spectrum of institutions leading to fragmented implementation. Consequently, national policies, programmes and planning procedures are often implemented without proper consideration of their external effects with regards to resource use efficiency and development opportunities.

Policies and laws may be often conflicting and in some instances may not provide the right incentives for development and resource management due to overlaps, inconsistencies and gaps. Inadequate monitoring and evaluation of these guiding policy frameworks often leave much unknown of the impact they have on the environment and the livelihoods of the people they were intended to improve. The MFMP takes these issues into consideration and will ensure that there is integrated planning and regular updates with regards to changes in the policy environment. Monitoring and evaluation will form part of the MFMP and the use of indicators will guide the monitoring process. There is need to strengthen the implementation of policies and enforcement of relevant legislation in order to improve the use and management of the area's resources. The need for strengthening and streamlining the current institutional frameworks will go a long way in the process of effective implementation of government policies.

8.6. Forthcoming and draft policies

Government is currently reviewing and up-dating various policies and drafting new ones where gaps exist (Table 33). It is important that the implementation of the MFMP takes new policy developments into account and ensures compliance as well as optimal use of the new policies and legislation.

Table 33: Draft and forthcoming policies, strategies and legislation

Sector	Policies/Strategies	Lead Organization	Status
Water	National Water Policy 2010	Water Reforms Unit - MMEWR	Draft
Indigenous Knowledge Systems (IKS)	IKS policy 2010	Department of Research, Science & Technology	Draft
Fire	Draft Fire Management Strategy	DFRR	Draft
Wetlands	Draft Wetlands Strategy 2008	Department of Environmental Affairs	Draft
Energy	Draft Energy Policy 2009	Department of Energy Affairs	Draft
	Biomass Energy Strategy 2009	Department of Energy Affairs	Draft
Climate	National Meteorological Service Act 2009	Department of Meteorological Services	Draft
Forests and Range Resources	Forest Policy 2010	Department of Forestry and Range Resources	Draft
	Review and Consolidation of three Acts (Forest Act 1968, Agricultural Resources Conservation Act 1974 and Herbage Preservation Act 1977)	Department of Forestry and Range Resources	Draft
Environmental Planning	Environmental Management Act	Department of Environmental Affairs	Draft
Land use	Draft National Land Policy	Ministry of land and Housing	Draft
Tourism	Tourism 2010	Department of Tourism	Draft

9. Evaluation of management scenarios

This chapter presents the findings of the evaluation of different management scenarios for the MFMP area. The evaluation was based on the findings of the previous chapters (2-8) and the identified key issues and drivers of change (section 9.2). The evaluation approach is discussed in 9.3 followed by a presentation of the main findings of the scenario evaluation (9.4).

9.1. Introduction

Management of the MFMP area is sectoral and fragmented and is inadequately coordinated. This has led to numerous resource use conflicts, decline of some natural resources and sub-optimal resource use and missed development opportunities. The main objective of the FMP is to improve local livelihoods and sustainable use of natural resources.

The major conflicts are between:

- Wildlife and agriculture, whereby competition for grazing resources together with expansion of human activities has led to contact between livestock and wild animals. There are many incidences of wild animals' predation on livestock in the MFMP area, especially around protected areas (PAs). Wild animals such as elephants and hyenas damage arable fields in most parts of the MFMP area;
- Mining and agriculture, where ground water is the major source of water and the mining activities use substantial amounts of groundwater thus putting pressure on these resources. For example, the Dukwi well field is under pressure from Sowa Town and surrounding villages; and
- Livestock damage to crops occurs where fields are adjacent to grazing land and livestock herding is inadequate. This situation is exacerbated by the fact that most arable fields are not appropriately fenced to prevent livestock from damaging crops. However, the use of drift fences has greatly reduced livestock-crop conflict in Matshumo area.

The conflicts are expected to increase in future due to population growth, commercial development (e.g. mining and tourism) and growth of the livestock sector. Land use zoning and fencing have been used to reduce conflicts and damage to property.

Some resources are currently under utilised such as the MNPNP and other tourism development areas. The missed opportunities include tourism potential that could be based on the: scenic beauty, wilderness and wildlife resources as well as heritage and archaeological sites;

There is evidence of natural resource depletion. The water abstraction in Dukwi well field is well above its recharge capacity. Increased number of livestock that exceeds the carrying capacity has led to depletion of grazing resources. Some wildlife species are in decline.

Pressure on the MFMP area is expected to increase in future due to population growth and associated increases in subsistence activities (e.g. agriculture and collection of natural resources) as well as growth of the commercial sectors (e.g. mining and tourism). In order to maintain the integrity of the ecosystem and maximise development gains, there is need to improve development planning and natural resource management. It is important to identify and assess the different management options that could be used for the wetland. The scenario component develops and evaluates future development and management options for the MFMP area.

The overall objective of the scenario component is to evaluate the impacts of different management options for the area and to identify a preferred management path for the MFMP. The scenario evaluation activities covered:

- The formulation of scenarios based on different expected and desired development and conservation options taking into account climate change and other cross cutting factors, such as population dynamics and rainfall;
- Collection of data and opinions about the impacts of the different scenarios on rural and national development as well as resource conservation and management;
- Evaluation and ranking the scenarios according to their suitability; and
- Identifying the preferred scenario and incorporating the implications in the MFMP.

9.2. Key management issues and drivers of change

The key issues for scenario analysis are based on the sustainability aspects of: Ecological/physical, economic, social and institutions and management. The identified issues are mainly informed by consultation with communities, component reports, field trips and interaction with the government officials in the MFMP. These are listed in Table 34.

Table 34: Key issues for scenario development

Sustainability aspects	Issues
Ecological	Wildlife and bird species, Ecological hot spots, Resource conservation and requirements, Ecosystem services
Physical	Water quality, Water quantity, Land degradation, Soil erosion
Economic	Employment opportunities, Subsistence activities and rural livelihoods, Productivity and growth, Under-utilised potential (e.g. tourism potential spots)
Social	Poverty reduction, Benefit distribution, CBO & CBNRM, Rural livelihood improvements and security enhancement, Human health, Archaeological and heritage sites
Institutional & management	Fencing as a management intervention, Sectoral & fragmented planning & resource management, Different administrative districts, International commitments and obligations Land tenure and management, Role of and partnerships with public, private and civil society sectors, Different types of conflicts such as human-wildlife and land use conflicts

Several drivers of change were identified that are important for scenario evaluation. These factors or drivers of change are man-made and natural features that are likely to influence future management of the MFMP area. They are often cross-cutting in nature and have to be taken into account in all scenarios and their evaluation. The drivers of change include rainfall variability, climate change, population growth and development projects. The drivers of change can be classified into three groups:

1. Factors/drivers that the local community can control such as herding and arable farming practices.
2. Factors/drivers that the local community may have or has influence over but decisions about them fall within authority of, in this case, District Council, Land Board and central government. Examples include conflict management, land tenure, service delivery, mining concessions and hunting.
3. Factors/ drivers that the local community has little or no control over such as rainfall dynamics, climate change and drought.

The factors are briefly discussed below. The impacts of climate change are varied. The results of Global Climate Models indicate that there will be higher temperatures and evapotranspiration as well as changes in rainfall patterns. Climatic events will be varied leading to more extreme events such as droughts and floods. Rainfall is also a cross-cutting driver of change. The decrease or increase in rainfall will have a bearing on any scenario or management option. The rate of population growth influences the level of demand for land, water, and other resources. High population growth will exert pressure on resources and requires complex management strategies. The rate of population growth is predicted to be modest over the next ten years (CSO). However, when tied to the demand for resources such as grazing land, assuming the current livestock ownership per capita will obtain in 10 years time (2021), there will be significant increase in shortage of grazing land in the Makgadikgadi.

Some of the on-going and planned development projects will have positive and negative impacts on parts of the MFMP area. The construction of the Mosetse Dam (capacity of 53.6 MCM) would reduce the amount of water reaching the Sua Pan. Sua Pan is important for flamingo breeding and the dam will have affect flamingo breeding by 5% in the long term (Water Resources Consultants, 2010). Other activities include the on-going mineral exploration, possible reopening of the Damtshaa Diamond Mine. Zone 4a, which forms a large part of the FMP area on the Boteti Sub-district has recently been declared Foot and Mouth Disease (FMD) free zone and the Department of Veterinary Services has applied to the European Union to allow beef products from Zone 4a access to the EU market. If beef is from Zone 4a is granted access to EU market, the value of cattle may increase.

9.3. Approach and methodology

9.3.1. Approach

Stakeholders use and appreciate the area in different ways and the different perceptions informed the development of scenarios and alternatives. The approach towards development and evaluation of the scenarios was an open and evolutionary process that involved many stakeholders from the communities, government, agriculture, mining, and tourism sectors.

The scenario development is based on the sustainable development and ecosystems approaches (see chapter 1). The sustainable development approach advocates for development that does not compromise the future generations' access to resources and is based on the interdependence of environmental, economic, social and institutional sustainability aspects. The sustainable development approach advocates for utilisation of natural resources for economic growth and improvement of local livelihoods without compromising the integrity of the natural resource base. The guiding principle of the ecosystem approach is the conservation of the ecosystem structure and functioning in order to maintain the ecosystem services. The ecosystem approach highlights the importance of involvement of all relevant stakeholders in the management of an ecosystem.

The basis for development of scenarios is routed in Botswana's planning tradition and principles. These include: sustainable development, economic growth, social justice and economic independence. The scenarios also reflect the core values of Vision 2016 and the MDGs. These include poverty reduction, environmental sustainability, improved access to water and sanitation, better health and educational backgrounds. These are enshrined in the overall objective of the FMP; *to improve people's livelihoods through sustainable use of the wetland's natural resources.*

9.3.2. Methodology

A multi-criteria analysis (MCA) using a computer software, DEFINITE was used for scenario evaluation. DEFINITE was developed by the Institute for Environmental Studies, The Netherlands (Janssen and Herwijnen, 2006). The DEFINITE software is a systematic approach that has superior graphical presentation and interaction/feedback opportunities. It is transparent, widely used and tested. It was used for input, graphical presentation and analysis of information from stakeholders.

9.3.2.1 Scenario and criteria development

As mentioned earlier, the scenarios were developed through consultations with key informants/ experts, planners and a workshop with stakeholders from the communities, tourism, land use planners, economic, ecology, water sector, district councils and agricultural sector during the months of July, August and September.

The 1st workshop and team meeting provided platforms to discuss and develop scenarios and the criteria used to evaluate these scenarios. The 2nd workshop was mainly used to evaluate the scenarios with the assistance of MCA software, DEFINITE. The process of developing the scenarios and criteria is discussed below.

The main purpose of the July workshop was to present main findings to date of the MFMP project and get feedback or comments and to explore, formulate and discuss scenarios. This workshop explored the usefulness of the scenario approach. The role of scenario analysis in the overall MFMP project was explained to the workshop participants and then an example of scenario analysis developed by the project team was presented to the participants. The main aim of presenting the scenario example was to stimulate and focus discussion on scenarios.

The scenarios presented were based on the current situation, economic growth, wise use concept, resource protection and conservation. The main groups of scenarios are summarised as follows:

1. The current situation (CT) scenario defines the situation as it is now in the Makgadikgadi including NDP 10 and DDP 7 projects. Two alternatives emerged under current trends: a. CT+H = Current trend plus NDP 10 and DDP7 projects with hunting allowed. b. CT-H = Current trend plus NDP 10 and DDP7 projects without hunting
2. Economic growth scenario prioritises sectoral economic growth and two alternatives emerged: a. Mining expansion and traditional subsistence agriculture. B. Mining expansion and commercial livestock ranching.
3. Resource conservation and protection scenario priorities conservation and turning WMAs into protected areas (PAs). The management of PAs is the same as current situation where PAs are basically for conservation with little or no benefit to communities around them. There are two alternatives under resource protection: a. All gazetted wildlife management areas (WMAs) become protected areas. b. All WMAs become protected areas.
4. Wise use scenario is based on concept of sustainable use and Ramsar convention guidelines.

Once the scenarios were developed, it was important to develop the criteria that will be used to evaluate the different management options on the Makgadikgadi wetlands. The criteria developed are based on the sustainability aspects: economic, socio-cultural, ecological, biophysical and institutional governance.

After the July workshop, the project team met over two days in August to discuss and incorporate comments from the July workshop, agree on the alternative and criteria. Based on the results from the component reports, the 1st workshop and the team meeting four main groups of scenarios emerged. Each scenario has several alternatives as follows:

1. Current trends: a. Current trends and b. Current trends with all fences removed

2. Resource protection and conservation: a. Conversion of all WMA into PAs and b. Conversion of all WMA plus biodiversity hotspots into PAs.
3. Rapid economic growth: a. Mining, b. Commercial livestock ranching, c. Increase in tourism facilities and d. Expansion of traditional agriculture into WMAs
4. Sustainable Use: a. Sustainable use and b. Sustainable use with a wildlife corridor.

These scenarios/alternatives are discussed in the sub section below.

9.3.2.2 Description of scenarios/alternatives

The scenarios and alternatives outline the main development & management options for the FMP area. Four main scenarios were developed and evaluated: The first one describes the current situation and trends, the business as usual scenario. The second scenario is based on resource protection and conservation whilst the third scenario prioritises rapid sectoral growth of mining, commercial livestock ranching, traditional subsistence agriculture and tourism. The fourth scenario is based on the sustainable use concept where there is balance between resource use and conservation. These were be evaluated through a multi-criteria analysis with weighed criteria; economic, ecological, socio-cultural, biophysical and governance/ institutional.

It is worth noting that these scenarios and alternatives are broad ideas based on results of component reports (volume 2), perceptions and inputs of stakeholders and interactions with local communities. For example, the alternative 'Expansion of traditional agriculture into WMAs' derives from the local communities' request for more land for agricultural activities. Some scenarios may seem far-fetched, such as 'Current trends with all fences removed', but the discussion and evaluation of these provide invaluable insights into improved management of the area.

Current situation and trends (CT)

This scenario describes the current situation in the area and includes current policy trends. The other characteristics include; the current population growth, NDP 10 and DDP 7 projects such as Mosetse Dam, possibility of reopening of Damtshaa Diamond Mine and FMD free status for Zone 4a. In addition it includes on-going mining exploration activities and no hunting within 25 km of boundaries with protected areas.

Management features:
The current situation is characterised by sectoral management and development with continued conflicts between human and wildlife resources, between livestock and crops. Intervention to these conflicts is ad hoc. There are no changes in land use zones and tenure with general under development of tourism & sub-optimal land use.

Alternatives
a. CT – refers to the current situation in the area
b. CT and all fences removed. The current situation and trends with the removal of all veterinary, drift and other fences in the MFMP area.

Resource protection and conservation

In this scenario, priority is given to resource protection through increasing the size of protected areas by conversion of all WMAs (NG 47 & 49 & CT 10 & 11). The management of PAs is the same as

current situation, where PAs are almost purely for conservation with little or no benefits for communities around the PAs and very little tourism in the MNP.

Management features

This scenario advocates for expansion of fully protected areas (PAs). The management of PAs is government led with emphasis on conservation & protection. This implies reduced opportunities for agriculture, mining, settlements and other human activities.

Alternatives:

a. Conversion of all WMA into Parks or Reserves (protected areas). The primary land use in WMAs is natural resource utilisation. Other land uses compatible with wildlife are allowed. WMAs are used by communities for CBNRM activities, for example. Once these are converted to PAs, they will be strictly for protection and conservation of wildlife with little or no benefits to communities around them.
b. Conversion of all WMA plus biodiversity hotspots into PAs. The top ranked unprotected areas are the Boteti River, Nata River, CT8, Lake Xau, the Mosu escarpment area, Rysana Pan, the Mea Pan area, NG51, Ntwetwe Spit, and Mompswe Pan area. Some of these areas are currently used by communities and converting them into PAs will lead to loss of use of these areas.

Rapid economic growth

Priority is given to rapid economic growth of agriculture, mining, and tourism. The development of agriculture includes both the traditional or subsistence farming and commercial livestock farming.

Management features:

There is **r**apid agricultural, tourism and mining growth. This may lead to reduced opportunities for wildlife and BD through loss of WMAs. Tourism growth is mainly through expansion of tourism facilities such as lodges and associated activities and there is increased opportunity for communities to engage in tourism sector. There will be increased pressure on water resources and increased human-wildlife and other conflicts.

Alternatives

a. Commercial livestock ranching. Establishment of commercial livestock ranching blocks in areas identified as suitable for pastoral activities in the MFMP area. The identification of these areas was based on the following:

    a. Defined carrying capacity of the region
    b. Availability of ground water resources
    c. Areas that are not in conflict with current arable fields
    d. Areas that are not in conflict with current/existing boreholes

b. Mining. Expansion of mining activities such as uranium mining, expansion of brine abstraction area in Sowa. The impacts strongly depend on the location and size of the mines. This is difficult/ impossible to predict at this stage.
c. Traditional agricultural development. Expansion of traditional agriculture into all WMAs.
d. Tourism facilities growth. This alternative covers an increase in tourism infrastructure/facilities such as lodges, camps.

Sustainable use

This scenario seeks to balance resource conservation and utilisation through wise use of the area. Wise use would ensure that the area could be designated as a RAMSAR site. Sustainable use would include:

- Protection (and secondary use) of BD hotspots;
- Resolution of major conflicts and conflict spots;
- Sustained development of tourism development spots;
- Protection (and secondary use) of archaeological & heritage spots/ sites;
- Most suitable use and livelihood improvements in other areas;
- Use in all areas should contribute to livelihood improvements.

Management features:
This scenario envisages a holistic and integrated resource management, based on participatory and adaptive resource management. The planning process will be based on pre-cautionary principle and shall meet Ramsar management and use requirements. Furthermore, it encourages location of the right activity in the right area. These will lead to reduced conflicts and greater economic and livelihood benefits.

Alternatives:

a. Sustainable use, as outlined above, envisages a holistic and integrated resource management, based on participatory and adaptive resource management.
b. SU plus creation of a wildlife migration corridor that would connect MNPNP and Central Kgalagadi Game Reserve (CKGR) thus re-establishing old migration route of wild animals between MNPNP, CKGR and the Kgalagadi Transfrontier Park. The earmarked corridor is currently used and it will connect area free from FMD to areas that are prone FMD. Hence there is a risk of spreading FMD.

As mentioned earlier, the 1st workshop agreed that the suggested criteria are comprehensive to evaluate the scenarios. However, the workshop and team discussions suggested modification of the sub-criteria. The major changes have been on the Ecological sub-criteria where impact on wildlife sub-criterion was expanded to include impacts on carnivores and impacts on herbivores. The impact on ecosystem function and services was added under the ecological sub-criteria. The Governance and institutions sub-criteria differentiate between different types of conflicts unlike lumping all of them under one sub-criterion. The modified sub-criteria are shown on Figure 35.

Figure 35: Modified criteria and sub-criteria based on July workshop and team meeting

Economic impacts
Sub-criteria: *Employment creation, Income generation, Contribution to national economy, Public infrastructure, Economic diversification and Balance of trade*

Socio-cultural impacts
Sub-criteria: *Poverty reduction, Improved livelihood security, Impacts on vulnerable groups, Impacts on archaeological & heritage sites, Impact on social structures and capital e.g. HR development & education, Impacts on human health*

Impact on ecological resources
Sub-criteria: *Impacts on carnivore wildlife, Impacts on herbivore wildlife, Impacts on birds, Impact on vegetation (veld products, wood, etc.), Impact on grazing conditions, Impact on wildlife & bird mobility, Impact on ecosystem functioning & services*

Impacts on the biophysical environment
Sub-criteria: *Land quality, Impact on water quality, surface water quantity, ground water quantity*

Governance and institutions
Sub-criteria: *Compliance with environmental. & NRM policy framework, Institutional diversification, Institutional decentralisation, Impact on human - wildlife conflicts, Impacts on livestock - crop conflicts, Impact on land use*

9.4. Scenario evaluation

The DEFINITE is a multi-criteria analysis software package with several steps: problem formulation, framework design, impact assessment (scoring and weights) and finally the evaluation. Problem formulation is development of scenarios/alternatives and the framework design involved developing criteria to evaluate the scenarios/alternatives. A workshop was organised to discuss and agree on the scenarios and criteria that would determine the evaluation. The scoring used in scenario evaluation was based on whether a particular scenario/alternative has a positive or negative impact of the sub-criteria. The range of scores used is as follows:

+	(0.67)	Small positive impact
++	(0.83)	Big positive impact
+++	(1)	Very big positive impact
0	(0.5)	Insignificant or no impact
-	(0.33)	Small negative impact
--	(0.17)	Big negative impact
---	(0)	Very big negative impact

Both quantitative and (mostly) qualitative data were used. Primary data informed the evaluation process and the data was collected through workshops and interactions with communities, government officers, tourism sector, farmers, and mines. Secondary data in the form of government reports, population census, district and national development plans was used to develop background information on the different criteria. The MFMP component reports informed the development of scenarios. The data background document was provided to the 2nd workshop participant to inform their evaluation of scenarios.

9.4.1. Results by criterion

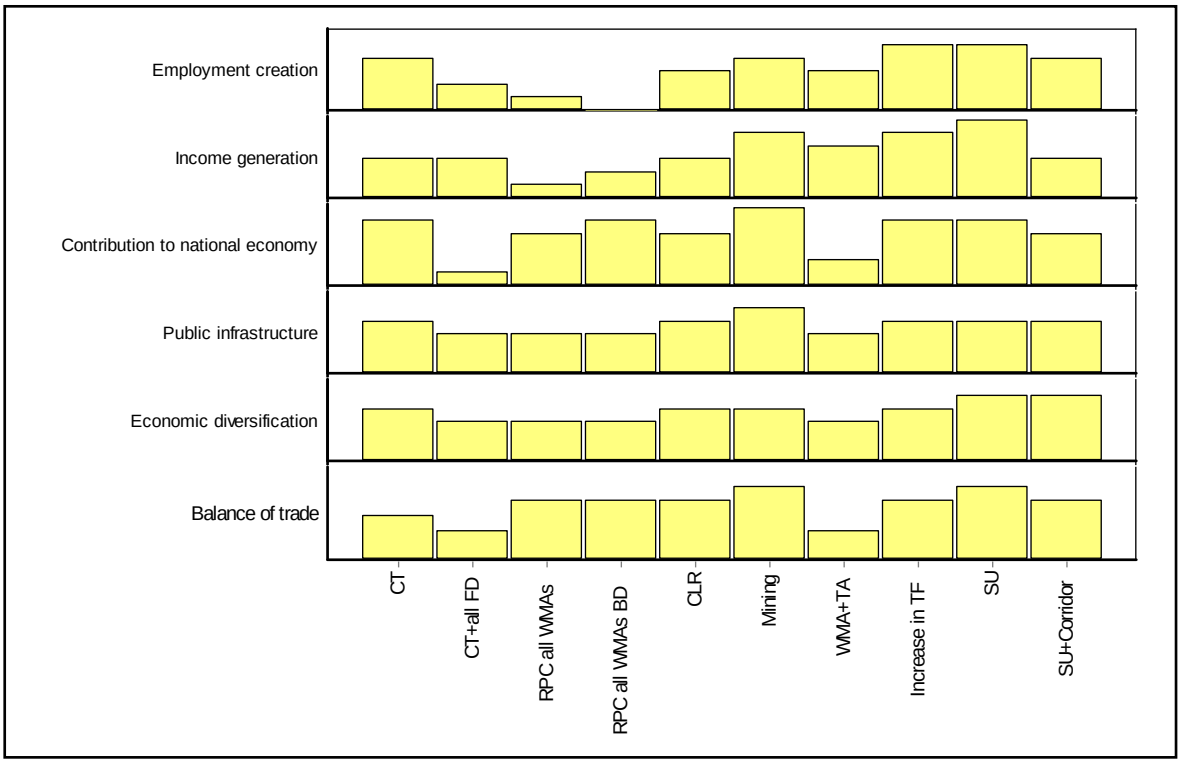
The stakeholder workshop on scenario evaluation was held beginning of September 2010. The main objective of the workshop was to evaluate different management scenarios for the MFMP area. The workshop participants were divided into four groups and each group was made up of people from different institutions, sectors and backgrounds. The groups mainly had representatives from the tourism, community and trusts, ecology and wildlife, mines, land use planners, agriculture, economic planners, and councils. Two presentations were made to give an overview of the process of scenario development and to guide group discussions. Each group was given sheets of all criteria and sub-criteria to score, that is, each scored alternatives using the economic, socio-cultural, ecological, biophysical, and governance and institutions. The background information document was given to workshop participant to assist and inform the scenario evaluation. The background information included results of component reports, demographic information on population, health, employment figures and socio characteristics of the FMP area. It also included land uses, land demand for crops and livestock. After scoring, the groups assigned weights to the sub-criteria and subsequently assigned weights to the criteria.

The following sub-section discusses the results of the group discussions on scenario analysis at a workshop in September. The results are the average scores of all the four groups presented by criterion. The scores were standardized with --- (0) being least score and +++ (1) being the highest score. The results are presented graphically on Figures 33 to 37. The bars indicate the level of impact of alternatives on the different sub-criteria. For example, on Figure 36 the alternative Mining has the highest score of +++ for the contribution to national economy criterion and alternative CLR has no significant impact attaining a score of 0 for the income generation criterion. On Figure 33, the alternative CT all FD has the least score of --- for the impact on carnivore wildlife criterion.

9.4.1.1. Economic criterion

The ‘CT alternative’ scores high for employment creation after ‘SU’ and ‘Increase TF’ (Figure 36). However, the CT alternatives score low on income generation with ‘Mining’ and ‘Increase TF’ scoring high in this regard. ‘SU’ scores highest for income generation sub criterion. Income generating opportunities under ‘Current trends’ are fewer and ‘Increase TF’ is expected to have high spin offs, such as selling crafts and cultural activities, that will create local benefits. ‘Mining’ scores higher than all other alternatives in terms of contribution to the national economy because of its high value added. There are major diamond mines adjacent to the MFMP area. ‘Mining’ scores relatively high with regard to employment creation but lower than the ‘SU’ and ‘Increase TF’ mainly because ‘Mining’ is capital intensive. The ‘Mining’ alternative scores high for public infrastructure because mining activities are often accompanied by improved public infrastructure such as roads, schools and hospitals which will also benefit local communities. The MNPNP is currently mostly a conservation area that provides little direct local economic benefits. The area provides few employment and income generating opportunities for the local communities hence the alternatives under (traditional) resource protection score low with regards to employment creation and income generation.

Figure 36: Economic criterion scores



Notes:

SU – Sustainable use, SU+Corridor – Sustainable plus wildlife corridor, Increase TF – increase in tourism facilities, CLR – Commercial livestock Ranching, WMA+TA – Traditional agriculture expansion into wildlife management areas, Mining – Expansion of mining activities, CT – Current trends and situation, CT + all FD – Current trends and situation with all fences removed in the FMP area.

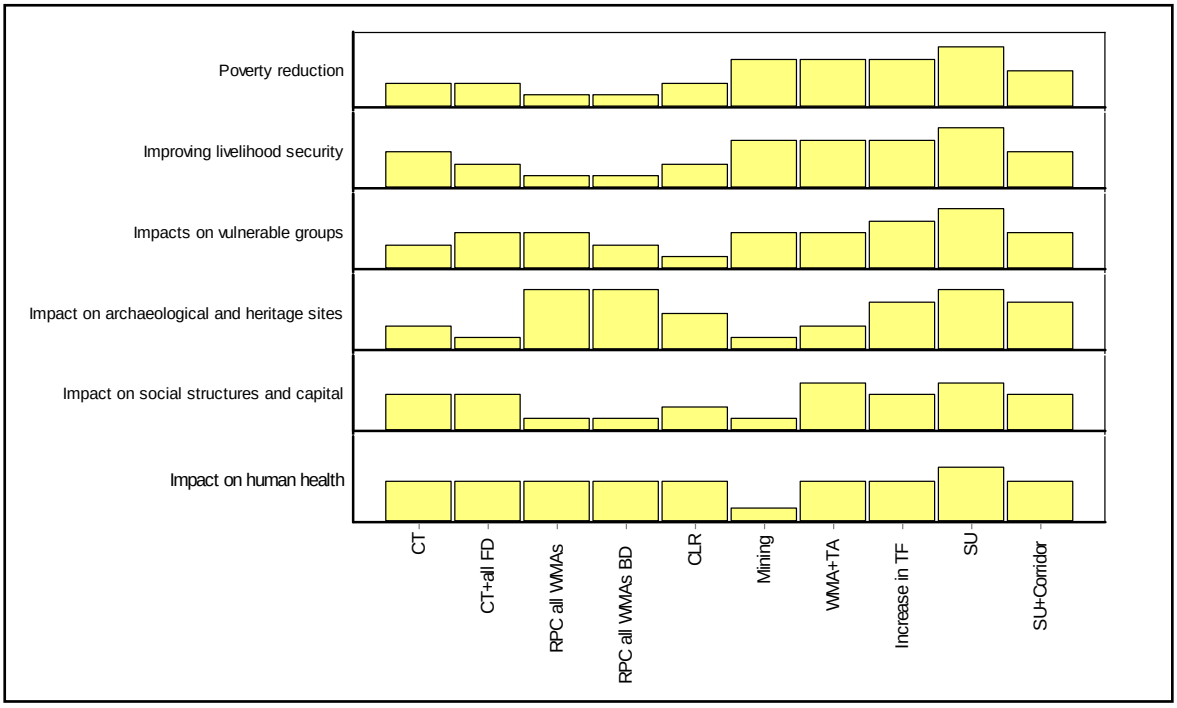
9.4.1.2. Socio-cultural criterion

The main objective of developing the MFMP area is to improve local people's livelihoods. The alternatives under 'Resource protection' and 'CLR' have little impact on poverty reduction. The 'CLR' are said to benefit fewer locals and employ fewer people compared to, for example, 'WMA+TA' which would benefit locals. The 'Resource protection' alternatives scored low on poverty reduction and improving livelihood security because of the lack of direct local benefits. The protected areas require a shift in management away from conservation towards conservation & development models involving, for example, public private partnerships, communities and private management where investors would invest in infrastructure. Communities would benefit from joint venture partners in managing the parks. On the other hand, the 'Resource protection' alternatives score high in terms protection and have less impact on archaeological and heritage sites.

Under 'Current trends', the tourism potential is not fully exploited and has limited benefits, for example employing about 350 people. The high scores for 'Increase in TF' with regards to poverty reduction, livelihoods improvement and impact on vulnerable groups sub criteria are due to tourism potential based on scenic beauty, unique landscape and heritage sites in the MFMP area (Figure 37). The tourism, ecological and archaeological reports (volume 2) identified tourism areas, biodiversity hotspots and heritages sites that have potential to be developed for tourism. According to the livelihood survey and other consultation with local communities, local communities are currently not benefiting from tourism and related CBNRM activities. The Tourism component identified the need for alternative tourism models that would benefit local communities, for example, joint venture partnership between CBOs and private companies. One of the strategies to strengthen the CBOs

would be to provide extensions officers to work closely with and assist the CBOs development over time. Empowering CBOs may lead to improved CBNRM activities and improve local livelihoods. Despite the identified tourism potential, it is important to note that tourism is vulnerable to international market dynamics. An extreme international event such as an act of terrorism or an economic depression could destabilise the tourism market.

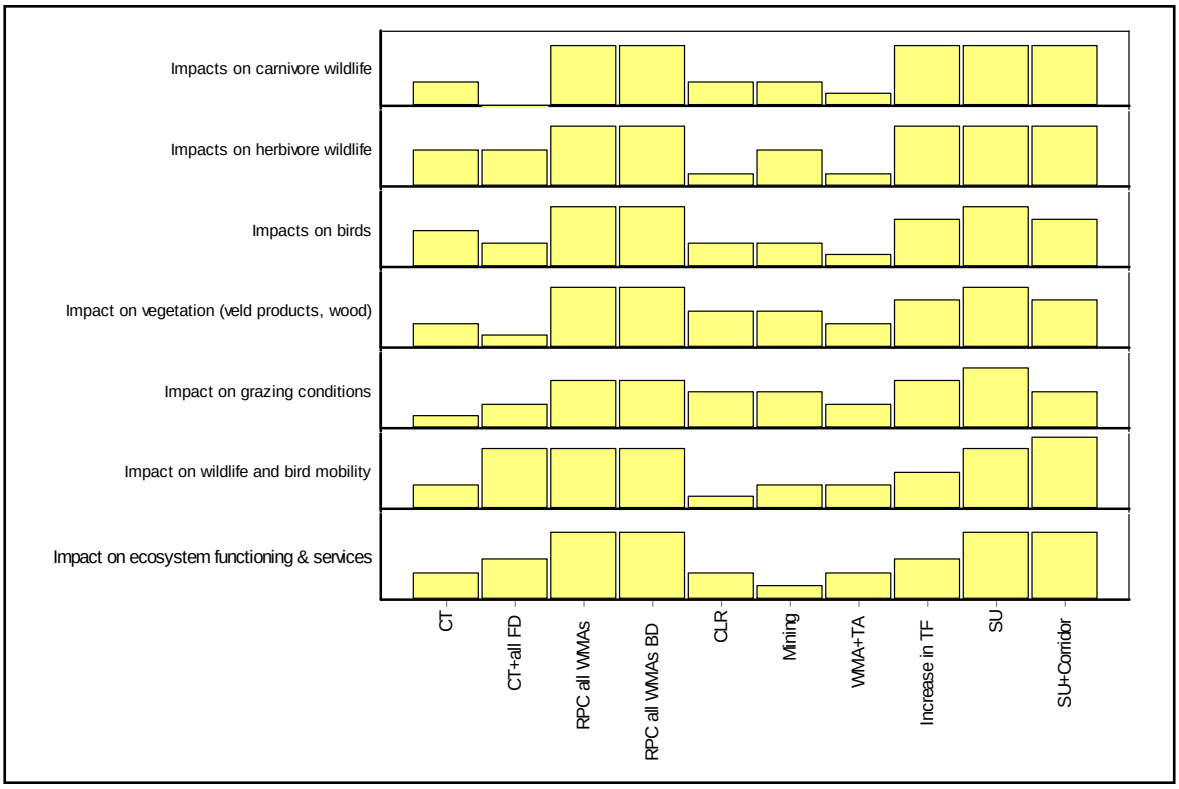
Figure 37: Socio-cultural criterion scores



9.4.1.3. Ecological criterion

The 'Current trends' alternatives score low for the ecological criterion with an exception of impact on wildlife and bird mobility criterion where alternative 'CT all FD' scores very high (Figure 38). The main feature of this alternative is the removal of all fences in the MFMP area. This will allow for movement of animals hence the high score for the impact on wildlife and bird mobility criterion. However, 'CT all FD' will have a negative impact on archaeological and heritage sites. The 'CT alternative' scores low for the impact on vegetation and grazing conditions due high pressure on these resources. The grazing conditions are mainly affected by over stocking in some parts of the MFMP area. The 'Resource protection' alternatives score high under the ecological criteria because the protected areas provide a safe environment for wildlife. The ban on consumptive resource use activities in protected areas has a positive impact on the biodiversity of the area. The expansion of subsistence agriculture into wildlife management areas (WMA+TA) scores low for the impact on carnivore and herbivore wildlife and birds, mainly because human activities in most cases will drive out wild animals.

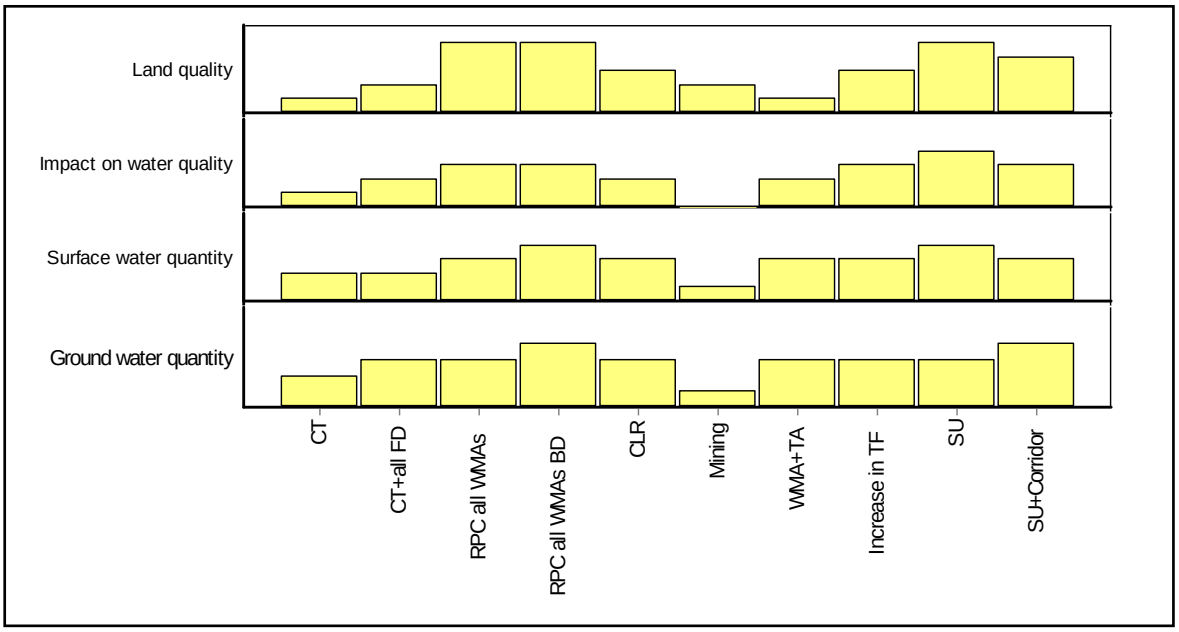
Figure 38: Ecological criterion scores



9.4.1.4. Biophysical criterion

The 'CT alternative' scores low for the land quality sub criterion (Figure 39). Some parts of the MFMP area are currently experiencing overgrazing and land degradation. Similarly, the 'Mining activities' scores low on land quality. The Mining alternative also score low for the Water quality, Surface and ground water quantity sub criteria. The mining activities and associated localities utilise huge amount of water. The major source of water in the MFMP area is ground water. Even though some of the mines are located outside the MFMP boundary some of their well fields are within the MFMP area. The water abstraction rate in some areas such as Dukwi well field is well above the rate of recharge hence the low score for the mining sector for the biophysical criteria.

Figure 39: Biophysical criterion scores



9.4.1.5. Governance and institutions criterion

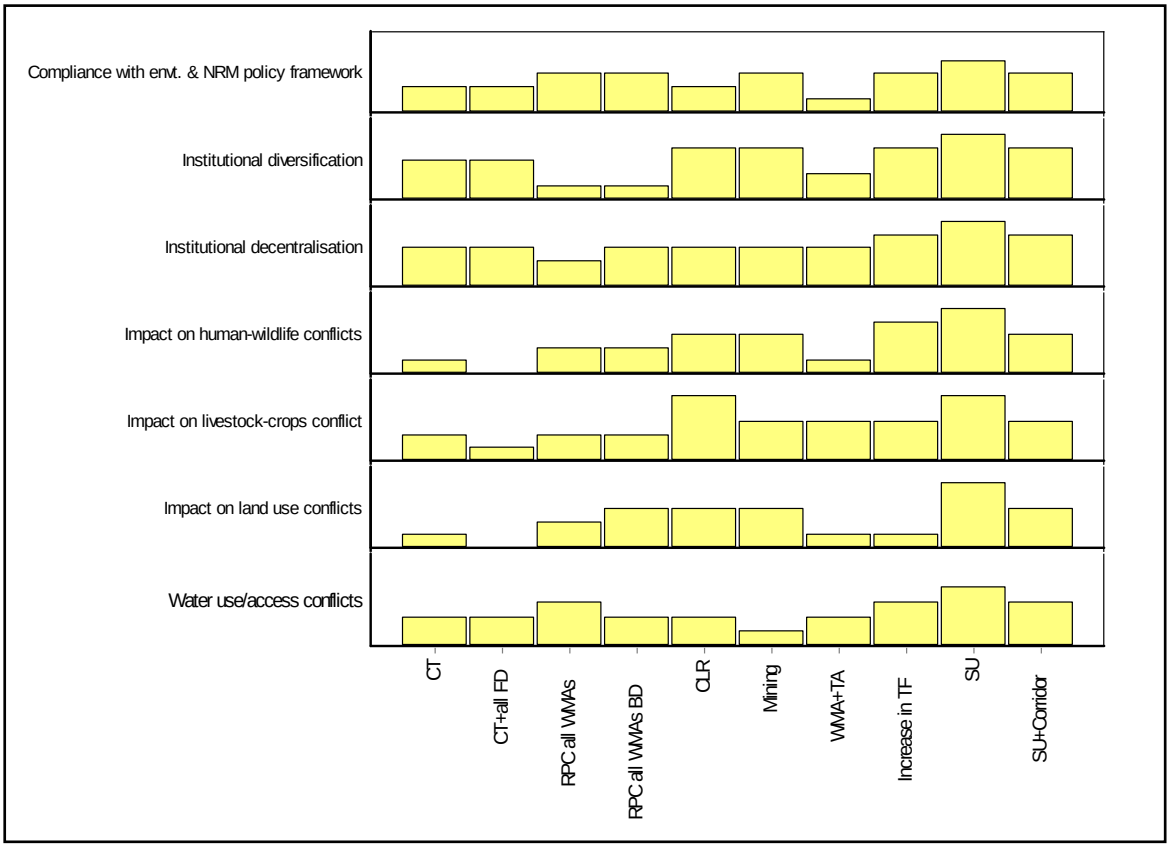
The 'Current trends' alternatives score low for the governance and institutions criterion (Figure 40). The 'CT all FD' alternative will exacerbate the problem of human-wildlife conflict because some fences such as the MNPNP western side electric fence were constructed to reduce contact between wildlife and human activities, in particular livestock and crop production. Similarly, the livestock crop damage incidences will increase without fences as drift fences are effective in reducing livestock damage to crops. The fences also demarcate different land uses thus reducing land use conflicts. Furthermore, the fences are important for controlling diseases such as the FMD and removing all fences may lead to spread of certain diseases. The important lesson out of the CT all FD alternative is the role of fences and one of the recommendations is to undertake SEA of all fences to determine the role of different types of fences and how they could be adjusted to optimise their use and reduce fence maintenance costs. The FMP area is currently characterised by conflicts and these are dealt with on an ad hoc basis hence low score for Current trend alternatives.

The expansion of traditional agriculture into WMAs (WMA+TA) scores low under the conflicts sub criteria because it will increase incidences of human wildlife conflicts with wild animals damaging crops and predation on livestock. The Mining alternative scores low on the water use and access conflicts because mining activities draw out huge amounts of water. The Orapa/Letlhakane Diamond and Soda Ash Mines use significant amount of water. The livestock sector also depends on the same source of water and concerns have been raised about high water use rates by the mines at the expense of other sectors such as the livestock. IWRM provide mines with opportunities to efficiently use water and find alternative sources of water. It is worth noting that in 2009, Orapa and Letlhakane Mines commissioned the construction of a large storm water dam whose primary objective is to harvest rainwater. Much of Orapa's surface area is paved, and storm water is being collected in a new dam. This can be emulated elsewhere where similar conditions exist.

The 'SU' alternative scores high for the governance and institutions criteria because it envisages reduction of conflicts through coordinated planning and co-management of the MNPNP. It is

important to allocate land use based on suitability of a particular piece land. It is also important for future allocations to avoid potential conflicts by allocating pastoral land away from arable fields, for instance.

Figure 40: Governance and institutions criterion scores



9.4.2. Overall results

During the September workshop, participants were divided into four diverse groups. Each group scored and assigned weights to the sub criteria and criteria. The scores and the criteria weights of the four groups were averaged to get the overall ranking.

The weights are meant to indicate the relative importance of the (sub-)criterion as compared to other (sub-)criteria. The weights allocated to the main criteria by the groups are generally similar among groups; for example, the 'Socio-cultural criterion' was assigned 20% by all groups. Similarly, the 'Bio-physical criterion' weights are similar across the groups. The 'Economic criterion' weights for groups 2 and 4 are close to the average whilst groups' 1 and 3 weights deviate from the average. The weights allocated to the sub-criteria are on average the same across the groups. However, there are cases where the differences between groups were significant. For example, Group 1 allocated 40% to 'Poverty reduction sub-criterion' and other groups' weights were between 24% and 29%. Similarly, Group 4 allocated the 'Impact on vulnerable groups' sub-criterion' 2% whilst groups 1, 2 and 3 allocated it 15%, 18% and 17%, respectively. Table 34 shows the groups' weights for the sub-criteria and criteria as well as the groups' average weights. The second column provides a brief description of indicators of the each sub-criterion. The average sub criteria weights and criteria average weights were used for the final results of groups' average (Figure 41).

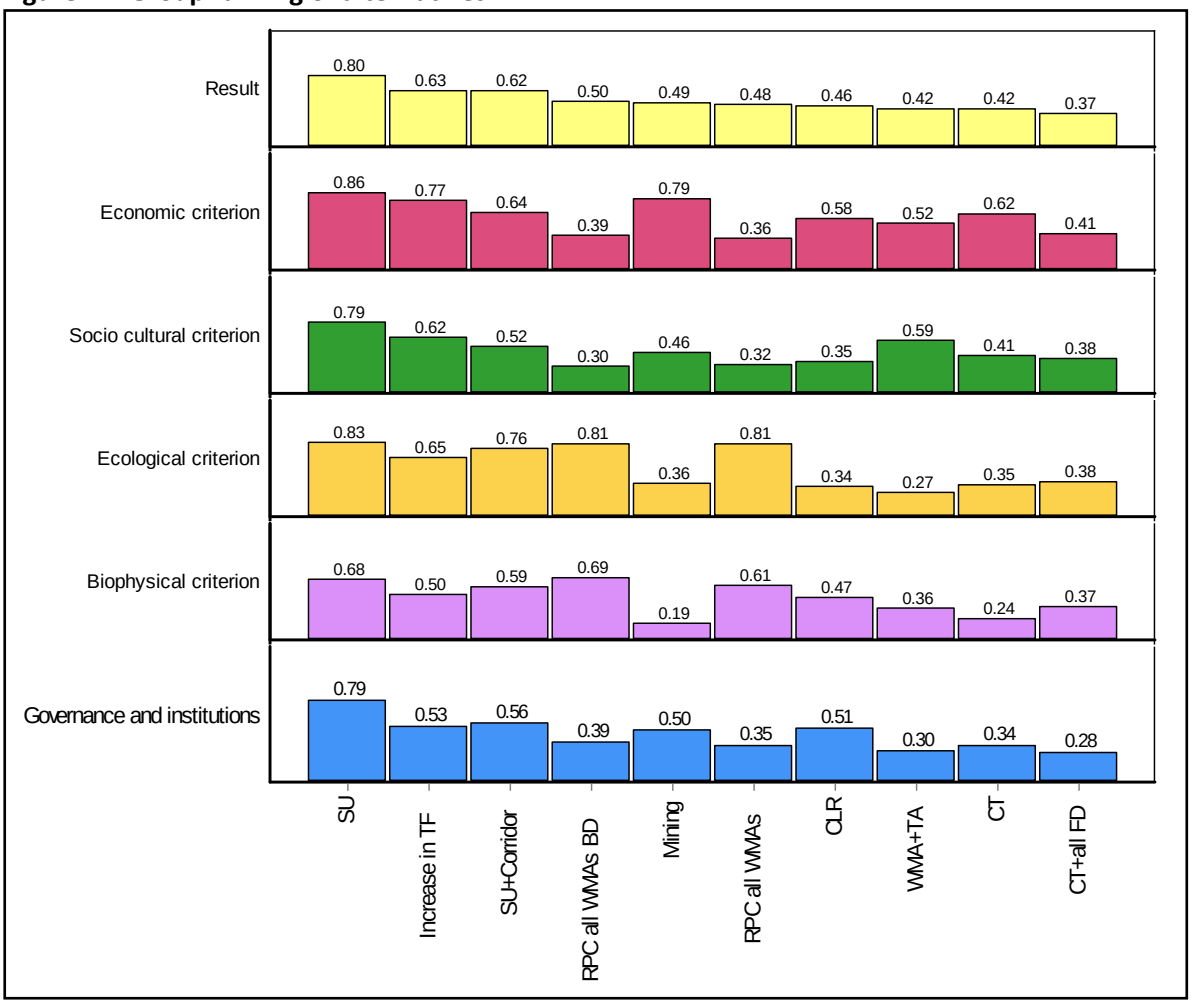
Table 35: Groups' criteria and sub-criteria weight (%)

	Description of the sub-criteria	G 1	G 2	G 3	G 4	Sub criteria average	Criteria average
Economic criterion		35	31	20	25		27.75
Employment creation	Number jobs (formal, informal, pierce jobs etc.)	20	24	19.75	30	23.44	
Income generation	Contribution to local incomes of households, farms & companies (in-kind & cash)	35	23	22.88	35	28.97	
Contribution to nat. Economy	Value added (economic, i.e. direct & indirect)	5	13	18.25	7	10.81	
Public infrastructure	Increase in roads, schools, clinics, communication, recreation	15	14	11.38	15	13.85	
Economic diversification	Increase in mix of non-traditional agriculture (e.g. Mining, tourism, manufacturing, commercial agriculture)	20	13	15.75	10	14.69	
Balance of trade	Increase in exports (beef, minerals, tourism) &/or decrease in imports	5	13	12	6	9.00	
Socio-cultural criterion		20	20	20	20	20.00	20
Poverty reduction	Decline in people living below PDL and poverty intensity	40	29	23.5	25	29.38	
Improving livelihood security	Increased no of livelihood options & sources	20	19	16	30	21.25	
Impact on vulnerable groups	Vulnerable groups: female household head, youth, orphans, elderly, disabled and minority groups	15	18	17	2	13.00	
Impact on archaeological & heritage sites	No and % of sites affected without mitigation measures	5	7	17.38	8	9.35	
Impact on social structures and capital	Support for existing social processes & institutions (e.g. Social villages processes & networks)	8	10	13.88	15	11.72	
Impacts on human health	Changes in types of diseases and their incidence (increase or decrease)	12	17	13.25	20	15.56	
Ecological criterion		10	20	25	25	20.00	20
Impacts on carnivore wildlife	Impact on key indicator / threatened species: Lion, hyena, cheetah, and wild dogs	15	13	10.38	10	12.10	
Impacts on herbivore wildlife	Impact on key indicator / threatened species: Zebra, wildebeest, buffalo, giraffe, and elephant	15	13	11	10	12.25	
Impacts on birds	Impact on key indicator / threatened species: flamingos, pelicans, wattle crane	15	11	12	10	12.00	
Impact on vegetation (veld products, wood, etc.)	Impact on key indicator / threatened species:	15	16	15.75	15	15.44	
Impact on grazing conditions	Grass cover and species composition	5	18	17.63	15	13.91	
Impact on wildlife & bird mobility	Impact on wildlife corridors and linkages	10	11	11.38	10	10.60	
Impact on ecosystem functioning & services	Eco services: Provisioning, Regulating, Cultural & Supporting	25	18	21.88	30	23.72	
Biophysical criterion		15	14	20	18	16.75	16.75
Land quality	Extent of land degradation and soil erosion	23	28	41.25	40	33.06	
Water quality	Water quality for key parameters (ground & surface)	26	26	21.25	10	20.81	

Surface water quantity	Amount of water in pans impact on wet spots	26	24	17.5	25	23.13	
Groundwater (GW) quantity	GW abstraction vis-a-vis GW recharge	25	22	20	25	23.00	
Governance & institutions		25	15	15	12	16.75	16.75
Compliance with environmental. & NRM policy framework	Meeting policy requirements (national, regional and global)	25	13	13.88	15	16.72	
Institutional diversification	Government core tasks & increased role for private sector & civil society	20	18	12.63	20	17.66	
Institutional decentralization	Greater roles for local government, CBOs, etc	20	16	9.5	25	17.63	
Impact on human - wildlife conflicts	Incidences and amounts of predation, crop damage and injuries (PAC)	8	22	14.13	9	13.28	
Impacts on livestock - crop conflicts	Incidences and amounts of crop damage	8	8	11.63	6	8.41	
Impact on land use conflicts	Consequences for conflict spots	15	12	24.75	13	16.19	
Impact on water use conflicts	Consequences for water use conflicts	4	11	13.5	12	10.13	

Figure 41 shows the summary of the results of the overall MCA results. The scores of the four groups were averaged and the average weights of the sub criteria and overall criteria weights in Table 34 were used. The bars on Figure 41 represent the average scores of the alternatives for different criteria. The Results is overall results of the criteria and the weights. The alternatives are ranked 1 to 10 with 1 as the most preferred scenario management option and 10 is the least preferred management option.

Figure 41: Group ranking of alternatives



Notes:

SU – Sustainable use, SU+Corridor – Sustainable plus wildlife corridor, Increase TF – increase in tourism facilities, CLR – Commercial livestock Ranching, WMA+TA – Traditional agriculture expansion into wildlife management areas, Mining – Expansion of mining activities, CT – Current trends and situation, CT + all FD – Current trends and situation with all fences removed in the FMP area. Scores and rankings represent the average of the groups.

Figure 41 shows that the 'Resource protection' alternatives scored lowest for the 'Economic criterion' with 'SU' and 'Mining' alternatives scoring the highest, respectively. Under the Socio-cultural criterion, 'resource protection', 'CLR' and 'CT all FD' alternatives score very low. The 'Protected areas under the current management' model provides little benefits to local people and the 'CLR' can be allocated to fewer individuals and also employ a small number of people, which explains their low scores. The 'WMA+TA' alternative scores the lowest under the 'Ecological criterion' as the WMAs would be lost to wildlife management. The current trends, 'CLR' and 'Mining' alternatives also scored low due the negative impacts on ecological resources. The 'Resource protection' alternatives scored the highest after the 'SU' alternative under the Ecological criterion mainly because management of protected areas is conservation oriented. The 'Mining' and 'CT' alternatives scored lowest for the Biophysical criterion, mainly because of the negative impact of mining activities on the water resources and land quality. The 'RPC all WMAs BD' comes out as the best under the Biophysical criterion due to positive impact on land quality and it utilizes less water compared to 'Mining'. The 'CT' and 'WMA+TA' alternatives score lowest for the Governance and Institutions mainly because of the resource conflicts under the current trends and the envisaged increase in human-wildlife conflicts under the 'WMA+TA' alternative.

With regards to the overall results, the 'CT' alternatives emerge as the lowly ranked management alternatives. The 'SU' is the top ranked alternative followed by 'Increase TF' and 'SU + Corridor' alternatives. The 'SU' alternative is ranked number one due to balance between resource use and conservation. The 'SU' also advocates for reduction or the resource conflicts through integrated planning and management. The 'Increase TF' is second best alternative because of the identified tourism potential in the MFMP area based on scenic beauty and heritage sites. The 'SU plus wildlife corridor' management option ranks third. The general consensus was to keep the 'SU + Corridor' alternative as it is and outline its major constraints and risks.

The above overall result has several important management implications:

1. There is need for a new form of management, i.e. moving away from the current management characterised by continued conflicts and sub-optimal utilisation of the wetlands resources and most importantly high poverty levels;
2. The traditional protection management paradigm practiced in the MNPNP needs to be overhauled. More development investments are needed inside MNPNP and more local benefits need to be generated. Co-management with the private sector and communities would have major advantages. The Park's management and development need to be fully integrated within the broader MFMP area instead of being a conservation island;
3. Tourism needs to be developed as long as it provides more local benefits and innovative partnerships models are introduced. This would enhance investments and local benefits. Joint venture partnership between CBOs and private companies is an alternative model that would assist and empower CBOs in managing their CBNRM projects;
4. Conservation and utilisation of heritage archaeological sites needs to be pursued to safeguard the country's cultural heritage and to create development opportunities; and
5. Development opportunities of agriculture and natural resource use need to be pursued as long as they are sustainable. Suitability mapping and use of sustainable management practices are necessary.

The MCA showed that no decision can be made as yet regarding the wildlife corridor between the MNPNP and the CKGR. The costs and benefits need to be studied in more detail as the corridor could have major implications, including:

- The risk of spreading of FMD into the CKGR and beyond into areas that are FMD free. This will have detrimental impacts on the livestock sector and the country's economy;
- Displacement of communities currently using the area;
- Uncertain ecological advantages. Some participants were of the view that the envisaged movement of wildlife from MNPNP to CKGR is unlikely to occur; and
- Creating ecological linkages between major parks will boost tourism.

9.4.3. Sustainable use scenario & management

The previous section showed that sustainable development and use is the most beneficial management scenario for the MFMP area. In this section, some of the characteristics are further explored. SU scenario seeks to balance resource conservation and utilisation through wise use of the area. Sustainable use would include:

Conservation and use of biodiversity hotspots

All identified hotspots should be conserved and used in such a way that the resources do not decline. The top ten biodiversity hotspots are the Boteti River, The Makgadikgadi Pans National Park,

Nata Sanctuary, Nxai & Kudiakam Pan, Nata River, CT8, Boteti Delta – West, NG47, Lake Xau and Mosu escarpment area. Maintaining habitat quality and integrity of these hotspots will help protect the biodiversity. The precautionary principle must be applied when utilising these hotspots. Particular attention should be paid to the management of BD hotspots outside currently protected areas, as these are most exposed to over utilisation.

The identified wet spots should similarly be conserved and used in such as way that they are maintained. Most wet spots are included in the above BD hotspots.

There should be protection and secondary use of archaeological & heritage spots or sites. The sites include; Mosu Escarpment, Kayishe, Khama Ruin, Unikai water spring, Thitaba, Lekhubu, Xanikaga, Ngcaezini Pan, Chapman's Baobab, Green's Baobab and Baines' Baobabs. The development and utilization of these should also benefit local communities and improve their livelihoods.

Resolution of major conflicts and conflict spots
Types of conflicts include human-wildlife, livestock-crops and land use conflicts. Livestock predation by wildlife is widespread around PAs (e.g. Phuduhudu and Xhumaga). Measures to minimise these conflict include: improved land use planning, improved herding and kraaling of livestock, translocation of problem animals, wildlife proof fencing and controlled taste aversion. Wild animals also damage crops with elephants being main culprits in the Gweta and Nata area, whilst hyena incidences are common in Mmatshumo area.

Measures to mitigate and prevent these conflicts include; fencing of arable fields combined with use of chilli pepper deterrent and clustering of arable fields. Land use conflicts, for example, between cattleposts and tourism in the CT 10 and 11 areas. Prevention of future conflicts requires allocation of land based on most suitable use and avoiding allocating conflicting uses in the same area.

Sustained development of areas with tourism potential
The mapping of areas with tourism potential (ATP) has been completed. It is important to develop these tourism areas within limits of acceptable change. The livelihood survey highlighted lack of benefits from tourism in the area and it is therefore important to develop management models to improve on the current CBNRM model. Community Based Organisations (CBOs) need capacity building and empowerment through training and provision of extension officers whose task would be to assist CBOs in their daily activities. This is vital for sustainable community involvement in tourism.

Optimal resource use
Most suitable use and livelihood improvements require location of the right activity in the right area to reduce conflicts and to optimise use of land for greater economic and livelihood benefits. The drive towards development that contributes to livelihood improvements is important in maintaining the integrity of the MFMP area. Poverty is widespread in the Makgadikgadi area and focus should be on improving livelihoods.

Re alignment of fences and proper fence maintenance
The scenario evaluation clearly showed that fences can serve a purpose provided they are suitably located and well maintained. Some of the current fences were constructed a long time ago and their role has changed after changes in the veterinary status and zones. Moreover, fences are expensive and often not properly maintained. It is therefore part of SU to review all fences to determine their effectiveness and impacts and to recommend changes in fence alignment, specifications and maintenance. For instance, the community of Xhumaga is the view that realignment of the MPNP fence to give wild animals' access to the Boteti River would improve tourism attraction in their

village. This process will help in finding ways to optimize efficiency of fences. The costs of maintaining fences are high and realignment of some fences may help reduce these costs.

MNPNP management and development

The current management of protected areas (PAs) provides little benefit to the local communities. There is need to find management alternatives that would provide communities the opportunity to utilize the PAs. Partnerships between government, community and private sector would provide the opportunity to optimise utilisation of PAs. If community benefits are realized, the community will actively protect and conserve PAs and the willingness to put out fires will increase. Veld fires are a challenge in the FMP area and communities are of recent reluctant to assist authorities put out fire. Where there is abundant grass in PAs, communities could be allowed to harvest the grass. This will reduce the fuel load in case of fire outbreak and contributes to local communities' livelihood improvement.

Increasing local benefits

Sustainable development allows for consumptive and non-consumptive resource uses such as mining and wildlife as long as these activities benefit local community livelihoods. It is important for private companies in the MFMP area to develop and implement programmes that deliberately target local community empowerment such as supporting CBOs, development of community infrastructure and apprenticeship or training programmes. Lack of skills amongst locals is the main reason why local people often dominate the low paying positions in private companies. These programmes will sustain communities even after the life span of these private projects.

Although the SU alternative is ranked number one, its implementation will take time and requires significant resources. Some of the challenges in implementing SU include:

- The human-wildlife conflict is one of the major problems in the FMP that affects local people's livelihoods. The Wildlife report (volume 2) identified several mitigation strategies for human-wildlife conflicts such as insurance schemes, indirect compensation, fencing, chilli pepper deterrents, cluster fencing, improved animal husbandry and land use planning. All these strategies require financial and human resources to implement. Local community awareness raising and training to deal with problem animals are processes in themselves. Some of the strategies can be implemented within the recurrent budget;
- Sectoral planning has been identified as one of the factors that leads to sub optimal use of resources and conflicts in the FMP. A change towards integrated planning and management requires a change of mindset within different institutions and their staff. This requires training programmes for effective implementation; and
- The benefits from the CBNRM projects are not sufficiently trickling down to households, and communities are of the view that tourism brings little livelihood benefits. CBOs and communities need to be empowered and strengthened to make them successful. This support requires financial resources and extension officers dedicated to CBOs.

10. FMP activity plan

This chapter describes the proposed MFMP activities. These will be carried out from 2011 onwards. The initial plan was to continue the development of a Makgadikgadi Integrated Management Plan (MIMP) parallel with the implementation of the MFMP. During the concluding stakeholder workshop it was decided that the MFMP was comprehensive and did not require an additional MIMP to be prepared in 2011 and 2012. Therefore, this chapter focuses on activities that need to be implemented to ensure sustainable development of the Makgadikgadi area. This is a positive development as long as the following needs to be kept in mind. There is need to broaden the scope of the MFMP during its implementation:

- The proposed expansion of the MFMP area (chapter 10) requires additional work beyond the current MFMP boundaries;
- While the MFMP focused on the highest ranked, biodiversity areas, wet spots, archaeological and heritage sites, areas with tourism potential, many more were identified. Additional work on these spots needs to take place later on to ensure that they are conserved and utilised to the benefit of local livelihoods;
- Further studies and monitoring are needed to better understand the ecosystem and its linkages with livelihoods and poverty; and
- Consideration is given to the possibility for the Makgadikgadi wetland to be declared a RAMSAR site.

10.1. Introduction

The proposed MFMP activities are part of the scenario "***Sustainable Development of the Makgadikgadi Project Area***" (see chapter 9). This scenario emerged as the 'preferred management option after a multi-criteria analysis. Therefore 'sustainable development' constitutes the core of the proposed activities. The overall aim of the MFMP (and ultimately MIMP) is described as follows: "*to improve people's livelihoods through sustainable use of the wetland's natural resources".*

The MFMP activities follow from the earlier chapters but this chapter can be read independently and therefore there is some overlap with previous chapters.

The MFMP is premised on several guiding principles:

- Planning must be holistic and cut across economic sectors and natural resources;
- Plan implementation must benefit rural livelihoods and the environment;
- Special attention needs to be paid to poverty reduction and the most vulnerable groups;
- Local stakeholders should be involved in the preparation, planning and implementation;
- The local population must develop a sense of 'ownership' of the plan; and
- The plan should be implemented by government, private sector and civil society.

10.2. Sustainable development and the ecosystem approach

The concept of sustainable development is accepted in Botswana, southern Africa and the world at large as a guiding principle for development planning and natural resource management. In essence sustainable development aims to balance economic development and growth with resource conservation. Where trade-offs exists, informed decisions and often compromises are made have to be made and options will be vigorously pursued where conservation can be combined with growth and development ('win-win' situation). Developments and projects need to be sustainable from an

ecological, economic, socio-cultural and institutional perspective. *Ecological sustainability* requires that:

- Renewable natural resources such as wildlife, grass and trees are used at a level not exceeding their regeneration capacity;
- Non-renewable resources are used in such a way that alternatives for their use are available upon their depletion and that their revenues are used to sustain future development;
- Pollution is kept within the limits of the natural absorption capacity such that pollution can be broken down naturally; and
- The integrity of the ecosystem is maintained such that biodiversity and ecosystem services are kept in-tact.

Economic sustainability requires that natural resources create significant value added (Botswana at large), income and benefits the livelihoods of the local population (e.g. employment & income). Moreover, the economy needs to diversify to reduce reliance on a particular sector and exports of products would generate foreign exchange and permit imports. *Socio-cultural sustainability* requires that the benefits of resource uses are fairly distributed, that poverty is being reduced and that people actively participate in (or 'own') development. Vulnerable groups should be fully involved and benefit. *Institutional sustainability* requires that effective implementation of the plan is secured. The institutions involved should be able to make the required contributions, assess their performance and where needed adjust the plan to ensure implementation and delivery. Participation of all stakeholders contributes to institutional sustainability but reliance on one particular implementation agency poses an institutional sustainability risk.

The principles of the ecosystems approach are summarised in Table 36. The principles clearly show that, similar to sustainable development, the ecosystems approach advocates for integrated environment-development planning.

Table 36: Principles of the ecosystems approach

Development	Environment	Environment & development
Principle 2: *Management should be decentralized to the lowest appropriate level.* **Principle 9:** *Management must recognize the change is inevitable.* **Principle 11:** *The ecosystem approach should consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices*. **Principle 12:** *The ecosystem approach should involve all relevant sectors of society and scientific disciplines*.	**Principle 3:** *Ecosystem managers should consider the effects (actual or potential) of their activities on adjacent and other ecosystems.* **Principle 5:** *Conservation of ecosystem structure and functioning, in order to maintain ecosystem services, should be a priority target of the ecosystem approach.* **Principle 6***: Ecosystem must be managed within the limits of their functioning.* **Principle 7:** *The ecosystem approach should be undertaken at the appropriate spatial and temporal scales*. **Principle 8:** *Recognizing the varying temporal scales and lag-effects that characterize ecosystem processes, objectives for ecosystem management should be set for the long term*.	**Principle 1**: *The objectives of management of land, water and living resources are a matter of societal choices.* **Principle 4:** *Recognizing potential gains from management, there is usually a need to understand and manage the ecosystem in an economic context. Any such ecosystem-management programme should reduce those market distortions that adversely affect biological diversity; align incentives to promote biodiversity conservation and sustainable use; and internalize costs and benefits in the given ecosystem to the extent feasible.* **Principle 10:** *The ecosystem approach should seek the appropriate balance between, and integration of, conservation and use of biological diversity.*

The RAMSAR Convention provides a framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. The concept of wise use is the overarching principle of Ramsar which has been adopted in the MFMP. This states that: "*The act of designating (listing) under the Convention a wetland as internationally important is an appropriate first step along a conservation and sustainable use pathway, the endpoint of, which is achieving the long-term wise (sustainable) use of the site".* Wise use can essentially be equated with sustainable use and thus RAMSAR is an effort to achieve sustainable development of wetlands. The objectives of the Ramsar Convention are to:

- Establish national networks of Ramsar sites in each Contracting Party which fully represent the diversity of wetlands and their key ecological and hydrological functions;
- Contribute to maintaining global biological diversity through the designation and management of appropriate wetland sites;
- Foster cooperation among Contracting Parties, the Convention's International Organization Partners, and local stakeholders in the selection, designation, and management of Ramsar sites;
- Use the Ramsar site network as a tool to promote national, supranational/ regional, and international cooperation in relation to complementary environment treaties.

Currently, Botswana only has one Ramsar site (the Okavango Delta) and the possibilities and net benefits of applying for Ramsar status of the Makgadikgadi wetlands must be pursued during the MFMP implementation.

The time frame for future Makgadikgadi activities is as follows:

- 2011 – 2012: MFMP implementation & MIMP development
- 2013 onwards: MFMP & MIMP implementation

10.3. Ecosystem management

Sustainable development is operationalised through concepts such as Integrated Water Resources Management (water), the ecosystems approach (mostly for wildlife, biodiversity and protected areas) etc. Table 37 provides general resource management directions for all resources and environmental concerns.

Table 37: General resource management directions

	Sustainable development & ecosystems approach
General	All resource management should be flexible and adaptive to deal with natural hazards (fires, droughts & floods) and climate change Commercial resource use: User- pays- principle & Polluter-pays-principle Subsistence resource use: some payment (possibly in kind management responsibilities) Maintenance and use of biodiversity Use natural resources beneficially to improve livelihoods within the limits of their sustainability Resource management is a shared responsibility of all stakeholders Management responsibility needs to be decentralised Prevent or minimise pollution
Water resources	Management to be based on Integrated Water Resource Management Greater emphasis on resource use efficiency Use of non-conventional supplies (rainwater harvesting, re-use of treated wastewater & desalination)

	Water demand management in buildings and reduced water losses
Wildlife resources	Control of elephant numbers & occurrence Off take (legal & illegal) not higher than regeneration Special protection of threatened species Protection of migratory routes Better balance between wildlife conservation & utilisation in all 'wildlife areas' Protected Area (PA) management needs to be participatory (with communities and other local sectors) and decentralised. Pas need to create tangible local benefits. PA management should become growth engine for wildlife and tourism and be fully integrated in the area's development
Land	Most suitable use be promoted Productive capacity of land is maintained Avoid land degradation & bush encroachment
Vegetation	Use should not exceed natural re-growth Loss of species should not occur – be minimised. Protection and controlled use of threatened species Need to prevent depletion of firewood species through development of substitutes (e.g. solar power, gas, electricity) & energy demand management.

Development planning and management

Development always leads to change but the question is whether the changes are acceptable and worth it? This depends on the generated benefits and on the costs/ irreversibility of change. Future developments need to take place within the ecological boundaries. Otherwise, ecosystem functions will be compromised and the integrity of the system will be at risk. Management needs to take place within an economic context, in this case the need to create livelihood benefits and economic growth. Underutilised natural resources need to be used to their full potential and the efficiency of natural resource use needs to be increased. Development and management of the area is a shared responsibility of all stakeholders and therefore, partnerships between the private sector, communities, government and other institutions need to be established.

Use and maintenance of ecosystem functions

The functions of the ecosystem and goods and services provided are fully described in the technical report on Ecology and Hydrogeology (volume 2). The environment is a provider of goods and services, regulates environmental processes and supports human activities. Moreover, the environment provides cultural services and information – knowledge. These functions, goods and services need to be recognised and supported through management.

Recommended MFMP activities are:

1. Fully integrate the sustainable development and ecosystems approaches and the their guidelines and principles (see earlier this chapter and vol. 2) in the management planning and development activities during implementation of the MFMP – (**DEA Implementation Unit**);
2. The most important function that maintains the ephemeral wetland nature is the surface water hydrological regime of the wetland, i.e. the seasonal input from rainfall, rivers, and groundwater and subsequent loss to evaporation. Management activities should include: develop and implement basin level IWRM for the MFMP area **DWA lead agency** to ensure adequate monitoring and effective IWRM accordingly;
3. More detailed valuation study of protected areas, wildlife management areas and communal areas based on a survey; and
4. Integration of indigenous knowledge into MIMP management.

Soils

The origin and geomorphology of the Makgadikgadi's closed basin drainage system provides the mineral salts and nutrients that control the biological component of the system. A unique chemical composition and high nutrient content provides for a unique biological species composition and a highly productive aquatic system. These conditions also control the prevalence of grasslands surrounding the pans and the seasonal productivity that supports and maintains large herbivore populations and their associated predators and scavengers.

Aeolean erosion and transport of soils influence soil structure and sensitivity in the Kalahari sandveld, provide salts and nutrients downwind of the pans in the surrounding grasslands, contribute to groundwater salinity downwind of the pans, e.g. around Rakops, and play a major role in the Aeolian deflation of the pan surface and shaping of the systems topography. These activities ensure the pan surface topographical balance and maintenance of a material deficient deflation system.

Monitoring

- Improved basin wide monitoring of rainfall, temperature and evaporation rates at all the main villages surrounding the MFMP area, and on the main pans themselves – **Department of Meteorological Services** DMS in collaboration with private stakeholder);
- Monitoring the amount and extent of flooding on the pans by MODIS satellite imagery or alternative satellite imagery, and determine the relationship between river discharge and rainfall and flood extent and period – **DWA**.
- Monitoring of the groundwater levels around the pans at and adjacent to the wet spots; (**DWA** to lead, with input from **BotAsh, Debswana,** and **WUC** for the Dukwi and Mokoboxane well fields);
- Groundwater control through groundwater recharge is another main function via palaeolake 'proto pans', fossil rivers, fault lines and general shallow groundwater through-flow, and includes groundwater and capillary fringe control of pan surface deflation and chemical/mineral dissolution and leaching **–DWA and BotAsh** to improve monitoring of specific, strategically positioned groundwater well points on the pan and areas adjacent to the pan in order to get a better understanding of the processes of ground water through flow; and
- River discharge from the Okavango system is also a very important hydrological function, particularly, in light of the recent recurrence of the Boteti's surface discharge to Lake Xau. Seasonal differences in flood regimes between these river systems and the MFMP, contributes important seasonal variation in resource availability and for large mammal population sustainability, an important connection exists among the wetlands of the north. – **DWA** to monitor hydrological regime, seasonality and period of the river.
- Borehole chemistry monitoring around the pans- **DWU & Dep. of Mines**;
- Satellite image analysis of the dust emissions from the pans (**DMS & DGS**);
- Monitoring grass encroachment on the pan surface will help understand the processes behind this phenomenon under accelerated conditions, e.g. Botash well field; and
- Botash need to initiate a monitoring study of changes in the surface and groundwater chemistry of the middle basin of Sua Pan, as a result of the pumping of waste 'bitterns' onto the pan surface (Botash & DoM).

Connectivity and mobility

Connectivity and mobility within the MFMP area and between it and other ecosystems in northern and central Botswana, and in the case of birds, in the rest of the continent and beyond is another crucial process in the biological functioning of this wetland system. Unpredictable and highly

variable changes in rainfall, flooding and associated conditions drive the movement of mammals and birds in and out of the system. It is, therefore, critical to ensure that the migration routes and flyways that maintain this connectivity are kept open and free from obstacles – see wildlife-birdlife section.

Mitigating adverse impacts of development
Development always brings change. Future unsustainable uses should be addressed using the precautionary principle management approach, with adaptive management using key indicators to highlight potential adverse impacts. The potential impacts of the Mosetse Dam on the ecology of the pan system, for example, should be addressed by focused monitoring and adaptive management through effective environmental flow requirements if possible.

10.4. Management of natural resources

10.4.1. Land

Land resources need to be better utilised and land use conflicts need to be reduced. This will provide the basis for livelihood improvements, development and growth and maintaining ecosystems integrity.

Improved management of land used by communities
Usually, communities depend on Tribal Land. Due to inadequate management of State Land in the MFMP area, communities have encroached upon State Land. Therefore, while community used land within the MFMP area is primarily under Tribal land tenure, there are also communal interests in certain parts of CT7, CT8, CT10 and 11, which are State Land. There is significant conflict between pastoral and arable farmers, while rangeland degradation is an issue of increasing concern. While calls to tribalise the State Lands of CT10, CT11 and parts of CT7 have been made in the past, a recent Cabinet Directive "Guidelines on the Management of Rural State Lands, 2010", has made it clear that there will be no change in land tenure. However CHA specific land use management plans will now be developed under the guidance of the Department of Lands and Districts to regulate mixed use development, with lease applications approved according to appropriate and optimal use.

Activities for State Land within the MFMP area (CT10, CT11 and small areas of CT7 and CT8):

1. CHA specific land use management plans must abide by the recommended zones defined by the MFMP pastoral and arable land use suitability maps to ensure mitigation of future land use conflicts (**Dept. of Lands / DLUPUs**);
2. CHA specific land use management plans must abide by the recommendations made within the MFMP on relevant Biodiversity Hotspots, conflict areas, archaeological and heritage sites and Tourism Development Areas (**Dept. of Lands**);
3. Tourism license applications for new developments and the change of leases to permit tourism activities must be frozen until the MFMP Tourism LACs have been developed (**Dept. of Tourism / BTO / DLUPUs / Dept. of Lands**);
4. Borehole development must be stopped within the state lands until the land use management plans have been developed to help optimise land use and reduce land use conflicts **(Water Utilities / DLUPU / Dept of Lands**); and
5. Lease applications for boreholes to develop cattle posts within the state lands must be regulated by the forth coming management plans for these areas, which themselves must

abide by the recommended zones defined by the MFMP pastoral and arable land use suitability maps (**DLUPU / Dept. of Lands**).

Activities for both State and Tribal communal land:

1. Tribal Land Boards and District Land Use Planners must follow the recommended zones defined by the MFMP pastoral and arable land use suitability maps to ensure mitigation of future land use conflicts when allocating new land for boreholes, cattle posts, fields etc. (**Ngwato Land Board / Tutume & Boteti Sub-District Land Use Planners**);
2. Before more land is allocated for fenced ranching, the use of existing fenced component ranches and leasehold ranches should be evaluated. A third of the ranches are not used efficiently, while ten percent are undeveloped (**Dept. of Lands / Tribal Land Boards**);
3. Tourism Licence applications must be frozen within the tribal communal lands until the MFMP Tourism LACs have been developed (**Dept. of Tourism**);
4. Arable farming land is limited within the MFMP. New farming techniques that help improve productivity within these limited areas must be introduced. These include improved techniques for tillage, use of manure and growing of alternative crops (**Dept. of Crop Production**);
5. The use of chemical pesticides and fertilisers must be prohibited in all allocated fields and unallocated Molapo fields within 100m of rivers and alluvial floodplains; and
6. An SEA should be conducted to define areas suitable for commercial horticulture within the MFMP area.

Activities for Protected Areas:

1. MNPNP: apart from the significant ecological benefits, the MNPNP provides few economic or social benefits, especially at the local scale. There is a need to increase the local benefits and for participatory management that will enable tourism growth and improved benefits for surrounding communities through: establishment and development of viable community zones inside MNPNP; development of CBNRM activities around the MNPNP (e.g. Xhumaga); Support to be provided to existing CBOs, with prioritised land allocation to these CBOs; creating opportunities for crafts and other activities for tourists; employment of local population for maintenance activities inside the MNPNP;
2. Flamingo Sanctuary: increase the local benefits and encourage community participation in management through: development of CBNRM activities around the sanctuary; creating opportunities for crafts and other activities for tourists; employment of local population for maintenance activities inside the sanctuary; and
3. Nata Sanctuary: increase the local benefits and support the joint venture between the communities and JVP.

10.4.2. Wildlife

Wildlife resources need to be sustained, wildlife- human conflicts need to be resolved and wildlife needs to generate more local benefits. The MNPNP encompasses just over 20% of the total MFMP area. Apart from the significant ecological benefits that the park provides there are few associated economic or social benefits, especially at the local scale. There is a need for improved management that will enable the improved availability of accommodation, better use of existing facilities (e.g. occupancy rate of camps is around 20%) improved tourism marketing and improved benefits for surrounding communities.

Improved management and use of National Parks

1. Review of different Park management models, including different extents of privatisation, and adoption of participatory, adaptive and more decentralised park management with a better balance between utilisation and conservation and generation of more local benefits from the Park (**e.g. in partnership with Birdlife Botswana project**);
2. Improve the marketing of the tourist attractions of the MNPNP and the MFMP such as the zebra and wildebeest migration, archaeology along the Boteti and within the park (**BTO, in collaboration with CBOs and private sector**);
3. Investment in improved tourism infrastructure in the MPNP to facilitate improved game viewing within the park such as an extended road network, additional private and public campsites to the east of the park, improved maintenance of existing artificial water points (**DWNP**); and
4. New community use zones should be developed and implemented within the MNPNP, i.e. along the Boteti River to assist in the creation of CBNRM initiatives (DWNP); natural resource collection zones should also be established in the north-east of the MNPNP, where communities could cut under supervision or during the day (**DWNP**); and
5. Plan development & implementation for Flamingo Sanctuary (DWNP & Birdlife Botswana).

Improved elephant management and control

The Botswana elephant population is rising at around 6% per annum, with an increasing spatial extent of the estimated 156 000 elephants into areas such as the MFMP area. The Makgadikgadi area has seen a gradual increase in the numbers and spatial influence of elephants in the past decade, with a resulting increase in human wildlife conflicts. The elephant management plan (2008) provides CHA specific guidelines for management which should form the basis for recommended management within the MFMP.

Activities for elephant management are:

1. Implementation of the Elephant Management Plan for the MFMP area to control elephants and mitigate conflicts (**DWNP**). The Makgadikgadi FMP area covers four different zones within the Elephant management plan:
    a. Elephant free zone (CT8, CT19, CT21, CT13, CT14 & CT15);
    b. Reduced conflict zone (CT4, CT5, CT6, CT7, CT10, CT11, NG49 & NG51);
    c. Maximise benefits from elephants (NG47); and
    d. Protected areas (NG48 & CT9).
2. The Makgadikgadi Game Proof fence should be electrified from the national grid, which is soon to supply electricity to Xhumaga. Sections of the fence should be electrified separately to account for where it crosses the water of the Boteti River. This should be addressed in the fence SEA (**DWNP**).

Birdlife

The MFMP area presents one of the most important bird areas within southern Africa, but much of the wetland areas crucial to migratory birdlife are not protected. The establishment of the Flamingo Sanctuary is a significant step towards the protection of these vital areas, as it the identification of the Biodiversity Hotspots.

Activities to improve birdlife management:

1. Finalise and implement the Flamingo Sanctuary regulations (**DWNP**);
2. Develop and implement a management plan for the area with communities and other stakeholders; the preferred allocation of parts of CT 13, including the flamingo sanctuary

and CT 21 to local communities is part of a new CBNRM initiative. The exact area needs to be delineated in consultation with CBOs (**DWNP, Birdlife Botswana & Community CBO**);
3. Development species-specific action plans for two globally threatened birds, for which the area comprises a major habitat: Lesser Flamingo (to be done in 2011) and Chestnut-banded Plover (to be done in 2012) (**Birdlife Botswana**);
4. Revise bird hunting quotas within the MFMP area (**DWNP & Birdlife Botswana**);
5. The fence SEA must consider birdlife issues with specific reference to those fences that are aligned across the salt pan or in close proximity to the salt pan **(DVS & DEA).**

Development and management of Artificial Water Points (AWPs)

Artificial water points have been developed inside the MNPNP along to Boteti River to stabilise and improve wildlife numbers and reduce their exposure to drought. A holistic approach to the management of these existing water points and for the development of new water points is required to ensure that the natural dynamics of the system are not detrimentally affected, while use of the water holes by wildlife and the benefits of the water points for use by tourism activities is maximised.

Activities for the development and management of AWPs:

1. The nine AWPs along the Boteti River are not utilised to their full potential by wildlife as they are located within the dense Acacia riparian wooded shrubland of the Boteti. The bush (all shrubs of < than 3m, but no mature trees) should be cleared from around the AWPs for a distance of 80m, to help attract wildlife to use these AWPs in safety from predators (**DWNP**);
2. If the Boteti fence alignment is changed then the AWPs may become obsolete while the river is still flowing and should therefore be switched off until the Boteti River stops flowing (**DWNP**);
3. Any AWP developed in the eastern side of the MNPNP, or CT11 should be operated on a seasonal basis. The AWPs should not be filled towards the end of the wet season in order not to attract migratory wildlife to remain resident in the region. The AWPs should only be operated from between April-October to help build up true resident species numbers such as kudu, hartebeest, springbok and impala (**DWNP & Private operators**);
4. New AWPs should be developed by DWNP in the north western area of the MNPNP and by the Xhauxhwatubi Development Trust in NG49 to facilitate wildlife's improved access to grazing resources and break their restrictive central place foraging strategy around the water points for Xhumaga and Meno-a-Kwena. Improved water access would also reduce the risk to wildlife from loss of forage material along the Boteti River from fire;
5. If the Boteti River stops flowing again then provision must be made to develop a second deep, permanent pool for the resident hippo population to help alleviate social stress (**Private operators**);
6. The AWPs established by the hunting safari operators within NG47 and NG49 should be maintained, even if hunting operations cease following the implementation of the 25km no hunting buffer (**Private operators**); and
7. All AWPs must be managed in accordance with Limits of Acceptable Change (LAC) such as those defined by the Chobe NP Management Plan (Figure 42) (**DWNP & Private operators**).

Figure 42: Management guidelines for AWPs

If there is a 40% reduction in the number of trees between a) 2m and 5m tall, or b) over 5m tall and between 3km - 5km from any of the artificial waterholes compared with baseline data – switch off pump for 2 dry seasons.

If there is a 20% reduction in the number of trees between a) 2m and 5m or b) over 5m tall and between 5km - 7km from the waterholes compared with baseline data – switch off pump for 2 dry seasons.

If bush encroachment between 100m to 500m from the waterhole exceeds twice that of the baseline data – switch off pump for 2 dry seasons.

If elephants at a waterhole on any day between September and November exceed the estimated number that the yield of the borehole can provide (estimating each elephant requires 200l per day) - switch off pump and establish a monthly rotation strategy between boreholes.

If there are three reports of elephants damaging infrastructure in a year - switch off pump and establish a monthly rotation strategy between boreholes.

Anti- poaching

Poaching of zebra within the MNPNP is estimated to be 10% per annum, while declines in other herbivore populations may be related to poaching pressure.

Activities required to improve anti-poaching:

1. Community involvement and avoid a solely top-down approach of 2-4 below (**DWNP**);
2. DWNP or BDF to have permanent Anti-Poaching-Unit (APU) based within the MNPNP to conduct regular patrols (**DWNP**);
3. Private operators to have direct line of communication with DWNP APU to assist with anti-poaching; and
4. Concessionaires of NG47, NG49 and also possibly CT11 and the Nata Sanctuary to employ permanent anti-poaching patrol units within each of these areas to assist DWNP.

Improved wildlife compensation

Current compensation systems are not effective as methods to appease local communities for the impacts of human-wildlife conflict. DWNP compensation payment is low, while the administrative process and payment are slow. In order to change people's perceptions and attitudes towards wildlife the compensation system needs to be modified.

Activities to improve wildlife compensation system:

1. Review of alternative compensations scheme models; this activity should also include exploring insurance compensation schemes, in point 3 below (**DWNP**);
2. Indirect compensation in the form of improved CBNRM initiatives or improved involvement in tourism operations is required, especially in high conflict areas. This would be facilitated with improved land allocation to the CBOs in high conflict areas to help initiate their own CBNRM projects, such as along the Boteti River, in CT10 and in CT11 (**BTO**);
3. The high negative impacts from wildlife for communities living next to PAs in the MFMP are not associated with many benefits from wildlife. Indirect compensation in the form of

improved CBNRM initiatives or improved involvement in tourism operations is required, especially in high conflict areas. This would be facilitated with improved land allocation to the CBOs in high conflict areas to help initiate their own CBNRM projects, such as along the Boteti River, in CT10 and in CT11 (**BTO**);

4. Insurance schemes should be piloted as part of CBNRM initiatives. Community based insurance schemes would improve the payment and speed of assessment and payment of compensation to farmers. Payment into the scheme should be made by all stakeholders, i.e. farmers, tourism enterprises, CBOs, and DWNP (**Botswana Predator Conservation Trust and DWNP**); and
5. Develop and implement more pilot capacity building and education/awareness projects on human-wildlife conflict in the area, e.g. Gweta. Improved community awareness and the provision of training is required about different forms of conflict mitigation such as the use of chili peppers / field clusters / improved fencing designs etc. An on-going World Bank funded project should be directed at areas such as Gweta which have seen a significant rise in human-elephant conflicts where alternative training mechanisms would provide a significant benefit to communities (**DWNP**).

Wildlife migration

Connectivity between the MFMP area and the more northerly systems of the Okavango, Linyanti and Chobe river systems is a prerequisite for ensuring the long-term viability of wildlife populations within the MFMP.

Activities to maintain wildlife migration:

1. The WMA status of area to the north of the MFMP area should be preserved and gazetted (**Dept. of Lands**);
2. A feasibility study on the potential to develop a fenced corridor linking the CKGR and the MNPNP should be undertaken (**DWNP, Dept. of Lands & Ngwato Land Board**); and
3. The eastern fence along the Nata Sanctuary should be realigned to the original lease area boundary, to help link up the Botash mining lease area (with several hundred wildebeest) with the Sanctuary. This will help to improve resource availability for wildlife in the area and help to build numbers within this wildlife population (**Botash & Hedgerow**).

10.4.4. Water resources

Water resource management in the MFMP area needs to be based on the concept of Integrated Water Resources Management (IWRM). This is in accordance to the 2006 Review of the Botswana Water Master Plan and SADC Policy and Strategy. IWRM requires that water resources are considered as:

- Renewable resources, which should not be mined (some groundwater resources may however be fossil). Moreover, sufficient water needs to be reserved to maintain ecosystem services;
- Economic and social goods. Water has a value and price but needs to be affordable for the basic needs. Water resources need to be used as efficiently as possible after the environmental requirements and basic human needs have been met; and
- A joint responsibility of all (even though the resource is owned by the State). This means that all stakeholders are responsible for the efficient and sustainable use of water resources.

The hydro(geo)logical report (volume 2) has improved the understanding of the hydrological flood regime, and identified so-called ‘wet spots’. There is, however, current knowledge of these

hydrological 'hot spots' is inadequate and needs to be improved. Furthermore, a start has been made with the construction of a water balance for the area, but the current water balance is incomplete due to data gaps. More work is needed in this regard.

Continued pumping by Botswana Ash in the north basin of Sua Pan has had significant impact in terms of groundwater draw-down by up to three meters in the pumping well field area of the pan. The understanding of the recharge of this brine and of the impacts the pumping on the groundwater in the surrounding pan and grasslands is still limited[4]. There is, therefore, an urgent need to evaluate the feasibility of a long term monitoring program in and around of Botash well field, using additional strategically placed monitoring boreholes to improve understanding of brine, surface and ground water processes, recharge controls and rate as well as its impact on the level/topography of the pan. This would be a pre-requisite to allocation of an extension of the well field concession area to the south.

Recommended activities to encourage sustainable water use and management are:

1. Ensure that water use and management are fully integrated into land use planning and vice versa. At present, water and land management are largely separate processes and planning cycles (LB & DWA);
2. Carry out a more detailed analysis of the identified wet spots and their management requirements. Until the spots are better understood the precautionary principle should be applied to their use;
3. Explore sustainable water supply source as alternatives to Dukwi and Orapa well fields, for example other well fields and access to the possible Kazungula – Francistown water transfer scheme;
4. Defer up-stream river developments with significant down-stream impacts. At present, deferment of the construction of the Mosetse dam is recommended until more info about the required environmental flow for the Pans is available. This should be combined with a cost-benefit analysis and search for alternative water supplies **(DWA);**
5. Removal of all river bunds/weirs in the lower Boteti River to allow natural flows and flooding (**DWA/Debswana/DEA; mostly done or completed)**;
6. Preparation of an area specific IWRM plan with emphasis on water demand management. This would include:
    - recycling of wastewater;
    - re-use of mine water
    - Use of saline water for mining (where possible) and desalination ;
    - Search for water resources to meet future water commercial water needs, especially mining, including use of saline and storm water;
7. Initiative discussions with relevant stakeholders in shared water courses (Okavango and Nata Rivers) and ensure flow requirements for the Pans will be met in future; and
8. Ensuring that water demand management (WDM) is fully integrated in all projects and developments in the MFMP area. This include re-use and recycling of wastewater, water harvesting and desalination (**DWA and DEA**);
9. Compile a complete water balance for the MFMP area, including ground and surface water. This requires:
    I. Improved hydrological monitoring of the main discharge rivers flowing onto Sua Pan, in the East and the Boteti River, to the west, and additional monitoring sites on the Lepashe and along the Nata and Mosetse Rivers closer to the pan would

[4] Current indications are that recharge of brine is minimal, making it a non-renewable resource.

be very beneficial to capture the amount of groundwater loss in the karstic areas next to the main pans (**DWA**);

II. Improved understanding of the topography of the river basin catchment and the pan surface to understand the dynamics of river discharge and flooding intensity and period **(DWA)**;
III. Assessment of minimum environmental flow requirements to sustain ecological integrity **(DWA)**;
IV. Assessment of the impacts on groundwater levels of dewatering for mining;
V. Understanding of the impacts of climate change on water sources **(DMS and DWA).**

10.4.5. Rangeland resources

The Makgadikgadi pans are surrounded by grasslands and woodlands, which support important livelihood sources. Relatively little is known about the status of the area's flora, but the main threats to wild plants come in the form of non-sustainable harvesting, hydrological changes, alien invasive species, climate change and overgrazing. According to the Red Data List rangeland degradation poses the most serious threat. Most of the rangelands are used for communal grazing and high livestock numbers around watering points and settlements put increasing pressure on the indigenous flora. Degraded lands are in turn subjected to bush encroachment and facilitate the spread of invasive species. In addition, over harvesting of wood and other vegetation products is posing a threat to vegetation, particularly in the drier areas to the southwest.

Proposed activities for sustainable management of rangeland resources:

1. Establish the distribution and status of RDL and endemic species throughout the MFMP area (**DFRR**);
2. Establish IPAs areas based on the above study and develop and implement formal protection and guidelines for the appropriate management of these IPAs, in order to provide protection and appropriate management of Red Data List species in the area. RDL species found in the area include *Hoodia lugardii*, an *Orbea* sp., *Blepharis bainesii*, a *Harpagophytum* sp., *Panicum colorautm var makarikarienses, Panicum pilgerianum*, and *Sporobululs bechuanicus* (**DFRR)**;
3. Some trees, including stands of Baobabs (*Adansonia digitata*) and Bird Plum (*Berchemia discolor*), are listed as protected and some stands of Baobab and Marula are protected as national monuments. Other exceptional stands of Baobab and Marula should also be listed, e.g. the extensive stand of Baobab trees in the southeast corner of Sua Pan-Mea Pan area. Trees on communal land are unprotected and appropriate management of these trees should be incorporated into CBNRM activities (DFRR);
4. Establish a community based rangeland (and livestock management) scheme in the Rakops - Mopipi area, similar to the ones ran by the Indigenous Vegetation Project. Such schemes have considerable potential to address poverty and poor management of communal resources. While measures have the potential to improve the primary and secondary productivity of the rangelands, they will not overcome the ecological constraints imposed by poor rainfall and soils. A carrying capacity of 16.5ha/lsu should, therefore, be adhered to (**Department of Livestock Production and DEA Implementation Unit**);

10.5. Waste management and pollution control

Increased waste is an outcome of economic development and improved living standards. Waste it however, must be minimised and where it is inevitable, must be properly collected and disposed off. The management of waste should ensure protection of the environment through education, awareness and enforcement of relevant legislation. Sensitisation to good practices, and the enforcement of legislation must be strengthened within the MFMP area. The Waste Management Strategy of 1998 states that waste management will be carried out in a manner that protects human health and the environment, and that ensures prudent use of natural resources. It captures the principles of prevention, the polluter-pays and the principle of cooperation. The strategy adopts an internationally accepted waste management hierarchy of: waste reuse and recycling; waste treatment and waste disposal.

Local communities and other important stakeholders need to participate in the development and implementation of waste management plans within the MFMP area. Though most villages within the MFMP area have dump sites, there is still a problem of indiscriminate dumping; abandoned burrow pits turn into waste dumps. The absence of a District Waste Management Strategy exacerbates the problem. There is inadequate monitoring to ensure that the contractors decommission the burrow pits at the end of the project as per Environmental Management Plans (EMP).

Development and implementation of District Waste Management Plans for both Tutume and Boteti sub-districts as required by the Waste Management Act of 1998. These plans should contain information on:

- Kind and quantities of controlled waste being generated;
- Waste disposal sites and public and private waste management facilities in its area;
- Staff, equipment and other material used for operating the publicly owned sites;
- Kinds and quantities of controlled waste;
- “Local litter plan” as part of the local waste management plan, as required by the Waste Management Act of 1998 (section 11).
- Methods that the local authority intends to use in the management of waste; and
- Estimated costs of the different waste management methods in the plan.

Development and implementation of Waste Recycling Plan should include.

- Kind and quantity of controlled waste that could be recycled;
- Implication the recycling plan would have on the waste management services provided by the local authority; and
- Estimated costs or saving attributable to the methods dealing with waste in the manner provided the plan.

MFMP activities to improve the management of waste are:

1. Sanitation programmes to improve access to safe sanitation (**CDC, Sowa Town Council, Boteti & Tutume Sub-Districts)**;
2. Establish community participation in waste management within the MFMP area (eg. collection of waste by donkey carts) **(CDC, Sowa Town Council, Boteti & Tutume Sub-Districts);**

3. Institutional support to communities to initiate and incorporate waste recycling projects as part of their management plans for Trusts (**CDC, Sowa Town Council, Boteti & Tutume Sub-Districts);**
4. Explore the use of new, appropriate/Best Available Technologies for onsite sanitation facilities (**DWM&PC, CDC, Sowa Town Council, Boteti & Tutume Sub-Districts);**
5. Privatisation of some aspects of waste management (e.g. collection) (**DWM&PC, Sowa Town Council, CDC, Boteti & Tutume Sub-Districts);**
6. Improve the management of waste within tourism facilities and ensure that all dumping sites are fenced (**BTO, DOT, DWM&PC, CDC, Boteti & Tutume Sub-Districts);**
7. Improve the monitoring of waste management through the implementation of their EMS (emissions, re-use of coal waste, waste water/bitteons from the processing) and regular inspection for compliance by government (**DWMPC, private sector, Botash);**
8. Ensure compliance with the national policies requirements and international obligations (waste management strategy, NMPWWS, Waste Management Act, SC on POPs, Basel Convention) - (**DWM&PC, private sector, CDC, Boteti & Tutume Sub-Districts);** and
9. Intensify public education and awareness on waste management within the MFMP area (**DWM&PC, CDC, Boteti & Tutume Sub-Districts).**

10.6. Hazard management

Fires

While fires are integral part of semi arid ecosystems, they also have a significant detrimental impact on both livelihoods and wildlife within the MFMP area. The economic valuation and livelihood surveys identified the importance of natural resource use to rural livelihoods in the region, while the fencing the MNPNP has increased the vulnerability of wildlife to the impacts of fire and subsequent loss of forage.

Activities to improve the management of fires are:

1. A holistic and systematic review of the firebreaks within the MFMP area is required to ensure that alignments are effective, while not exposing fragile soils to excessive wind erosion. Consideration should be given to firebreaks placed within the MNPNP, running North-to-South in an alignment 20km East of Xhumaga to protect the forage along the Boteti River (**DFRR and DWNP**). This review should be linked to the review of all fences;
2. Implementation of the Fire Management Strategy should be employed at a local level within the MFMP area to help mitigate the development and spread of fires, such as extensive education and public awareness for local communities, and provide training and encourage local participation in fire management (**DFRR**);
3. Construction and maintenance of firebreaks in line with the results of the firebreaks review (DFRR & DWNP);
4. Conduct Public Education and Awareness campaigns on fire management within MFMP area (**DFRR, CDC, Boteti and Tutume sub-district)**;
5. Facilitate the development of District Fire Contingency Plans for both Boteti and Tutume Sub-districts (**DFRR**, **Sowa Town Council, Boteti and Tutume sub-district)**;
6. Maintenance of fire break networks within the MFMP area (**DFRR, CDC. Boteti and Tutume sub-district**; and
7. Develop a Fire Zone Map for MFMP area (**DFRR, Dept of Surveys and Mapping**)

Drought

Drought refers to a deficiency in rainfall in terms of its timing, spatial and temporal distribution and / or overall amounts received. It includes the effects and severity of the deficiencies on crop/plant growth, livestock, wildlife, water supplies, and ultimately human livelihoods and food security in general. Droughts have a major adverse impact on people's livelihoods and economic growth.

Therefore, drought monitoring and management is a national priority and Botswana has a well established continuous drought monitoring process in place to ensure effective preparedness and response. Village, district and national government institutions participate in the process. Government carries out drought and food security assessments once or twice yearly as may be necessary. The purpose of the Drought and Food Security Assessments is to complement early-warning monitoring reports compiled on a monthly basis by the various Government Departments and Ministries. The assessments are the yard stick used to determine the need or otherwise for Government interventions, particularly taking into account the prevailing situation and levels of vulnerability as revealed by such assessments.

Recommended activity to cope with droughts is:

1. Participation in established drought monitoring framework and identification of the required measures to cope with droughts in the MFMP area (VDCs, Councils & DDCs). This requires collaboration between the (sub-) districts.

Climate change
Climate change will have an impact on people's livelihoods and on natural resources as well as the integral ecosystem. Temperatures will increase and so will evapotranspiration. Extreme events are expected to increase with increased frequency of droughts and floods, affecting for example crop production. The impact on river flows and the wet spots is uncertain. However, the Transboundary Diagnostic Analysis for the Okavango River Basin shows that increased levels of upstream developments (e.g. irrigation, dams, hydropower projects and water transfer schemes) in the basin are likely to adversely affect the Okavango Delta and the Boteti River. High levels of development in the basin would lead to significant drying out of the delta and the Boteti River; medium development *and* climate change would have the same impact.

The MFMP strategy aims to further the understanding of the impacts of climate change on the area and to increase people's coping strategy. The following activities are proposed:

1. Area specific application of climate change predictions and the consequences for water resources through the application of the WEAP model to the MFMP area. The Water Evaluation And Planning model (WEAP) is a useful tool to complete a water resources analysis and is proposed to be used in Botswana by the World Bank. The proposed adaptations and mitigation measures can be implemented as part of the IMP (**DEA, DWA & DMS**); and
2. Ensuring that impacts of climate change (as a cross cutting issue), in particular preparedness for droughts and floods, are incorporated into development planning and development of specific sectors (e.g. crop and livestock production and tourism) (**MFDP, MoA, MEWT and MMEWR**).

10.7. Biodiversity hotspots

Biodiversity Hotspots are areas of highest conservation priority and assist in directing limited management and conservation resources in a strategic manner to help address the protection of

biodiversity and ecosystem functioning. As well as providing direct protection to species, site conservation can also reduce the loss of natural habitats, the main cause of extinctions. BD hotspots also provide ideal reference sites for monitoring the state of biodiversity.

Main activity for biodiversity hotspot management:

1. Immediate protection, conservation and management of the highest ranked priority hotspots, identified in the Ecology and Hydrogeology report (volume 2 and Tables 8 and 38 in this report). These sites should be appropriately considered in spatial planning (Land Board, Department of Lands and District Councils). Priority should be given to those sites most vulnerable, and those outside protected areas. Table 38 shows a simple management framework matrix for the ten sites, listed in order of priority, including the character and management implications for each. It is recommended that specific management plans are developed for these hotspot areas, and that an appropriate management provision is included in the CHA management plans. Three management plans should be produced per annum as follows:

   2011: Boteti River and up-dating MNPNP and Nata Sanctuary Plan
   2012: Nata River, Boteti Delta and NG 47
   2013: Lake Xau, Mosu and Rysana Pan

   Beyond 2013, management plans need to be developed for all BD hotspots, preferably as part of management plans for larger areas (e.g. CHAs).
   A development freeze is required in all BD hotspots until their site specific management plans are complete (**DLUPUs, Land Boards, Dept. of Lands**).

   A valuation element of these hotspots should be incorporated into this management planning to clearly identify their potential benefits to local communities. The management plans should be guided by reputed management principles such as the IUCN Protected area guidelines, the Ramsar Guidelines to Management Planning (Wise Use Handbook No 16), IWRM guidelines etc..

Table 38: Management measures for priority biodiversity hotspots

Rank	Sites	Management measures
1	Boteti River	Management Plan required (CT8??)- Community use protected area guidelines (Category IV, IUCN) Need for IWRM practices and improved rangeland and veld products management
2	MPNP	Protected area (MPNPNP) management plan review and update to category 1b/Wilderness area guidelines (IUCN)
3	Nata Sanctuary	Protected area (Sanctuary - JVP) management plan already in place, update to incorporate 1b/Wilderness area guidelines (IUCN)
4	Nxai & Kudiakam Pan	Protected area (MPNPNP) management plan review and update to category 1b/Wilderness area guidelines (IUCN)
5	Nata River	Community use protected area guidelines (Category IV, IUCN) Need for IWRM practices and improved rangeland and veld products management
6	Boteti Delta	State Land Management Plan required - Community use protected area guidelines (Category IV, IUCN). Need for IWRM practices and improved rangeland and veld product management
7	NG 47	Management Plan required - Protected area (WMA) using category V/Landscape area guidelines (IUCN)
8	Lake Xau	Management Plan required - Community use protected area guidelines (Category IV, IUCN). Need for IWRM practices and improved rangeland and veld products management
9	Mosu	Management Plan required (CT8??)- Community use protected area guidelines (Category IV, IUCN). Need for IWRM practices and improved rangeland and veld products management
10	Rysana Pan	Management Plan required (CT8??)- Community use protected area guidelines (Category IV, IUCN). Need for IWRM practices and improved rangeland and veld products management

It is important to recognize hotspots in the context of their place in the overall ecosystem. Hotspots also provide locations to monitor change; including as reference sites and indicators representing the broader ecosystem integrity. The hotspots should provide priority locations/reference sites for monitoring change to the systems biodiversity, according to the responsibilities and action required under the agreements of the CBD, UNCCD and UN Climate Change agreements.

In addition, there needs to be an 'ecologically coherent network' of BD hotspots to ensure connectivity and robustness. Building and integrating the concept of "hotspot" conservation into the overall protection and conservation of the Makgadikgadi requires significant further attention to highlight their links with and importance to other hotspots, the system as a whole, and the ecological functions that maintain the systems' integrity (see research section).

2. All 61 hotspots need to be formally recognised and incorporated in management plans, land use planning and in the EIA process and the precautionary principle should be applied to any proposed development or project. The sixty one BD hotspots were identified through a multi-criteria analysis based on the best scientific knowledge and include (see E & H Report, volume 2):

- "Wet spots"; areas of pronounced and prolonged surface water, identified in the specialist hydrological report, and which were also deemed the most important habitat for wetland birds;
- Core mammal distribution 'hotspots', identified in the wildlife component report, as areas of most concentrated large mammal numbers year round;
- Important Bird Areas (IBA);
- Important Plant areas (IPA), identified in Botswana's Biodiversity Strategy Action Plan (2003), as areas containing Red Data List species on and around the MFMP area, and;
- Sites/areas of important hydrological input and, therefore, ecosystem functioning, i.e. the main rivers and discharge points.

3. More detailed assessment (or cross check) of community knowledge about all biodiversity hotspots, in particular the most important ones. In this way, indigenous knowledge would be fully utilised to identify the most important areas are for wildlife, birdlife and other biodiversity aspects. Examples of important wildlife areas that came up in the community consultations as part of the MFMP were Lenao la ga Kwalabe, near Kedia in CT8, Sexhara and Thabatshekwe pans near Zoroga. The ranking of the hotspots should also be adjusted according to this community consultation feedback.

10.8. Environmental monitoring and research

Monitoring and research are integral part of the MFMP implementation. Monitoring and research are done for several reasons:

1. Management effectiveness: impact assessment of the MFMP in terms of its sustainable development objectives of conserving resources and the ecosystem and improving livelihoods;
2. Improving the understanding of the MFMP ecosystem (e.g. climate change, hydrology, small predators) and its uses to fill gaps and provide a better foundation for management; and
3. Early warning of emerging management challenges (e.g. alien invasive species).

10.8.1. Monitoring programme

Sound ecological monitoring is essential to monitor change in the ecological character of a wetland system and to enact effective, adaptive management strategies in response to that change. Indicators are used to facilitate monitoring and these should be key ecological (physical, chemical or biological) features that reflect the state or response of the system to those changes occurring as a result of impact. The "Limits of Acceptable Change" (LACs) approach to monitoring also requires good baseline data to monitor change by effective, consistent monitoring to record change and act with appropriate management interventions to mitigate any changes that exceed set thresholds over and above the natural variation of the indicators. Most of all, good monitoring requires the capacity, or if absent, the training required to conduct the monitoring. To ensure successful management, any monitoring and management plan should complement existing regional strategies such as from the DWNP and the MOMs surveys, DWA hydrological monitoring and private monitoring at mines.

Where unacceptable change to the ecological character of a wetland occurs, identified by a negative impact on the related indicator/s, the local management authority, e.g. DEA / DWNP / DWA, local communities, and private institutions should intervene to correct those negative impacts through interactive, flexible and feasible management interventions/mitigation methods.

The monitoring programme should be an integral part of a site specific wetland management plan (Ramsar Wise Use Handbook, Vol 16). Monitoring is defined in the Ramsar Framework for Wetland Inventory (Ramsar Wise Use Handbook 11 & 12) as "*Collection of specific information for management purposes in response to hypotheses derived from assessment activities and the use of these monitoring results for implementing appropriate, adaptive management".*

Monitoring should be participatory and encourage multi-sectoral engagement in the activities required for efficient, cost effective monitoring. Indeed, much of the monitoring required (outlined in the table below) can be incorporated into existing government, NGO and private institutions' monitoring programmes. The monitoring programme outlines the monitoring targets and appropriate indicators. Orapa and Letlhakane management, for example, already have a good effective monitoring program, that can be implemented straight away, which will continuously look at new ways to combat the growing loss of groundwater resources and extraction requirements. As a result, some initiatives have already been put in place such as drilling for alternative saline groundwater sources to the south of Orapa and northeast of Mopipi, a desalination plant, and the drilling of ultra deep boreholes to access saline water, and improved borehole efficiency through rehabilitation. Long-term plans proposed also consider piping in water from the Gweta aquifer or from the newly proposed Zambezi pipeline.

The Ramsar framework for wetland monitoring programme has been adapted for the MFMP to better reflect the Makgadikgadi priorities for resources conservation as well as economic growth and livelihood improvements. Regular monitoring is required and it is recommended that the framework is adopted at the start of the MFMP implementation. A more detailed monitoring framework is provided in Appendix 3.

Table 39: A proposed sustainability monitoring programme framework for the MFMP area

Monitoring of 'Economic, social and institutional sustainabiltiy'
These monitoring costs are estimated to be P 0.3 – 0.5 million p.a.

Management goal	Source	Indicator	Method & costs	Data availability	Responsibility
Improving livelihoods	Income Employment Increased agricultural productivity	Poverty reduction Increase in no of livelihood sources Decreased number of people on welfare Increased livestock off-take and animal quality Increased arable yields Increased income & employment from natural resource harvesting & processing	Household Income and Expenditure survey (costs absorbed) Employment statistics (costs absorbed) Est. Livestock sales (BMC, local butchers) (costs absorbed) Est. Crop yields and area harvested (costs absorbed)	HIES – CSO Mon. Survey Councils MoA – extension staff	CSO DEA – IU
Economic growth through tourism, improving agriculture and mining	Revenues and value added from mining & tourism	Increase in commercial enterprises and value added Formal employment in private sector	Company registration Est. Revenues Employment stats Valuation follow up study P 250 000 one time)	Registry of Companies, DoM, BTO and DoT CSO	
Increasing local benefits		No of local support & social responsibility programmes of enterprises (e.g. mining & tourism) Tourism & CBNRM partnerships Increase local benefits from MNPNP	MFMP impact assessment study (annual) P 100 000 p.a.	DWNP & CBNRM Forum	DEA – IU
Participatory, decentralised and consultative management		Non-state participation in management of MNPNP (e.g. meetings) Increased implementation by local institutions Successful CBNRM projects Non-state participation in MFMP implementation committee	MFMP impact assessment study (annual)	Study	DEA - IU
Coordinated management		Coordination between districts of	Meetings and coordinated		DEA - IU

across districts and sectors		the MFMP Cross sectoral planning & development	actions (absorbed costs)		
Protect and support vulnerable groups		Participation of women, poor and youth in MFMP projects Benefits derived from MFMP by the poor, women and youth	MFMP impact assessment study (annual)	Councils and study	DEA - IU
Protection and utilisation of cultural heritage sites		No disappearance of artifacts & other cultural heritage Number of management plans and fenced sites	Survey of NM and other key lists (P 200 000 p.a.)		DNM&M

Ecological and biophysical sustainability

The costs of ecological and biophysical costs are estimated to be P 2 million per annum.

Management objective	Source	Indicator	Method & Costs	Data availability	Responsibility
Altered Ecosystem integrity: Through impacts on main ecosystem functions –	Surface Water abstraction (dams, irrigation, mining), Groundwater exploitation (increased boreholes, mining off take, mining brine, municipal), Pumping brine onto pan, Catchment soil erosion and pollution, Altered water levels or pollutant affecting keystone species and/or trophic level interaction, Fences, roads and power lines impacting on keystone species and/or trophic level interaction, Climate change	• Keystone indicator species – Zebra, Elephant, Flamingo, Pelicans, crustacean community, • Borehole Water Chemistry and draw-down level at key well point sites, e.g. BotAsh. • Daily rainfall – river hydrology - flood extent relationships. • Borehole density & livestock numbers, • Fire occurrence and dust emissions	• Key stone species population counts (DWNP aerial surveys resumed, & BLB, private research/institution) – P250,000/annum. • Borehole level monitoring at Botash & strategic peizometer readings of shallow ground water at conflict sites, e.g. BotAsh well field (DWA & BotAsh) – P300,000 initial outlay and P50,000/annum with help from BotAsh and Debswana • Conductivity, pH, & nutrient measurements from Identified Conflict areas & top ten 'Wetspots' (E & H Component) (DWA) – P50,000/annum. with help from BotAsh and Debswana • Strategic sampling of algae and invertebrate community at key conflict sites, e.g. BotAsh, Mosetse Dam basin and Dukwi Copper mine food waters (DWA) – P50,000/annum, • Daily rainfall events analysis and modelling in climate change models (DMS& researchers) – absorbed, • Fire occurrence and scare monitoring, concentrating on sensitive areas, e.g. MPNPNP (DFRR, DoA, DGS) – COSTS absorbed, • Borehole and livestock numbers and carrying	-DWNP aerial survey data for mammals Wetlands, -International Bi-annual waterfowl counts for birdlife, -Independent research baseline data for Elephant, Zebra, Flamingo and Sua crustacean community. DGS and independent study (see site inventory) borehole data, Botswana Ash pumping data, DMS and DWA annual monitoring database for rainfall (data for 11 stations since 1960's) and river discharge (data for 4 rivers since 1970's)	Lead: DEA Implementation Unit in collaboration with the Wetlands Stakeholders Committee.

			capacities monitored, concentrating on high impact areas, e.g. Rakops (MoA– statistics & DFRR) - absorbed		
Altered hydrologic regime	Altered surface water flow, e.g. dams, irrigation Groundwater exploitation Climate change Boteti River Flow – natural	• Flow magnitude, timing, duration, frequency in relation to rainfall, • Pan dusts increase from pan • Borehole level drawdown, on pan and surrounding rangeland, municipal and mining boreholes, • Daily Rainfall data and temperatures, • Salt bush (*Suaeda merxmuelleri*) encroachment on pan surface, with nebka dune formation • Indicators of improved/decreased social and livelihoods	• GIS remote sensing (free MODIS imagery) analysis of flood extent in relation to daily rainfall events and river discharge (DGS & DMS – statistics, & research) – P30,000/annum, • Piezometer groundwater monitoring at top ten Wet spots' (E & H Component), (DWA with help from BotAsh and Debswana) – absorbed costs. • Improved River Discharge at all inflowing rivers – increase number on each & increase info collected to include chemistry and nutrient samples (DWA) – P600,000, • Borehole levels and recharge (DGS & DWA) – P100,000 • Opportunities and constraints presented by recent Boteti River flow and their impacts to local livelihoods (Community Consultations - Statistics) – absorbed by government statistics & research	DMS rainfall and temperature (data for 11 stations since 1960's). Botswana Ash borehole record database since 1991. DGS borehole data – initial depth and pump rate. DMS temperature data from 11 Met stations around MWS, since 60's Observation data in BotAsh reports and independent observations and reviews. DWA to monitor amount, extent and period of river flow, and DWNP to monitor fish population and off take. Indigenous knowledge and related existing literature & reports	DWA to lead – also include UB / ORI / Researchers DMS to lead climatic monitoring, with input from UB / ORI / Researchers DWA to monitor Boteti, DWNP to monitor fish and independent study could look at the impact of the river on local livelihoods
Degraded water quality	Development: Housing, Lodges, and other tourism infrastructure, sewage and other pollutants, Groundwater abstraction, Industry, including Mining – sewerage and chemical pollutants, Commercial agriculture –	• Water Chemistry, in conflict areas • Phytoplankton Rapid assessor developed and used in conflict areas • Invertebrate (Crustaceans & Odonata) rapid assessors developed and used in conflict areas (DWA & researchers) – P200,000 • Keystone Bird numbers and avian diversity and breeding success in key conflict areas (BLB & researchers) – P100,000	• Strategic targeted Chemical tests at impact sites (DWA) - absorbed, • Rapid assessment tests of phytoplankton and invertebrates at target impact sites & key functioning hotspots (DWA – researchers) – P200,000. • Strategic BLB waterfowl counts and targeted breeding success monitoring (BLB & researchers) – P100,000	MODIS archive since 2000, Land Use maps and plans, Independent study database on water chemistry, phytoplankton and crustacean communities (see site inventory) Biannual Wetlands International waterfowl counts and independent studies on flamingo	DWA to take lead, involving Stakeholders, e.g. mining companies, UB/ORI/Researchers BLB

Tourism related pressures	Tourism activities including game drives and associated impacts and lodge & campsite footprint and associated impacts	• Environmental LAC'S identified by the tourism component, according to different tourism zones, • Tourist/bed night Carrying capacities derived in tourism report	• Wildlife observations and disturbance (BTO, community conservation officers and private operators) – absorbed • Pan surface disturbance – grass encroachment or dune formation, (BTO, community conservation officers and private operators) – absorbed • Road maintenance and state (BTO, community conservation officers and private operators) – absorbed • Visitor satisfaction and feedback (BTO, community conservation officers and private operators) – absorbed	Indigenous knowledge and DWNP reports, Indigenous knowledge and related literature Initiate observation database	
Biodiversity Loss	Hydrological alterations, Pollution, Disturbance (physical and chemical) Habitat loss or fragmentation	• Biodiversity at BD Hotspots, • Threatened species, e.g. Wattled Crane, Flamingo, Chestnut banded Plovers, Vultures species, Lion and Brown Hyaena, • Development Footprint (Land Use GIS Map)	• Monitoring key indicator species at biodiversity hotspots, and assessing threat from habitat loss, pollution and other disturbances (DWNP, community conservation officers, Private tourism operators and researchers) – P250,000. • Updating development footprint – from Land Use (Dept of Lands, Tribal boards, and councils), - P50,000	Background literature and data on some key indicator species through DWNP surveys and independent studies, Need for biodiversity hotspot assessments during FMP to establish 'status quo' as baseline	
Conflicts	Conflicts between pastoral and arable, Wildlife Conflicts, e.g. between agriculture (pastoral and arable) and wildlife Conflicts between mining and tourism Conflicts between tourism and agriculture	• Agricultural conflict in land use planning , • Livestock and Wildlife mortalities in PAC records, • Crop raiding in PAC records, • Mines and tourism conflicts, • Community benefit from and perception of tourism industry on resource benefits,	• Monitor the frequency and extent of agricultural overlap (MoA) – absorbed • PAC record analysis and conflict type and frequencies (DWNP & researchers) – P50,000 • Monitor the impact of mining on community and tourism through visitor satisfaction, amount of support from mines and operator feedback (DoM, DEA) – P100,000, • Tourism-community partnerships (formal and informal) and social responsibilities projects (BTO) – P150,000	PAC records from DWNP Department of Agriculture records and land use planning for agricultural sector plans Mining responsibilities and impacts from literature and Mining licenses Tourism report on location and improved community-private relationships/partnerships	

10.8.2. Research

There are a lot of unknowns about the MFMP area, dynamics in livelihood strategies in relation to the changing ecosystem, the biophysical and biological components, their interactions, and the processes and functioning that maintain the integrity of the system. While the implementation of the MFMP needs to start in 2011, improvements in understanding of the system and its people/ users are important to attain sustainable use and management of the area. Research activities are, therefore, recommended during the FMP implementation phase. The results need to feed into the planning and decision making process during the IMP phase in order to ensure adaptive management.

Recommended activities for the MFMP:

1. Establishment of a Makgadikgadi Research Fund to encourage more research in the area. The Fund would particularly encourage supervised student research (Bachelors, Master and Ph.D). Financial contributions could come from the public (e.g. BTO & NEF) and private sector (e.g. mines and tourist operators) as well as from international sources;
2. Identify and agree on research priorities with the main stakeholders;
3. Use on-going and already funded research by their integration into the MFMP;
4. The following research topics are suggested by the MFMP team (but need to be assessed in more detail by the stakeholders):
    - Livelihood survey of Sowa Town and people living in localities to improve the understanding of livelihood issues that may be different from residents of villages (DEA);
    - Climate change impact modelling and impact on water resources using WEAP. The climate of the MFMP is highly variable and unpredictable. Access to daily rainfall data and modeling it against regional and global events will be key to prediction the impacts of climate change and its consequences for livelihood sources as well as the region's infrastructure (DMS);
    - A detailed economic valuation survey in four villages on the direct use value and a valuation study of the MNPNP under different management scenarios. This will validate and add to the MFMP results and provide a better understanding of the importance of natural resources for subsistence and commercial use (DEA & CAR);
    - A knowledge gap exists of groundwater and surface water hydrology, and this hampers our understanding of the drivers of surface water extent and flood period, as well as the impacts of ground water use on the pan system. A study of the shallow groundwater though flow into the pan would, therefore, prove highly beneficial, involving the placement of strategically placed piezometers along transect grids, in the ten highest ranked 'wet spots' and, in particular, along the conflict area of the BotAsh well field (DWA);
    - Natural resource inventory and indigenous knowledge based veld product resource use area identification will be key to adding to the valuation and effective protection of the natural resources, which should include ecological parameters (e.g. habitat, seasonal), thresholds of harvest and regeneration periods (DFRR);
    - Study of brine recharge and impacts of abstraction. The dynamics, amount and direction of deep brine recharge in the Botswana Ash well field is still an anomaly in our understanding of its long term impacts to the groundwater draw down above this resource and its impacts on the surface hydrology of the north basin. Further focused studies into this are critical in order to reach this level of understanding, and should be conducted prior to any expansion of the mining lease area (Botash);
    - Indicators of vulnerability need to be developed for livelihoods impacts from potential impact on subsistence veld product harvesting, and pastoral and arable farming as a result of unsustainable use, development conflicts and climate change (MoA, IU and Independent research);
    - Further study of the biodiversity hotspots, their number and state/dynamics of their outstanding features are, and how they are linked in the system, which would also include a valuation of the goods and services they provide to the local communities. This would be essential to set priority

management objectives/requirements for the BD hotspots. Local Indigenous Knowledge will form an essential component of this study;

- Study of commercialisation opportunities and requirements of main veld products in consultation with the local population (DFFR, LEA & DEA);
- Identifying the opportunities and constraints presented by the return of flow in the Boteti River and the flooding of Lake Xau will highlight its impacts on the livelihoods of local communities (DWA, Implementation unit);
- Further research is required to identify and develop key rapid response bio-indicators, e.g. pollution or chemical composition alteration impacts on invertebrates, e.g. aquatic crustaceans and Odonata species, in order to clearly identify indicator thresholds, and re-define limits of acceptable change. Further targeted research on the population dynamics and modelling of key ecosystem integrity indicators, and/or threatened and endangered species of wildlife and birdlife should also be included (DWNP, DWA, ORI & Independent research);
- A study to conduct a targeted vegetation inventory and status of RDL species in the main biodiversity hotspots would improve understanding of the vegetation status and threat potential in the area (DFRR and DWNP);
- A detailed tourism marketing study should be carried out to clearly define the Makgadikgadi brand in the different tourism development zones and identify the marketing potential of each area and the system as a destination in its own right (BTO); and
- Predators such as lions are associated with extensive human wildlife conflict within the MFMP area, with the incidence of wild dogs becoming increasingly common. However our knowledge base of predator numbers and distribution within the system is limited. Directed predator specific research/ monitoring must be undertaken within the MFMP (ORI, DWNP & Independent Research).
- Research on carbon sequestration of salt pans;
- More research on groundwater recharge and salinity;
- Valuation of Protected Areas, WMAs and communal area;
- Livelihood surveys among people living outside settlements (localities, lands etc.);
- A study of the physico-chemical characteristics and biological composition of the hydrological 'wet spots' will shed a lot more light on the physical and biological characteristics of the MFMP AREA and its functioning, to get a better handle on the underlying physico-chemical and biological interactions and functions of the wetland systems 'core' and how they vary and are inter-connected (DWA and Independent research); and
- A short term in depth study of the pan surface morphology and sedimentation dynamics, and its association with groundwater and Aeolian erosion will help a great deal in our understanding of the pan surface equilibrium and the thresholds that tip the balance of erosion and deflation (DGS, independent Research).

10.9. Strategies towards economic sectors

10.9.1. Mining sector

The mining sector is critical to Botswana's economy. Large diamond mines (Orapa and Letlhakane) operate just outside the MFMP area. Production at a small diamond mine inside the MFMP area (Damtshaa) is suspended until 2011. Currently, Botash is the only operational mine inside the MFMP area, mining soda ash and salt from the pans and creating significant value added (chapter 5). However, exploration for uranium, diamonds, precious stones and other minerals is on-going in large parts of the MFMP area. If successful and with the expected global recovery and subsequent rise in mineral prices, new mines are likely to be established in the area in future.

The strategy towards the mining sector should be to implement proper environmental management plans and mitigation measures (as result of EIAs), and to increase backward and forward linkages

with the local economy to increase livelihood benefits. The mining sector is generally capital intensive and generates limited direct employment opportunities. However, the indirect benefits can be significant.

Botash has the intention to expand brine abstraction beyond its current license area. If it becomes a concrete plan, a full EIA should be carried out as the new abstraction area is, among others, close to the new Flamingo Sanctuary. The EIA should be informed by the results of the on-going monitoring exercise of the current abstraction area.

While it is likely that more mines will be developed, their impacts are difficult to predict and will depend on the nature of the mining and the exact location.

Proposed MFMP activities are:

1. EIAs and associated EMPs should identify and mitigate the most important environmental concerns of each new mining development. Mine closure plans need to be drawn up for all mines and implemented to avoid long term land degradation. Moreover, EMPs should have local benefit enhancement programmes to ensure benefit to rural livelihoods and the region at large. Environmental audits should be carried out to assess compliance with the EMPS (**DEA**);
2. Monitoring of mineral prospecting results with the aim to ensure that new mining activities are integrated into the MFMP and MIMP (**DEA & DoM**).
3. When new mines are established, mining processing activities should be clustered as much as possible as has happened with diamond mining in the Orapa-Letlhakane area. Employees of new mines should live in existing settlements to prevent settlement proliferation. This would lead to larger and better serviced settlements, which create market for local produce.
4. Mining in National Parks, the wet spots and pans as well as all other BD hotspots should be avoided as much as possible (**DEA, DWNP & DoM**);
5. Opportunities to develop other economic sectors in mining towns should be stimulated to avoid ghost towns when the mineral are depleted. Sowa Township and mining area have been identified as Areas for tourism potential (ATP). The costs and benefits of opening Orapa need to be investigated (**Council and mining companies**);
6. Mining enterprises should be encouraged to stimulate local developments such as community based natural resource management initiatives and purchase of local inputs (where possible) (**mining companies, DEA, DWNP and local authorities)**; and
7. Future mining projects will aggravate pressure on water resources, and could contribute to further groundwater depletion. Large mines will require additional water sources and water transfer schemes. Implementation of integrated water resource management and water demand management (as for example Debswana does) is required for each future mining project (**DoM, DWA & DEA**).

10.9.2. Livestock production

The livelihood survey has shown that the livestock sector generates important cash and in-kind benefits. However, the current use value is relatively low. Grazing areas cover a large part of the MFMP area and are often degraded, particularly around villages; the potential for commercial livestock production is limited. Future population growth will put extra pressure on communal rangelands unless popular participation in the livestock sector decreases. However, the increased grazing requirements (around 6 500 km^2 by 2021) can be accommodated in existing and new suitable rangeland areas (se land use).

The strategy towards livestock for the MFMP area should focus on improving productivity and livelihood benefits from existing grazing areas and to reduce the current conflicts with wildlife and crop production. Rather than expanding livestock grazing areas, the focus should be on better use of existing areas.

The following activities are proposed:

1. Community based livestock and rangeland management systems need to be promoted and established. These systems aim to improve livestock production and animal husbandry practices, control livestock numbers and improve rangeland conditions. This activity would be modelled on the results of the Indigenous Vegetation Project, earlier carried out by the Ministry of Agriculture and UNDP;
2. Reduction of livestock wildlife conflicts by implementation of the approved plan to move cattle from Phuduhudu village to the BLDC ranch in NG49. Opportunities for movements of cattle posts to other Nata or BLDC ranches need to be investigated as part of management plans for CT 11. These ranches or underutilised and could host several thousands of animals;
3. Promote the use of existing livestock support programmes such as LIMID, particularly for small herd owners;
4. Following recommendations made within the Review of the National Land Use Map (2009) the Agricultural White Paper no 1 (1991) should be implemented, where it recommends the concept of communal land management with permanent agricultural extension teams attached to communities, community assisted where necessary with water development, communities assisted in fence development, services and technical assistance provided in range management and rehabilitation with farming cooperatives encouraged to provide necessary inputs and marketing services (**MoA**).

10.9.3. Crop production

The MFMP area is marginally suited for crop production due to rainfall and soil constraints. More productive flood recession farming is possible in river beds, especially the Boteti River, where higher soil moisture and fertility enable higher yields. Extra arable land requirements due to population growth are estimated to be relatively small around 800 km^2) and restricted to village areas. It can be accommodated within suitable arable areas (see land use section). Most households are currently engaged in crop production to contribute to livelihoods because they have few alternatives. It is important to maintain the subsistence role of the sector until better livelihood sources are available.

The MFMP strategy towards the sector aims at increasing livelihood contributions from the sector and safeguarding and utilizing the limited arable potential. The following activities are recommended:

1. Extension workers should identify the 'serious' crop farmers and advise them to improve crop husbandry and source assistance from existing government programmes such as ISPAAD. The choice of crops should reflect the natural suitability of the area and needs;
2. Suitable arable areas (e.g. molapo areas) need to be protected in land use planning in order to retain their food production potential;
3. Clustering of fields in designated areas should be encouraged so as to facilitate coordinated fencing and protection from problem animals; and
4. Construction of drift fences must be encouraged to reduce crop damage by livestock and wildlife.

10.9.4. Tourism sector

Tourism is underdeveloped but there is a potential for growth. Sustained development of the MFMP area includes tourism expansion that benefits local livelihoods and participatory park management, where significant local benefits are generated. Areas of Tourism Potential (ATPs) have been identified a potential for tourism expansion. These include the MNPNP, Sanctuaries and other areas of biodiversity, archaeological, heritage and scenic significance. While the tourism sector generates significant revenues, community and local benefits are very limited.

The MFMP strategy towards the tourism sector aims to expand and diversify the tourism sector and to increase local and national benefits. CBNRM projects require continued support over a long period of time to systematically empower the CBOs. It is important that CBOs are adequately supported by government, private sector and NGOs. The following activities are recommended:

1. The identified ATPs require coordinated and efficient management for them to be sustainable. It is therefore important for each of these areas to have a management plan. The proposed activities are:
    I. On an annual basis, develop management plans for at least three ATPs. The development of the management plans (IU, BTO & private sector).
    II. Limits of acceptable change and management recommendations should be included in these management plans (BTO);
    III. The starting point could be the Nata communities, which are already in partnership with Hedgerow Company, then the MNPNP & CT11 (in conjunction with DWNP), Sua (in collaboration with Botash mine) and the Gweta area.

Table 40: Recommended development of new/additional tourism facilities in the ten ATPs (2011-2015).

	Areas of Tourism Potential	Type of Development Permitted/Encouraged	No. of new facilities over next 5 years
1	Nata (e.g. Sanctuary, CT 5, Southern Sua Pan Area)	High-end Luxury Lodges (Wildlife/NRM)	1 only: 1 x 24 bed Lodge in the western Nata Sancturary area;
		Mid-market Lodges Camps (Wildlife/NRM)	1 only: 1 x 24 bed Lodge in the eastern sector of Nata Sanctuary – as a Community Venture;
		Campsites and Caravan Parks (General)	1 only: 1 campsite in vicinity of the actual Sanctuary with maximum of 10 camping units, each accommodating no more than 2 tents per unit (max 4 people per unit). Ship it in, ship it out basis – totally self-contained camping).
2	Nxai National Park, Makgadikgadi National Park	High-end Luxury Lodges (Wildlife/NRM)	2 only: 1 x 24 bed Lodge in NW of MNPNP; and 1 x 24 bed Lodge in SE section of MNPNP
		Mid-market Lodges Camps (Wildlife/NRM)	1 only: 1 x 24 bed Lodge inside Nxai Pans part of the MNPNP, north of Phuduhudu just within the north-western park boundary.
		Campsites – exclusive CKGR style	5 only 5 separate 'exclusive' or wilderness campsites in the SE MNPNP, each with maximum capacity of 10 people (max 4 tents & 4 vehicles) based upon the CKGR Sundays Pan type campsites. These should be in a general cluster of having about 5 kms between them to facilitate ease of maintenance, with one more remote site that provides ease of

				access to the zebra migration. Ship it in, ship it out basis – totally self-contained camping, with proposed developments
3	Sua Salt Mines	Mid-market Lodges Camps (Wildlife/NRM)	1 only:	1 x 24 bed Lodge to the south of the salt mining works.
4	Gweta (e.g. Gweta Area, CT 7, CT11)	High-end Luxury Lodges (Wildlife/NRM)	1 only:	1 x 24 bed Lodge in CT7
		Mid-market Lodges Camps (Wildlife/NRM)	1 only:	1 x 24 bed Lodge in CT7
		Campsites – exclusive CKGR style	4 only:	Each with maximum capacity of 10 people (max 4 tents & 4 vehicles) based upon the CKGR Sundays Pan type campsites. These should be in a general cluster of having about 2 kms between them to facilitate ease of maintenance. (all near NE corner of MPNP)
5	Xhumaga, Meno a Kwena, Leruo la Tau (Boteti)	High-end Luxury Lodges (Wildlife/NRM)	1 only:	1 x 24 bed Lodge South of Xhumaga towards the Tsoe area just inside of MNPNP within wildlife fence(or just outside on Community land). DWNP has already allocated a lodge in this area, but it has not been developed and could be allocated to the local communities.
		Mid-market Lodges Camps (Wildlife/NRM)	1 only:	1 x 24 bed Lodge just inside of MNPNP near Main Gate on Xhumaga Community land within wildlife fence; and
		Campsite general	1 only	1 along Boteti River
6	Kubu-Mosu-Mea-Nkokwane	High-end Luxury Lodges (Nature & Isolation)	1 only:	1 x 24 bed Lodge somewhere along the cliff edges where it would not impact upon the skyline.
		Mid-market Lodges Camps (Birding)	2 only:	1 x 24 bed Lodge in eastern sector of the area . 1 x 24 bed Lodge in the vicinity of Nkokwane Pan with views over the pan.
		Campsites – exclusive CKGR style	1 only	1 south of the cliffs near Tlala-mabeli along the main Francistown-Orapa road
7	Phuduhudu	Mid-market Lodges Camps (Wildlife/NRM)	1 only:	1 x 24 bed Lodge just outside of Nxai Pans NP near Phuduhudu Gate on Phuduhudu Community land or just within park boundary.
		Campsites general	1 only	1 general campsite just outside of Nxai Pans part of MNPNP near Phuduhudu Gate on Phuduhudu Community land or just within park boundary.
8	Rysana Pan, Txzbaka, CT 10, Lake Xau	Mid-market Lodges Camps (Isolation, adventure)	1 only pan	1 x 24 bed Lodge/Camp adjacent to north Rysana
		Low-market Lodges Camps (adventure)	1 only	1 x 36 bed Chalet Camp catering for adventure groups south east of Mokobaxana
		Campsites – exclusive CKGR style	4 only:	Each with maximum capacity of 10 people (max 4 tents & 4 vehicles) based upon the CKGR Sundays Pan type campsites. These should be in a general cluster of having about 2 kms between them to facilitate ease of maintenance
		Campsites – exclusive CKGR style & mass	1 only	1 x 18 unit camp-ground catering for adventure groups south east of Mokobaxana. Total maximum carrying capacity of 72 people (18 x 4 persons).
9	Tsoe/CT10/Tamtiga	Mid-market Lodges Camp	1 only	1 x 24 bed Lodge/Camp adjacent to the southern boundary of the Makgadikgadi NP fence with access rights into the southern section of the park. This is an opportunity for a Community JVP to be developed.
		Camp site	1 only	1 in NW corner of MPNP
10	Zoroga-Ntwetwe Spit-CT7	Mid-market Lodges Camp	1 only:	1 x 24 bed Lodge in the area of an arc of 30 km radius to the south of Zoroga, tracing westwards

				and to the north of Zoroga (not on the eastern semi-circle of that arc). Possible Community JVP opportunity.
		Camp site	1 only	1 south of the main Nata-Maun road servicing travellers cutting across the pans from Kubu Island

2. Development of infrastructure within the MNPNP. The current infrastructure is dilapidated and the road network is poor thus hindering accessibility within the park. More tourists need to be attracted through better management and improved and more varied accommodation. Proposed activities are:
    I. Improve road networks up to reasonable and acceptable levels so as to enhance accessibility; **(DWNP**);
    II. Development and improvement of campsites and lodges in line with the limits of acceptable change; **(DWNP)**;
    III. Engage the private sector in developing and managing some of the infrastructure within the PA, thereby fostering partnerships and investments in the parks **(Private companies through BTO, HATAB)**;
3. Preservation and development of archaeological sites in the MFMP area. These are important for education and research, cultural heritage and for poverty reduction. The most important archaeological sites are national monuments and the sites on the 'list of 100' should be preserved and developed within the MFMP; **(DNMM).** The activities to be undertaken are:
    I. Development of sites for public use and access: Mosu escarpment (Khama Ruins, Kahyishe, Unikai springs and stone walls), Lekhubu management area (Lekhubu ruins and Thitaba stone walled settlement), Historic tree formation (Baines' Green and Chapman's baobab trees), East Sowa (Toranju Ruin and Tshwane game trap) and Mopipi (Xanikaga);
    II. Proper management of 9 National Monuments and 11 sites of the 'List of 100' in the MFMP areas (**DNMM**);
    III. The UNESCO project on National Heritage should be implemented within the context of the MFMP (**DNMM**). There is need to adjust the site to include Sowa pan;
    IV. Preservation of the most sensitive sites. These are Ngcaezini Pan, Boteti River Mouth, Lekhubu Ruin, cairns and occupation deposits, Thitaba, near Lekhubu, Semowane sites, Hippo Tooth, Xanikaga, Khama Ruin, Kayishe, Tlapana Ruins and North Ntwetwe Pan. Some of these sites are part of sites that can be used by the public hence they need to be properly protected and managed;
    V. Participation of local population and CBOs in the management, protection and development of the archaeological and heritage sites. **(Implementing Unit, Communities & DNMM);** and.
    VI. Further work on improved management, protection and & development of listed archaeological sites.
4. Tourism marketing and branding of the MFMP area given the diverse tourism potential of the MFMP area. It is important to highlight the overarching character and potential tourism products so as to best optimise visitors' experience. The proposed activities are:
    - Development of a market and branding strategy based on the area's characteristics and diversity and needs and expectations of the visitors**. (IU, a private company in collaboration with BTO**). From visitors should be collected and analysed (**BTO**);
5. For each tourism zone, an assessment of limits of acceptable change should be undertaken specific to each zone. This would ultimately enhance optimal visitor experience while at the same time protecting the natural resource base of the wetland system **(DEA & BTO)**; and

6. Support for the development of the selected settlements into tourism nodes and support infrastructure (**Councils, DEA, BTO, DoT**);

10.9.5. Natural resource use

The MFMP area is endowed with a variety of natural resources including such as thatching grass, mophane worms and wild fruits and vegetables. Such veld products are important as they are mostly harvested for subsistence and livelihoods (see sections 3.2 and 5). Commercial use is limited (e.g. thatching grass). The extent, to which local communities are involved in the harvesting of these products differ spatially. For instance, harvesting of grass is common across the MFMP area (but is more pronounced in the Nata/Gweta area) while fishing is more common along the Nata River and the Boteti River, when it is in flood. No land use zones are specifically designated for harvesting of veld products. Harvesting typically occurs in communal rangelands, where policies focus on livestock production. As a result, harvesting of veld products is neglected in policies and planning.

Although the MFMP area still has abundant veld products, their accessibility and marketing pose challenges for communities to benefit from the utilisation of these resources.

The MFMP strategy towards harvesting of veld products aims to give veld products or natural resources a higher policy profile, to ensure sustainable use of veld products and to increase the benefits derived from harvesting through processing, storage and marketing. The following activities are recommended:

1. Official recognition of veld product use in development and land use planning (**DLUPU & DDC**);
2. Identification and mapping of the main veld products with community participation and based on local knowledge **(IU &DFRR);**
3. Incorporation of key veld products in activities of CBOs as provided for under the CBNRM Policy. The Kgetsi-ya-Tsie CBO model is recommended for veld product activities of CBOs. CBOs need to acquire community user rights for veld products such that the users benefit more and that external users can be restricted. Moreover, sustainable harvesting practices need to be adopted and resource stock need to be monitored **(DWNP & DFRR);**
4. Establishment of a marketing strategy and storage facilities for veld products with a commercial potential to ensure sales throughout the year (e.g. around Nata). It is proposed to start with thatching grass and mophane worms (with a proven commercial potential) **(LEA, BEDIA, DFRR, IU, communities and private sector).**

10.10. Strategies towards livelihood improvement

Livelihood improvement is a core component of the overall MFMP objective. However, it must be recognised that there are no quick or easy solutions for poverty reduction and livelihood improvements. The MFMP preparation did not identify a single activity that could resolve poverty and livelihood insecurity. Instead, a multitude of different measures and activities is likely to improve livelihoods and reduce poverty. The proposed activities are discussed below.

Most households have multiple livelihood sources to increase livelihood security. The sources include formal and informal employment, crop and livestock production, gathering of veld products and social welfare. While many households participate in agriculture, the production and benefits are limited, especially for crop production. Crop production is particularly important for those without and with few other livelihood sources. The area has limited suitable arable land and low

unreliable rainfall. Grazing resources are limited and overstocking in some parts of the MFMP area has led to the depletion of these grazing resources. Gathering of veld products is free and important for subsistence livelihoods and to a lesser extent for cash income. While many households are involved in gathering, it is particularly important for the low income group. Government institutions are the major source of formal employment with private mining and tourism companies employing fewer local people. Formal employment is attractive because of its monthly wages but the employment opportunities are very limited. Government social welfare programmes are particularly important to vulnerable groups and the poor. The welfare programmes include monthly food rations, provision of educational requirements to children in poor households and currently temporary employment through the Ipelegeng programme.

Based on the above, the conclusion is that livelihood sources are limited, insecure and vulnerable to shocks such as diseases, drought and climate change. Consequently, poverty is relatively high. The MFMP strategy towards livelihoods is to widen and diversify the options and to increase the returns from existing livelihood sources. The proposed MFMP activities are:

1. Further understanding and widening of the livelihood options:
    I. The FMP livelihood survey was mainly focused on major villages. It is important to extend the survey to the extended MIMP area and to people living in localities.
    II. Create more tourism opportunities with tangible livelihood benefits. This can be done through community based tourism operations, tourism employment and community support activities. Support of existing CBOs and communities around the new Flamingo Sanctuary should be the starting point;
    III. Review and implement new livelihood options due to flowing of the Boteti River. Opportunities include fishing, and the possible availability of reeds which households can use for construction of houses. The river also provides water for livestock owners and reduces the cost of fuel used by boreholes to draw water;
    IV. Development of horticulture near larger settlements (e.g. Orapa and Lethlakane);

2. Increase benefits from existing sources:
    I. Veld products: implement measures to strengthen the sector (see 10.7.5.);
    II. Livestock production: implement measures to strengthen the sector (see 10.7.3).
        a) Improvement of livestock husbandry through kraaling and proper herding will reduce incidences of predation on livestock by wildlife animals and will reduce the chances of livestock damaging crops;
        b) Farmers should be encouraged and empowered to utilize the Livestock Management and Infrastructure Development (LIMID) programme (develop kraals, construction of dip tanks, spray races, crushes, loading ramps, fodder barns and fodder processors);
        c) Education of farmers to keep livestock numbers based on the carrying capacity of the area;
        d) Most villages have Farmers' Associations and these could be used as community rangeland management committees with technical assistance from Agricultural Extension Officers.
    III. Crop production:

a) Diversify crops based on (sandy) soils, susceptibility to diseases, pests and market conditions. Farmers could also grow fodder for livestock and veld products;
b) Prepare molapo farming programme for years when Boteti River is in flood;
c) Construction of fences around their arable fields to prevent damage of crops by livestock and some wild animals (individual fields and drift fences);
d) Encourage use of arable support schemes by the poor and vulnerable groups, who wish to seriously engage in crop production.

IV. Tourism and CBNRM:
a) Develop capacity of CBOs particularly in the fields of natural resource management and monitoring, business skills development, financial and records management; project management; proper administrative and governance skills;
b) Identify, nurture and support new CBOs/ area specific CBNRM support programme;
c) Encouragement of mutually beneficial partnerships between CBOs and private companies. Such partnerships have proven to be more successful than CBOs working by themselves;
d) Offer on-the-ground extension support for the implementation of Trust Management Plans of the two operational CBOs (1 officer for each 2-3 CBOs). The role of extension officers will be to assist communities in daily activities of running their Trusts and to identify and resolve at an early stage emerging challenges.
    - The Mokopi Conservation Trust (MCT) has a management plan in place developed through the Indigenous Vegetation Project (IVP). The MCT requires financial assistance to implement their management plan;
    - The Gwezotshaa Trust requires assistance to revise their management plan and its implementation. The Trust could be allocated part of CT11 for use in collaboration with joint venture partners;
    - The villages of Mosu, Mea, Mokobilo and Mmatshumo could be assisted to develop a collaborative arrangement to utilize the Flamingo Sanctuary. Mosu village (through Guma Ku Tshaa Trust) is the process of developing a management plan to utilize the Mosu escarpment area. NGOs have played an important role in supporting CBOs, and it is important for NGOs to continue supporting CBOs in the MFMP area.

V. Formal employment:
a) Government employment. Government employment is already very high and unlikely to increase in future. However, government can stimulate local employment by sourcing out of maintenance of government properties to local maintenance companies and by sourcing as many local inputs as possible. Ipelegeng can be used for skills development and for environmental rehabilitation projects such as debushing bush encroached areas (and producing charcoal) .
b) Private sector employment.

- Mines, tourism and other private companies should be encouraged to employ local communities and use local inputs where feasible and possible;
- Companies should be encouraged to develop and implement a social and economic responsibility strategy, which would cover human development and apprenticeship programmes and business entrepreneurships.

VI. Social safety networks. Given the poverty situation in the MFMP area and limited livelihood options, it is important to continue supporting and giving out these social safety nets programmes exclusively targeting the vulnerable and under privileged members of the community.

10.11. Land use

10.11.1. Land use suitability

Almost 55% of the MFMP area is designated for pastoral, arable and residential land use (the remainder is protected area), with an emphasis on pastoral activity within these areas. Growth within the agricultural sector is expected and based on its relationship with estimated human population growth there will be a shortage of grazing land, with the potential for increased rates of land degradation. To ensure that future growth within these sectors is sustainable it is imperative that any expansion occurs in the identified suitable areas. Important sites of biodiversity have also been defined to ensure they are suitably protected, while tourism zones have been aligned in cognisance of the current land use designation and location of biodiversity hotspots and areas of high tourism suitability. Sectoral expansion should occur in areas suitable for the particular activity. Where land uses can be changed, they should move to areas identified as most suitable. The arable and pastoral suitability of new areas is shown in Figure 43. Figure shows the overlay of biodiversity hotspots and the arable and pastoral suitability.

Livestock production
Suitable areas of around 7 000 km^2 (almost 1 500 km^2 is highly suitable) have been defined for the growth of the livestock sector based on carrying capacity, ground water availability and the resilience of the land systems, as well as existing constraints.

Proposed MFMP activities to ensure sustainable livestock sector growth are:

1. The pastoral land use suitability maps should be used when allocating boreholes / cattleposts (**Tribal Land Boards / Dept of Lands / MoA**);
2. Land within these highly suitable pastoral areas should be zoned for livestock production (**Tribal Land Boards / Dept of Lands / MoA**);
3. Existing undeveloped fenced ranches around the periphery of the MFMP area should be allocated and fully used before more land is allocated to livestock in communal areas (**Tribal Land Boards / Dept of Lands / MoA**);
4. To help reduce conflict for limited land (e.g. CT11), alternative strategies for land allocation should be assessed. The BLDC ranches in NG51 are currently under-utilised and could be allocated for communal livestock production (**Dept of Lands / MoA**);
5. The recently undertaken 'District Inter-Ministerial Committee' study should reviewed when determining the viability of the pastoral regions in northern CT7, due to the potential presence / absence of Mogau. If not present then this area forms a prime site for future pastoral expansion (**Dept of Lands & Dept. of Agriculture**);

6. Water exploration should be undertaken in western CT8 to help assess the potential for livestock expansion within the area (**Dept of Lands & MoA**).

Arable agriculture

Suitable areas (around 3 700 ha) have been defined for the growth of the arable sector have been defined based on soil fertility, surface water availability and proximity to existing settlements, as well as existing constraints.

Figure 43: Arable and pastoral suitability

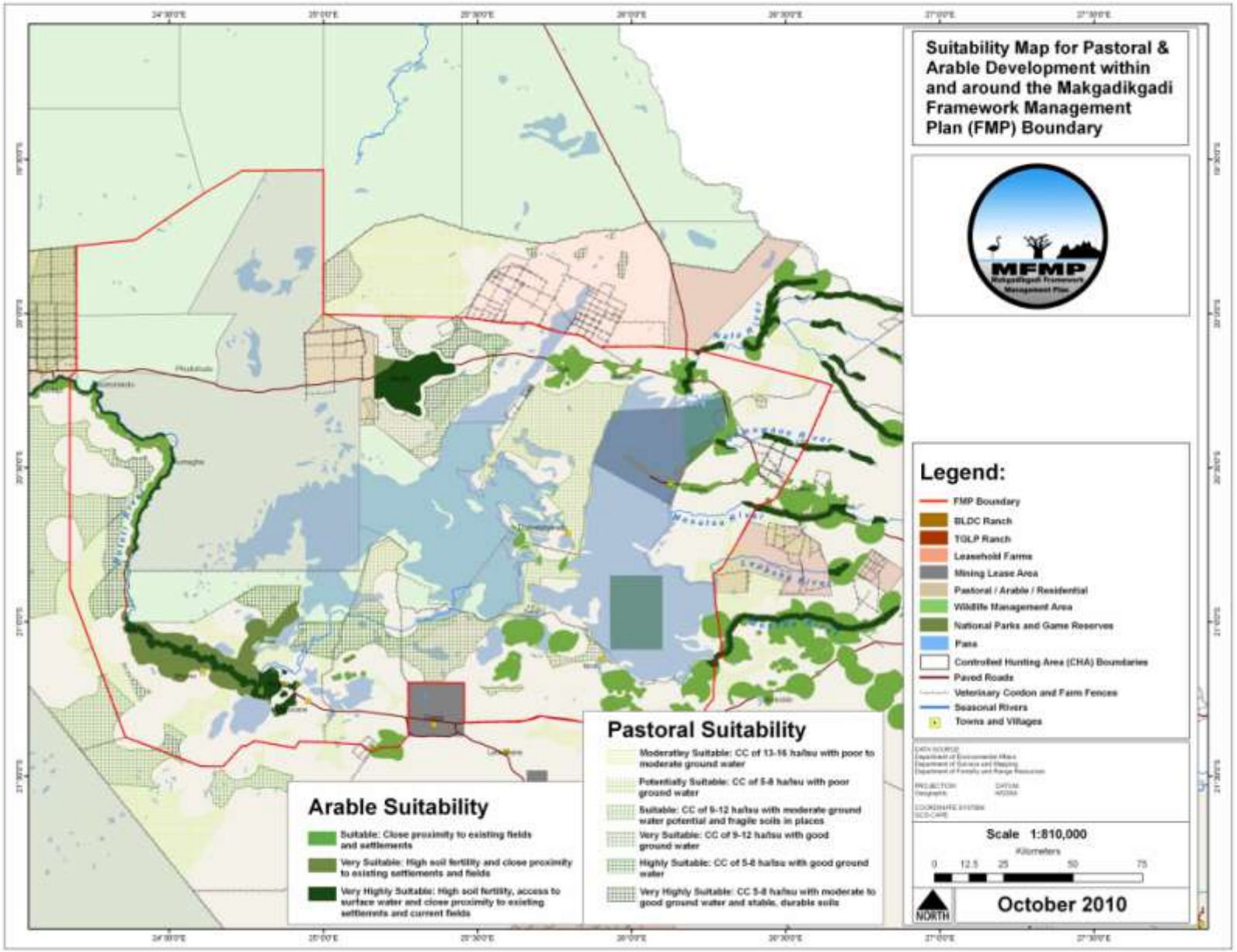
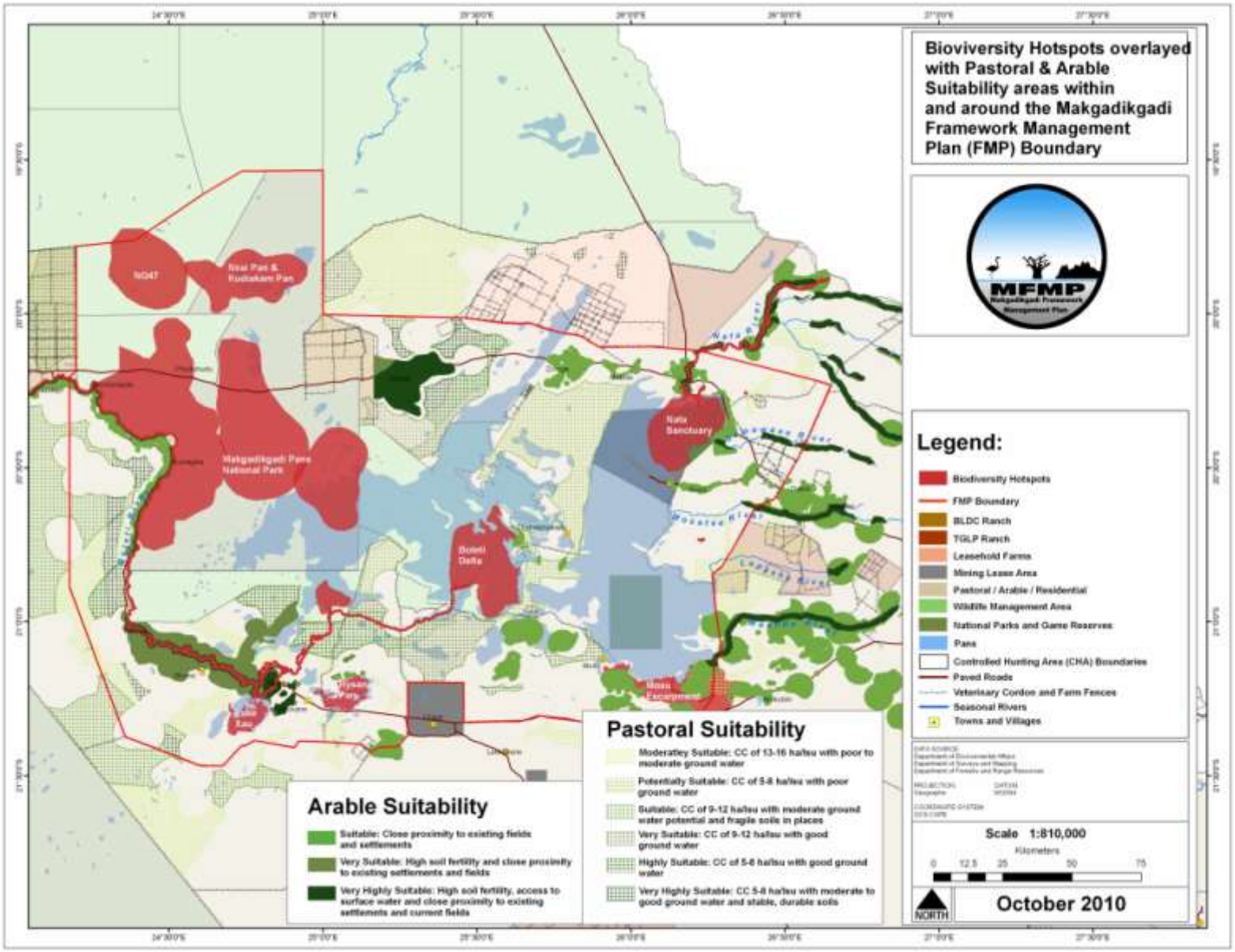


Figure 44: Biodiversity hotspots and land use suitability



Proposed activities required to ensure sustainable arable sector growth are:

1. The arable land use suitability maps should be used when allocating fields within the MFMP (**Tribal Land Boards & Dept of Lands**);
2. Suitable areas for arable development are limited; greater emphasis on improved productivity is required before land use expansion within the arable sector occurs (**Dept of Lands & Dept. of Agriculture**); and
3. An integrated land use planning approach is required for field allocation. Any new fields should be allocated within clusters, especially within high conflict areas such as; Nata, Zoroga, Gweta and the Boteti area (**Tribal Land Boards & Dept of Lands**).

Tourism

Tourism has been identified as a future growth sector within the MFMP area. Tourism development must take into account the fragility and sensitivity of the region's ecology and existing land use activities to ensure its sustainable development and long-term success, while greater effort must be made to help integrate local communities within the sector.

Activities for sustainable development of tourism and heritage are:

1. Tourism development areas must be recognised in land use planning (**Land Boards / Dept of Lands**);
2. The LACs of tourism development areas are established as soon as possible (**BTO / DWNP**);
3. The LACs will help to inform which type of tourism can be promoted and what infrastructure can be developed (**Dept. of Tourism & BTO**); and
4. Until LACs have been determined, the precautionary principle should be applied to any proposed tourism development.

Biodiversity conservation

Biodiversity hotspots have been identified based on a systematic assessment of the MFMP area with a multi-criteria evaluation of the identified sites to help prioritise sites of international importance, as well as those that are sensitive and vulnerable hotspots.

Activities required for the sustainable management of the biodiversity hotspots are:

1. The framework management plans developed for the top ten biodiversity hotspots should be followed when any development is considered within the defined areas or during any land use planning and allocation exercise. Allocations should only be made where a management plan exists and the allocation is in line with this plan. A time frame for the development of the management plans for the remaining hotspots has been defined within the ecology component report(**Tribal Land Boards & Dept of Lands**); and
2. The use of RAMSAR guidelines and IUCN guidelines on Protected Areas is recommended to formalise the biodiversity hotspots status and improve their management (taking into account the current land use of the area). IUCN category IV (Conservation through active management) best defines the conservation and management approach required for hotspots outside current protected areas (**Tribal Land Boards & Dept of Lands**).

10.11.2. Land use conflicts and fencing

Land use conflicts

A series of key conflicts within the MFMP area have been identified, such as between wildlife and people, and livestock and arable farming, while other competing claims for land exist between farming and tourism, and potentially between mining and all other forms of land use. These conflicts need to be minimised and mitigated and one of the best forms of mitigation is a land use approach

Proposed activities to mitigate land use conflicts are:

1. The allocation of arable fields must be done using an integrated land use planning approach, allocating new fields in clusters away from park boundaries and away from defined elephant pathways (**Sub-District Councils and Ngwato Land Board**);
2. Government should support voluntary relocation of people away from conflict hot spots (**Sub-District Councils and Ngwato Land Board**);
3. The approved relocation of cattle from Phuduhudu to the Makalamabedi BLDC ranch should be facilitated with Government support to help provide water provision within the ranches. This must be expedited to ensure reduction of future conflicts (**DWNP, Sub-District Council & Dept. of Water Affairs**);
4. Along unfenced boundary lines of the Makgadikgadi Pans National Park no cattleposts or boreholes should be developed within 6km of the park boundary to help limit human wildlife conflicts (**Sub-District Councils and Ngwato Land Board**);
5. Pastoral, arable and tourism land use suitability zones have been identified to help reduce the potential for future land use conflict. These should be used by the appropriate authorities to help develop further farming activities to mitigate future land use conflicts (**Sub-District Councils and Ngwato Land Board**).

Conflicts should be monitored and the effectiveness of the MFMP in terms of conflict reduction should be regularly assessed.

Fencing

The MFMP area has at least around 1 000 km of fences, which are difficult and expensive to maintain and some of which have lost their primary function (e.g. disease control and conflict reduction).

The main proposed activity to ensure the sustainable and effective fences is a Strategic Environmental Assessment (SEA) of all fences within the MFMP area. The evaluation of the fences should be multi-faceted with specific reference to their existing function of mitigating disease transmission, impacts to wildlife and birdlife movement and the costs of maintaining the fences (**DVS**). The fence SEA should address:

- The role of the fences that cross the open pan surface. These fences have been shown to have a detrimental impact to birdlife and due to their alignment may not be serving a functional service to mitigating disease transmission;
- A strategic realignment of the Boteti fence to allow for CBNRM activities on the eastern and western banks of the Boteti River, to allow access for wildlife to the Boteti River and to allow access to water by livestock. Community opinions should be fully part of the re alignment process;

- Electrification of the Boteti fence with regard to the problems of crossing the flowing Boteti River and the current lack of maintenance of the Boteti fence. Poor maintenance of the fence is threatening the FMD status of zone 4A to the west of the fence, while enabling human-wildlife conflict to prevail;
- The need for and alignment of the eastern Makgadikgadi fence in light of the demand for increased pastoral land and the importance of the CT11 region for the long-term viability of the zebra and wildebeest migration;
- The potential for increasing the number of drift fences within the MFMP. Drift fences have been identified as one of the most effective (60% conflict reduction) mitigation strategies for pastoral / arable conflict;
- The cause for potential for improving the currently dilapidated state of the BLDC ranches fences. These ranches are not being effectively used and could be allocated to local communities for pastoral development;
- The implications of the proposed fencing of the Nata-Makalamabedi road by the Dept. of Roads. The proposed fence would restrict the movement of wildlife within the region of the Makgadikgadi Pans National Park and a strategic alignment of fences would help mitigate potential impacts;
- Potential for a fenced corridor linking the CKGR with the MNPNP with a specific feasibility assessment.

This activity should be closely coordinated with the assessment of the firebreaks.

10.11.3. IMP area

The MFMP boundary was agreed with the Project Steering Committee in view of the one year time frame of the MFMP project and the ecological/ hydrological and administrative/ management factors (see section 1.3). The 945m contour line around the pans was used a guide to ensure the project area encapsulates the majority of the ecological and hydrological features.

While the MFMP area remains the core area of the management plan, it is recommended to ultimately expand the area to fully conform with the Ramsar recommendations for boundary alignment:

- The area covered should allow management of the site to be undertaken at the appropriate scale for maintaining the ecological character of the wetland;
- To provide adequately for all the ecological and conservation requirements of the systems wildlife populations and habitats;
- Particular attention should be given to ensuring that wherever possible the limits of the sites serve to protect them from potentially damaging activities, especially those likely to cause hydrological disturbance;
- Boundaries should include those areas of land necessary to provide and maintain the hydrological functions needed to conserve the international importance and integrity of the site; and
- It is important that planning processes are operating to ensure that potential negative impacts arising from land-use practices on adjoining land or within the drainage basin are suitably regulated and monitored to provide confidence that the ecological character of the Ramsar site will not be compromised.

The recommended MIMP area comply with the guidelines on the development of future Ramsar Sites; “Ideally, boundaries should include those areas of land necessary to provide and maintain the

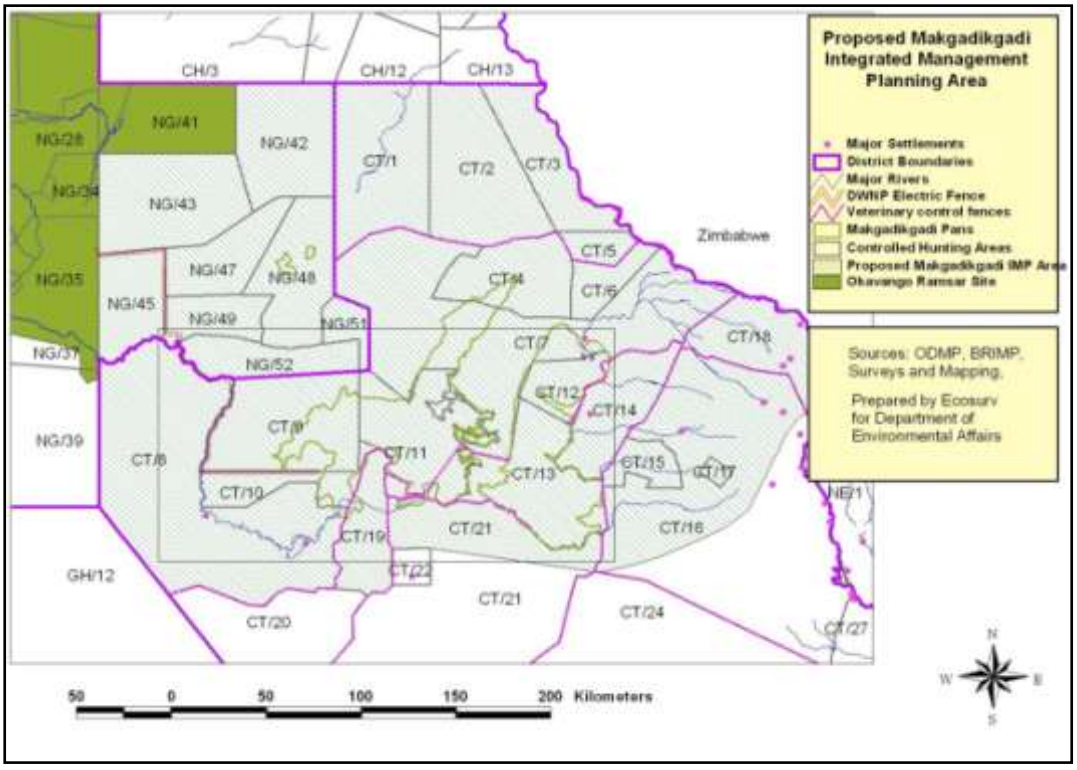
hydrological functions needed to conserve the international importance and integrity of the site."(Ramsar Guidelines).

In light of these requirements the MIMP boundary should include the following:

- Linkages to the river basin and the Okavango Delta Ramsar Site;
- Linkages to the major wildlife systems which lie north of the wetlands;
- Consideration for the presence of physical barriers limiting animal movements;
- Inclusion of drainages important to the hydrology of the pans particularly those feeding the Flamingo nesting sites on Sua Pan (e.g. Nata River);
- Use of the controlled hunting area administrative boundaries wherever possible; and
- Inclusion of communities, which are directly reliant of the resources of the wetlands system.

As the recommended MIMP boundary covers hydrological catchment of Sua Pan it extends across the Zimbabwe border and must therefore address transboundary water issues. It also contains much more agricultural land in the Tutume sub-district. The MIMP area needs to include Orapa as the mine has an extensive socioeconomic and hydrological impact on the region through employment creation, ground water extraction, even though its physical footprint is relatively small. The MIMP area may also benefit from the inclusion of the administrative centre of Letlhakane.

Figure 42: Proposed boundary of the MIMP, incorporating the core MFMP area



10.12. Water use

Surface water resources are limited to the pans (saline) and ephemeral rivers. Most activities depend on groundwater, some of which is highly saline. Groundwater is under heavy pressure from mining activities. Part of the MFMP area relies on the heavily over utilised Dukwi aquifer. Only livestock and wildlife use surface water; other sectors (and also livestock) rely on groundwater. Recent water sector reforms have made WUC responsible for all settlement water supplies and for wastewater treatment and its re-use and recycling. Given the current water constraints, future economic activities are likely to face water constraints.

Given its limited availability and importance, efficient and effective use of water resources is therefore necessary for sustainable economic, social development and maintaining environmental integrity. Access to sufficient water of good quality is a basic need. Furthermore, recognising that there are various water uses, water allocation and use of water should be in a manner that none of the water users are worse off and ensuring that there is understanding and awareness on the need to use water efficiently taking into account environmental water needs and future needs as well. water is

The MFMP strategy is to use water more efficiently, to re-use wastewater and exhaust the potential of other forms of water demand management so as to enhance water use efficiency and water availability:

1. Improvement of fresh water treatment to meet new BOBS standards for drinking water. This may require establishment of desalination facilities (as Debswana has done in Orapa);
2. Effective protection of borehole areas and groundwater zones by imposition of use restrictions;
3. Water demand management measures should be implemented in government buildings and promoted by WUC for other users:
    - Rainwater harvesting techniques should be encouraged so as to capture rainfall. The government has installed water tanks in most institutional houses but there is need for education. Furthermore, rainwater should be collected for farming and horticultural purposes as well;
    - Meet WUC average water loss figure of 22%;
    - Re-use of grey water. In future, if the government considers developing wastewater treatment facilities, re-use of treated effluent and mine water should thus be encouraged. This has proven to be cost effective and ensures optimal water use in other countries such as Namibia and Zimbabwe. One of the major challenges would be creating awareness among the user community about using wastewater; and
    - Adequate and timely recording of water pumping at the boreholes is necessary so as to monitor the abstraction levels for better data management and monitoring of water use.
4. Future mining projects should include a fully developed IWRM and WDM plan as part of their EMPs. As much as possible non-potable water should be used for processing purposes.

10.13. Institutional structure for MFMP implementation

The MFMP implementation should be based on the principles of good governance, decentralisation and participation of all stakeholders.

For effective handling of environmental issues and management of natural resources, there is need to apply the principles of good governance (transparency, rationality, accountability, reduction in time and costs, participation and regulatory independence). The policies should emphasize on the participation of multiple stakeholders like implementing and policy making agencies of the government at local, central, state levels; the legislatures and judiciary; the public and private corporate sectors; financial institutions; industry associations; academic and research institutions; independent professionals and experts; the media; youth clubs; community based and voluntary organisations. Thus institutions of local self-governance have an important role in management of the environment and natural resources and MFMP implementation

Implementation structure

The MFMP will be implemented by all stakeholders. Details of tasks and responsibilities are provided in appendix 1. The DEA will establish a local **Implementation Unit (IU)** and stakeholder participation will be ensured through the establishment of a **Stakeholder Participation Committee** (SPC) with representation from communities, the private sector, local and central government as well as NGOs and academia.

The DEA will be responsible for the day- to-day project execution and management with the implementation unit housed in already existing district office (Serowe) and additional staff which will be focussing on the implementation and monitoring of the MFMP activities. Project activities will be undertaken by relevant governmental and non –governmental institutions, private sector and CBOs.

The SPC will be responsible for ensuring that all sectors participate and carry out their responsibilities. It will also offer advice on progress with implementation and the need for modification. Together with the IU, it will ensure that further MIMP activities will be undertaken and the results be integrated into the MFMP.

Central government is responsible for formulation and implementation of policies to facilitate the sustainable use of natural resources. With decentralization, local governments assume greater responsibilities and would become the focal points for MFMP activities developed in the project area. Local governments have to be effectively linked with the national levels as well as with local communities and the private sector. Especially with activities derived from the MFMP, local government's roles will include guiding local communities, facilitating the capacity-building of local communities, catalyzing the interactions between the community organizations and the organized private sector, installation of monitoring mechanisms.

The *private sector* has important roles to play in the MFMP implementation in support of bringing larger local benefits from their activities, support communities and as investors to boost development. It is important that the private sector is actively engaged in the implementation process.

NGOs help reduce government domination and burden at local level. They often act a a bridge between communities and government. Therefore, their major role of NGOs will be to "*facilitate institutional development/strengthening*" in the communities. At the community level, in order to and achieve effective implementation of the MFMP activities and sustainable use of natural resources, the challenge is to facilitate and institutionalize a process through which rural communities themselves would evolve local organizations to satisfy their own local needs.

MFMP and other on-going and planned activities

Project 'Strategic Partnerships to improve the financial and operational sustainability of Protected Areas'- Birdlife/DWNP. The project goal is to strengthen the sustainability and management effectiveness of Botswana's system of protected areas. The project objective is improve the financial

and operational sustainability of small but biodiversity-rich Protected Areas in Botswana through enhanced working partnerships between public, private, NGO, and community stakeholders.

The MFMP should seek collaboration with poverty reduction strategies and programmes such as the Poverty and Environment Initiative, based at the Ministry of Finance and Development Planning. Poverty reduction is given much greater priority than hitherto (also through the Office of the President) and the MFMP area could made a focal point.

Project: 'National Environmental Research Council dust project'. The project is funded by the UK National Environmental Research Council and the overall aim of the research is to collect the first dust source-area process data tailored to climate model grid –box resolution from targeted remote sensing and fieldwork in order to develop a new generation of model dust emission schemes. This initiative will fit well in the implementation of the MFMP as it provides for research in the MFMP area and opportunities for funding and capacity building.

Plans exist to apply for World Heritage Status for the Makgadikgadi[5]. This would support the protection of the World Cultural and Natural Heritage. According to the Botswana World Heritage Tentative listing document of 2010, Makgadikgadi salt pans landscape fulfills World Heritage criteria as it is:

- Is an outstanding example of a traditional human settlement, land use which is representative of a culture or human interaction with the environment especially when it has become vulnerable under impact of irreversible change;
- Contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance;
- Is an outstanding example representing major stages of earth's history, including the record of life, significant ongoing geological processes in the development of land forms, or significant geomorphic or physiographic features;
- Contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.

A possible World Heritage Site declaration brings advantages such as an enhanced reputation of the area nationally and internationally (e.g. for tourism), likely international cooperation in its protection and mobilisation of funds.

Programme monitoring
To ensure successful implementation, progress needs to be monitored by the SPC and the IU. The following activities are necessary:

1. Development and monitoring of sustainable development indicators; and
2. Feedback of monitoring results into the MIMP and the management of the area.

10.14. Education, training, knowledge building and awareness raising

This encompasses networking, training, capacity building, collaborating and dialogue. The activities come in different forms such as advocacy, persuasion, education, dissemination, guidelines, recommendations, conversation, discussions, dialogue, counselling and edu-entertainment. Implementation of the Communication strategy will be the ideal tool to enhance the education,

[5] Currently,Tsodilo Hills is the only World Heritage Site in Botswana (since 2001).

knowledge building and awareness raising by providing the strategic and practical guidance to the communication activities that supports the implementation of the plan.

Indigenous knowledge
Communities possess considerable local knowledge that could not be fully tapped during the MFMP preparation. Therefore a recommended MFMP activity is to document the Indigenous knowledge, particularly with reference to biodiversity hotspots, long term resource trends (e.g. history of the Boteti River), archaeological & heritage sites and wet spots.

Partners could help in increasing awareness of IK, disseminate IK practices and help to build local educational centres for the identification, documentation and dissemination of IK practices. This documentation will then help in raising awareness of the importance of IK among development partners and applying IK in the development process.

In conclusion, the MFMP strategy aims to keep local stakeholders fully involved in the MFMP implementation process and to benefit from their views and knowledge. This requires the development of a consultation & participation strategy throughout the MFMP implementation (DEA-IU).

Recommended MFMP activities are:

1. Document and publish indigenous knowledge of the MFMP area, with particular reference to the biodiversity hotspots, the wet spots, the archaeological and heritage sites and the area's history;
2. Prepare a book on the Makgadikgadi area with popularised scientific findings. This books would inform policy makers, decision makers, local communities etc. about the values of the area and the need to conserve and utilise its resources sustainably.
3. Establishment of a Makgadikgadi information centre (e.g. linked to the MNPNP or a CBNRM project).

Training of members
There is need for training of community members more especially members of the trust on the general processes of project management, administration and financial management. Training should also be extended to members of the community in the areas of natural resource utilisation for livelihood improvement. The mining, tourism and other private companies need to collaborate with government in helping in the area of human development.

10.14. Funding and costs

The MFMP development has been funded in the current NDP 10. The MFMP implementation will be funded through existing government (development and recurrent budget options). These will however not be sufficient for implementation all the recommended activities. Public Private Partnership is encouraged and this could be initiated through consultation with the institutions such as Botswana Confederations of Commerce, Industry and Manpower (BOCCIM). Furthermore, national and international funding opportunities need to be explored in more detail. The need to identify funding opportunities is important to augment the required financial resources. The following opportunities will be explored with the MFMP.

Global Environmental Facility

The Global Environmental Facility (GEF) is considered World's largest sponsor of projects in developing countries to protect the global environment while supporting sustainable development. The GEF is the financial mechanism for the United Nations Conventions on Biodiversity, United Nations Framework Convention on Climate Change, United Nations Convention to Combat Desertification, and Stockholm Convention on Persistent Organic Pollutants (POPs). The focal areas funded under GEF are; Biodiversity, Climate Change, International waters, ozone depletion, land degradation, Persistent Organic Pollutants. The GEF encourages countries to integrate GEF priorities within broader national environment and sustainable development frameworks. The MNPNP presents a good opportunity as a framework for development of project proposals for activities within the plan. The DEA is the National Operational Focal Point for GEF in Botswana. Botswana has been allocated funds under the current GEF 5 for the following focal areas:

- Biodiversity US$ 2.11 million
- Climate Change US$ 3.18 million
- Land Degradation US 5.21 million

Total **US$ 10.50 million**

National Environmental Fund Order, 2010

The National Environmental Fund is a special fund to finance and promote activities designed to conserve, protect and manage Botswana environment. Receipts into the Fund includes, revenues from sale of hunting quota and concessions by communities, resource royalties, revenues from levies, fines and licenses for environmental pollution and management. The MFMP activities fall within the spectrum of the activities funded under the NGO fund.

The fund provides for activities dealing with:

- Sustainable development;
- Sustainable use of natural resources and related activities;
- Development and implementation of CBNRM activities;
- Support eco-tourism sector and the development of national heritage sites;
- Rehabilitation of degraded ecosystems;
- Climate change mitigation and adaptation;
- Waste management and pollution control;
- Environmental awareness and education;
- Environmental research and monitoring; and
- Compensation for damage caused by wildlife.

Assistance to NGO Fund

Government recognizes and appreciates the important role played by NGOs, as partners in development. They have demonstrated their ability to reach the vulnerable and disadvantaged sections of the society. They are therefore expected to complement and support developmental role played by Government Department and Ministries. Consequently, it has become necessary to have a framework for the relationship between NGOs and Government, under which Government will continue to provide financial support to NGOs. Government has developed guidelines to establish and strengthen administrative mechanisms at ministerial levels in order to enhance control, coordination, monitoring and evaluation of NGO projects/programmes that are supported by Government. Programmes such as the Community Based Natural Resources Management (CBNRM) which have been recommended within the MFMP could benefit from this fund. Relevant NGOs can be identified to assist community trusts within the MFMP implement CBNRM projects.

The Center-piece of the administrative structure set up for implementation of the NGO Fund guidelines is the Ministerial NGO Project Appraisal Evaluation Committees (MINPACs) in Government ministries, which have direct dealings with NGOs. The objectives of the MINIPAC are to ensure that measures are in place for follow-up on how funds are used through the lifespan of each project; get an early indication of whether the project is on course so as to take appropriate action, if need be, before releasing more funds, as well as ensure that NGOs have no latitude to use funds for purposes other than for which they were requested. The Department of Environmental Affairs administrates the NGO Fund

Tropical Forest Conservation Fund (TFCF)
The Government of Botswana in 2007 established a special fund, known as the Tropical Forest Conservation Fund (TFCF). The purpose of the TFCF is to promote activities designed to conserve, maintain and restore the forests of Botswana. Eligible activities supported by TFCF includes:

- Establishment, restoration, protection, and maintenance of parks, protected areas and reserves;
- Development and implementation of scientifically sound systems of NRM;
- Training;
- Sustainable use of diverse animal & plan species;
- Research and identification of medicinal uses of plants to treat human diseases, illnesses and health related concerns; and
- Development and support of livelihoods.

The TFCF is administered by Forest Conservation Botswana based in Gaborone.

Community Conservation Fund
Recognizing the importance of communities in the management of natural resources the Government of Botswana established the Community Conservation Fund (CCF). Many communities have little or no experience in the active management of their resources and the legal and commercial issues surrounding such management. Training, legal assistance, technical advice and seed money for various community initiatives are therefore essential in the first formative and operational years of such projects if they are to succeed. The CCF is established to defray some of the costs to Community Based Organizations (CBOs) of acquiring necessary skills and undertaking various activities related to the use of natural resources and the conservation of wilderness and wildlife . The CCF is specifically established to provide financial support to community based organizations involved in CBNRM for a variety of activities both revenue and non-revenue generating, including viable conservation initiatives geared to the protection and breeding of endangered species or environmental education. Only CBOs will be considered for funding. Both existing CBOs and those in formation can apply. Proposals must show that any benefits resulting from the funding will be used in environmentally and socially beneficial ways.

Other possible funding sources
If the area is declared a World Heritage Site, funding can be sourced from the World Heritage Fund. This has regional clusters in Harare and Namibia and the African World Heritage Fund in South Africa. UNESCO funds training and capacity building programmes and also in partnership with other international institutions. The training and capacity building is in the field of heritage management, indigenous knowledge, research in different scientific and cultural fields. The training is for professionals in Government institutions and non-governmental organisations including community based organizations. There is a "National Tentative List", also currently under review, for sites and

areas under consideration for application to UNESCO for declaration as World Heritage sites. This includes the "Makgadikgadi Cultural Landscape". Contrary to expectations that this would be the rich archaeological landscape of the Mosu Escarpment on the south side of Sowa Pan, the three-paragraph description only refers to Lekhubu Island and Thitaba. According to the NMMAG, "although the Makgadikgadi is proposed as a cultural landscape, it is currently considered to be listed as a natural landscape since the cultural aspect is perceived to be not of outstanding universal value" (Mohutsiwa Gabadirwe e-mail 18/2/2010). The proposal, as is, is still in very early stages.

Sustainable development of the MFMP area will maintain greater biodiversity and a rehabilitated vegetation cover than under the current trend scenario (chapter 9). This is likely to be associated with an increased carbon sequestration of the MFMP area. The 'extra' carbon sequestration due to sustainable development could be used to secure funding from funds such as GEF and carbon trading.

Another opportunity exists within the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM) which is based in Rome, Italy. ICCROM funds training programmes to strengthen capacity in the preservation and restoration of cultural properties. The training is for mid-term career professionals and decision-makers including; archaeologists, architects, conservator-retorers, environmental lawyers, conservation scientists and engineers working for public institutions such as museums and non-governmental organizations..

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Appendix 1: Matrix of planned MFMP activities

Category	Activity	Responsible institution(s)	Link with objectives	Costs	2011	2012	2012+
1.Management of natural resources	More detailed valuation study of protected areas, wildlife management areas and communal areas based on a survey;	DEA, consultant support and Birdlife Botswana (PAs)	Resource use & conservation	P 500 000 & Birdlife project	X	X	
	Integration of indigenous knowledge into MFMP implementation	DEA	Livelihoods & resource conservation	P 250 000 p.a. (linked with comm. Strategy) DEA	X	X	X
Land	Development of specific CHA land use management plans (LUMP) for State land areas outside the Park taking into consideration land suitability maps, hotspots and tourism zones	DoL	Optimal land use, conservation of hotspots & conflict reduction	P 250 000 – 750 000 per CHA depending on the size and diversity	CT 11	CT 10	CT 7?
	Freezing of tourism licenses within the Tribal and State Lands until management plans have been developed with LACs (below level indicated in Table 40)	DoT & DoL	Optimal tourism development & livelihood benefits	0	Until LACs have been established	Until LACs have been established	Until LACs have been established
	Freezing of borehole applications within the State Lands until land use management plans (LUMPs) have been developed	LB & DWA	Optimal land use	0	Until LUMPs have been prepared	Until LUMPs have been prepared	Until LUMPs have been prepared
	Grant leases for boreholes (cattle posts) as per the pastoral land use suitability map and availability of sufficient space	LB & DWA	Optimise land use & productivity	0	X	X	X
	In both State and Tribal Lands, the agricultural suitability maps should guide allocation of land resources	LB & land use Planners	Optimise land use & reduce conflicts	0	X	X	X
	Assessment of level of use of BLDC and Nata ranches to ascertain their potential for pastoral expansion	DoL, MoA & LB	Increase livestock productivity & create space for expansion	P 200 000 BLDC (from recurrent moA budget) P 400 000 Nata ranches (from recurrent MoA budget)	BLDC ranches	Nata ranches	Expansion into & full use of ranches (where possible)
	Implementation of the Agricultural White Paper No. 1 of 1991 (communal land management)	MoA	Increased livelihood benefits & reduced need for agricultural expansion	Recurrent budget MoA	X	X	X
	Introduction of new crop farming techniques that enhance crop productivity	MoA-Dep. of Crop Production	Increase crop production & livelihood benefits	Recurrent MoA	X	X	X

	Promote cooperative farming from within the communities	MoA	Increased livelihood benefit	Recurrent MoA	X	X	X
	Identify with communities areas where drift fences could resolve conflicts & construct drift fences	MoA & communities	Conflict reduction & increased livelihood benefits	Costs depend on length of fence; from MoA budget	Identification	Construction	construction
National Parks management & tourism							
	Improvement of tourism facilities within the park (roads, lodges & camps)	DWNP, DoT & private sector	Tourism growth & livelihood benefits	P 5 million government & P 10 million private sector	Public facilities	Private sector facilities	X
	Actively explore benefits of (partial) private management of the Makgadikgadi and Nxai Pans National Parks	DWNP & private sector	Tourism growth & increased livelihood benefits	No costs to GoB; mobilises private investments		X	X
	Development of new community use zones within the Makgadikgadi National Park, i.e. along the Boteti River	DWNP, DoT, BTO, DFRR & communities	Increase livelihood benefits from MNPNP	0	X	X	X
	New and existing power lines bisecting waterbird flight paths to be fitted with sufficient deterrent reflectors	BPC	Bird protection & conservation	To ascertain costs	X	X	X
Wildlife	Implementation of the elephant management plan within the MFMP area	DWNP	Conflict reduction & tourism development	Recurrent DWNP	X	X	X
	Realignment & electrification of the Boteti fence from the national grid	DWNP	Conflict reduction	To ascertain costs from BPC; GEF		X	X
	Implementation of the flamingo sanctuary regulations as well as development and implementation of its management plan	DWNP & Birdlife Botswana project	Flamingo protection & conservation	P 0.5 - 1 million & Birdlife project/GEF			
	Development of country species-specific action plans for globally threatened species	DWNP, DFRR, Birdlife Botswana and others	Species conservation & protection	P 250 000/ species	1	1	1
	Inclusion of birdlife issues in the fence SEA	DWNP & Birdlife	Species conservation	0	X		
	Full utilisation of the artificial water points (AWPs) within the MNPNP	DWNP	Conservation & Sustainable use of wildlife in MNPNP	Recurrent park budget	X	X	X
	Seasonal operation of AWPs located on the eastern side of the MNP or CT11	DWNP & Private operators		0	X	X	X
	Development of new AWPs in the north western part of MNPNP as well as NG49 for improved water access	DWNP		P 0.2 -0.5 million/ borehole		X	X
	Development of deep, permanent hippo pool for the alleviation of social stress when the Boteti River stops flowing	Private operators	Hippo conservation & tourism development	P 250 000			X
	Maintenance of privately owned AWPs within hunting areas	Private operators	Resource conservation & tourism growth	Own budget operators	X	X	X

	Management of AWPs in line with the LACs	DWNP & Private operators	Wildlife conservation & management	0	X	X	X
	Establishment of a permanent anti-poaching unit (APU) based in the MNPNP	DWNP		Recurrent DWNP		X	X
	Employment of permanent anti-poaching patrol units within NG47, 49 and CT 11	Concessionaires		P 240 000/yr/area		X	X
	Indirect compensation through support for CBNRM initiatives	BTO	Conflict reduction & livelihood mitigation	Community support at P 250 000 p. a. per community	X	X	X
	Pilot community based insurance schemes as alternatives to the current compensation system	DWNP, MoA, BTO & private sector	Conflict reduction & livelihood mitigation	Contributions from stakeholders & P 100 000 starting costs (GEF)		X	X
	Extend compensation for livestock losses to damage due to hyenas & wild dogs	DWNP	Livelihood mitigation	P 250 000 p.a. in area	X	X	X
	Capacity building and community awareness on human-wildlife conflict mitigation strategies	DWNP, DEA & MoA	Conflict reduction & livelihood mitigation	Recurrent DWNP	X	X	X
	Preservation of the conservation status of the WMAs to the north of MFMP – gazetting	DoL		0	X	X	X
	A feasibility study on the potential to develop a fenced corridor connecting MNP and CKGR	DDWNP, MoA, DoL & LB	Resource conservation	P 1 million	X		
Water	Development of 8-day resolution MODIS pan water maps for the period of 2000-2010	DWA & DGS	Basis for ecosystem conservation & wet spots	Independent research budget		X	
	Pan wide baseline survey of sediment composition, mineralogy and spectra as well as shallow groundwater chemistry and dynamics	DWA	Improved ecosystem understanding and of wet spots	Can be combined with on-going research by UCT	X	X	
	Up-scale accurate recording and collection of daily rainfall data	DMS & DWA	Improved ecosystem understanding and climate change	DMS & DWA recurrent budgets	X	X	X
	Evaluation of the feasibility of a long term monitoring program in and around of BotAsh wellfield	BotAsh & DWA	Sustainability of soda ash mining	Botash part of EMP	X	X	X
	Further development of the water balance	DWA & others	Improved ecosystem understanding and the role of water resources	P 0.5 – 1 million (GEF)	X Linked with on-going research	X Linked with on-going research	
	Improved hydrological monitoring of the main discharge rivers flowing onto Sua Pan, in the East and the Boteti River, to the west	DWA	Improved ecosystem understanding and the role of water resources	DWA recurrent (partly on-going)	X	X	X

	Postponement of Mosetse dam until more information on groundwater input and environmental flow requirements is obtained	DWA & DEA	Minimisation of risks threats to ecosystem; pre cautionary principle	DEA & DWA to pursue through GEF funding	X	X	X
	Implementation of water legislation	DWA	IWRM & WDM	DWA recurrent budget			
	Reduce, reuse and recycling of wastewater	Communities, government, mines, private tour operators	Water conservation & efficiency	All stakeholders	X	X	X
	Updating of Icesat elevation recording of the pan catchment and pan floors	DWA	Improved ecosystem understanding and the role of water resources	P 500 000 (e.g. Debswana)	X		
	Water quality compliance with BOBS standards	DWA & Councils	Improved living conditions	Part of DWA recurrent budget	X	X	X
Rangeland resources and vegetation and livestock	Protection and management of range resources in line with IUCN's Red Data List. These include: *Hoodia lugardii, an Orbea sp., Blepharis bainesii, a Harpagophytum sp., Panicum coloratum var makarikarienses, Panicum pilgerianum, and Sporobululs bechuanicus*	DWNP, DEA & DFRR	Resource conservation	GEF	X	X	X
	Listing and protection of some tree species such as Baobab found in the area	DFRR	Resource conservation	GEF	X	X	X
	Comprehensive site inventories and monitoring of key threatened and endemic plant species in the Biodiversity Hotspots	DFRR	Resource conservation	P 120 000 per site	X	X	X
	Monitoring of alien invasive species	DFRR & communities	Ecosystem protection	Recurrent DFRR budget	X	X	X
	Community management of range resources	CBOs & DFRR	Resource conservation	P 250 000 per CBO; GEF	X	X	X
	Improved rangeland management and livestock husbandry: rotational grazing, reduced stocking rates, increased herding	MoA – Dep. Livestock Production & farmers	Livelihood benefits & security & rangeland conservation	MoA recurrent budget	X	X	X
	Pilot community based rangeland resources management project (Mokopi Trust)	Implementation unit, Department Forestry and Range Resources	Livelihood benefits & poverty reduction	P 500 000 p.a.GEF & Debswana			
	Water quality compliance with BOBS standards	DWA & Councils	Improved living conditions	Part of DWA recurrent budget	X	X	X
2. Waste management and pollution control	Development and implementation of District Waste Management Plans for Tutume and Boteti sub-district, including waste recycling	Tutume and Boteti Disctict Councils	Pollution reduction & reduced health hazards	P 1 million per plan	X	X	

	Increasing access to basic sanitation and services	DWMPC, Boteti and Tutume Sub-District Councils	Improved living conditions	Local authority recurrent budgets	X	X	X
	Enhanced community participation in waste management	Central District Council (Boteti and Tutume Sub-Districts) & communities	Livelihood benefits	0		X	X
	Institutional support to communities to initiate and incorporate waste recycling projects as part their management plans (for Trusts)	CDC, Boteti & Tutume Sub-Districts	Resource conservation and livelihood benefits	Part of CBO support	Start with existing CBO villages	X	X
	Support for implementation of the "Green Scorpion" concept within the MFMP	Ministry of Local Government, CDC, Boteti and Tutume Sub-Districts		No extra costs	X	X	X
	Explore & pilot the use of new, appropriate/Best Available Technologies for on-site sanitation facilities	DWMPC, Central District Council, Boteti and Tutume Sub-Districts	Improved health conditions	P 500 000 (GEF)		X	X
	Piloting of privatisation of some components of waste management (e.g. waste collection)	DWMPC, Central District Council, Boteti and Tutume Sub-Districts, private sector	Livelihood benefits & pollution control	Private sector costs Cost savings for government		X	X
	Ensure adequate management of waste within existing and new tourism facilities	BTO (grading), DoT, DEA (EIA/EMP), DWMPC, Central District Council, Boteti & Tutume Sub-Districts	Pollution control	Part of existing monitoring	X	X	X
	Effective monitoring of waste management at the soda ash mine	DWMPC & BotAsh	Pollution control	No extra costs	X	X	X
3. Fire and hazard management	Review of the proposed firebreaks in the area to ensure effective alignments and maintenance of biodiversity	DFRR	Reduced fire hazard & conflicts	P 500 000	X		
	Implement the fire management strategy	DFRR	See above	No extra costs		X	X
	Strategic development and operation of firebreaks within the MNPNP	DWNP	See above	Depends on the length (GEF)		X	
4. Drought management and climate change	Maintenance and utilization of early warning systems	DMS	Livelihood security and adaptation	Recurrent DMS costs	X	X	X
	Drought monitoring and management, incl. monthly early warning reports	DMS, DFRR, MoA	Livelihood security and adaptation	Recurrent budgets	X	X	X
	Promotion & utilisation of drought resistant crops	MoA – DCP & farmers	Livelihood security and adaptation	MoA recurrent budget	X	X	X
	Utilisation of the Water Evaluation and Planning model for climate change predictions	DEA, DWA and DMS	Adaptation & reduced infrastructure damage	P 500 000		X	
	Climate change preparedness to be infused into development planning at sectoral level	MFDP, MoA, MEWT & MMEWR.Also district	Adaptive development planning	No extra costs	X	X	X

		councils					
5. Biodiversity hotspot management	Protection and management plans for the highest ranked BD hotspots	DoL, DEA, DFRR, DWNP & LB	Resource conservation	P 100 -250 000 per hotspot (GEF)	3	3	4
	Recognition of all 61 BD hotspots in land use planning; development of management plans for all BD hotspots over time	DoL, DEA, DFRR, DWNP & LB	Resource conservation & protection	GEF	X	X	X
	Detailed inventory of indigenous knowledge regarding BD hotspots and incorporation of the findings in BD hotspots management (plans)	Implementation Unit, communities	Resource conservation & protection and env. in formation generation	P 250 – 750 000	X		
6. Land Use							
Land use suitability	Use of pastoral land use suitability maps when allocating boreholes and cattleposts	LB & DoL	Increase land productivity	No costs	X	X	X
	Utilisation of undeveloped fenced ranches for livestock production	LB & DoL	Increased land productivity	Compensation depends on lease conditions		X	X
	A site assessment of mogau in northern CT7 and if absent, the area could be developed for pastoral expansion	DoL	Increased land productivity	P 100 000	X		
	Water exploration in CT8	DoL & MoA	Increase user options & optimal land use	P 0.5 – 1 million		X	
	Use of arable land suitability maps when allocating fields; Implementation of integrated land use approach for field 1 allocation	LB & DoL	Increased crop productivity & optimal land use	No costs	X	X	X
Land use conflicts	Support and subsidise voluntary relocation of people away from conflict hotspots	LB & District Councils	Reduce conflicts & optimal land use	Uncertain; follow compensation guidelines			
	Water provision to the BLDC ranches upon relocation of cattle from Phuduhudu to the Makalamabedi BLDC ranches	District Councils, DWA	Reduce conflicts & increase productivity	P 100 000/borehole		X	X
	Development of management buffer zones within 6km around all protected areas	DWNP	Reduce human wildlife conflicts	Possible costs of relocation & compensation			
Fencing	Strategic Environmental Assessment (SEA) of current fence alignments within the MFMP area	MoA, DEA, DFRR, DWNP DoL, LB & communities	Conflict reduction, costs savings and optimal resource use	P 1 million (GEF)	X		
7.Water use	Feasibility studies of desalination plants within the MFMP areas to meet BOBS standards	DWA & WUC	Improved living conditions	P 250 000		X	
	Development of IWRM plan and implementation of IWRM and WDM, e.g. RWH techniques, re-use of grey water, monitoring of water abstraction.	DWA, WUC, private sector & communities	Water conservation & efficiency	P 500 000 for plan; implementation costs estimated later	IWRM plan	Impl	Impl

	Exploration of future water supply and transfer schemes within IWRM & WDM strategy to secure possible future mining activities	DWA, WUC & mines	Water efficiency	P 500 000 for study		X	
	Participation of relevant stakeholders in IWRM & WDM implementation within the MFMP area	All relevant stakeholders including the communities	Participatory resource management	Cost sharing	X	X	X
	Borehole and groundwater protection	DWA & LB	Reduce conflicts	No extra costs	X	X	X
8. Economic sectors & livelihoods							
Mining	Implementation of EMP & mitigation measures as per EIA recommendations for future mines including closure plans and benefit enhancement programme	Mines	Resource conservation & rehabilitation and increased livelihood benefits	Mines	X	X	X
	EIA for brine expansion	BotAsh	Resource conservation & sustainable use	Botash	X	X	X
	Promotion of spatial clustering of mining processing activities	Mines	Increased economic development	No extra costs	X	X	X
	Development of other economic activities in mining areas	District Councils, DoM, mines, LEA & CEDA	Economic growth and diversification & livelihood development & security	Recurrent budgets	X	X	X
Livestock production	Move livestock from Phuduhudu village to the NG49 BLDC ranch	Ministry of Agriculture	Conflict reduction	P 0.5 - 1 million		X	
	Encourage the use of livestock support programmes such as LIMID	MoA Dep.Livestock Production	Increased livestock productivity & livelihoods	Existing LIMID budget MoA	X	X	X
Crop production	Identification of 'serious & committed' crop farmers and advise on improved crop productivity	MoA extension officers	Rise in crop productivity & increase in livelihoods	No costs through extension workers	X	X	X
	Protection of Molapo areas in land use planning	Department of Lands, Ministry of Agriculture		No extra costs apart from routine land use planning	X	X	X
Tourism	Archaeological sites to be declared national monuments & their protection	DMNM	Heritage protection	Cost of protection vary from site to site	X	X	X
	Enhanced local participation in protection and utilization of archaeological sites	Communities, Implementation Unit	Livelihood benefits & heritage protection	P 250 000 per site (GEF)	X	X	X
	Marketing of (and research on) the tourist attractions of the Makgadikgadi area	BTO	Tourism growth	Recurrent BTO & private sector	X	X	X
	Development of tourism support infrastructure in villages that support several ATPs	Implementation Unit & BTO	Tourism growth	Private sector (incl. Debswana & Botash)	X	X	X
	Development of management plans for three ATPs per annum and these should be in line with the LACs.	DoT, BTO, Implementation unit	Sust. Tourism development & resource conservation	P 300 – 500 000 per ATP (GEF)	3	3	3

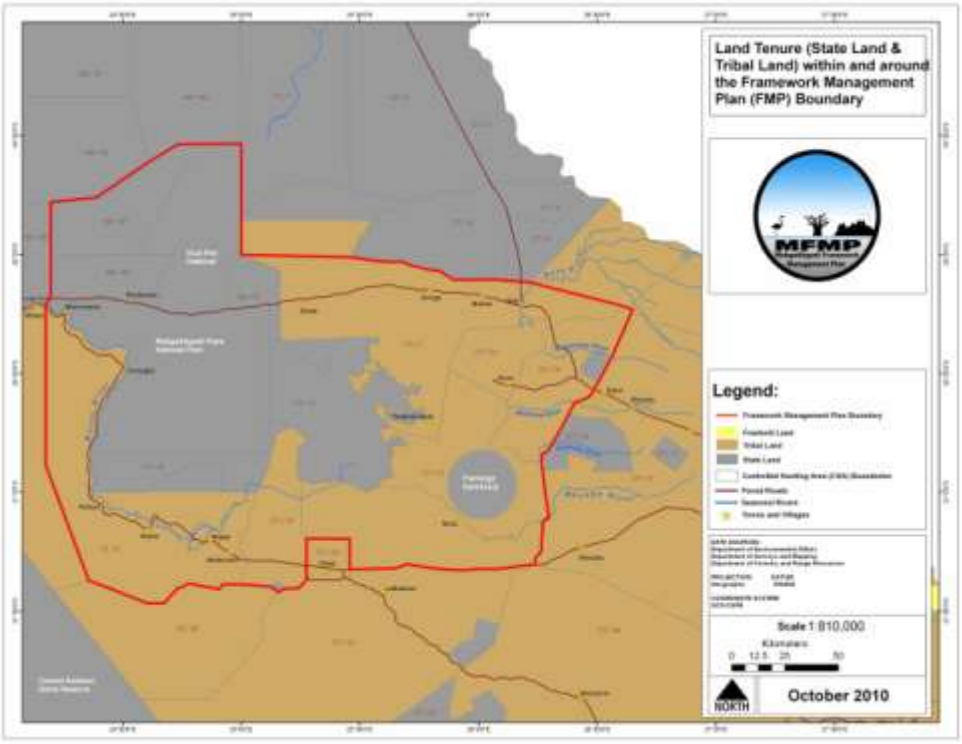
	Assessment of LACs for each tourism zone	DoT, BTO & Implementation unit	Resource conservation	P 0.5 - 0.8 million	X		
Natural Resource Use	Identification and mapping of key natural resources within the MFMP area	DFRR, Implementation Unit, communities	Resource conservation and livelihood benefits	P 0.5 – 1 million (GEF)	X		
	Identification of resource rich areas in the parks and allow sustainable community use	DWNP, Implementation Unit	Livelihood benefits	P 100 000 (GEF)	Identification	Use	Use
	Capacity building of communities to enhance sustainable and profitable resource utilisation	LEA, BTO & NGOs	Livelihood benefits	From existing community support funds	X	X	X
	Use and documentation of indigenous knowledge in harvesting and management of natural resources.	DNMM & communities	Livelihood benefits & resource conservation	P 250 000	X		
	Market analysis and marketing strategy for selling veld products	Implementation unit	Livelihood benefits	P 250 000 per product (GEF)	1 product	1 product	1 product
	Development of a strategic storage facility for abundant products like thatching grass and other veld products	DFRR, Implementation unit, Communities	Livelihood benefits & econ. growth	P 0.5 – 0.8 million (GEF)		X	X
	Incorporate viable veld products in existing and new CBNM projects (e.g thatching grass & morula) based on the Kgetsi ya Tsie model	DFRR, Gwezotshaa Trust, Nata Trust, Implementation Unit	Livelihood benefits & resource conservation	No extra costs	X	XX	X
9. Livelihoods improvement	Establishment of market places for veld products such as morula and thatching grass	DFRR, Implementation unit & Communities	Livelihood benefits & security	P 250 000 per market place		X	X
	Identification and exploitation of opportunities for fishing reed production etc. along the Boteti River when in flood	DFRR, DWNP & Communities	Livelihood benefits & security	DFRR & DWNP recurrent budget	X		
	Diversification of crops, fodder production	Farmers, MoA	Livelihood benefits & security	From existing MoA support schemes & research	X	X	X
	Community rangeland management committees through existing bodies such as farmers' committees	Communities & MoA	Livelihood benefits & security	From existing MoA support schemes	X	X	X
	Small scale horticultural projects to supply villages, mines and tourism facilities	MoA & farmers	Livelihood benefits & security	From existing MoA support schemes	X	X	
	Development and implementation of local community empowerment and beneficiation strategies	Mines, private sector & communities	Livelihood benefits & security	Cost for mines	X	X	X
	Diversification of the Ipelegeng programme (beyond grass cutting to include reclamation of gullies, ind. tree planting, bush encroachment control etc.& decentralization of maintenance programmes to village level	Ministry of Local Government, PEI-MFDP	Livelihood benefits & security	Ipelegeng budget	X	X	X
	Continued support to CBOs to fully participate in tourism activities: capacity building	Government, NGOs, BTO, & LEA	Livelihood benefits & security	Community support fund & dedicated CBO support staff	X	X	X

	Community extension offices in the MFMP area for CBO support	BTO	Livelihood benefits & security	Existing BTO budget	X	X	X
	Development and management of CBNRM plans for exIsting and new CBOs	CBOs, Donors, Government, NGOs	Livelihood benefits & security	P 500 000 per plan??	1	1	1
	Livelihoods survey and analysis in localities and other parts of the FIMP area	DEA, PEI-MFDP	Livelihood benefits & security	Existing DEA budget & PEI-project		X	X
	Continued targeted government support through the social safety nets programmes	Ministry of Local Government	Livelihood benefits & security	Existing welfare programmes	X	X	X
10.Institutions and governance	Coordination, implementation and monitoring of MFMP activities	Implementation unit based in the district, other government and non-government al organizations, private sector, communities		DEA budget provisions (GEF)	X	X	X
	Linkages and partnerships with existing projects in the MFMP area	Implementation unit		No extra costs	X	X	X
11. Education, knowledge building and awareness	Implementation of the communication strategy	DEA		DEA recurrent budget	X	X	X
	Development of local education centres for documentation and dissemination of indigenous knowledge	Private companies, NGOs		P 1 million per centre		South (Mopipi, Matshumo or Rakops)	North (e.g. Gweta or Nata)
	Training of communities in resource use, management, business, financial management, tourism development, etc.	Government, Private companies, NGOs		From existing CBO funds	X	X	X
12.Environmental monitoring and research							
Monitoring	Adoption of the proposed sustainable development monitoring framework for the MFMP area	Implementation unit		P 2-3 million p.a.	X	X	X
Research	Research topics have been suggested in section 10.4 Research Fund to be established through the National Environmental Fund, research window	IU, GoB, NGO, UB & independent researchers		Through funds with funding from private sector, academia, GEF/climate change-biodiversity & land degradation	X	X	X
13. Funding	Public private partnerships	Private companies, government					
	Explore opportunities through GEF	DEA					
	Utilisation of the National Environmental Fund	DEA					

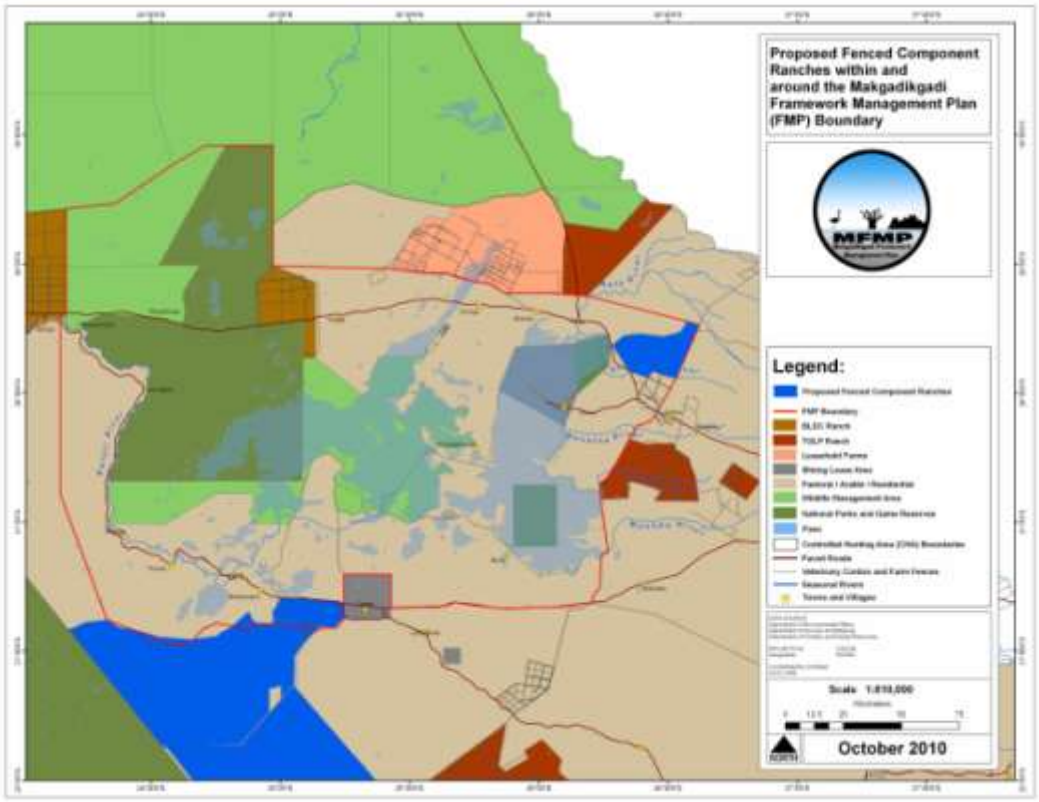
	Support CBNRM projects through the NGO fund	DEA & NGOs					
	Utilisation of the Tropical Forest Conservation Fund	DEA & DFRR					

Appendix 2: MFMP maps

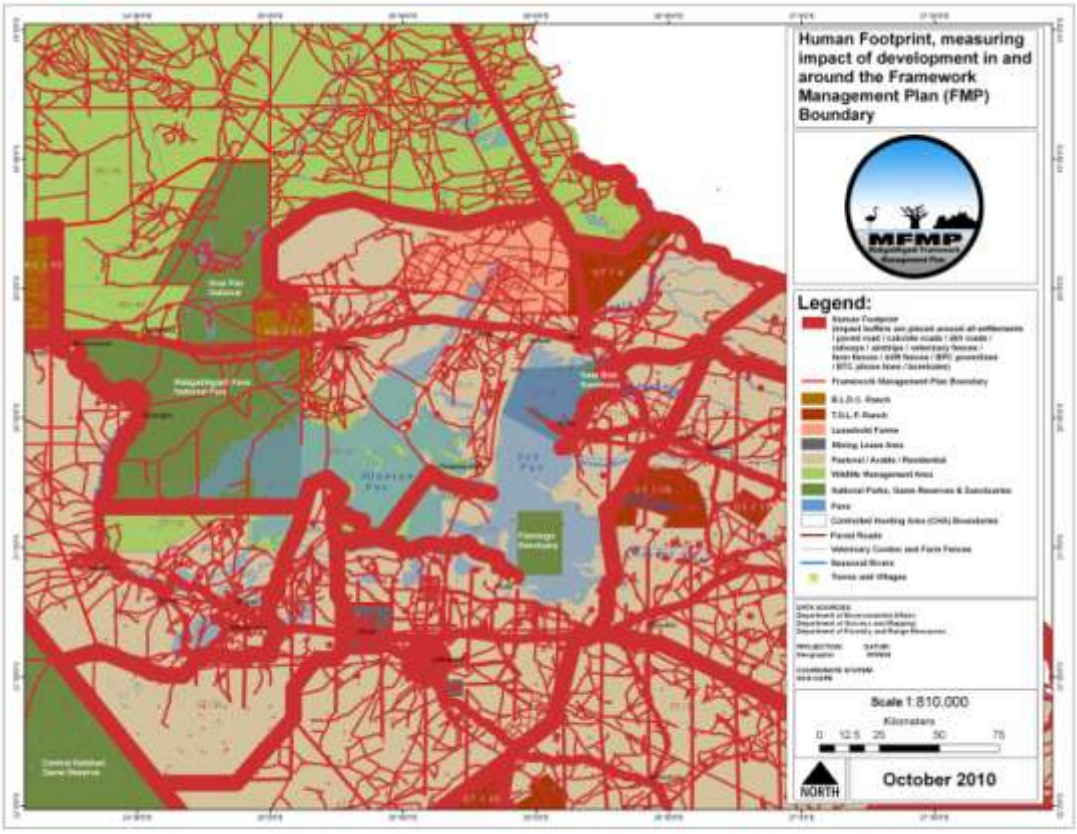
Land tenure within and around the MFMP area



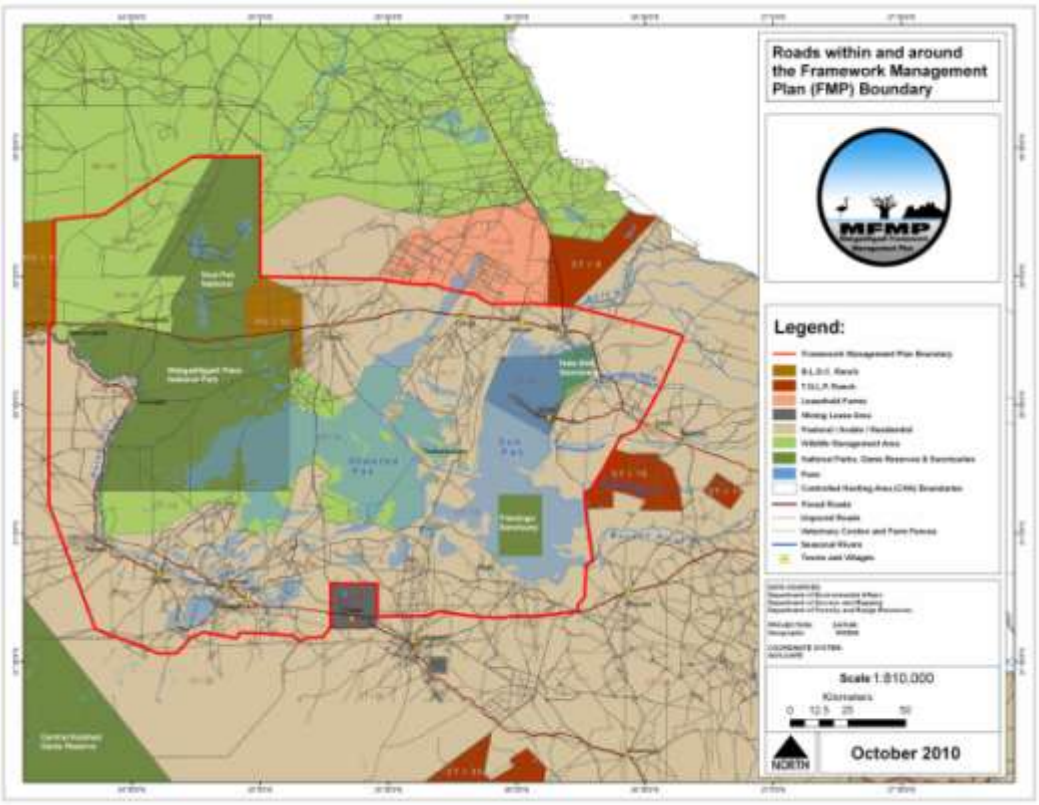
Proposed and existing ranches around the MFMP area



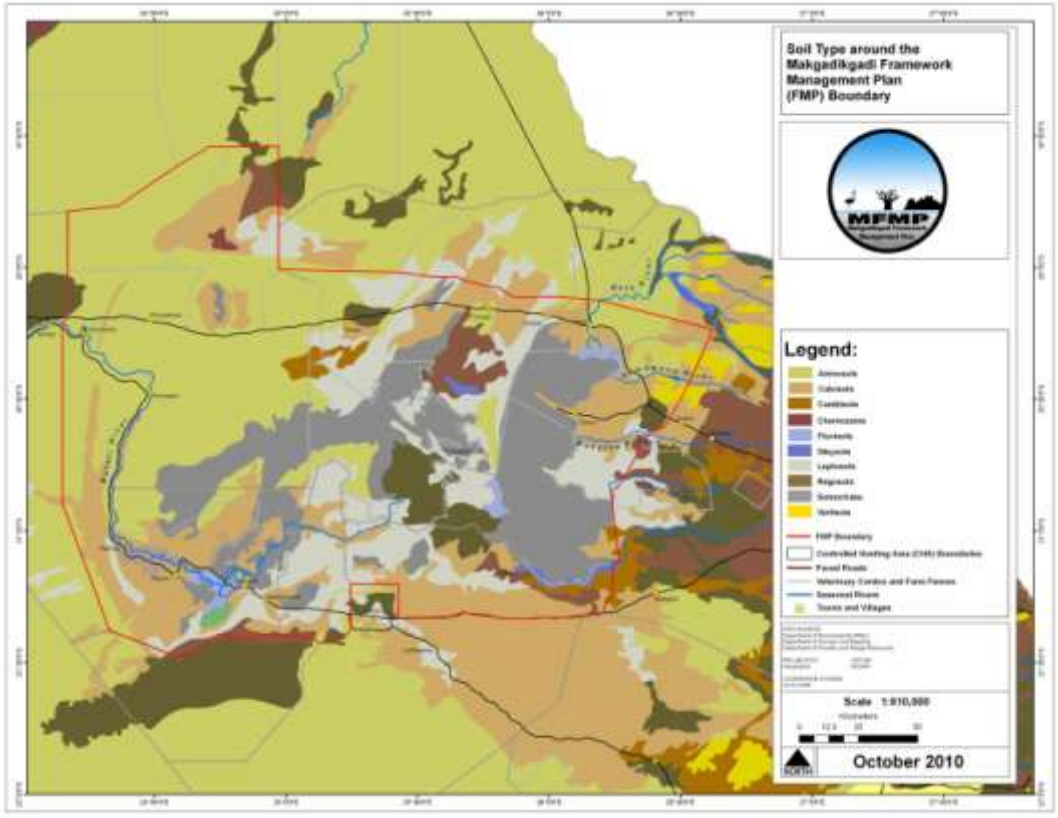
The "human footprint" of development within and around the MFMP area



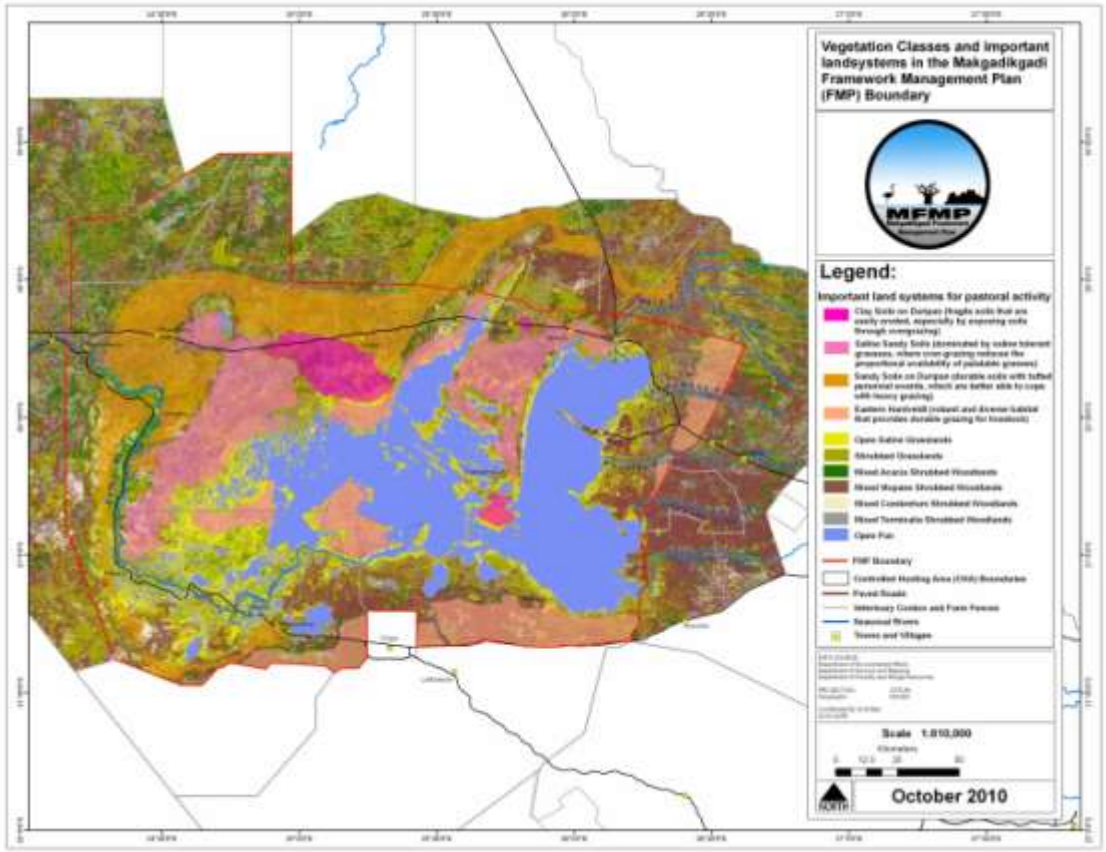
Roads within the MFMP area



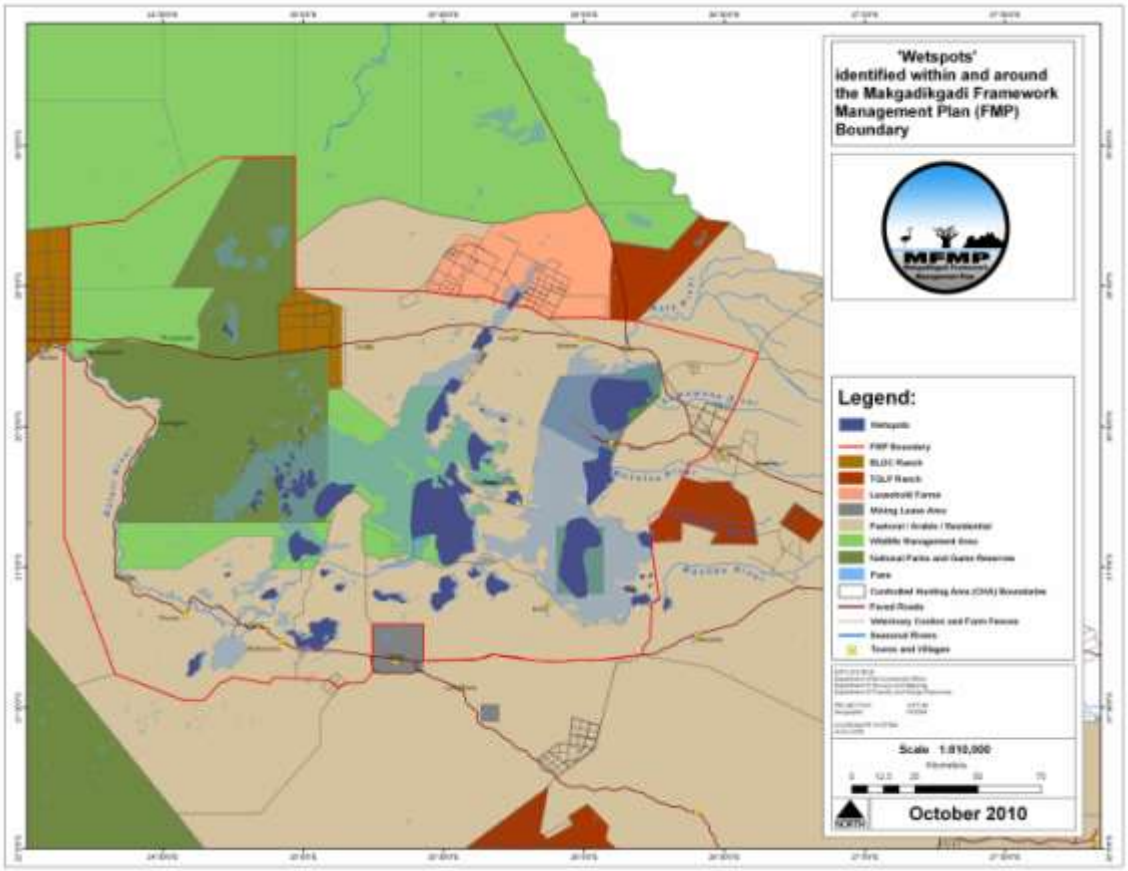
General soils within the MFMP area



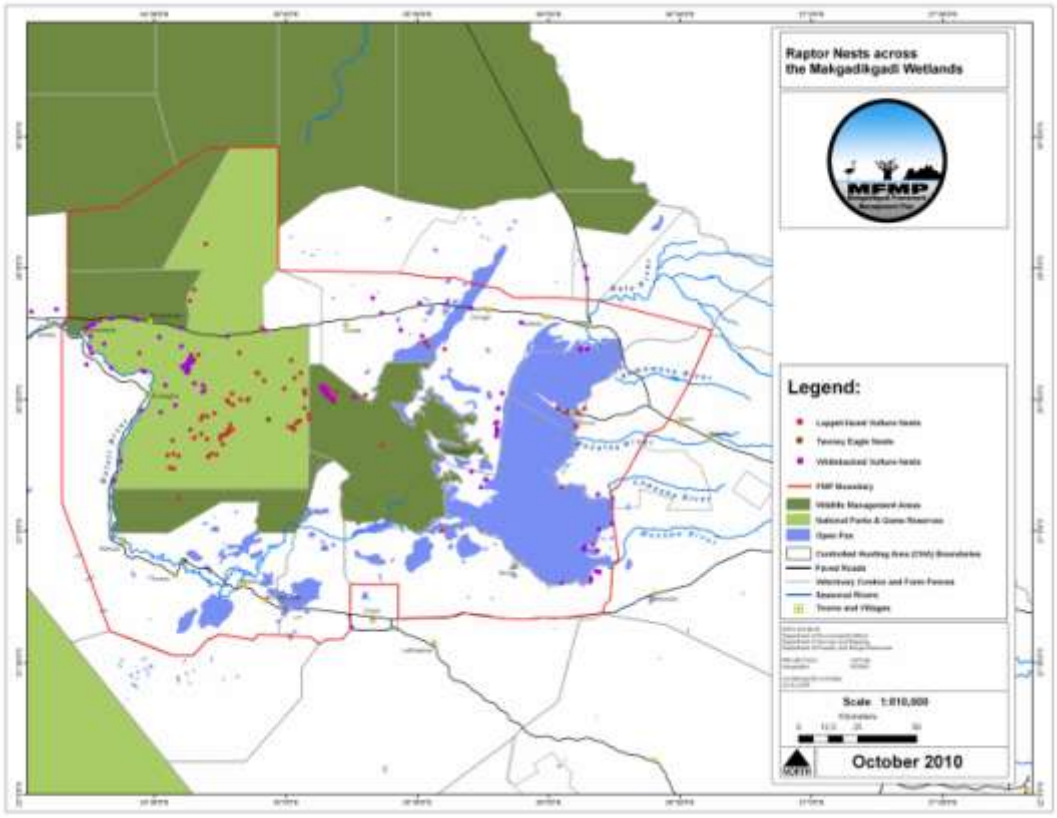
Vegetation map of the MFMP area



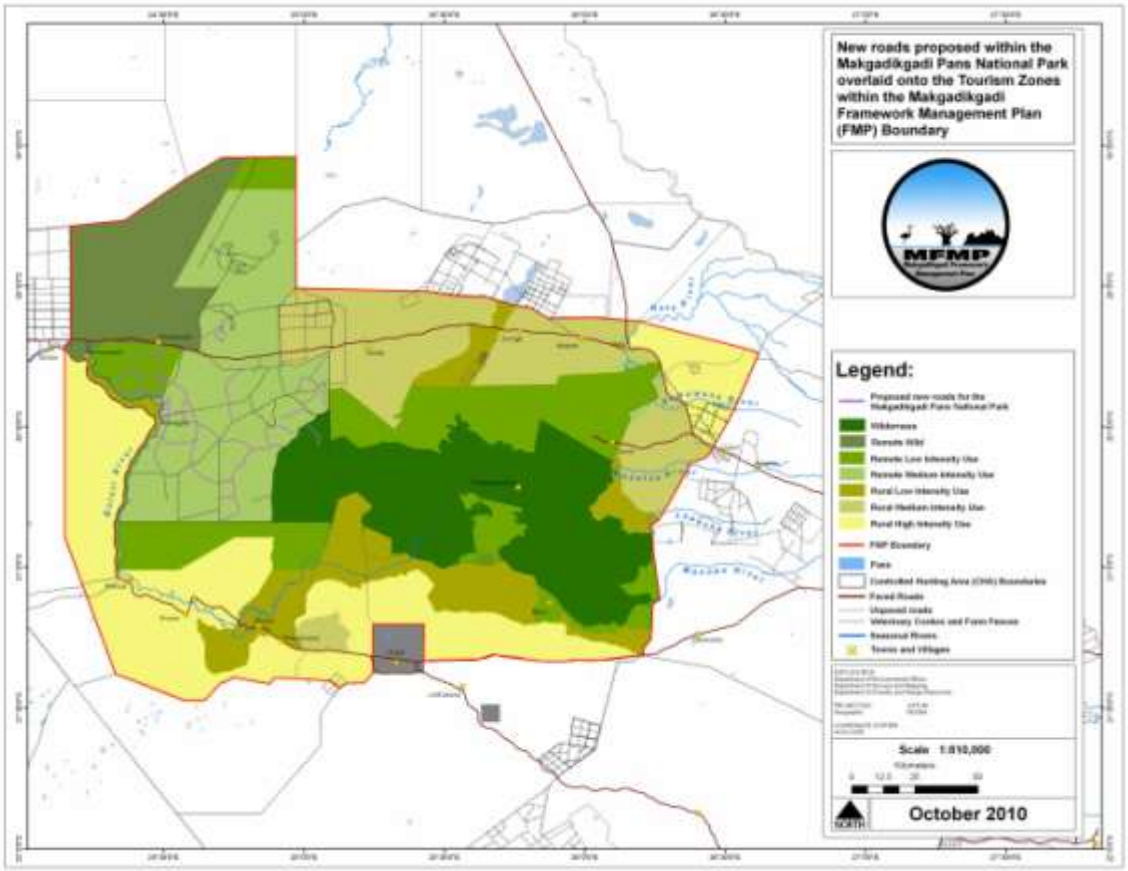
Wet spots within and around the MFMP area



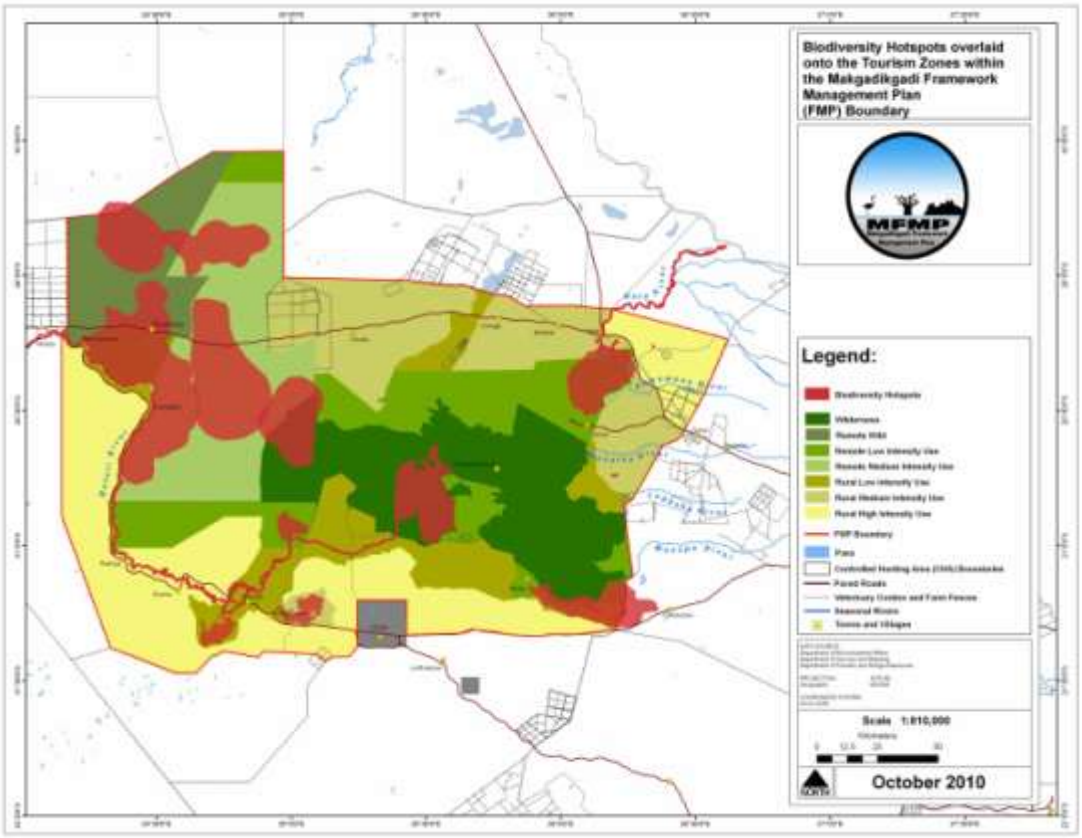
Distribution of known raptor nests across the Makgadikgadi wetlands



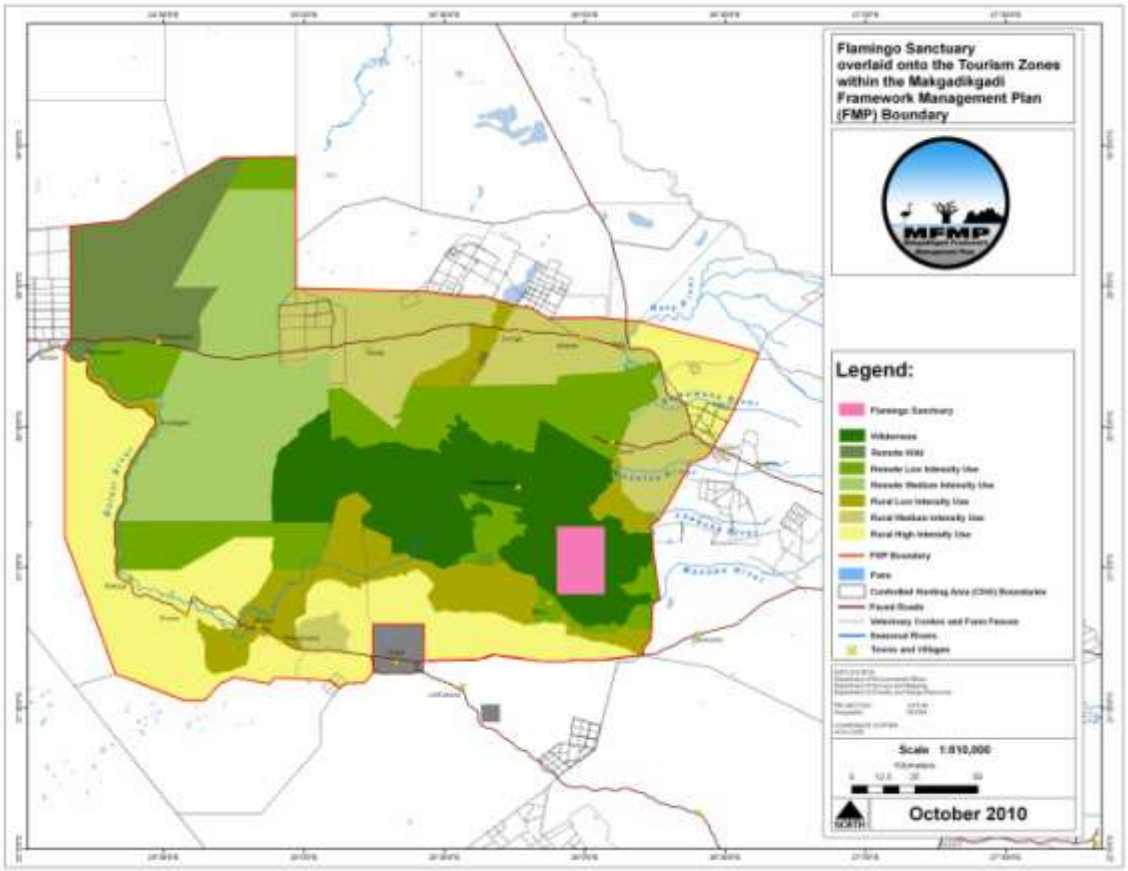
New proposed roads in Makgadikgadi Pans National Park



Biodiversity hotspots overlaid onto the tourism zones within the MFMP area



Flamingo sanctuary overlaid on to the tourism zones within the MFMP area



Arable land use suitability within and around MFMP area