MDM/9/11/1/2010

STATUS QUO REPORT

ENVIRONMENTAL MANAGEMENT FRAMEWORK FOR METSWEDING DISTRICT MUNICIPALITY

March 2011

A Report for: Metsweding District Municipality

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This Status Quo report is the first deliverable as part of the development of the Metsweding EMF developed by SSI Environmental on behalf of Metsweding District Municipality and GDARD.

Please reference this report as:

Metsweding District Municipality (2011). Metsweding District EMF: Status Quo Report. Report 1 of the Metsweding Environmental Management Framework and Environmental Management Plan.

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DOCUMENT DESCRIPTION

Client:
Metsweding District Municipality

Report Name:
Environmental Management Framework for Metsweding District Municipality

SSI Environmental Reference Number:
E02.PTA.000284

Authority Reference:
MDM/9/11/1/2010

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Date:
March 2011

Location:
Metsweding, Gauteng Province

TABLE OF CONTENTS

Table of Figures

List of Tables

List of Photos

List of Maps

Appendices

ABBREVIATIONS AND ACRONYMS

AMD	Acid Mine Drainage
AIDS	Acquired Immunodeficiency Syndrome
ARC	Agricultural Research Council
BIMS	Biodiversity Information Management System
CBA	Critical Biodiversity Area
CBD	Central Business District
CBO	Community Based Organisation
CCP	Cities against Climate Change Programme
CFL	Compact Fluorescent Lamp
DEA	Department of Environmental Affairs
DTI	Department of Trade & Industry
DWA	Department of Water Affairs
EIA	Environmental Impact Assessment
EMF	Environmental Management Framework
EMP	Environmental Management Plan
GDA&RD	Gauteng Department of Agriculture and Rural Development
GDP	Gross Domestic Product
GVA	Gross Value Added
GIS	Geographic Information System
HIV	Human Immunodeficiency Virus
HSP	Housing Sector Plan
I&AP	Interested & Affected Parties
ICCC	International Climate Change Conference
ICLEI	ICLEI-Local Governments for Sustainability (formerly International Council for Local Environmental Initiatives)
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
IEP	Integrated Environmental Plan
ITP	Integrated Transport Plan
IUCN	International Union for the Conservation of Nature
LED	Local Economic Development
MDM	Metsweding District Municipality
MEC	Member of the Executive Council
MIG	Municipal Infrastructure Grant
MOSS	Municipal Open Space System
NEMA	National Environmental Management Act
NGDB	National Groundwater Database
NGO	Non-Governmental Organisation
NSBA	National Spatial Biodiversity Assessment
PSDF	Provincial Spatial Development Framework
QDS	Quarter Degree Square
RDP	Reconstruction and Development Programme
SANBI	South African National Biodiversity Institute
SAHRA	South African Heritage Resources Agency
SDF	Spatial Development Framework
SEMP	Strategic Environmental Management Plan
SoER	State of the Environment Report

SWOT	Strength, Weakness, Opportunities & Constraints
WMA	Water Management Area

Executive Summary

The Metsweding District Municipality is an area within the Gauteng province experiencing growth and development pressure. Pressure factors include urban development and expansion, a backlog in infrastructure provision, demand for housing, and urbanisation.

The Metsweding District Municipality can be described as a transition zone located between the City of Tshwane urban metropolitan area and the rural areas of the Mpumalanga province. There is an intensification of development towards the west of the District in the areas that border the City of Tshwane. The most important **functional regional linkage** is therefore with the City of Tshwane (and to a lesser extent the Ekurhuleni Metropolitan Municipality), with a considerable amount of urban development spilling across from the City of Tshwane municipal area into the western parts of Metsweding, namely Kungwini West.

The Metsweding District is largely rural in character, with approximately 95% of the area comprising typical rural land uses and activities such as nature areas, ecological features, conservation areas, farming and cultivation, rural residential and non-productive farm portions/ vacant land. The District has a significant but underdeveloped agricultural base.

The formulation of the **Environmental Management Framework** for Metsweding is therefore necessary to ensure that development and growth is sustainable and does not take place to the detriment of the sustainability of the natural resource base.

In essence, the Environmental Management Framework defines a spatial development structure that can be supported by the natural resource base and which most closely matches the social and developmental desires of the local communities. The environmental management framework consists of an analysis of both the current and desired states of the biophysical and socio-economic environments, and a spatial interpretation of management actions that are required to reach the desired state of environment in the Metsweding District Municipality.

The **Status Quo Assessment** highlights the fact that the area has a high natural resource quality in terms of species richness due to the convergence of various biomes. Unfortunately, habitats in the central and southern parts of the study area are rapidly degrading due to large scale agricultural activities, urban expansion, mining and land transformation, especially the remaining untransformed fragments of Rand Highveld Grassland and Central Sandy Bushveld.

Most of the activities in Metsweding centre around the towns of Cullinan, Rayton and Bronkhorstspruit and associated townships, with agriculture and mining being the most prevalent activities. The development of the Roodeplaat and Bronkhorstspruit Dams, Dinokeng Game Reserve and the rich cultural history in the Cullinan area have resulted in an increase in local tourism activities. Transformation of the natural environment is linked to these land use activities as well as continued urban growth.

The levels of land transformation from natural conditions have been high and there have been biodiversity losses as a result. The highest impacts have been on the grassland areas as well as within the freshwater ecosystems. Information on red data species and critical biodiversity areas exists which should be used to inform environmental management in the municipality.

The areas that have a **high ecological or biodiversity value** are: ridges and mountains as a high proportion of the threatened and near threatened priority plant species in the study area occur within this habitat; vegetation of high conservation importance as this area contains a

vegetation type of elevated conservation value. In general, these areas have been transformed to a high degree and remaining natural habitat needs to be conserved in order to retain components of these ecosystems and its biodiversity in the landscape. There are some threatened organisms that occur within this area which also require protection; and thirdly rivers and drainage lines: the main perennial rivers draining the study area are important hydrological features in the landscape and also provide vital ecological corridors through the landscape.

The **main threats** to the natural environment in Metsweding are related to pressures on natural resource base amidst development and expansion of the urban areas, as well as extra-urban agricultural and mining extensions. An important step to managing these issues is the recognition of the value of wetlands and watercourses, as well as their associated aquatic ecosystems must form part of the development planning of both the urban and rural areas of Metsweding.

1 INTRODUCTION

1.1 Introduction

SSI Environmental was appointed by Metsweding District Municipality (MDM) to develop an Environmental Management Framework for the Metsweding District Municipality. An Environmental Management Framework (EMF) for the Metsweding District Municipality will be crucial in guiding sustainable land use development within the District. The EMF will provide a tool to ensure that sustainable development within important identified geographical areas takes place. The ultimate goal is to ensure that water resources, biodiversity and associated ecosystem services of the various biomes are sustained and secured for the benefit of current and future generations. Crucially, SSI Environmental was the lead consultant for the completed Dinokeng Project EMF, which is one of the fundamental building blocks and sources of information for the broader Metsweding EMF. This provides us with an intimate knowledge of a portion of the study area and a sound platform to develop a comprehensive and user-friendly EMF for Metsweding Municipal Area.

The environment in which we live is dynamic and is continuously changing over time. This environment comprises resources, economic, political, social and physical characteristics. Development, urbanisation and population expansion are the main driver of degradation of the earth's natural environment and resources. In recent years there have been a movement towards better management of the environment and natural resources with the announcement of protocols and conventions, including the Kyoto Protocol and the International Climate Change Conference (ICCC).

South Africa proclaimed the National Environmental Management Act (Act No 107 of 1998), which creates the legislative context for the management of South Africa's physical environment and ecological resources.

1.2 Metsweding District Municipality

Metsweding District Municipality (MDM) consists of two local municipalities namely: Kungwini Local Municipality and Nokeng Tsa Taemane Local Municipality. MDM's main urban centres include Rayton, Cullinan, Refilwe, Rethabiseng, Roodeplaat, Ekandustria, Ekangala, Silverlakes, Zithobeni and Bronkhorstspruit.

MDM has a very small economy which is mainly driven by the manufacturing industry. The District contributes less than 2% to Gauteng's Gross Domestic Product (GDP). Other opportunities for economic growth are available in agriculture, mining, and tourism.

A number of key drivers have been identified as a threat to the natural environment of MDM:

- Mining activities
- Urban sprawl and development pressures
- Informal settlements
- Illegal industrial activities
- Alien vegetation and degraded lands

The significance of these drivers is a function of the level of human activities and the technology applied. The fundamental premise of sustainable development is integration of environmental factors into development policies, programmes and projects within a strategic environmental framework.

1.3 Rationale for Metsweding Project

The aim of this project is to develop an Environmental Management Framework to improve the integration of biodiversity into land use planning and decision making through a combination of activities including:

- engaging in institutional co-ordination mechanisms;
- providing accurate, relevant information and materials;
- providing appropriate training and targeted awareness raising; and
- facilitating one-on-one follow up and support and also to guide future land use and development within the municipality.

The integrative, multi-disciplinary nature of sustainable development necessitates that co-ordinated efforts are undertaken across different policy sectors to ensure that the goals of development over time are achieved in those sectors. This entails systematic and continuous processes of information generation, policy and implementation monitoring, as well as the evaluation of the sustainability of development. The sectors concerned include the three traditional vertical pillars of sustainability, namely social, economic and environmental sectors, embedded in a horizontal layer of good governance that enables the achievement of durability over time. Therefore, an EMF for Metsweding is important as a foundation for the Integrated Development Planning (IDP) cycle and municipal Spatial Development Framework (SDF) process.

1.4 Understanding the Scope of Work

An EMF is the integration of spatially represented information connected to parameters, such as ecology, hydrology, infrastructure and services. The main purpose of an EMF is to pro-actively identify areas of potential conflict between development proposals and critical/ sensitive environments.

Factors playing a major role in the development of the EMF are the acquisition of data, comments from all sectors that have and may receive positive or negative effects from the development and lastly all inputs and use of future development plans for the study area. All aspects must be in line and complement each other rather than have separate studies for each area of the municipality.

The Metsweding Spatial Development Framework (SDF 2006) is the spatial representation of the Integrated Development Plan (IDP) process which plays a major role in the planning, development and implementing of any future development and growth of a municipality. The SDF and IDP focus on the importance of service delivery in a municipality as well as development trends within the municipal area, and are therefore a key starting point for the EMF. The full extent of the District Municipality forms the study area for the Environmental Management Framework.

1.5 Metsweding Project Objectives

Environmental Management Frameworks are spatially referenced compendiums of social and biophysical environmental information regarding the particular study area. They generally aim to consolidate environmental knowledge from various sources into a more accessible form that can be integrated into other planning processes.

As a form of strategic environmental assessment or planning, these frameworks can:

- Allow for a wider consideration of impacts and alternatives;
- Be used as a pro-active tool to support the formulation of strategic action plans for sustainable development;
- Increase the efficiency of tiered decision making (including strengthening of project-level EIA);
- Allow for a systematic and effective consideration of the environment at higher tiers of decision making; and
- Improve consultation with and participation by the public.

1.6 Summary of the Metsweding Situational Assessment

1.6.1 Location of the Municipality

The Metsweding District Municipality is situated on the north eastern part of Gauteng Province. The district municipality consists of two local municipalities namely: Kungwini and Nokeng Tsa Taemane.

Metsweding District Municipality spans over an area of approximately 4062.87 km^2 which amounts to 26.6% of the total area of Gauteng province (MDM, 2010). MDM is bordered by:

- Nkangala District Municipality (Mpumalanga Province) to the east
- Waterberg District Municipality (Limpopo Province) to the North
- City of Tshwane Metropolitan Municipality (Gauteng Province) to the West

The main urban centres of MDM include Rayton, Cullinan, Refilwe, Rethabiseng, Roodeplaat, Ekandustria, Ekangala, Silverlakes, Zithobeni and Bronkhorstspruit.

1.6.2 History and Background

MDM was established on 5 December 2000 as a Category C cross-boundary municipality as per Notice 6767 of 2000 as published in the provincial gazette extraordinary No. 141 of 01 October 2000, in terms of Section 12 of the Municipal Structures Act, Act No. 117 of 1998. Kungwini and Nokeng Tsa Taemane comprise the local municipalities under Metsweding and are classified as category B municipalities.

Historically, Metsweding is the place where South Africa's biggest diamond was discovered. Additionally it is rich in culture and the Tswana, Ndebele, Pedi and Tsonga speaking communities can trace their origin back to Metsweding. There are about 20 cultural and heritage sites in Nokeng municipality and about 8 sites in Kungwini municipality.

1.6.3 Demographic Profile

The 2001 Census by Statistics SA established that MDM has a population of roughly 162,268 people with Kungwini municipality comprising of approximately 109,065 and Nokeng municipality comprising 53,205 people.

In 2007, Nokeng Tsa Taemane local municipality had the least population in Gauteng province and notably, the population of Metsweding had decreased from 2001 by 5.4 % and stood at 153,539. This population is now anticipated to have risen by 2% which is the annual district population growth rate. Therefore, from these statistics, it can be approximated that the 2010 population of MDM is 194,721. The majority of the population in MDM is concentrated in Kungwini local municipality, specifically in Bronkhorstspruit, Refilwe/Cullinan town, Rayton town, Zithobeni and Ekangala townships.

The 2001 census and the 2007 community survey revealed that a majority (70%) of the population in MDM live in formal dwellings while 20% live in informal dwellings.

1.6.4 Social Environment

MDM has a variety of infrastructure which include:

- primary health care clinics
- lower and upper primary and high schools
- libraries
- community centres
- fire and rescue services
- one private district hospital in Bronkhorstspruit

Most of the facilities are predominantly in Kungwini local municipality.

1.6.5 Socio-Economic Environment

Metsweding municipality is challenged by high unemployment rates and low skills among the labour force. This is worsened by limited economic and working opportunities in the district and the migration of skilled workforce to bigger metropolitan cities. This has the net effect of a population with low levels of disposable income and thereby, reducing buying capacity which is an economic stimulant.

The manufacturing sector is MDM's economic backbone although the recent global economic recession has made the economic situation bleak. The major economic activities of manufacturing and government services are mainly concentrated in Kungwini municipality thus forming a skewed distribution among the population.

Services

The local municipalities of Kungwini and Nokeng are mandated to provide bulk water, sewerage and electricity services. The *Comparative Information on Basic Services 2009* report compiled by the Department of Cooperative Governance and Traditional Affairs provides updated data on the state of service provision in Metsweding.

Water is one of the basic human needs and statistics indicate that an average of 78% of the population in Metsweding have access to water supply. This distribution is similarly reflected in the local municipalities whereby 78% of households in Kungwini and 77% of households in Nokeng Tsa Taemane have access to water supply. Nevertheless, a mere 14% of households in Metsweding have access to free basic water and there is a backlog of 45% of basic water supply in the district.

Just over 50% of households have access to basic sanitation services which represents a backlog of sanitation provision services of 35% in Metsweding district. Some of the major factors influencing the provision of water and sewerage services in the district include the rapid development in housing and old piping reticulation systems which have not been upgraded in tandem with the growth experienced in the district.

Electricity in Metsweding is supplied by both Eskom and the local municipalities. Majority of the population in the urban nodes of Metsweding now have access to free basic electricity which is mainly used for lighting, cooking and heating. However, Metsweding faces the risk of increased electricity supply in the coming years due to the rapid expansion especially in Kungwini municipality. In addition, the rural population is yet to be adequately supplied with free basic electricity.

1.6.6 Terrain

Metsweding consists of undulating topography, generally flattest in the north. Occasional steeper, rocky ridges occur in the south of Nokeng and in the south-west of Kungwini. The terrain class according to Kruger (1983) comprises mainly “Plains with moderate relief” with a small area of “Plains with low relief” in the far north and an area of “Lowlands with parallel hills” in the south-west. The altitude above sea level falls from around 1 550 m in the far south to as low as 950 m in the extreme north-east.

The area is drained by several small rivers, many of whom are seasonal, but the largest rivers are the Pienaars, which flows northward from the Roodeplaat Dam close to the western boundary, the Elands, which rises south of Cullinan and flows northward to the Rust de Winter Dam, then eastward towards Marble Hall and the Bronkhorst Spruit (which flows through the Bronkhorstspruit Dam before joining with the Wilge River, which flows northward to the Olifants River.

1.7 Approach

The Environmental Management Framework is a strategic assessment to be put in place to provide guidance regarding future policies, plans and development initiatives.

The Department of Environmental Affairs provides the following definition for an EMF as “to proactively identify areas of potential conflict between development proposals and critical sensitive environments”. The focus of an EMF is to promote sustainable development on a development planning and implementing level. Decision-makers can use the EMF as a framework for future development initiatives and to identify area of critical importance of the proposed area.

An EMF can only be useful if the development of the EMF used spatially representative information regarding environmental factors as well as land-use and socio-economic trends. All municipal areas within South Africa are obligated to prepare an IDP with associated sector plans for the municipal area over a period of five years. The role of the IDP is to identify the environmental, social and economical backlog in the municipality and then address these backlogs by developing future development plans to address these problems. South Africa as a developing country has the problem of poverty and infrastructure degradation within the municipal areas of the country. Issues such as housing, water services, electrical services, infrastructure maintenance and upgrading is some of the critical backlogs of municipal areas and therefore it can be assumed that problems of a lesser extend is left out in the development plans of the Integrated Development Plan.

Therefore an EMF is a useful tool to complement the IDP to ensure that the initiatives are met without compromising and harming sensitive environments within each municipal area.

1.7.1 Introduction to an EMF

The EMF is a management is a decision support system that provides ‘state of environment’ information, and integrates spatial planning for management. This tool is a strategic tool for integrating environmental considerations into management decisions.

This is achieved through the integration of spatially represented information with various environmental aspects as well as land-use and socio-economic activities. The decision support system is developed on a Geographic Information Systems (GIS) platform, the data of which can easily be integrated into existing GIS platforms because of the spatial nature of the information. The focus of its implementation is in the fields of environmental and development planning, and environmental impact management. The EMF has the capability to be tailor-programmed and designed to meet specific requirements. The versatility of the EMF enables its

application at various scales ranging from local authority planning areas (1:2 500), to regional planning (1:50 000).

The final stage is the integration of the conglomeration of base information sets into a single coverage depicting and spatially delineating the potential environmental sensitivity of the area. This in turn forms the basis for a holistic environmental development framework that guides development and conservation priorities.

The EMF is therefore developed on a two tier basis comprising:

- Spatially represented information – digital and electronic maps, and
- A comprehensive policy and guideline framework.

The overall aim is to facilitate decision making that will ensure that sustainable management (conservation) of the natural resource base of the TLM. As such, the EMF will provide the following information:

- A complete survey of the sensitive areas,
- State of environment information based on all the baseline data – feature status,
- Identification of nature and conservation worthy areas,
- A comprehensive basis of baseline environmental and cultural-historical information,
- Identification of potential historical terrains and places of importance (special features),
- Development of environmental sensitivity zone classification,
- Development of an environmental development framework,
- Essential environmental information for land use planning and guidance for spatial development strategies,
- Classification of the area into zones of varying suitability and sensitivity for development, or local control zones,
- Establish an environmental framework within which sustainable development can take place.

1.7.2 Technical Development

The technical development of the Environmental Management Framework (EMF) entails the integration of spatially represented information with environmental policies and management requirements.

The EMF must be the overall basket within which all environmental and development decision-making information is kept and organised. It will therefore have:

- A database component;
- A policy component;
- All the different deliverables linked to an interactive GIS; and
- Reports.

It is a policy instrument that guides decision-making in a proactive way. The EMF must attempt to bridge the gap between the policy jurisdictions of the local and the provincial government departments. It must recognise the different functions and provide a mechanism that integrates provincial and local authority needs in decision making.

The following diagram illustrates the composition of the components:-

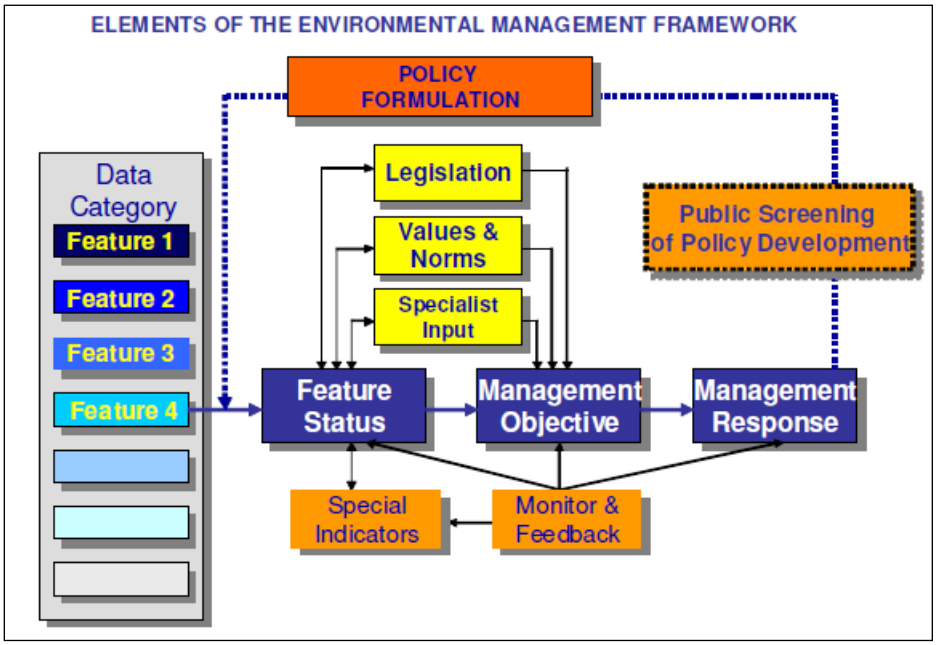


Figure 1: environmental management framework components

1.7.3 Phased and multidisciplinary approach

The basic approach in this proposal is the use of multi-disciplinary expertise to conduct the work. Due to the short timeframe in which the project has to be completed, an approach where project components are developed in parallel facets instead of in a linear process was proposed.

The different elements are:

- The specialists are responsible for the gathering and assessment of information pertaining to the current status of the environment, infrastructure and development activities. The primary reporting output will be this Status Quo Document.
- The environmental management specialists are responsible for the gathering and assessment of information pertaining to legal, policy and economic aspects as well as the integration thereof with the results of the status quo assessment. The primary reporting output will be the Desired State. Similarly this team will be responsible for the intermediate elements (feature descriptions, feature status, feature objectives, etc.) that feed into the GIS system and also for the production of the different project outputs. The most important responsibility of the unit will be to ensure that all the project information is integrated into comprehensive logical, scientifically based and user-friendly end products
- The GIS component is responsible for the creation of an interactive GIS interface that holds all the relevant information in a repository that can be constantly updated throughout the project, the collation and manipulation of which provides the required data for the intermediate and final project outputs.
- The public participation team will make sure that the public and all stakeholders are provided with the opportunity to give inputs into the project at two specific stages:
- Draft Status Quo report; and
- Draft Strategic Environmental Management Plan (SEMP) and EMF report.

This will take the form of two Public Open Days with scheduled focus groups (such as landowners; environmental groups; business people, NGOs and CBOs, conservancies; etc).

- A small management and administration unit is responsible for overall project management and the review and editing of all products. This group is also responsible for liaison with the MDM, and GDA&RD.
- Ultimately, the Status Quo will be compared to the Desired State, in order to compile management strategies and interventions that are required to steer the development of the area towards an ideal spatial framework. The Environmental Management Plan and other strategies will constitute the final Environmental Management Framework.

1.7.4 Gathering of Information and Information Review

In order to create a basis to work from, it will be important to establish a proper database of spatial information in the GIS.

The information has been sourced from various organisations and institutions including GDA&RD, MDM, Kungwini Local Municipality, Nokeng Tsa Taemane Local Municipality, various national and provincial departments, research organisations and consultancies.

In addition non-spatial information will be recorded and organised in a database which includes the following:

- Development and land-use aspects; and
- Social and economic aspects.
- The information required for the above has been sourced from:
- The National Environmental Management Act (Act No. 107 of 1998)(NEMA), as amended;
- The Constitution of the Republic of South Africa (Act No. 108 of 1996);
- The Development Facilitation Act (Act 67 of 1995)(The 'DFA');
- The National Environmental Management: Protected Areas Act (Act No. 57 of 2003);
- The National Environmental Management: Biodiversity Act (Act No. 10 of 2004);
- The "EIA Regulations" (or 'EIA Regs') in terms of Chapter 5 of NEMA, 1998 (Regulations 543, 544, 545,546 of June 2010), specifically Chapter 8 on Environmental Management Frameworks;
- Environmental Management Framework Regulations of June 2010;
- Guideline Document developed by the National Department of Environment Affairs and Tourism on Strategic Environmental Assessment in South Africa, Feb 2000;
- Conservation and Agricultural Resources Act;
- Various government guidelines, policies (also internal administrative policies) ;
- Relevant Acts related to water management (Dept of Water Affairs);
- Relevant Acts related to minerals and mining (Dept of Minerals and Energy);
- National Spatial Bio-diversity Assessment 2004: Priorities for Biodiversity Conservation in South Africa;
- Integrated Development Plans (IDPs) and Spatial Development Frameworks and any Master Plans for MDM;
- Gauteng Spatial Development Framework;
- Gauteng Biodiversity Assessment;
- Projects and documents (existing and ongoing);
- GIS information and files for previous work completed in MDM; and
- Existing studies completed for MDM

1.7.5 Status Quo

This report forms the status quo assessment of the district.

1.7.6 Environmental Sensitivity Evaluation

Once the Status Quo report and Desired State of Environment has been completed, the status of each of the features will be assessed. An environmental sensitivity evaluation, represented spatially in the system, comprises the integration of all the data categories and features.

1.7.7 Strategic Environmental Management Plan

The output of the Environmental Management Framework is the Strategic Environmental Management Plan (SEMP). The plan will be constructed to ensure that the end products are target driven and to enhance all desired state initiatives developed as part of the EMF.

In the establishment of this Desired State of the Environment, the following will be taken into account:

- Environmental feature management objectives (e.g. objectives for flood dissipation areas along rivers and streams);
- Legal and policy requirements;
- Development needs; and
- General opportunities and constraints (not linked to a specific feature).

The desired State of the Environment assessment will place specific emphasis on the following aspects:

- Sensitive natural environments;
- Biodiversity and conservation status of fauna and flora;
- Any high potential agricultural areas;
- Development needs and desired land uses;
- Infrastructure requirements (roads, services, etc.); and
- Open space networks.

This section will form the basis of the required EMF. The report will be in a similar format to the Status Quo report. The information contained in these documents will also be spatially linked in the GIS where it can be compared in an overlay fashion.

A further requirement of the SEMP is to develop a system to evaluate, monitor and report on progress made toward the State of the Environment. A set of indicators and measurable timescales will be developed as part of this phase.

1.7.8 The Elements of the Strategic Environmental Management Plan

This section will form the basis of the required Strategic Environmental Management Plan. The information contained in these documents will also be spatially linked in the GIS where it can be compared in an overlay fashion. Typical content aspects of the SEMP will include:

- Identification of provincial and local government environmental and sustainability priorities
- Establish objectives to meet the priorities
- Establish principles to effect the objective (parameters)
- Establish an implementation plan
- Identify and assign responsibility within an institutional framework

1.7.9 Geographic Information System (GIS)

An integrated GIS is a critical component of the project, around which the various inputs and outputs will be centred. As mentioned above, all data will be spatially represented in GIS format to enhance the use of the EMF in the future. Environments are also ever changing and therefore the GIS tool can be changed as environment change and new development takes place.

The GIS will also take the results of the project into the future and will have to be updated periodically in order to deliver an ongoing up to date input into the environmental management of the area.

The EMF should result in an effective management tool for MDM as well as for GDA&RD and Local Authorities. This is particularly important in terms of having a system that can be continuously updated to reflect changes in land use in the area, and as a decision support tool in the assessment of such development applications.

1.7.10 Public Participation Process

The emphasis of public participation will be on providing inputs into the Draft Status Quo report which then forms the basis for the Desired State of the Environment, and final EMF report. The Draft EMF report will also be made available for public review and input.

The public participation process is critical to the overall success and sustainability of the project, and will be managed and conducted by SSI Environmental's Public Participation Unit.

Public participation will be focussed involving stakeholders to ensure that there is maximum involvement of all stakeholders in the planning, implementation and outcome of the project.

The participation process has the following goals:

- Inform public and provide opportunity for meaningful and timeous inputs by stakeholders; and
- Provide feedback to stakeholders.

The outcomes of the Public Participation process should include:

- To promote transparency and an understanding of the final Environmental Management Framework;
- Appreciation of the value and functionality of the final EMF as a decision-making tool in assessing land use applications and the strategic management of the project; and
- Encouragement of a shared vision and a sense of ownership.

The main process tools that will be used are:

Identify and register all Interested & Affected Parties (I&AP) and establish an I&AP register to record issues, comments and inputs. The database will be prepared by SSI Environmental using Maximiser, an expert database software package, and will be utilised to record participants and responses. This database will be continually updated throughout the process. This database will be updated on an on-going basis throughout the project process, and will act as a record of the communication/ involvement process.

Advertisements in local newspapers informing the public of the project and increasing awareness of the objectives of the project, and then also to invite comments and inputs on the draft Status Quo report and the draft EMF report. All advertisements will be generated by SSI Environmental, and forwarded to the client for review and approval prior to placement.

Hosting of two Public Open Days with scheduled sessions with different role-players and focus groups (such as landowners; eco-tourism operators; civic structures etc) focusing on the:

- Draft Status Quo report; and
- Draft EMF report

1.7.11 Environmental Management Framework

Information for the EMF will principally be drawn from the GIS component and all the foregoing products.

Natural resource development and utilisation is important in any sustainable development scenario for the area. It will therefore be important to determine the type of eco-tourism and conservation activities that should be propagated for the future and try to match that with the natural resource potential of the area. The focus will be on the conservation of all sensitive environments and sustainable utilisation of resources when future development takes place.

Buffer zone areas will be established to enhance the protection of environments.

It is intended that the outcomes and recommendations of the EMF will be incorporated into the existing Spatial Development Framework and Integrated Development Plans for MDM.

1.7.12 Action and Implementation Plans

Action plans for the implementation of the EMF will be formulated to ensure that the EMF is implemented in an efficient manner. Special emphasis will be placed on resolving current contradictions between various planning documents. The exact nature, focus and extent of the action plans will be determined during the course of the study.

A key focus in this phase will be the formulation of a set of guidelines to assist the MDM and GDA&RD in making informed and rapid decisions when evaluating development applications in the municipality to ensure that the development is within sustainable limits.

1.7.13 Institutional arrangements

Of critical importance is the development of monitoring and reporting systems to control and measure the success of the implementation of the EMF and SEMP. Recommendations on the organisational structure for the project will be included to ensure sustainable management of the site, ensure legislative compliance, deal with any internal capacity constraints and enhance inter-governmental relations.

2 LEGAL CONTEXT

The legal origin of an EMF is embedded in Section 24 (3) of the National Environmental Management Act, 1998 (NEMA) (as amended) which allows the Minister of Water and Environmental Affairs (DWEA) or Member of the Executive Council (MEC) to whom a provincial premier has assigned the responsibility for environmental affairs, to compile environmental information and maps of particular geographical areas which must be taken into account in decision making by authorities.

The Environmental Management Framework Regulations of 2010 (published in terms of chapter 5 of NEMA) provides specific regulatory requirements pertaining to the development of an EMF. It specifies that either the Minister or an MEC may initiate an EMF for an area, and that a draft EMF must be subjected to a public participation process. Once the draft EMF has reviewed in the light of any representations, objections and comments received, the Minister or MEC may adopt the EMF as an environmental management tool.

The regulations prescribe that an EMF which has been adopted must be taken into account in the consideration of applications for environmental authorisation in or affecting the geographical area to which the framework applies. However, the geographical attributes described in the EMF may be used to list activities that may or may not occur in certain areas without environmental authorisations (Section 24 (2)). Activities that are thus exempted from environmental authorisation, may be made subject to norms and standards laid down in terms of Section 10 of NEMA.

TABLE 1: REGULATORY FRAMEWORK FOR ENVIRONMENTAL MANAGEMENT FRAMEWORKS

Legislative reference		Legislative text
NEMA (2)&(3)	**S24**	The Minister, or an MEC with the concurrence of the Minister, (2) May identify geographical areas based on environmental attributes, and as specified in spatial development tools adopted in the prescribed manner by the environmental authority, in which specified activities may not commence without environmental authorisation from the competent authority, or may be excluded from authorisation by the competent authority May also identify activities contemplated in paragraphs (a) and (b) that may commence without an environmental authorisation, but that must comply with prescribed norms or standards. (The listing of activities must comply with the process prescribed in section 24A) (3) May compile information and maps that specify the attributes of the environment in particular geographical areas, including the sensitivity, extent, interrelationship and significance of such attributes which must be taken into account by every competent authority (i.e. delegated regulatory authority)
NEMA (4)(b)(vi)	**S24**	Procedures for the investigation, assessment and communication of the potential consequences or impacts of activities on the environment (commonly known as Environmental Impact Assessments) must include, with respect to every application for an environmental authorization and where applicable, consideration of environmental attributes identified in the compilation of information and maps as contemplated in subsection 24(3).

Legislative reference	Legislative text
NEMA S10	The Minister, or an MEC with the concurrence of the Minister, (10) May develop or adopt norms or standards for activities, or for any part of an activity or for a combination of activities, contemplated in terms of subsection (2)(d); may prescribe the use of the developed or adopted norms or standards in order to meet the requirements of this Act; may prescribe reporting and monitoring requirements; and may prescribe procedures and criteria to be used by the competent authority for the monitoring of such activities in order to determine compliance with the prescribed norms or standards. Norms or standards contemplated in paragraph (a) must provide for rules, guidelines or characteristics that may commonly and repeatedly be used; and against which the performance of activities or the results of those activities may be measured for the purposes of achieving the objects of this Act.

3 DEVELOPMENT PLANNING AND LAND USE ASSESSMENT

3.1 Regional Context

The Metsweding District Municipality is located in the north-eastern part of Gauteng and is bordered by the City of Tshwane and Ekurhuleni Metropolitan Municipalities in the west and south-west, Waterberg District Municipality in the north (Limpopo Province) and the Nkangala District Municipality in the east (Mpumalanga Province). After the 2011 local government elections, Metsweding, Kungwini and Nokeng tsa Taemane will cease to exist as municipal entities and will be incorporated into the City of Tshwane and Ekurhuleni Metropolitan Municipality. The District Municipality covers a total area of 4,170 km², of which 2,202km² lies in Kungwini and 1,968km² in Nokeng tsa Taemane (NTT).

See Map 1

The regional position of the Metsweding District Municipality can be described as a transition zone located between the City of Tshwane urban area and the Mpumalanga rural areas, with a clear intensification of development towards the west of the District in the areas that border the City of Tshwane (Plan Associates, 2007). The most important functional regional linkage is therefore with the City of Tshwane (and to a lesser extent the Ekurhuleni Metropolitan Municipality), with a considerable amount of urban development spilling across from the City of Tshwane municipal area into the western parts of Metsweding. The City of Tshwane acts as a major centre for higher order goods and services as well as employment opportunities for people living in Metsweding.

3.2 Regional Road linkages

The district and the settlements within are well served and connected by internal road infrastructure, with the main towns located adjacent to major roads. The N4 National route, which runs through the district in an east-west direction, is the major linear structuring element in the district and a major movement route connecting the District to the City of Tshwane in the west and towns like eMalahleni and Middelburg further east.

There is a railway line that runs between Tshwane and Mpumalanga through the centre of Metsweding, roughly parallel to the N4, (with links to Cullinan and Ekandustria) and another between Tshwane and Ekurhuleni, which cuts across the western/south-western part of Metsweding. These railway lines are however currently only being used for freight.

TABLE 2: MAJOR REGIONAL ROAD LINKAGES BETWEEN THE DIFFERENT AREAS IN METSEDING

Road	Linkage
East-West	
N4 National Road	City of Tshwane Emalahleni, Middelburg and the remainder of Mpumalanga
R104 (Pretoria Road extension)	City of Tshwane
M6 (Lynnwood Road)	City of Tshwane
M30 (Garsfontein Road)	City of Tshwane

Road	Linkage
R50 (Delmas Road)	City of Tshwane Mpumalanga
R513 (Zambesi Road extension)	City of Tshwane
Moloto Road (R573)	City of Tshwane KwaMahlanga and areas further east in Mpumalanga
North-South	
N1 National Road	City of Tshwane Gauteng Limpopo Province
R25	Ekurhuleni Metropolitan Municipality Mpumalanga (Groblersdal)
R42	Ekurhuleni Metropolitan Municipality

See Map 4

3.3 Internal Spatial Structure

The Metsweding District is largely peri-urban and rural in nature, interspersed with a number of towns, villages and suburban/peri-urban settlements, the latter being mainly concentrated along the western boundary, adjacent to the City of Tshwane.

The major town in the District is Bronkhorstspruit, with the only two other formal (albeit smaller) towns being Cullinan and Rayton. Ekandustria, which lies approximately 12km north of Bronkhorstspruit is a major industrial area.

The district and the settlements within are well served and connected by internal road infrastructure, with the main towns located adjacent to major roads. The N4 National route, which runs through the district in an east-west direction, is the major linear structuring element in the district and a major movement route connecting the District to the City of Tshwane in the west and towns like eMalahleni and Middelburg further east.

Other large land uses in the District include two large prisons (Baviaanspoort Prison south of the Roodeplaat Dam and Zonderwater Prison south of Cullinan) and the Wallmansthal Military Base.

Table 3: Land Cover below indicates the general land cover in the District. This shows that 3.35% of the area is used for settlements (including agricultural holdings), 1.08% for industrial and mining activities and 95.57% for rural uses and activities. Only 16.4% of the district is used for cultivation purposes.

See Map 2

TABLE 3: LAND COVER

	Summarised Land Cover	%	
Settlements	Commercial	0.13	3.35
	Urban formal residential	0.9	
	Urban informal residential	0.11	
	Smallholdings	2.21	
Industrial	Industrial Heavy	0.05	1.08
	Industrial Light	0.17	
	Mines and quarries	0.86	
Rural	Natural	56.4	95.57
	Waterbodies	0.7	
	Wetlands	0.68	
	Woodland	20.94	
	Cultivated	16.4	
	Degraded	0.36	
	Erosion	0.09	
Total		100	100

Source: Business Enterprises, 2008

3.3.1 Settlement Distribution

There are three formal towns in Metsweding, namely Bronkhorstspruit in Kungwini (the largest of the three) and Cullinan and Rayton in Nokeng tsa Taemane. Closely linked to these towns are the townships of Zithobeni (Bronkhorstspruit) and Refilwe (Cullinan). Other main township areas in the District include Ekangala and Rethabiseng adjacent to the Ekangala industrial area and the Steve Bikoville township (previously known as Kekana Gardens) along the north-western border, which forms part of the greater Hammanskraal urban complex.

Metsweding District Municipality has a large number of informal settlements (different sources estimate these differently) of various sizes scattered across the municipal area. The majority of the informal dwelling units in the District are located in Nokeng Tsa Taemane Local Municipality (55%). Kungwini Local Municipality has more informal settlements than Nokeng tsa Taemane (i.e. the settlements in Nokeng are generally larger than those in Kungwini) (Plan Associates, 2007). The majority of these villages and informal settlements are located far apart

from each other and major towns, and therefore pose the challenge of providing and maintaining services at high cost.

Agricultural Holdings are found throughout the rural environment, but with a large concentration along the western boundary of the District adjacent to the City of Tshwane, where these agricultural holdings display the typical characteristics of a peri-urban transitional environment. Although largely residential in character, a mix of non-residential activities such as nurseries, builders' yards, kennels, tea gardens etc. and illegal industrial and commercial uses can be found in these transition areas.

The last settlement type, but perhaps the one with the largest impact in terms of the development of the municipality over the last number of years, is that of private residential estates (security estates). These can be found predominantly in the western part of the municipality, adjacent to the City of Tshwane, where an ever-increasing number of estates are being developed as part of the outward expansion of the Tshwane urban area. Main development areas include the Rietvlei Dam area, the Mooikloof area, the Silver Lakes area and the Roodeplaat Dam area. These developments are introverted and suburban in character.

The highest population densities are found in previously disadvantaged township areas such as Steve Bikoville (previously Kekana Gardens), Refilwe, Ekangala, Rethabiseng and Zithobeni. These areas have gross population densities ranging between 34 and 60 people per hectare, compared with the much lower densities found in the three main urban (and previously predominantly white) areas of Cullinan, Rayton and Bronkhorstspruit where the gross population density range between 1 and 15 people per hectare.

TABLE 4: DISTRIBUTION OF POPULATION DENSITIES

Functional Sub-Area	Population Density (people/ha)	Functional Sub-Area	Population Density (people/ha)
Bronkhorstspruit	1.11	Rethabiseng	46.01
Greater Silver Lakes	1.67	Sehlakwana	9.54
Baviaanspoort	16.13	Ekangala	34.33
Cullinan	2.80	Zithobeni	38.77
Rayton	15.26	Steve Bikoville	44.45
Onverwacht	5.52	Refilwe	60.06
Vergenoeg	0.42		

Source: Business Enterprises, 2008

3.3.2 Rural Environment

The Metsweding District is largely rural in character, with approximately 95% of the area comprising typical rural land uses and activities such as nature areas, ecological features, conservation areas, farming and cultivation, rural residential (excluding agricultural holdings which were dealt with under settlements) and non-productive

farm portions/vacant land. The District has a significant but underdeveloped agricultural base (Metsweding, 2009).

The Kungwini Local Municipality currently allows subdivisions up to 4.2 hectares in the rural environment (Index, 2004), whereas the Nokeng tsa Taemane Local Municipality allows for different size subdivisions in different parts of the rural environment. Generally speaking, larger subdivisions are enforced in the northern part (20.0 hectares) whereas smaller subdivisions are allowed in the southern area around the existing urban development areas (1.0 and 2.0 hectares). Different planning frameworks in the Nokeng tsa Taemane area also makes different (sometimes contradicting proposals for subdivision) (Bohlweki-SSI, 2009).

3.4 Development trends in Metsweding District Municipality

3.4.1 Growth Trends

The areas that experience the highest development pressure (and are expected to continue to experience growth over the next decade or so) are the areas along the eastern boundary of the City of Tshwane, starting with the area to the west/south of the Rietvlei Dam in the south all the way past Mooikloof and Silver Lakes in the Kungwini area and the area around Roodeplaat Dam and Steve Bikoville in Nokeng tsa Taemane. The Silver Lakes area and (in future) the Rietvlei Dam area have become focus areas for commercial (mainly retail) development.

These areas (with the exception of Steve Bikoville and Pienaarspoort) have seen numerous new high-income residential estates being developed over the last number of years, which was in turn followed by retail and office development. These areas form part of the outward urban expansion from the metropolitan area, and are functionally linked to the City of Tshwane (rather than to any part of Metsweding). In addition, the strong east-west road network between the City of Tshwane and the Metsweding District Municipality act as conduits for this *eastward expansion of suburban development. Typical* densities in the Silver Lakes/Mooikloof/Olympus area range from approximately 10 dwelling units per hectare (e.g. Silver Lakes) up to 60 dwelling units per hectare (Olympus) (Index, 2004).

An area such as Pienaarspoort, which lies between Mamelodi and the N4, has not yet experienced significant growth, but it is anticipated that considerable new low-income residential development will have taken place by 2025.

Established areas such as Bronkhorstspruit (including Zithobeni), Cullinan (including Refilwe), Rayton and Ekangala have experienced fairly limited growth, with growth being the highest around the Bronkhorstspruit Dam.

3.4.2 Illegal Developments

The outward suburban expansion in the western parts of the municipality has also resulted in a number of illegal 'settlement' developments, in particular in the Kungwini area. Most of these are relatively small, consisting of 6 to 10 houses on a single 4.0 ha plot. Illegal industrial and commercial land uses on agricultural holdings and farm portions are also wide spread throughout the District. One of the issues that have been identified by the Nokeng tsa Taemane local municipality during previous studies in the area is the fact that there have been instances where application have been made for lodges or tourism accommodation on farm portions, and that these developments then end up as permanent residential estates.

In both cases, the local municipality does not have sufficient resources to manage illegal land uses. The illegal developments have a negative impact on ground water, traffic generation and the environment.

3.5 New Development Proposals and Initiatives

The areas around Silver Lakes will in future experience even greater development pressure if the proposed development of the new intersection on the N4 (to be developed by a private developer) realises (the so-called Hazeldean intersection). The new Kungwini Spatial Development Framework, 2010 (draft) has also earmarked a considerable urban edge around the Silver Lakes/Mooikloof area, which allows for a total of 26,000 hectares of developed land in this area (of which only a relatively small portion has already been developed). This allows for considerable further eastwards expansion of the urban footprint in the south-western part of the District. This urban edge was earmarked on the basis of the municipality's ability to provide services to new developments over the next five years. The Water Lake Farm residential estate along the Boschkop Road installed bulk water infrastructure from Lynnwood Road in order to service the development, and this has contributed to the opening up of the area for future development.

A major new regional commercial and residential node (the so-called M&T Node) is planned along the R21 in the vicinity of Irene and the Rietvlei Dam. This node will inter alia allow approximately 143,000m² of office space. This development is however currently hampered due to sewerage issues. A second commercial node is also being developed to the south of Mooikloof, adjacent to Mooikloof Ridge.

Other future major residential developments include low cost housing development in Zithobeni, which will almost double the existing housing stock in this area. The new power station that is being developed just east of Metsweding along the N4 has also resulted in an increased demand for residential development around the Bronkhorstspruit area, which has resulted in new township establishments to the south of the N4. New development in the Ekangala area is still hampered due to land transfer issues.

A major proposed infrastructure initiative in the area is the development of the Moloto Rail Corridor. This initiative involves the development of a new railway line between Moloto on the Gauteng-Mpumalanga provincial boundary (and extending further east into Mpumalanga) and Tshwane. The line will run roughly parallel to the R573 (Moloto Road). This project is motivated by the large numbers of commuters from rural areas travelling to employment destinations in Tshwane on a daily or weekly basis and the resulting high levels of congestion and unsafe travelling conditions on the Moloto Road. This project was approved by the National Cabinet during April 2008.

3.6 KEY SPATIAL ISSUES

3.6.1 Urban sprawl

Metsweding experiences enormous development pressure from residential development spilling over from Tshwane and pushing further and further eastwards into Metsweding. This development trend has a potential negative impact on environmental and urban functionality and sustainability, in particular relating to aspects such as the metropolitan physical and carbon footprint, the optimal use of land, the loss of potential agricultural resources, the distances over which engineering infrastructure must be installed, traffic generation etc.

The considerable urban edge that has been proposed for the Tshwane suburban extensions is also contrary to accepted national planning principles such as compaction (on metropolitan level), promotion of infill development, the optimal use of resources etc. Although roads and master planning infrastructure has been done for some of these urban expansion areas, the sense on the ground is that development is taking place in a fairly haphazard manner, with no consideration to an overall physical structure.

3.6.2 Dispersed settlements

The scattered location of settlements across Metsweding has a negative impact on the efficient and sustainable spatial development of the municipality, as settlements are not focused around strategic locations that can be incorporated into a network and hierarchy of places and infrastructure. Also, the important and necessary natural interrelationships and dependencies that exist between different types of settlements are not supported by the current spatial arrangement (e.g. poorer, dispersed settlements are not able to easily access economic opportunities from formal towns), which results in unnecessary movement between the different settlements on a daily basis.

In addition to this the majority of the settlements are located far apart from each other, and this creates the challenge of providing and maintaining services at high cost and creating further pressure on the need for social infrastructure and housing.

3.6.3 Informal settlements

The large number of informal settlements scattered across Metsweding is a major development issue. On the one hand the location of the majority of these settlements makes it impossible to integrate them with existing urban areas, but on the other hand these settlements are often too small to make the provision of services and infrastructure viable in situ. In addition, these settlements often have no regard for (or understanding of) aspects such as ecologically sensitive sites of high potential agricultural soil or dangerous dolomitic conditions etc.

One example of the inefficiencies related to these informal settlements is the case of an informal settlement close to the intersection of the R25 and the railway line where the municipality has to truck water to the site on a daily basis. This is despite the fact that there is a borehole on site, but the pumps have not been maintained.

3.6.4 Infrastructure

The lack of infrastructure (in particular water-borne sewerage networks) is one of the key factors restricting significant further growth in the municipality. On the one-hand this has a positive impact in the sense that it curbs urban sprawl (to a certain degree), but on the other hand developments that are taking place without such a system (such as subdivision of farm portions, illegal residential developments on farm portions etc.) pose an environmental hazard.

One of the solutions that the municipality employs is to allow developers to pay for the installation of bulk infrastructure in lieu of engineering service contributions. However, the provision of bulk services according to developer/market demands and their willingness to pay for the infrastructure provision might result in an ineffective spatial form if it is not done in accordance with a clear spatial vision. Often, “leap frog” developments are permitted provided that the developer installs the bulk infrastructure required to link the development to existing service networks. This then results in development that is not necessarily desirable from a spatial efficiency and sustainability point of view.

Lack of infrastructure also has an impact on the dolomitic areas and the quality of ground water.

3.6.5 Illegal developments

Illegal developments on farm portions and agricultural holdings and the lack of institutional capacity to address these developments are some of the greatest challenges facing sustainable and efficient spatial development in the Metsweding District Municipality.

These illegal developments include illegal (formal) residential developments, industrial developments and commercial developments. These illegal developments have a number of negative impacts, including environmental impacts (where such developments are located in close proximity to ecologically sensitive environments without proper regulations in place), visual and aesthetic implications, economic implications (e.g. reduction in tax base of the municipality) etc.

3.6.6 Rural and environmental conservation

Metsweding is in essence a rural municipality, with moderate to high agricultural and conservation potential (the latter in particular refers to the Nokeng tsa Taemane area). The rural and natural environment however experiences continuous development pressure from suburban expansion, subdivisions, illegal land uses and mining.

It is in particular the natural assets such as dams, rivers and ridges that are the most desirable for development (in particular exclusive developments). As such, assets such as the shorelines of dams are continuously threatened by development.

As the rural and natural environment is in essence Metsweding's greatest asset, care should be taken to protect these assets from unscrupulous and inappropriate development.

3.6.7 Conservation Lines

The municipality's experience to date has been that it is very difficult to enforce existing conservation lines/green belts in the municipality, due to the fact that the conservation lines (such as in the case of the Bronberg) is defined on the basis of slope rather than cadastral or legal boundaries.

In the opinion of the municipality, a stricter legal definition of the green belt, that is defined by cadastre and not a contour level will assist in enforcement.

3.7 Conclusion

In essence, the major issue or dilemma that faces development in Metsweding is the friction between large scale urban development pressure and the protection of the natural and rural environment, couples with the lack of institutional resources to manage this potential conflict.

4 SOCIO-ECONOMIC ASSESSMENT

This section is important to understand the social profile of the district in order to inform policy-making; contextualise social phenomena and understand the needs of the region. The number of people living in the area will connect directly to the extent of service-related and other needs.

MDM is the smallest municipality in Gauteng with regard to population size, even though it occupies the second greatest total area (behind Sedibeng DM), which is equal to 22.5% of the area of Gauteng Province. While it has already been indicated that KLM holds approximately twice the population of NTTLM, KLM occupies an area only 10% larger. Overall, MDM has the lowest population density in the province of 39 people per square kilometre – a figure which is very similar to the national average – although, if population growth has continued at the rates proposed by the 2001 census then density would, by 2007, have been approximately 47.3 per km2 (Rework once GIS information is available).

Even though the population density is low, taking enumerator areas into account reveals that there are very few uninhabited areas. Most areas of this DM could be classified into lightly or moderately populated areas with densities rising along the Tshwane boundary and within the Towns of Bronkhorstspruit and Cullinan. Approximately 30% of the populace live within the urban edge boundary (MDM ITP, 2005). Overall, this district has a population density much lower than that of Gauteng Province.

4.1 Population size and growth

The Statistics South Africa (StatsSA) Census of 2001 estimated the population of Metsweding District Municipality (MDM) to be 160 264 with an expected growth of 34 869 persons by the year 2010 (this is a 2% annual population growth estimate). This, in turn, left the total MDM 2010 population estimate at a figure of 195 142 residents. The population of KLM is largely urbanised (77.6%), while that of NTTLM is more rural with a growing trend of urbanisation in the form of the conversion of farms to townships and the increase of existing residential areas (MDM IDP 2009/2010).

In terms of the constituent local municipalities, namely Kungwini Local Municipality (KLM) and Nokeng Tsa Taemane Local Municipality (NTTLM), the following information is available.

See Map 5

TABLE 5: POPULATION OF MDM, KLM AND NTTLM

	KLM	NTTLM	MDM
2001 population estimate (Census):	107 063	53 201	160 264
Expected annual growth rate (Census):	3%	1%	2%
2010 population estimate (in 2001):	135 970	59 172	195 142
Community Survey 2007 Findings:	104 150	49 389	153 539
Discrepancies between 2010 estimate and 2007 findings:	31 820	9 783	41 603

Source: Stats SA (2001) & CS 2007

See Map *5*

Table 5 shows that over six years the population across the district and both LM's has diminished. The results from The Community Survey of 2007 (CS 2007) showed that the population of this DM had decreased by a figure of 6 725 persons (although the number of households had increased by approximately 500) since 2001, and that it differed 41 603 persons off from the estimate of the 2010 population.

These conflicting results are so marked as to cause data-related concern, especially since MDM was reported in 2007 as the only DM with a negative population growth in Gauteng. Nonetheless, it was decided that even though the 2001 census results and projections held the greatest data-related integrity, both 2001 positive annual growth rate projections and the negative projection (based on discrepancies between 2001 data and 2007 findings) would be represented here.

Taking the Census 2001 positive annual growth rate projections into account, the future population estimates would appear as follows:

TABLE 6: POPULATION GROWTH IN MDM, KLM AND NTTLM

	MDM	KLM	NTTLM
Annual growth rate estimate (based on census 2001):	2%	3%	1%
Projected 2011 population estimate:	199 813	140 049 (70.1% of the DM)	59 764 (29.9% of the DM)
Projected 2015 population estimate:	219 818	157 626	62 192

Source: Census 2001

This projection then (at the annual rate of 2%) provides that near on an estimated 200 000 people will be resident in MDM during the year 2011. Overall it has been shown, when making use of Stats SA 2001 census data, that at both the district and local municipal levels population growth remains positive, if only marginally so.

If the reported population discrepancy between 2001 census data and 2007 Community Survey (CS) data is accurate, then the MDM is facing what appears to be a negative annual population growth rate of approximately 1%. If this is in fact the case then the total 2011 population estimate for MDM would stand at approximately 147 489 persons. These two possible population growth projections differ by some 50 000 people and hence should be considered with caution.

Two factors that may serve to further confound both the annual population growth estimates, and the discrepancy between 2001 and 2007 data, is the prevalence of HIV/AIDS and rural-urban migration. Migration in search of work opportunities to the nearby urban centres of Pretoria and Johannesburg may be occurring.

4.1.1 Population growth and HIV/AIDS

In terms of HIV/AIDS there is unfortunately a relative paucity of reliable information pertaining to this disease's prevalence in the MDM, with a number of governmental and non-governmental organisations providing little or no relevant data.

It was stated by Green (2005) that an unofficial estimate Of Gauteng's HIV prevalence could possibly stand as high as one third of the total population of the province, although the most recent Metsweding District IDP (2010/2011) study places it at 12.1% provincially. HIV/AIDS prevalence in MDM increased from 3.7% in 1996 to 11.9% in 2004 and during this period the prevalence in NTTLM grew to 12.4% (higher than the provincial average of 12.1%), while in KLM it increased to 11.5%.

In addition, MDM has been recognised as the DM that contributes the least to Gauteng's GDP, as well as the DM with the greatest infrastructural deficits. This factor may serve to compound HIV/AIDS concerns by negatively impacting on levels of education, nutrition, access to necessary resources (e.g. healthcare, clean water etc), migrant labour (a factor known to worsen the spread of the disease), and other related problems such as the presence of related and unrelated life threatening diseases/conditions, the exacerbation of the plight of AIDS orphans and so on.

While it is extremely difficult to accurately estimate the actual toll that HIV may take on the MDM population, the marginally positive population growth rates projected since 2001 may be in jeopardy of slowing or even negativising if current HIV/AIDS trends continue or worsen.

4.1.2 Demography

The MDM has shown relatively stable gender distributions across the district with 48% female and 52% male (IDP 2009/2010). Although the above IDP figures show a slight skew in favour of males, the CS 2007 puts the proportions at almost exactly 50% male and 50% female. Data for the constituent municipalities reveal that KLM has a gender distribution of 51% male and 49% female and NTTLM's distribution is 53% male and 47% female (IDP 2009/2010).

The greater presence of males may be due to a large number of male workers required in mining activities around the Cullinan and Ekandustria areas, as well as quarries located along the R104 and agricultural activities within the whole district. In terms of the age of the population, it is dominated by working age people (aged 15 to 64), of which the majority is male. This factor may pose a threat to the DM since it implies a greater requirement for the provision of working opportunities for this population segment.

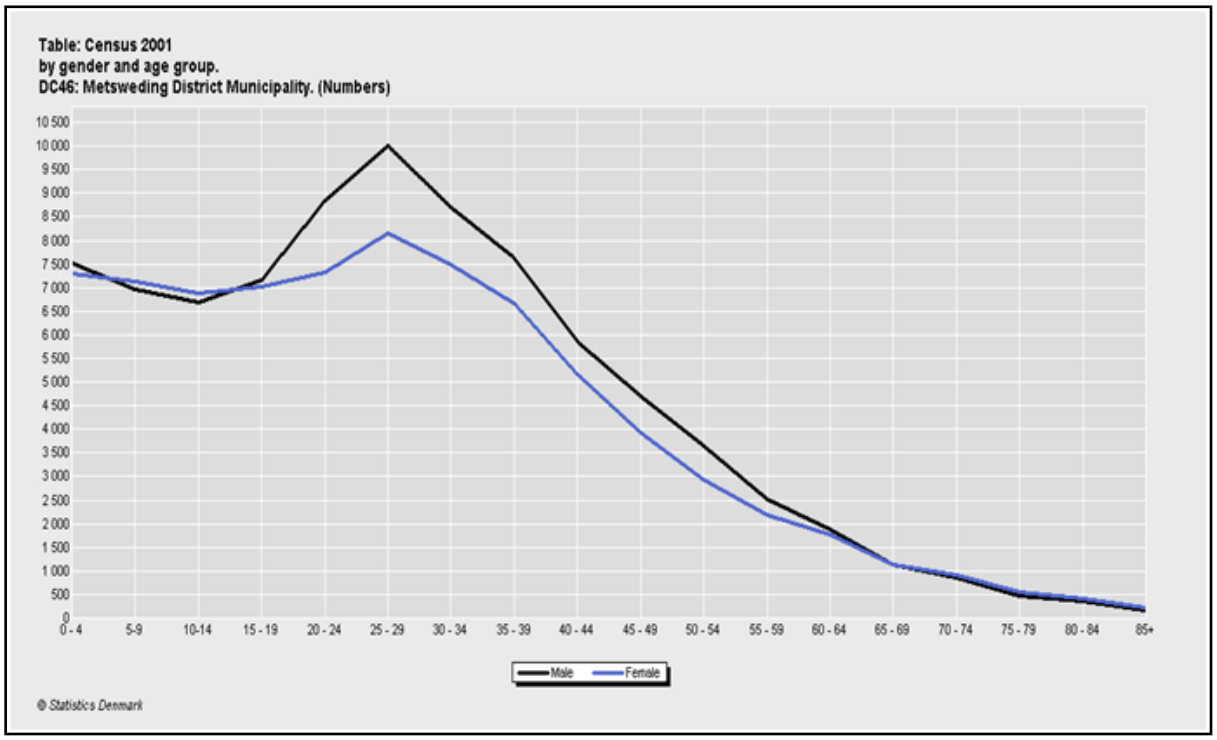


FIGURE 2: AGE CATEGORY DISTRIBUTIONS IN MDM

Source: MDM IDP 2009/2010

Two thirds of the population of MDM is of a working age. NTTLM has a much larger proportion of working age people (69.2%), dominated by males, than does KLM (64.7%). It seems that Kungwini has a much higher youth population (30.1%) than Nokeng (26.9%) or the district as a whole (28.8%), as well as a higher number of older people (65+) ('Youth', in this context, will be used according to the basic definition provided by the National Youth Act of 1996 which sees it as including persons aged 15 to 34).

This implies that Kungwini has a high age-dependency ratio and a lower quality of life on average. Moreover, KLM's working age residents have, on average, 0.6 dependents to support while NTTLM's have only 0.4 (MDM IDP 2009/2010).

The racial distribution of this district is one dominated by the Black African racial group (77%), followed distantly by Whites (20%) and a small portion of Coloureds and Indians/Asians (1% respectively).

4.1.3 Housing & Household Status

The CS 2007 revealed that there were a total of 46 502 separate households in this district, while the more recent IDP Report (2009/2010) reveals the figure to be closer to 51 004. Even though there appears to be an increase in household numbers, MDM accounts for only 2% of all households in Gauteng Province. A household is defined by 'a person or group of persons residing in a dwelling' (CS 2007). There are approximately double the numbers of households in Kungwini as there are in Nokeng Local Municipality.

TABLE 7: NUMBER OF PROVINCIAL, DISTRICT & MUNICIPAL HOUSEHOLDS

Information based on IDP Report 2009/1010, CS 2007 & Census 2001

	Number of Households		
Area	Census 2001	Community Survey 2007	MDM IDP 2009/10
Gauteng Province	2 651 243	3 175 578	2 651 243
Metsweding District	46 502	46 504	51 004
Kungwini	34 167	31 666	34 170
Nokeng Tsa Taemane	16 830	14 838	16 834

There has been an increase in the number of households in the district. Unlike the population figures in which both increases and decreases have been recorded from separate data sources, a small but steady increase in the number of households has been recorded in all the data sources consulted. This may be due to an increase in the number of formal dwellings in MDM which leads to a greater likelihood of these households being sampled in any given study and may not necessarily be due to an increase in actual households.

Nokeng Tsa Taemane was one of 6 municipalities which had a lower percentage of households living in formal dwellings (70%) than the provincial average (74%), while the Gauteng province had the highest number of households living in informal dwellings by province. Although at both provincial and municipal levels the number of formal dwellings is relatively low, increases in this sector have been recorded over the period 2001 to 2007.

TABLE 8: PERCENTAGE OF FORMAL & INFORMAL DWELLINGS, 2001 - 2007

	Gauteng		MDM		KLM		NTTLM	
Housing Type	2001	2007	2001	2007	2001	2007	2001	2007
Formal Dwellings	75%	74%	71%	73%	72%	75%	69%	70%
Informal Dwellings	24%	23%	24%	21%	22%	19%	28%	24%

Source: CS 2007 & Census 2001

PHOTO 1: INFORMAL HOUSING IN ZITHOBENI

4.2 Socio-Economic Profile

4.2.1 Levels of Education

Levels of education in MDM are rather low, especially in NTTLM. The most reliable data comes from Census 2001 which would show that a full 17% of the MDM population has no formal schooling whatsoever, and that only around 22% have completed matric or grade 10 (see table 8 below for details). Overall, the socio-economic implications of this are many with negative effects on employment possibilities, potential income generation,

skill levels within the district, innovation and business growth, and levels of literacy. Taking literacy as meaning exposure to formal schooling (no matter how little), NTTLM would have a higher adult literacy rate (87.5%) than KLM (79.6%).

TABLE 9: LEVELS OF EDUCATION IN MDM BY PERCENTAGE IN 2001

Level of Education	MDM (%)	KLM (%)	NTTLM (%)
No schooling	17	20.4	12.5
Some primary	15.2	15.6	14.6
Complete primary	6.1	5.9	6.5
Some secondary	29.4	26.4	33.2
Grade 10/grade 12	21.6	20.2	23.5
Higher education	10.7	11.4	9.7

Source: Stats SA 2001

The levels of education and literacy rates in the district are definite areas of concern within and may relate to the section below on education services - in which it is noted that certain facilities are either non-existent or require serious attention to bring them to a satisfactory level of educational service delivery. Levels of education may also be adversely affected by the rate of HIV/AIDS in which a number of school going children's education could be jeopardised by one or several deaths of immediate relatives. Furthermore, low income areas (rural and township areas) suffer from the kinds of infrastructural deficits (access to transport, roads, medical facilities and so on) which could hamper the potential for residents to have sustained exposure to the education system. This point is illustrated by the relatively low level of school attendance by Black Africans (majority of rural and township dwellers) as opposed to other populations groups.

See Map 5

4.2.2 Employment Levels

Employment levels have been a concern in South Africa for some time now and no single district is immune to the effects of unemployment. Areas suffering from high rates of unemployment very often experience higher rates of poverty, crime, substance abuse, abuse of women and children, and social and familial upheaval. For these reasons, employment levels are a social concern.

Employment statistics, intrinsically considered to be related to skill levels, income levels and education levels are low in this district, but more frightening is the dependency ratios. The IDP (2009/2010) claimed that about 16.7% of the workforce in the MDM is unemployed, this figure upon analysis of the latest Stats SA findings (CS 2007), appears to be accurate. The major cause for concern appears when one considers the dependency ratio in MDM. The IDP calculated this ratio to be somewhere in the region of 0.5, although this report would claim that the figure is closer to 0.7. When one takes the number of unemployed and adds them to the population of economically inactive (according to CS 2007 data) and divides this number by the amount of people who are employed, the dependency ratio rests at 0.7. The dependency ratio is indicative of how many dependents, on average, the employed population in MDM has to support and a figure of 0.7 is high.

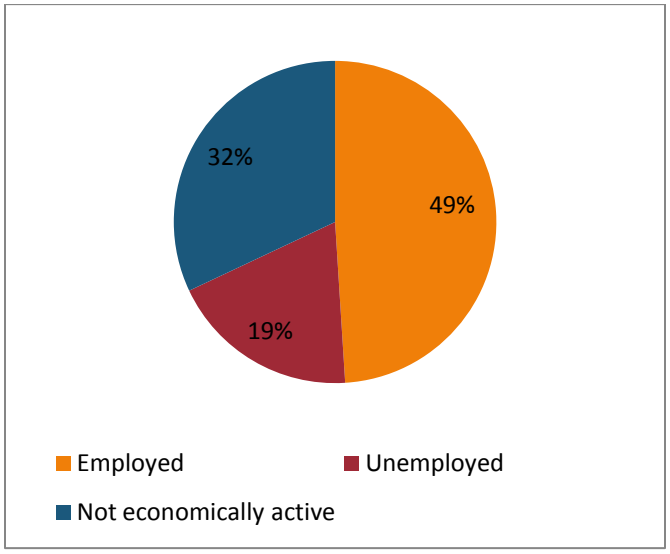


FIGURE 3: EMPLOYMENT STATUS IN MDM IN 2001

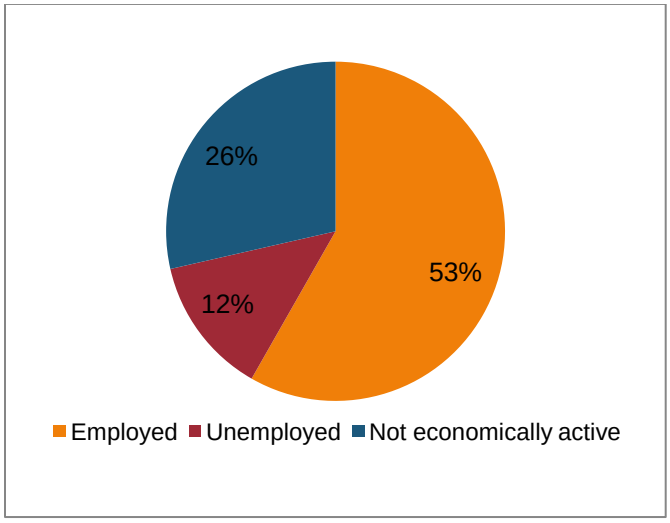


FIGURE 4: EMPLOYMENT IN MDM 2007

Source: *Census 2001 & Community Survey 2007, * 10% of respondents fell into the 'institution' or 'unspecified' categories*

Significantly it has been shown here that unemployment rose from 2001 to 2007 by 4%, this trend shows a rise in unemployment of 0.6% per year, although it must be stated that the not economically active population decreased by 6%.

Based on the information it is evident that NTTLM has a lower population and work force than KLM and that the black population group in MDM suffers the most from unemployment and economically inactive people. This fact also indicates that they bear the majority of the load making up the dependency ratio for the district. Upon calculation it emerges that the dependency ratio for this particular population group in MDM rests at 1.2 – a tremendously high figure considering the relatively low income distributions discussed below. This dependency ratio denotes the number of dependents, on average, that the workforce of MDM will have to support, therefore every working individual has an average of 1.2 persons dependent on them.

4.2.3 Social Grants

Social grants in MDM are widely accessed by community members with a total of 14 384 people accessing social grants in 2009 (MDM IDP). These include the following grants: old age grants, disability grants, foster care grants, care combination grants, care dependency grants, and child support which amassed a total value of R8 278 310,00 monthly. Pay points were located in:

- Zithobeni;
- Refilwe;
- Rethabiseng;
- Kleinsonderhout;
- Onverwacht;
- Jakkelsdans;
- Lappies se Winkel;
- Bronkhorstspruit;
- Rayton;
- Sekulula.

PHOTO 2: CULLINAN DIAMOND MINE, A MAJOR SOURCE OF EMPLOYMENT IN NTTLM

4.3 Services

See Maps 4 and 5

This section focuses on service availability and service delivery, i.e. access to water and lighting, sanitation conditions, waste removal services and so on. Within each sub-section, a specific focus on the respective LMs has been provided so as to delve more comprehensively into the state of services within the MDM.

According to the latest IDP Report (2010/2011), the MDM's major setbacks have been due mostly to insufficient funding and a lack of service delivery relating to the high levels of poverty and unemployment, coupled with a

lack of service delivery planning for the community. Furthermore, this area suffers from a lack of scarce skills, and an absent business plan. These factors have come together to cause major backlogs in service delivery as well as service delivery protests and looting in recent times. These problems appear to persist although the IDP has identified certain 'unblocking actions' such as more efficient use of funds, creation of job opportunities, and the dissemination of infrastructure development plans to communities.

4.3.1 Water & Sanitation

While this section will focus almost exclusively on access to water and sanitation facilities, it must be mentioned upfront that, regardless of water supply, groundwater quality is deteriorating; three local dams are experiencing pollution problems (Roodeplaat dam, BHS, and Rietvleiview); and water quality has been reduced in three major rivers locally (Elandsrivier, Pienaarsrivier, and Wilgerivier).

Metsweding levels of access to water and sanitation services is significantly below provincial average in terms of the percentage of households with piped water inside the dwelling as well as the total number of households with access to piped water. Although when one compares these findings to Census 2001 data, there has been a 7% increase in the number of households with piped water inside the dwelling; a 10% increase in the number of households with piped water in the yard; and fewer persons without access to water so good progress has been made in this regard.

Kungwini appears to be the region with the greatest challenge when looking into the number of dwellings with piped water inside. It must be stated though that MDM has experienced a 7% increase, since 2001, in the proportion of households with piped water inside the dwelling but a 6% decrease in the percentage of households with access to piped water overall.

TABLE 10: PERCENTAGE OF HOUSEHOLDS ACCORDING TO WATER SOURCE

	Gauteng		MDM		KLM		NTTLM	
	2001	2007	2001	2007	2001	2007	2001	2007
RDP standard		97.9%	77.7%	86.5%	77.7%	86.2%	61.9%	74.1%
Below RDP standard		2.1%	22.3%	13.5%	22.3%	13.8%	38.1%	25.9%

Source: Census 2001 & CS 2007

With a focus on sanitation, the CS 2007 recorded the percentage of individuals without a flush toilet. That is, those who make use of a pit latrine, bucket toilet, or who do not have access to a toilet facility.

It appears that the number of residents without a toilet had decreased from 2001 to 2007 across all regions but that by 2007 34.6% of residents in MDM still had no access to a flush toilet. This is an area of concern and one that is in breach of national government policies and requirements in terms of the RDP plan - which states that a VIP toilet with ventilation is the minimum acceptable requirement.

Taking a closer look at NTTLM:

- The water services authority in the Roodeplaat area has confirmed that additional capacity for their existing supply pipelines is not available and therefore external companies have been contracted in this regard (MDM IDP 2001/2010).

- People in the Roodeplaat area mainly make use of on-site sanitation systems (septic tanks & soak ways). While those in the rural areas and townships make use of groundwater and on-site sanitation (septic tanks & pit toilets are most common).
- Those in rural areas do not have their water and sanitation needs met according to the NTTLM IDP report (2007/2008).

In 2001 it was estimated by the DWAF (the old Department of Water Affairs and Forestry) that there was a water delivery backlog for around 5 700 households, even though this was seen as a conservative estimate at the time, the problem is considered to be worse today by the IDP (MDM 2009/2010). Sanitation levels were also below standard with only 62% of the population making use of flush toilets and the remainder having to use pit latrines, bucket latrines or none at all.

A depth view of KLM reveals the following:

- Access to water is a major challenge in KLM, especially with the number of informal settlements;
- Services are provided in the informal settlements but with no cost recovery to the municipality;
- A 2009 COGTA report claimed that there were 31 000 households in Kungwini, of which approximately 27 000 had access to a basic water supply (piped water access within 200m in line with RDP standards);
- Therefore, the backlogs for basic water supply rested at around 4 000 households;
- Kungwini supplies free basic water to approximately 1 587 indigents, a figure which has dropped dramatically since 2001 (13 031). This drop may be due to underreporting in the COGTA survey of some 4 309 households.

KLM currently has a total two water purification plants (1 in Bronkhorstspruit and 1 in Bronkhorstbaai, both in good condition according to the KLM IDP of 2009/2010), and a total of 8 water reservoirs which are used to service the region.

- KLM has six sewerage treatment plants. These are currently functioning well but will have to be upgraded in the near future. The current plants are located in:
- Bronkhorstspruit;
- Rethabiseng (ponds);
- Summer Place;
- Silverlakes;
- Ekangala (ponds);
- Dark City (package plants).

The following areas have been noted as requiring immediate sanitary assistance by the IDP (MDM IDP 2009/2010):

- Ekangala;
- Bronkhorstbaai;
- Rethabiseng;
- Silverlakes – presently discharging in Tshwane's sewerage lines;
- Rural areas;
- Sokhulumi (currently using pit latrines);
- Zithobeni X10;
- Informal settlements (on private land);

4.3.2 Refuse Removal

MDM recently commissioned a youth waste recycling campaign in the district as well as 8 environmental awareness and cleaning campaigns. This is a positive step, albeit that the IDP claim that there is a lack of dedicated personnel for future community projects such as these. Although educating the population regarding waste management and cleaning is important, this section will focus specifically on refuse removal facilities which are currently in place.

The MDM has a much lower percentage of households with refuse removal services than the provincial average of 86.2%, or even the national average of 61.6%. This is an area of concern for this district and, in particular, the NTTLM. The problem appears to have improved since 2001 but at a very slow rate. A calculation based on the table above would reveal that approximately 12 000 people live without proper refuse removal. This means that many people have no acceptable way of removing their waste and this refuse may end up in rivers or streams polluting the local water supply. It may also negatively affect indigenous wildlife and/or become a breeding ground for rodents and parasites that carry disease. The immediate health concerns from a social perspective are numerous as polluted water supplies and air, as well as the presence of parasites, rodents, and scavengers could also pose a great many disease problems.

Access to proper waste disposal sites is difficult in the NTTLM, a problem made worse by the fact that many of these sites operate without the requisite authorisation from government. The only solid waste disposal site in NTTLM is located in Rayton, while collection of waste in the remainder of the area is done on a contract basis in Pienaars River, Elands River, and Roodeplaat. The City of Tshwane has a waste disposal site nearby but there is growing concern in respect of its environmental impact (IDP 2007).

Recycling in KLM area takes place on an informal and erratic basis, while waste is disposed of at the Kungwini landfill site near Zithobeni which does not currently meet government standards. There is also a privately owned landfill site at Ekandustria. 85l bins currently service the residential areas, while 240l bins are in use in the business districts. Zithobeni, Ekangala, and Rethabiseng are problem areas which have been identified due to a lack of bins and illegal dumping (IDP 2010/2011).

4.3.3 Air Quality

In MDM, air quality is affected by veld fires, mining, industry, agriculture, landfills, and domestic pollution. The National Framework for Air Quality Management has rated MDM as potentially poor (mostly because of mining activities) which implies that air quality can be poor and may be deteriorating. From a community health perspective, this phenomenon is problematic as it may cause or exacerbate pulmonological problems (such as breathing troubles, asthma, pneumonia, bronchial disorders etc).

4.3.4 Energy Usage & Sources

In MDM, energy is supplied by Eskom and by the municipality, with free basic energy being supplied by both. Free access to basic electricity supply is a national government initiative with a total of 26 174 MDM households benefiting from this.

Currently there is availability of electricity within the urban centres of Bronkhorstspruit and Ekangala as they receive medium access to electricity but the informal and rural areas have little or no reliable access to electricity. In general, public lighting also remains a problem in Kungwini with a backlog amounting to approximately R200m (IDP 2010/2011).

4.3.5 Transport

4.3.5.1 Roads

The N4 in particular has been recognised as one of the strongest structural elements in this area (forming part of the 'Maputo Corridor') (MDM IDP 2010/2011). In addition, it was indicated that the road network within MDM comprised some 5 000km of roads, with these being classed as reflected in Table 11: Classified road network for MDM.

Table 11: Classified road network for MDM

Road Class	Road Length
Freeway	111.2km
Arterial	108.55km
Main	241.72km
Secondary	754.63km
Street	3667.31km
Total	4883.41km

Source: MDM ITP 2004/2009

TABLE 12: SUMMARY OF ROAD NETWORK RESPONSIBILITIES

Road Responsibility	Road Length
National	111.2km
Provincial	1156.8km
KLM	1889.36km
NTTLM	1651.46km

Source: MDM ITP 2004/2009

In KLM approximately 78% of the total road network is gravel, while the total road building backlog in monetary terms rests at approximately R2.6 billion. Of the total road length in this LM, only 212km exists in the townships, of which 118km is gravel (KLM IDP 2010/2011). This highlights yet another infrastructural and service related need that exists within the rural and township areas. The road network that does exist requires attention.

PHOTO 3: POTHOLES ON THE ROAD TO ZITHOBENI INFORMAL SETTLEMENT - NOTE THE CARS DRIVING ON THE SHOULDER OF THE ROAD IN ORDER TO AVOID POTHOLES

Transport in KLM is largely restricted to the road network with residents utilising the mini-bus taxi service, as well as the bus mode of transport. There are currently eight taxi ranks in the area which operate daily and a further operating only on Fridays/Weekends.

The main bus operator is PUTCO with depots in KwaNdebele and Ekangala (KLM IDP 2010/2011). In KwaNdebele some 30 000 commuters use the services daily with some travelling as far as 200km in either direction, there are also some 400 busses travelling between Tshwane and Moloto daily. Demand in KwaNdebele is growing at a rate of around 8% per annum says the KLM IDP Report of 2009/2010. An important destination from

KwaNdebele is Ekandustria (also in MDM) attracting about 500 trips daily, although this service provides a vast array of routes in all directions particularly to Johannesburg and Tshwane.

Regarding Ekangala, PUTCO has permits to provide service on 46 routes although they are currently only making use of 19. The main origin of these services is Ekangala Township with destinations being Springs, Benoni, Kaalfontein, and Tshwane (MDM ITP 2004/2009).

When looking at NTTLM, the majority of roads within Elands River, Pienaars River and Roodeplaat areas are gravel roads and are maintained by the municipality. Municipal road responsibility also occurs within the Cullinan and Rayton urban areas.

The movement of goods and people in the area, particularly the North-East quadrant, can generally be ascribed to the larger concentration of people in this area. This population has a limited access to goods and services and will commute to the South and South-West of NTTLM. Furthermore, several primary issues have been identified in the NTTLM area with regard to road status and usage:

- Areas of the R573 experienced dangerous operational phenomena, particularly bus-related (high speeds, overtaking, passenger off-loading). Areas of this road are also deteriorating and
- Many roads are in a below average condition with them approaching the end of their design periods;
- There is a lack of adequate facilities for bus and taxi stops.

For the most part, taxi services occur on an informal basis and are commuter driven, that is that formal schedules and services do not exist but are rather driven by community need. Facilities at most taxi ranks (appropriate seating, toilets etc) are also largely below satisfactory level.

PHOTO 4: FORMAL TAXI RANK

PHOTO 5: INFORMAL TAXI RANK

4.3.5.2 Rail Network

Overall, rail is not a particularly popular form of transport in this area since it does not link people's residences with places of work.

The MDM rail network is made up of a single line originating in Johannesburg and running through to Witbank and Nelspruit. The section of rail under MDM jurisdiction is approximately 175km long with 28 stations along this line. Public transport is largely made up of road commuters but this line does serve for transport (predominantly long distance) and freight purposes.

In the MDM area, Metrorail operates a daily commuter service from Pretoria to Rayton with one train leaving in the early morning (06:00) and another returning later that evening (17:50) (MDM ITP 2004/2009). Rovus Rail, a private train operator, occasionally uses services at Rayton station.

PHOTO 6: MAIN RAIL LINE THROUGH BRONKHORSTPRUIT

4.3.6 Airports

There are currently 7 airports/airfields in MDM which service a wide variety of needs. These are:

- Bronkhorstspruit, KLM
- Rhino Park, KLM
- Kitty Hawk Aero, KLM
- Cohen, KLM
- Lynx, NTTLM
- Orient, NTTLM
- Mongena, NTTLM

4.4 Social Infrastructure

Educational infrastructure has to be present, has to be in good working order, has to be properly equipped and staffed, and most of all it has to have sufficient capacity to meet and accommodate the number of people in the area.

Provision of information on healthcare is important as it helps to understand the requirements and status of the physical well-being of the population. Sufficient and well-functioning healthcare facilities and personnel will increase the life expectancies in the area; will improve the community's confidence in the municipality; will decrease human suffering and; will allow the human inhabitants of the area to live, work and function without the stress, cost, and upheaval caused by lingering physical ailments.

Emergency, safety, and security infrastructures are incredibly necessary because any large number of people living in an area will experience crime, emergency medical requirements, and security needs.

See Map 5

4.4.1 Educational Infrastructure

In MDM there is a major lack of tertiary and adult educational facilities which may be hampering further education, extending poverty and impacting on skill levels. The number of pre-primary schools needs to be analysed as it appears that there is a lack of such facilities for the MDM residents. NTTLM requires more secondary schools as there are currently only 2 public secondary schools, one in Cullinan and one in Donkerhoek. Assessment and intervention in all schools within the district must be undertaken so as to ascertain the extent of their infrastructural shortcomings and provide sustainable solutions to them.

TABLE 13: MDM SOCIAL INFRASTRUCTURE

Education in KLM		
Type	Number	Status
Lower/pre-primary Schools; primary; combined primary/secondary; secondary; tertiary (exact numbers per respective educational facility were not clearly or consistently indicated in IDP reports).	56	-Many of the schools in this area lack a wide variety of basic services such as access to water, sanitation, electricity, and telecommunications. -Some schools lack a basic administrations block for the effective and efficient running of day to day activities, while others lack fencing. -A massive number of these schools are currently without sports and recreation facilities. -In general a large improvement in standards of education facilities is required.
Type	Number	Status
Primary schools and secondary schools.	25 in total, 17 of which are public schools, 15 primary and 2 secondary.	-There is a distinct lack of reliable data as to the status, nature and requirements of educational facilities in NTTLM.

PHOTO 7: COMBINED SCHOOL IN CULLINAN

4.4.2 Health Infrastructure

MDM urgently requires a dedicated and fully equipped public hospital as people are currently having to travel at great cost for specialist care or are forced to go to a private hospital at even greater cost.

In KLM there are only two 24 hour clinics with an undisclosed “minor” number in NTTLM. This means that the people cannot always access 24hour care. A number of healthcare facilities require extension or renovation. There are, according to this data, only two ARV providing government clinics. There is a need to increase this number so as to comprehensively assist all HIV infected people in the district.

In terms of population distribution NTTLM requires additional primary healthcare facilities in Refilwe, Kekana Gardens, Onverwacht, Rust de Winter, Roodeplaat, and Donkerhoek. There is a great need for old age homes, childrens’ centres and more community centres. Mobile clinics may provide a good solution for those who find travel difficult, too costly, or are incapacitated.

TABLE 14: HEALTH INFRASTRUCTURE IN MDM

Healthcare in KLM			
Type	**Number**	**Name**	**Condition**
Hospital	1	-Bronkhorstspruit Hospital (private)	-Very good
Clinics and Public Health Facilities	8	-Rethabiseng -Zithobeni (ARV clinic) -Bronkhorstspruit -Ekangala -Dark City (24hrs) -Sokhulumi -Kanana -Paul Yong Nikkel (24hrs NGO)	-Needs extension -Needs extension -Good -Good -Good -Needs extension -Needs extension -Very good
Emergency Medical Facilities	2	-Bronkhorstspruit -Ekangala	-N/A
Multi-Purpose Community Centre	1	-Rethabiseng	-New
Old age home/early childhood centre	1	-Rethabiseng	-Planning and construction phase
Type	Number	Name/location	Condition
Hospital	1	-Cullinan Hospital (private)	Good
Clinics	9	-Cullinan Centre (only ARV provider to Refilwe, Cullinan and Rayton) -Steve Bikoville -Rayton -Refilwe -Onverwacht plot 75 -Plus 4 unlisted clinics.	*Unkown as NTTLM municipality does provide comprehensive data
Emergency Medical Facilities	2	-Cullinan -Steve Bikoville	-N/A
Multi-Purpose Community Centre	1	-Refilwe	-New

PHOTO 8: BRONKORSTPRUIT PRIVATE HOSPITAL

PHOTO 9: PRIMARY HEALTHCARE CLINIC IN BRONKHORSTSPRUIT

PHOTO 10: RAYTON PRIMARY HEALTHCARE CLINIC

4.4.3 Emergency, Safety & Security Infrastructure

There is a definite need for fire fighting infrastructure because in the agricultural areas and the Bronberg area fires are a problem and currently other municipalities are providing assistance. The construction of another police station would assist police officers who are understaffed.

TABLE 15: EMERGENCY, SAFETY & SECURITY INFRASTRUCTURE IN MDM

Emergency, Safety & Security Infrastructure		
Type	**Number**	**Location**
Fire Brigade (fire trucks)	Unknown – "shortage" stated by IDP for MDM 2009/2010.	Tshwane and Ekurhuleni Metros provide assistance when necessary.
Police Stations & Prisons	6 Police Stations 1 Prison	Police Stations: -Ekangala -Cullinan -Boschkop -Kameeldrift -Bronkhorstspruit -Weltered Prison: -Zonderwater
Traffic Officers	22	-Throughout the district but mostly patrolling provincial and main roads.

4.4.4 Crime

The crimes of major concern are those that appear to be on the rise in the district, they are:

- Robbery with aggravating Circumstances;
- Burglary;
- Theft of motor vehicle and/or motorcycle;
- Commercial crime;
- Shoplifting;
- Robbery at residential premises;
- Robbery at non-residential premises.

Overall these statistics show a relatively high crime rate considering the population size of MDM. They may point towards the need for newer and more stringent policing policy and perhaps the introduction of more policing infrastructure (police stations, human resources within the police force, stimulation on support for community policing forums and the like).

PHOTO 11: ZONDERWATER PRISON

4.4.5 Sport and Recreation Facilities

Sport and recreation facilities are abundant in the district but many of these have gone into disrepair, require maintenance, or are generally dilapidated.

KLM has a good number of facilities but plans need to be made in order to assess and solve the problem of the current conditions of most of them, especially those that are well utilised. Further well utilised but informal gravel facilities around KLM are:

- Two gravel soccer fields in Ekangala;
- One gravel soccer field in Dark City (ward 9)

- Netball and soccer fields in the Proper Section (ward 10)
- One multipurpose in Rethabiseng next to new RDP houses (ward 13)
- Two gravel soccer fields and two netball in Zithobeni (ward 6)
- Two gravel soccer fields and one netball in Zithobeni (ward 5)
- Two gravel soccer fields and one gravel netball court in Kanana (ward 3)
- L & J (ward 2) has two gravel soccer fields and one gravel netball court.

These facilities desperately require upgrading and maintenance as they are well utilised and important to the local population.

PHOTO 12: BRONHORSTSPRUIT SPORTS CENTRE

PHOTO 13: CULLINAN COMMUNITY SPORTS CENTRE

5 HERITAGE AND CULTURAL RESOURCES

The broad generic term *Cultural Heritage Resources* refers to any physical and spiritual property associated with past and present human use or occupation of the environment, cultural activities and history. The term includes sites, structures, places, natural features and material of paleontological, archaeological, historical, aesthetic, scientific, architectural, religious, symbolic or traditional importance to specific individuals or groups, traditional systems of cultural practice, belief or social interaction.

5.1 Legal Framework

The legal framework or protected heritage and cultural sites is legislated through the National Heritage Resources Act, Act No. 25 of 1999. The following are the most important sites and objects protected by the National Heritage Act:

- Structures or parts of structures older than 50 years.
- Archaeological sites and objects.
- Paleontological sites.
- Meteorites.
- Ship wrecks.
- Burial grounds.
- Graves of victims of conflict.
- Public monuments and memorials.
- Structures, places and objects protected through the publication of notices in the Gazette and Provincial Gazette.
- Any other places or objects, which are considered to be of interest or of historical or cultural significance.
- Geological sites of scientific or cultural importance.
- Sites of significance relating to the history of slavery in South Africa.
- Objects to which oral traditions are attached.
- Sites of cultural significance or other value to a community or pattern of South African history.

These sites may not be altered, damaged, destroyed or developed without prior approval of the South African National Heritage Resources Agency (SAHRA).

Protection can only take place if the sites are recorded and known. African knowledge and belief systems, cultural traditions etc. can only be preserved through recording. Only then can the knowledge gained through recording be used for education and entertainment.

5.2 Sites of importance

See Map 13

5.2.1 Stone Age

Southern Africa is the cradle of mankind. Early people lived here for millions of years. There is hardly any place in South Africa where one will not find remains of Stone Age people. These people were nomadic and constantly on the move following seasonal migrations of animals, ripening of fruit etc. No permanent living sites exist, though some sites were visited regularly.

The Late Stone Age started about 35 000 years ago and continued into historic times. This period is associated with the Bushmen (San) and pre-bushmen. The artefacts are much smaller than those of the Middle Stone Age and consist of a great variety of implements. The material used in manufacturing is a hard fine-grained semi-precious type of rock like agate, jasper and lidianite. The Late Stone Age is also the period of the so-called Bushmen rock art for which South Africa is internationally known. Only a few rock art sites occur in the study area. Late Stone Age material is found on the Magalies Mountain to the north and east of Mamelodi and throughout the whole era.

PHOTO 14: EARLY STONE AGE HAND AXE FROM KAALFONTEIN

Stone Age sites are only vulnerable if new development takes place like mining, agriculture, road building, townships development and so on. As long as the sites are not in the way of development they will be safe. Unfortunately as soon as a site becomes known through tourism or hiking trails the visitors all want to take souvenirs and the sites are destroyed.

5.2.2 Iron Age

This period starts about 2000 years ago with the migration of Black Farmers into South Africa. They brought with them knowledge of metal working, especially iron smelting, and also cattle, sheep, goats, chickens and dogs as well as various crops like millet, sorghum, spinach etc. They also introduced handmade pottery. Each cultural group decorates its pottery differently. Thus archaeologists rely on pottery to trace the migration roots of black people into South Africa.

In the southern part of the Metsweding area numerous Ndebele sites are found. These cover the area from Wallmannsthal to Roodeplaat Dam and southwards across the N4 along the Pienaarsriver. The greatest concentrations are south of the N4 highway between the Bronberg and the Magalies Mountain ranges. The most important site in the Metsweding area is called Komjekejeke and is situated at the Farm Downbern (494JR). Good sites have also been visited on the Farm Elandshoek (337JR) just southwest of Cullinan. All these sites are relative late sites. Komjekejeke was only occupied from 1873-1926.

PHOTO 15: A TYPICAL NDEBELE SETTLEMENT ON THE FARM MOOIPLAATS SHOWING OUTER AND INNER WALLS

All archaeological and paleaontological material as well as meteorites are protected under Act 25 of 1999, the National Heritage Resource Act. Section 35 (1-8) and may not be destroyed, damaged, excavated, altered or otherwise disturbed etc. unless a permit has been issued by the relevant heritage resources authority. In theory this protection is sufficient but in practice ignorant people destroy many of the sites. Especially Iron Age sites with stone walling are vulnerable. People collect the stones for building or gardening purposes and destroy important archaeological evidence. At Elandshoek (337JR) stonewalls have already been removed at two sites.

5.2.3 Black Peoples History, Beliefs and Customs.

5.2.3.1 Tswana speaking people

Tswana speaking people today live mainly to the west and north of Metsweding. Very little detail recording has been done in the past in this area and there is a great need for the recording of the oral history, beliefs and cultural practices etc. To the east of Cullinan lived the baKôpa, and North- West the maPulana. From Hammanskraal northwards lived mainly baKgatla-ba-Motsha with a number of smaller groups of baPedi in between.

PHOTO 16: EARLY TSWANE SITE ON THE FARM VLAKFONTEIN

5.2.3.2 Ndebele speaking people

In contrast to the Tswana speaking people the Ndebele history has been very well documented especially by Dr C.J van Vuuren (UP 1992) "*Die aard en betekenis van etnisiteit onder die Suid Ndebele*". As far as the Metsweding is concerned the following is important: On the 23 April 1869, the Berlin Mission Society bought a Farm on which they developed Wallmannsthal Mission Station. A Manala Ndebele leader Selamba had asked permission to settle on the Farm after a white Farmer Erasmus had annexed their traditional land on the Farm Mooiplaas (367JR) in 1870. When the mission secretary Dr Wangemann visited the mission station in 1884 Selamba was still living on the Farm at a site called Komjekejeke. Selamba became a prominent Ndebele leader. He had 12 wives 20 sons and 9 daughters. Selamba was succeeded by his eldest son, Buthi. He only reigned for four years and died in 1896. Buthi was succeeded by one of his younger brothers Nyumba who died in 1905. Nyumba's half brother Mbhongo (II) was appointed regent. He left Wallmannsthal in 1915 to settle to the east at Jakkalsdans (243JR). In 1919 he moved to Klipspruit (245JR) and Van Dykspruit (431JR) In 1926 the Ndebele who stayed behind at Wallmannsthal left to settle at Jakkalsdans. The Manala Ndebele of Selamba stayed for 53 years (1873-1926) at Komjekejeke near Wallmannsthal.

This site is an important site to the Ndebele as five of their chiefs were buried on this site. A portion of the Komjekejeke site has been bought by the Selamba trust for the Manala Ndebele.

5.2.3.3 Wallmannsthal

Wallmannsthal was established in 1869 as a mission station by the Berlin Mission Society. It became an important gathering site for displaced black people both of Tswana and Ndebele origin. Strong emphasis has been placed on education. The inhabitants of Wallmannsthal also became victims of forced removal in 1970. The site had to be evacuated for the establishment of an army training ground. The historic buildings and church were used as mortar targets by the military.

5.2.3.4 Valley between Bronberg and the Eastern extension of the Magaliesberg (including Donkerhoek)

This valley was the main settlement area of the Manala Ndebele. This includes the areas of Sammy Marks (Zwartkoppies), Sammy Marks, Silver Lakes, Swavelpoort, Tierpoort, Mooiplaats etc). Most Farms in this area have remains of Manala Ndebele settlements. In many cases the stone walls have been re-used by Farmers to built stonewalls, cattle enclosures and for gardening purposes.

5.2.3.5 Black People and the Anglo-Boer War

After the Boer forces introduced Guerrilla Warfare the British Army started with its tactics of building block houses and burning down of all Farms and crops. Women and children were put into concentration camps. Just east of Pienaarspoort at Van der Merwe station on the Farm Elandshoek 337JR as well as at Elands River on the Farm Kaalfontein concentration camps were erected for black Farm workers. Conditions in the black concentration camps were far worse than the concentration camps for white people. In total 116 000 black women and children died in the black concentration camps. Very little is known about the above two concentration camps. The cemeteries at Van der Merwe Station are neglected.

The settlement of the so-called "*Oorlamse*" is situated north-east of Cullinan on the Farm Onverwacht 424JR. These people were settled here after the Anglo-Boer War. They were the last survivors of the system of "inboekelinge" (apprentices). After slavery was abolished in 1834 both the colonies of the Cape and Natal and later the two Boer Republics passed laws for the capturing and "taming" of black children. On commando the participants were allowed to catch a number of so called apprentices who had to be registered with the local Magistrate. These children, normally between the age of 9 and 11, were raised on the Boer farms as apprentices, and were supposed to be released when girls were 21 and boys 25 years of age.

This practice continued till the 1880's. During the Anglo-Boer War a wealthy Boer farmer called Erasmus offered the "Inboekelinge" land after the war if they would fight on Boer side. Many of them became important "agterryers" attending to the horses of the Boers. After the war Erasmus kept his promise and bought the Farm Onverwacht 424JR. The "Oorlamse" community still lives there with Afrikaans as their home language. This history needs to be documented as squatters have now started moving into the area.

5.2.3.6 Holy Water (Sacred)

The source of the Elands River is on the Farm Kaalfontein (513JR). Unfortunately the site is now divided by the N4 and the R104. The Ndebele (Manala) see this site as a sacred place, which is mentioned in their chiefs prays songs. The Elands River is known as Ndubijana and water is collected from this source for royal ceremonies. The sacred fountain is no more in use. A new sacred fountain is now used about a kilometre to the west just south of the N4 highway.

Just east of Pienaarspoort is the Pienaarspoort spruit, which is used by the Zionist Churches of Mamelodi for baptising. One of the small tributaries of this river called Waterkloof is believed to be holy water, which is collected on a regular basis and used in cleansing ceremonies.

PHOTO 17: NDEBELE WOMEN COLLECTING WATER AT SACRED FOUNTAIN

PHOTO 18: NDEBELE WOMAN COLLECTING GRASS FOR BROOMS

5.2.3.7 Gravesites

Ancestral cemeteries occur on almost every farm. Some of the cemeteries are still visited while many have been forgotten. Most of these cemeteries are those of farm workers who used to live and work on the farms. As an example I photographed a number of cemeteries at Elandshoek 337JR. The present owner has no idea as to whom they belong. What is interesting of these cemeteries is that utensils like coffeepots dishes etc. are still placed on the graves. These utensils are broken during the funerals to release the spirits.

On the Farm Brandbach are the cemeteries of some of the very first farmers who settled here in the mid Nineteenth Century. Next to their cemetery is the cemetery of their slaves who had trekked with them.

5.2.4 Initiation sites

A number of initiation sites are known for both Sotho and Ndebele initiation. Near Mamelodi the Magalies Mountain is used for Sotho initiation. The Ndebele do not adhere to a specific site, but the locality depends on those who organise an initiation school. The site is normally a secluded spot, near the houses of the leader of the initiation school. Initiation takes place every four years. At these initiation schools between 8000 and 10000 young men are initiated every four years.

PHOTO 19: INITIATION SITE WITH PHIRI

5.2.5 Forced removal

Forced removal has taken place all over the Metsweding area. The largest removal took place was that at Wallmannsthal and Rust de Winter. At Wallmannsthal the mission station and black settlements were removed in the 1950-70's for the development of an army practice range. In the same region white Farmers and their black families were also displaced to clear an area of thousands of hectares for military purposes.

At Rust de Winter Tswana people were forcibly removed in the 1930 to make way for the Rust de Winter dam and irrigation scheme. This was reversed in 1985 when the land was expropriated from white Farmers to settle black Farmers on the Farms.

Many Ndebele families have been moved from white Farms to be resettled in Kwa-Ndebele.

5.3 Arrival of European Settlers and Later Developments

5.3.1 Farm Settlement

The first farmers started settling in the Metsweding area in the 1840s. By 1850 the first farms were registered. The original farms were very large (± 6 000 morgen). These farms were laid out according to water sources and arable land. The farmer would decide where he would erect his house only after he had determined where his water furrow could be constructed. The water furrow was the determining factor for farm layout. This practice continued till nearly 1940 and beyond. Only when the drilling of boreholes became easily available could farmers build houses away from water furrows. As land eventually became scarce farmers started dividing farms in such a way that each son and later grandson would receive a piece of land accessible to water e.g. the water

furrow on Kaalfontein at the Willem Prinsloo Agricultural Museum was used by six families. Looking at the 1: 50 000 maps this practise can easily be recognised by the way farms have been sub-divided.

On the lower lying land next to the water furrow a vegetable and fruit garden would be developed, mostly enclosed by a stone wall. One of the first plants planted, were poplar trees. They grow fast and supplied wood for construction. Originally farmers practiced mixed farming. Most farmers in the region had at least two farms: a Highveld (summer) and a Bushveld (winter) Farm. The farmers would move their cattle and other animals between winter and summer grazing. This practice continued until the 1940s. This practice eventually found its way into place names like Rust de Winter, and Wintervelt.

As modern technology became available and game started becoming scarce, this practice fell in disuse. Highveld Farmers had to collect enough hay to feed their animals through winter. This was made possible by tractors and better Farm implements. Today the Metsweding area is still a mixed farming area. Modern irrigation has been introduced on water rich farms.

5.3.2 Architecture and Landscapes

One of the biggest assets of the Metsweding area is its architecture and landscapes. As early as the 1840's the first alley of oak trees was planted. The first houses build by the white settlers were a pioneer type of which no examples have survived. Very few houses predating the Anglo-Boer War do exist as nearly all farms were burned down during the war. Many of these houses were rebuilt after the war. The best documented houses were the houses at the Willem Prinsloo Agricultural Museum, which consist of an 1880, 1913 and a 1920 house. Many of the older Farmhouses in the Cullinan Bronkhorstspruit area have been documented by Annemarie Carelsen of the Ditsong Institution. This also included the interior decoration and furnishings. On the Highveld region the landscape has been drastically changed by the introduction of wattle and gum trees. These trees not only provided much needed fire wood but also shelter against winter cold and wind. With the new laws on alien vegetation, these landscapes could change drastically.

A new architecture has been introduced in the last decade namely, the so-called game lodge architecture with its wood and thatched roofs. This architecture is supposed to create an African feeling.

PHOTO 20: HERVORMDE KERK 1909 BRONKHORSTSPRUIT

PHOTO 21: 1930'S HOUSE BRONKHORSTSPRUIT

PHOTO 22: 1880'S HOUSE KAALFONTEIN

PHOTO 23: 1920'S GABLED FARMHOUSE

Cullinan is unique in the sense that it represents English and mining architecture. It is a real jewel which needs a good conservation strategy. In contrast the Rust de Winter irrigation scheme represents the hard times of the 1930 depression. These buildings as a group are the best examples of the depressions state build houses in South Africa At other similar developments of the 1930's, these houses have long since been replaced or altered to such an extent that they are unrecognisable. An interesting house at Rust de Winter is that of Gen. Jan Smuts which was built with sand stone blocks. His son and grandson lived in the house. In front of the house is a beautiful alley of indigenous trees.

PHOTO 24: RECREATION HALL, CULLINAN 1920'S

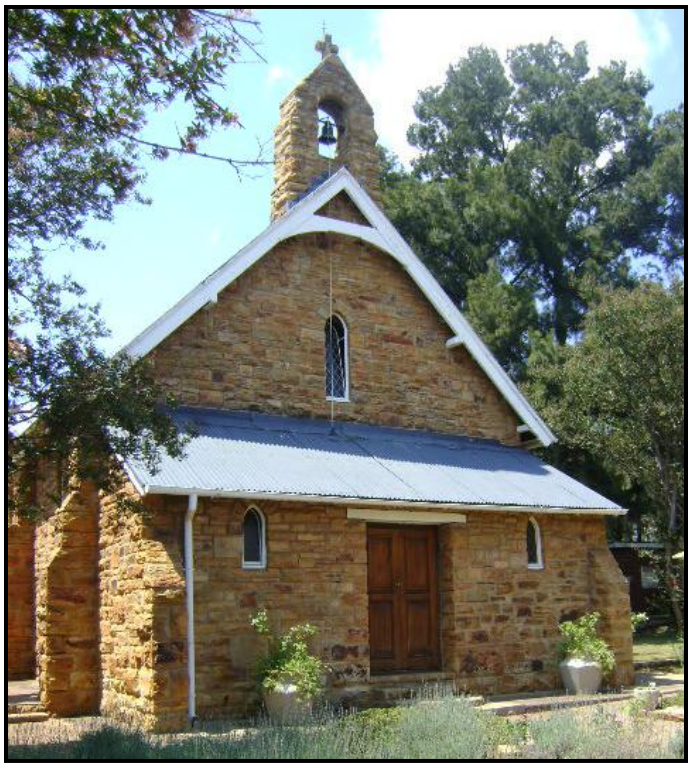


PHOTO 25: SANDSTONE CHURCH, CULLINAN

PHOTO 26: CORRUGATED IRON HOUSE, CULLINAN

These buildings represent the biggest energy investment in the area. Eight bricks in an old building represent an energy investment of 4.5 litre's petrol. To demolish these buildings will consume even more energy by the bulldozers and the transportation of the rubble. To build a new game lodge will take an enormous amount of energy, which has to be taken out of the environment. Whether it is clay, coal, electricity or fossil fuel it is taken out of the environment. If we really want to follow an integrated approach to the Metsweding area we have to maximise the existing resources, including old buildings. The re-utilization of existing buildings instead of erecting new ones will bring an enormous overall energy saving.

5.4 Towns

5.4.1 Cullinan

The town of Cullinan was established in 1902 on the Farm Elandsfontein, after the discovery of diamonds. The town was named after Thomas Major Cullinan, the founder of the diamond mine. Although the town prospered after its establishment the 1930s depression had a negative effect on the mine and the inhabitants of the town. By 1932 the mine had closed down. Because of job losses, many people left the town. Many wood and corrugated iron houses, so typical of early mining architecture, were demolished and sold together with their furnishings.

After the Second World War the economy improved and the mine re-opened in 1945. This had a positive impact on the town and surrounding area. Cullinan today is a beautiful little mining town with many of its old buildings still in place especially in Oak Avenue. The mine hole, shaft gear and most of the mine buildings date to the early 20th century and are protected by the South African Heritage Resources Act (Act 25 of 1999). The central part of the village should be preserved in a similar way as Pilgrims Rest including the mine buildings and structures.

Cullinan has become an important tourist destination.

PHOTO 27: 1920'S SHOP CULLINAN

5.4.2 Rayton

The Montrose Diamond Company established this town in 1903. The town was named after Ragel Ray Williston the wife of the first mine manager. Rayton started off as a boomtown, based on diamonds, like Cullinan. With the closure of the Cullinan mine in 1932 Rayton came to a standstill. Because of cheap stands people started buying these stands to settle in the town. In contrast to Cullinan, Rayton has almost lost all its historic buildings. Many people live in Rayton and commute to Pretoria every day, because of cheaper housing in the town. Some historic buildings have survived in the area north of the R555 road. These include the magistrates building, shops and houses.

PHOTO 28: 1920'S SHOP RAYTON

5.5 Mining

In the Metsweding area, diamonds, lead, fluorspar, clay and sand has been mined.

5.5.1 Diamond mining

Premier mine at Cullinan is by far the most important mine in the area. Premier has produced 119 781 048 carats since mining began in 1903. During that time the mine has produced a disproportionately high portion of the world's largest gem-stones. These include the 3 106 carat (uncut) Cullinan, still the largest diamond ever found in the world. In total it has produced seven of the world's largest and most precious cut diamonds, amongst which is the 530.2 carat Great Star of Africa and the 317.4 carat Lesser Star of Africa which form part of the British crown jewels. This mine is the only mine in the world where the light blue diamond is found. This blue diamond (type 2b) contains boron and is the best known conductor of heat and electricity.

PHOTO 29: MINING MACHINERY, CULLINAN

At present levels of production the mine will last another 20 years. A new Kimberlite pipe has been discovered recently, which will extent the mines life by another 40 years or more. The new investment in the mine is said to be in the region of R40 billion. Though this will create many new jobs and bring a new boom to the town, one has to hope that this new development will not alter the historic centre of the town. The mine itself also has great tourist potential as it is the world's leading diamond mine.

The story of migrant labour at Premier mine needs special attention. Historically, the mine labourers were virtually locked up within the mine grounds for up to two years at a time to try preventing diamond smuggling. No outside contact except by letter was allowed. The mine used its own coinage with which the labourers were paid and the coinage could only be spent in the mine shops, which were in the enclosed area. If a labourer eventually could go home for a much-needed rest, they were locked up in a special compartment for a period. They had to release their stomach's contents in buckets so that these could be scrutinised for diamonds, which had been swallowed. These old hostels are still in existence and should be preserved as well as the story of migrant labour. Unfortunately the buildings are deteriorating at an alarming rate.

Smaller diamond diggings are found southwest and north of Cullinan. All these diggings were alluvial diggings, which boomed in the period 1900-1930. During the depression these alluvial diggings closed down.

5.6 Anglo - Boer War Battle Fields

5.6.1 Battle of Bronkhorstspruit 1880

During the Angle Boer War British troops from Lydenburg were ordered to advance to Pretoria. They consisted of 252 soldiers under Lt. Col. Anstruther. On the 20 December 1888 they were attacked by a Boer commando of 250 men under the command of Genl. Frans Joubert, just south of Bronkhorstspruit. The battle only lasted a few minutes before the British raised the white flag. Four officers and sixty two British soldiers died in the Battle, including Lt. Col. Anstruther. On the Boers side only two men died.

The British soldiers were buried on the battlefield were their graves can still be seen next to the road to Bapsfontein. A small monument was erected by the Monuments Council on the site of the battle.

PHOTO 30: MONUMENT ON THE BRONKHORSTSPRUIT BATTLE FIELD

PHOTO 31: BRITISH TOMBSTONES AT BRONKHORSTSPRUIT BATTLE FIELD

5.6.2 Diamond Hill Battle Field

The last conventional battle of the Anglo-Boer War took place at Diamond Hill. The Boer forces had retreated from Pretoria and made a last stand at the Magalies Mountains to the east and south of Mamelodi. The Boer fortifications were erected all along the Magalies Mountain range. The fortifications on the Farm Pienaarspoort (339JR) are still in a relative good state of preservation. These fortifications are of historic importance and can be developed for tourism.

PHOTO 32: REDOUBT OF BRITISH SOLDIERS DURING THE BATTLE OF DIAMOND HILL

5.7 Other sites of interest

5.7.1 Graveyards

The Metsweding area has numerous small Farm cemeteries of which most are neglected, as family Farms have been sold. On these Farms there are also cemeteries of black Farm workers. In many cases no one knows who is buried where.

PHOTO 33: FARM WORKERS CEMETERY

Of the larger cemeteries the best-preserved one is that of the Italian prisoners of war at Zonderwater. In the prisoner of war camp at Zonderwater, some 94 000 Italian soldiers were imprisoned during the Second World War. Two hundred and thirty seven soldiers died in prison and have been buried here. Many of the soldiers preferred to stay in South Africa after the war. The Museum houses a collection of objects and memorabilia made by the prisoners of war.

PHOTO 34: ITALIAN PRISONERS OF WAR CEMETERY, ZONDERWATER

Another Second World War cemetery is situated in Cullinan, where South African soldiers have been buried. This cemetery forms part of the town cemetery. It contains a good spectrum of cemeteries art and is also worth a visit.

5.7.2 Infrastructure

From an historic point of view the NZASM railway line to Delagoa Bay built in the 1890`s passed through the area. Remains of this railway line can still be seen on the Farm Pienaarspoort 339JR.To safeguard this railway line against Boer attacks the British forces build block houses, which have unfortunately disappeared. It is along the same railway line that the two concentration camps for black people were built. The sandstone pillars of the NZASM Bridge over the river just north of Bronkhorstspruit have survived.

PHOTO 35: WILGERIVIER STEEL BRIDGE 1940S

PHOTO 36: STEAM BOILERS AT WILGERIVIER PUMPSTATION

PHOTO 37: WILGERIVIER PUMPSTATION WITH CHIMNEY FOR BIOLERS

5.7.3 Seltzbach Springs

The Seltzbach Springs are near the Van der Merwe station. This is the same Van der Merwe station where a concentration camp for black people was established during the Anglo-Boer War. The original station was about 4 kilometres from the present one. Mr D.S van der Merwe after whom the station was named was one of a few Afrikaans businessmen during the 1890s. He had a grocery store and later also a bottle store, where he sold his famous mineral water, called Seltzbach mineral water. Mr. This fountain is still today one of the sources of the Pienaarspoort loop, utilised by the Zionist Church for baptising. This bottling plant for the mineral water of Seltzbach was most probably one of the first industrial developments in the Metsweding area. The spring is situated on the Farm Elandshoek 337JR

5.7.4 Museums

In the area there are only three museums.

5.7.4.1 Mc Hardy House Cullinan

This museum is situated in Oak Avenue Cullinan and is one of the oldest houses in town. The house is fully furnished, with furniture of the beginning of the 20th century. There is also an exhibition of old mine machinery on a vacant stand in Oak Avenue.

5.7.4.2 Zonderwater Museum

This museum is situated in the cemetery for Italian Prisoners of War at Zonderwater.

5.7.4.3 Willem Prinsloo Agricultural Museum (Kaalfontein 336JR)

This museum is a satellite of the Ditsong Institution, which manages a number of National Museums. The museum consists of two major components the first being the architecture of the original Farm established by Willem Prinsloo and his children; the second component houses South Africa's largest collection of Farm implements and horse-drawn vehicles. The museum is well visited and receives some 50 000 visitors annually. The museum also organises major events like the National Mampoer Festival, Veteran Tractor Festival, music events and horse events. In the past the museum also had the largest collection of early-domesticated animals of Africa. These included the Namakwa fat-tailed sheep, which are listed on the red data inventory for endangered domesticated animals. Because of financial restrictions most of these animals was sold during 2000.

PHOTO 38: HORSE DRAWN VEHICLES, WILLEM PRINSLOO AGRICULTURAL MUSEUM

5.8 Conclusions

The cultural heritage resources of Metsweding spans a period of more than a million years. It covers the entire cultural development of people from Stone Age till today. It includes pre historic African history and colonial history. It depicts the interaction between the first humans and their adaptation and utilization to the environment, the migration of people, new technologies, warfare and the struggle for survival. It includes ethnic and racial conflict but also living and working together. It depicts the conquering of black people by whites, British imperialism and the struggle for freedom connected to the rise and fall of apartheid. The struggle for land forced removal of people and economic development of the region. The development of mining, migrant workers and the world's largest diamond. It also echoes population growth, over exploitation, pollution and depletion of resources. This legacy tells the story of how we all live together from the past to the present. This legacy is there to be used or abused or to be forgotten. With the Metsweding heritage resources project we have been given a unique chance to take full responsibility for this legacy. This brings with it an enormous responsibility. We have to integrate our cultural legacy into a conservation strategy in such a way that it will be sustainable and available to all. If it has to survive it has to add value, and to make a positive contribution to the project and those it will serve. Too many conservation projects of the past were entirely built on the Western concepts and values for conservation, serving mainly white South Africans and tourists from overseas. Here we have to work towards a new African model of conservation, which totally integrates culture and nature to the benefit of both.

The important point to make is that cultural resources are a non-renewable source. Once they have been lost, they are gone forever. The resources documented in this report, are only a minute portion of the total spectrum available in the area. Some of these like the Premier Mine in Cullinan are of national and international importance, as is the Willem Prinsloo Agricultural Museum.

6 MINING

The Metsweding District area is geologically complex due to the occurrence of a numerous contact areas and multiple layering.

The north eastern part of the study area largely forms part of the Bushveld Complex, with the south part of the Pretoria Super Group and the east largely part of the Waterberg Group. The various rock types that make up the Bushveld Complex, dated to 2.06 billion years, dominate the region. The largest area of the region is represented by a series of felsite and andesite volcanic rocks of the Rooiberg Group. The central- eastern and western areas adjoining the felsite rocks consist of the Rashoop granophyes and Nebo granites.

The northern boundary has the youngest rocks consisting mainly of the Ecca Group of sedimentary deposits of sandstones and shales beneath the Springbok Flats. In the area north of Pienaarsrivier there is also a coalfield associated with the Ecca Group. The rocks of the Ecca Group have been dated to between 150 and 225 million years ago.

The southern and eastern portion of the study area is geologically more complicated. The rocks of the Bushveld Complex extend south almost to Pretoria. However the ridges, which make up the dominant east-west features of the Pretoria landscape, are older than the Bushveld Complex rocks and dip to the north beneath the Bushveld Complex rocks. It is this dipping structure that yields the familiar steep scarp faces on the south and gentler sloping face on the north of the ridges. The ridges and valleys consist of hard quartzites and softer shales and mudstones of the Pretoria Group rocks. The valleys were formed by the erosion of the softer rocks. In many areas the rocks are intruded with diabase sills and one of the largest areas of this rock type is just north of Cullinan. The rocks of the Pretoria Group date to around 2.1 billion years ago (just before the Bushveld Complex rocks).

North of the Cullinan and east of Bronkorstspruit area the dominant rock, apart from the diabase sill mentioned above, is a large remnant of Waterberg sandstone, a rock or group of sediments that were deposited after the Bushveld Complex rocks. The Waterberg rocks represent the time of the development of an oxygen-rich atmosphere around the Earth, and date to about 1.8 billion years ago (McCarthy & Rubidge 2005).

Following the Waterberg depositional age, at about 1.2 billion years, there was a period of considerable volcanic activity which gave rise to the Pilanesberg Complex and associated volcanic intrusions of alkaline-rich rocks such as at Mamelodi quarry and the larger Leeuwfontein volcanic plug, which is north of the Mamelodi quarry. Further north of the Pienaarsrivierdam is a large oval area of volcanic rocks, approximately 15 km in diameter, which represent the remnants of the Roodeplaat volcano. These are also of post-Waterberg age as part of the series of rocks of the volcano that cut through the Waterberg-age rocks, but the Roodeplaat volcano may be as young as 550 million years. The remains of the volcano have been heavily eroded, and what remains is a shallow saucer-shaped area (Verwoerd 1976:171-173).

Most of the exposed rock of the Roodeplaat volcano consists of trachytes and pyroclastic breccias along with various tuffs or compacted volcanic ash flows. The inner zone has very few exposures, but consists of beds of tuffacious shales and quartzites.

See map 12

6.1 Economic mineral resources

The economic resources of the region can be broken down into two categories – current commercial mining operations and past abandoned mining operations and prospects. In the former category the only large and significant economic mining operations are the Vergenoeg fluorspar mine in the northern part of the area and the Premier diamond mine at Cullinan. Various smaller commercial sand/silica and clay mining operations are also present in the area.

The region has several economically important refractory clay producing quarries. On the southern boundary there is a large quarry just north of Mamelodi where both roadstone and various refined ceramic products are produced from the nepheline syenite rock. Alluvial deposits of silica are mined in the Pienaarspoort area and quartzite derived silicas along the ridge north of Bronkhorstspruit dam.

6.1.1 Fluorspar

The largest deposit is at the Vergenoeg mine, where an open cast operation is mining a very large funnel-shaped volcanic pipe. The pipe is oval in plan and measures 900 m x 700 m, and has a potential mining depth of at least 400 m. Fluorspar occurs with at least 40 other minerals in the ore body. The pipe in emplaced in Rooiberg Group rhyolitic rocks. The ore averages 20-40 % calcium fluoride and is one of the most important fluorspar deposits in the world (Wilson & Anhaeusser 1998:272). Associated deposits of fluoride occur on nearby properties such as Plattekop Hill and on the adjoining farm Naauwpoort.

Suphaku Holdings (Pty) Ltd is currently in the process of opening a new Fluorspar mine and associated plants on the farms Kromdraai 209JR and Naaupoort 208JR.

Other smaller deposits occur near Wallmannsthal where a large vertical ore body of high grade ore measuring 270 m x 100 m is intruded in the volcanic trachyte rocks. However, the specific deposit proved impossible to mine at this stage due to beneficiation difficulties.

Fluoride is used in a number of industrial applications i.e. the flux associated with mild steel welding rods, the cosmetic industry i.e. toothpaste, and in high-grade optical equipment i.e. a number of Canon lenses include a fluoride elements (lens) to reduce chromatic aberration.

6.1.2 Diamonds

One of the world's most famous diamond mines exists in the town of Cullinan, which is about 25 km east-north-east of Pretoria. Opened in 1902, it has been a major producer of diamonds, especially high grade and very large gem-quality diamonds since then. Most famous for the world's largest gem diamond — '*the Cullinan*' — at 3106 carats, the mine has produced about 300 stones of over 100 carats each. Among these are a significant numbers of colored stones such as the pink *Premier Rose* at 137 carats.

6.1.3 Refractory Clay

There are many deposits and operating quarries that mine high-grade refractory clay in the east and west of the study area. Some of the quarries can be seen as one drives north on the N1 highway towards Bela-Bela. The deposits are in the Ecca Group sediments that form a broad belt across the northern boundary of the study region.

6.1.4 Aggregate

A number of large quarries occur throughout the study area that mine aggregates. In most cases aggregate mining is only one of a number of products offered from the quarry e.g. lower grade quartzites are sold as aggregates while higher grades are crushed to form silica sands.

6.1.5 Sand Mining

Extensive sand mining occurs throughout the region. Commercial sand mining operations range from those mining foundry sands or high grade silica's in the Pienaarspoort area to the various building sand mining operations in the Boekenhout and Krokodilspruit catchments. Numerous informal mining operations take place along sand deposits in close proximity to residential areas i.e. KwaMhlanga and Moloto. Most sand extraction by the informal sector is used in the building industry.

6.1.6 Road building material

Road building material (organics- and clay-free unconsolidated material/weathered rock) is extracted on an informal basis throughout the region. Many of these borrow pits were opened up for the construction of specific road networks. A number of these have remained active and are still utilized by the informal sector.

6.2 Past mining activities

Past mining activities within the Metsweding area were mainly concentrated in the areas of the Nebo granite and its contact with the Rashoop granophyre. The main minerals sought were the ores of tin, lead, molybdenum, copper and zinc, along with minor amounts of gold and silver. The deposits occurred in what was called the Moloto tin field.

Three principle deposits are known as part of the tin field. They are the Prins Anna mine, south-east of the town of Moloto, which was mined principally for lead, zinc and silver. Another set of mines and prospects were located around the intersection of the R573 and R568 and contained tin, copper, lead, zinc and molybdenum with traces of gold and silver. These are, however, now covered by the urban development of KwaMhlanga and Kameelpoortnek. Just to the south of the intersection on the farm Zusterhoek 246 JR was a tin mine where copper, lead and zinc were mined. The third area was also for tin, but associated with arsenic and was located on the farm Allemansdrift 162 JR and consisted more of prospects than true mines. Tin ores were also be found on the farm Enkeldoorn 217 JR

Molybdenum was mined at the Houtenbek mine on the farm Houtenbek 194 JR along with zinc and lead. Prospects of similar minerals also occur on the adjoining farm Klipplaatdrift 193 JR and further southeast of Houtenbek on the farm Vlaklaagte 221 JR. Most of these mines are however no longer visible on the landscape.

The most significant lead and silver mine in the region was the Edendale Lead Mine, which is located north of Mamelodi on the Cullinan — Pretoria road on the farm Nooitgedacht 339 JR. It began operations in the late 1890s and continued with various operators until 1940. Five levels were put in, and two main shafts were sunk to about 200 m in depth. The mineralised veins extended for approximately 2500 m. During its life the Edendale mine produced just over 6000 tons of lead ore, 200 tons of zinc ore and 600 kg of silver.

During the site survey three abandoned un-rehabilitated coalmines were also located on the border of Metsweding (Known as Balmoral colliery situated on the farm Goedvertrauw 499).

6.3 Status Quo of mines in Metsweding District Municipality

A total of 428 individual mining sites were recorded during the survey, of these 184 mines are active with the remaining 244 closed (see figure 1). Of the closed mines 164 qualify for rehabilitation status with the remaining 80 unrehabilitated.

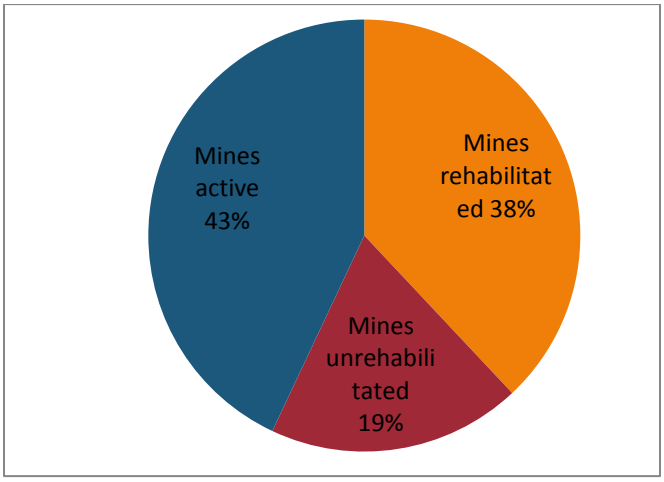


FIGURE 5: PERCENTAGE OF ACTIVE MINES AND THE REHABILITATION STATUS OF CLOSED MINES IN THE METSWEDING AREA

Interestingly the 2007 Metsweding mining study commissioned by the Gauteng Department of Agriculture, Conservation and Environment, Mining Directorate, found that in the Metsweding area there were approximately 202 mines legally operated mines, mining 16 different minerals and producing a wide variety of products (Mining in Metsweding 2007a: 2.1)

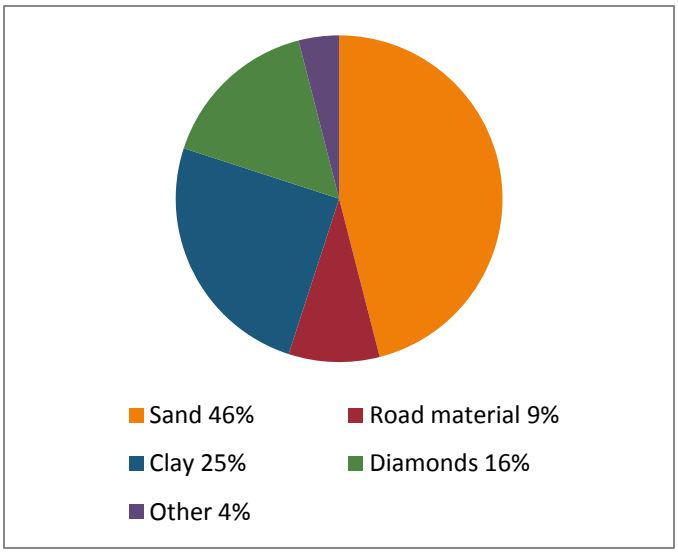


FIGURE 6: PERCENTAGE DISTRIBUTION OF THE DIFFERENT OF THE DIFFERENT LEGAL OPERATIONAL MINES IN THE METSWEDING AREA (MINING IN METSWEDING 2007A: 2.1)

6.4 Impacts of Mining

Mining activities are spread throughout the Metsweding area. The Mining operations range from large scale commercial mines such as the Vergenoeg Fluorspar Mine, Cullinan Diamond Mine and Delfsand Silica Mine to the various informal sand and road building material mines scattered all over the study area.

The 2007 Metsweding Mining: Cumulative Impact Assessment Report commissioned by the Gauteng Department of Agriculture, Conservation and Environment, Mining Directorate details a huge number of impacts in great detail (for more info see appendix A in specialist report).

Cullinan Diamond Mine (previously Premier Mine) is by far the largest mine in the area and a prime example of the social, economic and infrastructural impacts that a large mine can have on an area both positive and negative. The town Cullinan and Refilwe has been established as a direct result of the opening of the original mine and has grown to become a regional service center.

PHOTO 39: CULLINAN DIAMOND MINE, WITH ASSOCIATED TOWN AND INFORMAL SETTLEMENT.

Mining is no doubt an important economic driver within the local economy throughout the region, not only providing much needed job opportunities but also sustaining numerous secondary industries and acting as a local stimulus for growth.

The principle negative impacts associated with mining include the following:

- Loss of vegetation cover and habitat.
- Hydrological impacts
- Increased sedimentation and erosion.
- Pollution associated with mining operations.
- Introduction of invader plant species

PHOTO 40: TERMINALIA SERICEA/OCHNA PULCHRA WOODLAND PRIOR TO MINING

6.4.1 Loss of Vegetation cover and Habitat

One of the most obvious impacts associated with mining operations is the general loss of vegetation and habitat destruction associated with open cast mining. In some cases the impact is localized and small while in other such as the Witfontein, Boekenhout and Krokodilspruit areas large-scale destruction of the vegetation has taken place. Most sand resources in the area are of an alluvial nature and in many places associated with wetlands. This destruction of wetland habitat is most obvious along the valley bottom wetlands and sand is often removed to the very centre of the stream leaving no buffers whatsoever.

PHOTO 41: TERMINALIA SERICEA/OCHNA PULCHRA WOODLAND AFTER MINING

6.4.2 Hydrological impacts

Various impacts associated with water resources and hydrology occurs as a result from mining. These impacts can broadly be grouped into those that result in changed or altered flow regimes and those that impact on

water quality. Water quality impacts are clearly visible on some of the aerial photographs of the area (see figure 8). These are principally due to increased sediment-load and runoff velocities.

FIGURE 7: WATER QUALITY IMPACT AT THE VERGENOEG FLUORSPAR MINE. THE RED COLOR OF THE LOWER DAM IS DUE TO OXIDATION OF HAEMATITE THAT LEACHES FROM THE MINE WORKINGS

Unfortunately changes in flow regimes of the watercourses are more subtle in the landscape. This impact is principally associated with the sand mining operations. A sandy soil plays an important role in water retention within the landscape. Runoff from sandy areas is generally very low as most water infiltrate into the sandy horizons and move through the landscape subsurface. When these sandy aquifers become saturated and surface, these present in the landscape as hillside seepage wetlands or valley bottom wetland systems of a seasonal nature (see Figure 7 and Figure 8). Sand substrates are relatively shallow and mining operations extracts sand up to the plinthic horizons. This results in a reduction of the retention capacity of the landscape and subsurface flows become surface flows with increased velocity, erodability and sediment loads. These impacts are most obvious in areas where extensive sand extraction has taken place such as the Boekenhoutspruit and Krokodilspruit catchments. What is of additional concern is the fact that the Boekenhoutspruit flows through the core area of the Dinokeng Game Reserve.

FIGURE 8: WETLAND AREAS AT THE DELFSAND PIENAARSPOORT SILICA MINE PRIOR TO MINING IN MAY 2005

FIGURE 9: WETLAND AREAS AT THE DELFSAND PIENAARSPOORT SILICA MINE DURING MINING OPERATIONS.

FIGURE 10: THE EXTENT OF SAND MINING IN THE BOEKENHOUTSKLOOF AREA.

6.4.3 Sedimentation and erosion

With the removal of basal cover during the mining process, prolonged mining operations without rehabilitation and no rehabilitation after closure, numerous opportunities for increased sedimentation and erosion exist. The increase in erodability can in many cases be mitigated as it results from poor mining practices. A good example is the temporary diversion of water away from excavations by the use of small diversions with high flow velocities. Often poor rehabilitation of sand mines also result in the forming of a head cut and subsequent gully erosion, leading to lowered water tables and drying out of wetland.

PHOTO 42: SEDIMENTATION AND SILTATION AT THE VERGENOEG FLUORSPAR MINE.

6.4.4 Pollution associated with mining operations

Inevitably mining operations generate a variety of pollutants ranging from dust, noise, industrial waste and toxic waste. Of the various pollutants observed during the field survey the most prevalent form during the operational phase was hydrocarbon pollution. In many of the mining sites the heavy machines involved in excavation and transport are poorly maintained with hydraulic and other oil leaks visible on most vehicles. In one case, the old Edendale lead mine, waste dumps from the refractory process with very high lead concentrations remain unrehabilitated and present a significant health hazard.

Lastly, unrehabilitated mines, borrow pits and other excavations in close proximity to settlement or with unrestricted access become dumpsites. Often these dumpsites become water-saturated during the wet season and present major groundwater pollution risks (during the field survey in June many of the sites were still waterlogged).

PHOTO 43: DUMPING IN A UNREHABILITATED BORROW PIT CLOSE TO BOEKENHOUT MILITARY BASE

6.4.5 Introduction of invader plant species

Invader or alien plant species were observed on numerous of the mining sites visited; the most common being *Eucalyptus* and *Acacia* (Wattle) species. Although these invaders are currently restricted to the areas disturbed during mining these localized concentrations can in future become widespread. Often the mines act as vectors for the distribution of the invaders, trucks are often parked under invader trees and spread the seed to new mining areas.

PHOTO 44: INVADER PLANTS (EUCALYPTUS SPP.) ON AN OLD SAND MINE

6.5 Observations on Rehabilitation

Generally very few of the mines present in the area have properly rehabilitated their workings. In many cases some of the old machinery, buildings, stockpiles and other waste remain. Many of the sites historically mined in the last 15 to 20 years can be regarded as rehabilitated due to vegetation cover and the absence of active erosion. Proper rehabilitation and good vegetation cover are largely dependent on a suitable growing medium.

A number of well-rehabilitated sites are found throughout the area. In some cases these areas contribute to increased diversity and local habitat creation. A good example is the numerous seasonal pans that are created during the wet season. They provide important waterfowl breeding sites and some of the embankments of sand mines create breeding sites for bee-eaters and kingfishers.

Mines for road material or borrow pits were observed to be generally well-rehabilitated due to the fact that topsoil, which cannot be used in road building, is generally replaced resulting in good rehabilitation (see figure 14).

PHOTO 45: A WELL-REHABILITATED BORROW PIT ALONG THE OLD BRONKHORSTSPRUIT ROAD

PHOTO 46: A WELL-REHABILITATED BORROW FILLED WITH RAIN WATER, ADDING HABITAT AND DIVERSITY TO THE LANDSCAPE

Observations on sand mining operations reflect exactly the opposite and in most cases the areas are poorly rehabilitated. Generally sandy soils are poor or nutrient-deficient soils as a result of the extensive leaching. In addition the soils are generally shallow. The organic horizons in sandy soils are also very thin and undefined with limited organic matter. Mines subsequently tend to strip and stockpile only a very limited amount of topsoil to be used in the later rehabilitation and are inclined to maximize on the volume of sand that can be extracted. Mining takes place up to the plinthic horizons leaving no proper growth medium. In some cases the topsoil that was striped is not even replaced. Were saturated conditions exist localized wetlands often form over time.

PHOTO 47: *IMPERATA CELINDRICA*–DOMINATED WETLAND

PHOTO 48: A SAND-MINING AREA DOMINATED BY THE PIONEER PLANT *STOEBE VULGARIS*

Unfortunately a large proportion of sites that were mined remain unrehabilitated or poorly rehabilitated. A number of mine sites have also been converted into 4 x 4 or four wheeler tracks leading to a host of other problems.

PHOTO 49: A TYPICAL UNREHABILITATED SAND MINE APPROXIMATELY 10 YEARS AFTER MINING

PHOTO 50: AN UNREHABILITATED SAND MINE IN THE BOEKENHOUTSKLOOF AREA BEING USED AS A 4X4 TRACK, ALSO NOTE THE INVADERS PRESENT ON SITE.

One of the worst closure options is the use of areas where sand was extracted for rural residential development (see Photo 50). A number of subdivisions have taken place in the Kameelfontein area where these residential units are built within areas of artificial wetland, creating numerous problems with sanitation and dampness of the houses.

PHOTO 51: A HOUSE BUILT ON AN OLD MINING AREA, NOTE THE WETLAND VEGETATION DUE TO PROLONGED PERIODS OF WATER SATURATION

6.5.1 Impacts on fauna

The mining operations result in barren surfaces with little vegetation or the presence of alien vegetation which is not utilized by fauna species and is therefore not beneficial for biodiversity. Prior to rehabilitation of such land it is typical to find only common, hardy or introduced fauna species in these areas such as small rodents and hares. Larger fauna species may occur in the area but are expected to be drifting through the area and are normally only encountered along the edges of these areas. Considering the impact mining, especially open cast/ pit mining, has on natural vegetation, and therefore the ecosystem and aesthetic sense of place, these areas are a potential serious threat to the environment and need to be managed accordingly.

6.6 FUTURE MINING

From a geological perspective significant mineral resources still exist throughout the region and although some have been depleted at the local scale there are still numerous opportunities for mining in the Metsweding area. Some projects recently in the media include:

Delfsand (Pty) Ltd:

"A new property, Cullinan, adjacent to Delf, of some 600 hectares was acquired for R6.6 million in Feb. 2009. Pursuant to a desktop study and geological survey, Delf expects Cullinan to add to the quality and quantity of the alluvial silica. The company submitted all the relevant documentation to the regulatory authorities (including principally the DME) in support of its prospecting and exploration license application. Based upon initial desktop analysis and geological surveys the **available alluvial** silica appears to be of better quality and could be mined at lower costs due to the ease of access to the product and limited plant requirements to mine the product. The reserve acquired is also expected to increase the production capacity of alluvial silica and extend the life of Delf Pienaarspoort Silica"

Suphaku Holdings (Pty) Ltd Kromdraai, Naaupoort Fluorspar Mining Project:

"The Outwash Fan Deposit: The fluorspar mineralization occurs as a layer within the ferruginous conglomerates and breccias delineated by drilling. The thickness of the fluorspar layer varies between 1 and 9.5 meters and averages 4 meters. The layer dips to the east at between 7 and 15 degrees. A total of 159 boreholes have been drilled into this fan.

The Channel Lag Deposit: A horizontal fluorspar bearing ferruginous breccia has been mapped and drilled by Sephaku at the northern portion of Kromdraai towards the Vergenoeg Mine. This deposit occurs across an elevated hill formed as a large erosional remnant. This mineralization is of very high grade and is some 400 meters by 200 meters in extent and averages 17 meters thick. Sephaku has drilled 14 boreholes into this deposit."

6.7 Summary

From field observations it is evident that the smaller informal and possibly illegal mines represent the main threat to the area. Sand mining activities are by far the most destructive and widespread through the area. Large proportions of sand resources are associated with alluvial deposits and mining activities, which subsequently result in various negative impacts. These include the destruction of vegetation, loss of wetland habitat, and reduction in infiltration and retention capacity in the landscape, changed flow regimes, higher runoffs, increased sedimentation and associated hydrocarbon pollution.

Mineral resources and mining are key strategic economic resources within any developing economy with a value of millions if not billions. Mining operations and the associated infrastructural or economic development can be a key lifeline to the poor and communities in close proximity to these resources and cannot be wished away within the Metsweding area. The challenge in this case will be to find a balance between mining and the long term impact on the environment. Collectively the various mining activities in the area can pose a very real threat to the success of the larger Dinokeng initiative and need to be very carefully managed and controlled.

7 WATER RESOURCES

South Africa is a water-limited country that is committed to provide water to its entire people. The principles of water sustainability and equity form the cornerstone for South Africa's water policy. The protection of aquatic ecosystems is recognised as an essential priority not only for the maintenance of biodiversity but also to sustain freshwater resources, as water resources are unevenly distributed over the country, both in quantity and in quality.

To date, water resource management has made much progress in terms of understanding its functionality and importance on a broader catchment level; as with the paradigm shifts in resource management and socio-economic responsibility within South Africa and the implementation of the National Environmental Management Act (107 of 1998) as well as the National Water Act (NWA, 36 of 1998); has led to a greater emphasis being placed on the effective management and utilisation of water resources on all levels of government, market institutes and civil society.

7.1 Catchment areas

The Metsweding District Municipality is divided between two major Water Management Areas namely the Crocodile (West) Water Management Area and the Olifants Water Management Area.

The Crocodile (West) Marico WMA is situated on the western side of the Metsweding District Municipality, an area which is know as the Apies / Pienaars Sub-Management Area of the WMA. The Pienaars River flowing though the District Municipality supplies water to the Crocodile River which forms a major tributary of the Limpopo River. The Marico River is the second major surface water system in the WMA. The Roodeplaat Dam is the single largest dam resource in the Upper Pienaars catchment and forms part of MDM.

The Olifants Water Management Area is situated in the north eastern region of South Africa and covers an area of approximately 54 570 km². The Catchment is divided into nine secondary catchments and the main rivers are the Olifants River and associated tributaries namely the Klein Olifants River, Elands River, Wilge River and the Bronkhorstspruit. The MDM is situated in the upper reaches of the catchment with the main river systems being the Wilge River and Bronkhorstspruit Rivers.

River system structure varies from narrow channels with no defined riparian zones to river channels with well defined riparian zones.

See Maps 7 and 8

7.2 Rivers

Only representative river water resources status quo results for the Metsweding district municipality will be presented. Data from the RHP is thus pulled to provide contextualised estimations for each local municipality (Nokeng Tsa Taemane and Kungwini)

TABLE 16: RIVER HEALTH STATUS QUO INFORMATION FOR THE MDM

RHP Index	Nokeng Tsa Taemane	Kungwini
Water quality	fair C	fair C
IHI Instream	good to fair C	good to fair C
IHI Riparian	Good to fair (C-D)	Good to fair (C-D)
GI	Good-Fair (B-C)	Good-Fair (B-C)
RVI	Poor and fair (E-D)	Poor and fair (E-D)
Invertebrates	from natural to fair B	from natural to fair B/C
Fish	natural B	natural A/C (red data fish species recorded)
Desired Ecological State	It is desirable for the Elands River to be in a good ecological state. Restoring of the riparian zone through clearing of alien vegetation is the most important management intervention required Also, flow releases from the establishments of a reserve should be practised. B	It is desirable for the Bronkhorstspruit/Wilge River to be in a good ecological state. Platinum and Coal mining impacts significantly in selected reaches of the water resource area and water quality and water quantity issues needs to be well managed (water treatment, wetland creation and water recycling for utilisation). B
PES	Present ecological conditions are good B/C	Present ecological conditions are good. C
Overall category	C	C/D

7.3 Wetlands

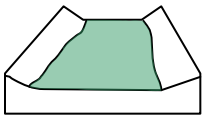
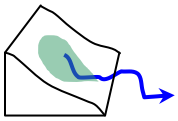
The Metsweding area is subdivided in various aquatic ecoregions based on general topographically, climatic and geologically similar features. The wetlands of the Metsweding area are made up of riverine corridors, associated floodplains and riparian zones as well as isolated depressions. Seepages also occur that feed into various river drainage lines. Rivers are primarily made up of smaller non-perennial streams and drainage lines that feed into larger perennial systems. The low-gradient perennial rivers (especially) support riparian areas that have typical floral species and community structure composition that is dependent on a semi-permanent or permanent

water source. These riparian areas are also regarded as being an integral and functional zone of the associated wetlands and therefore regarded as being an inherently ecologically sensitive habitat types. The most commonly accepted and used wetland types within the context of South Africa's wetland management are to describe wetlands as broad hydrogeomorphic units (Kotze *et al* 2004 and Kotze *et al*, 2005).

The most significant natural wetland types found in the study area in terms of surface area is the Floodplain and Valley Bottom systems. It provides the most water in terms of ecosystem services as well as habitat for cosmopolitan biota (birds, frogs, reeds). From an ecological and biodiversity perspective unchannelled valley Bottoms and Seeps provide areas for genetic fitness and are important in terms of system connectivity and thus conservation. Artificial wetland types will be found in the Flat wetlands as well as Depression wetlands.

See map 16

TABLE 17: WETLAND HYDRO-GEOMORPHIC TYPES TYPICALLY SUPPORTED INLAND WETLAND (KOTZE *ET AL* 2004).

Hydro-geomorphic types	Description	Source of water	
		Surface	Sub-surface
Floodplain 	Valley bottom areas with a well defined stream channel, gently sloped and characterized by floodplain features such as oxbow depressions and natural levees and the alluvial (by water) transport and deposition of sediment, usually leading to a net accumulation of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.	***	*
Valley bottom with a channel 	Valley bottom areas with a well defined stream channel but lacking characteristic floodplain features. May be gently sloped and characterized by the net accumulation of alluvial deposits or may have steeper slopes and be characterized by the net loss of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.	***	*/ ***
Valley bottom without a channel 	Valley bottom areas with no clearly defined stream channel, usually gently sloped and characterized by alluvial sediment deposition, generally leading to a net accumulation of sediment. Water inputs mainly from channel entering the wetland and also from adjacent slopes.	***	*/ ***
Hillslope seepage linked to a stream channel 	Slopes on hillsides, which are characterized by the colluvial (transported by gravity) movement of materials. Water inputs are mainly from sub-surface flow and outflow is usually via a well defined stream channel connecting the area directly to a stream channel.	*	***
Isolated Hillslope seepage 	Slopes on hillsides, which are characterized by the colluvial (transported by gravity) movement of materials. Water inputs mainly from sub-surface flow and outflow either very limited or through diffuse sub-surface and/or surface flow but with no direct surface water connection to a stream channel.	*	***
Depression (includes Pans) 	A basin shaped area with a closed elevation contour that allows for the accumulation of surface water (i.e. it is inward draining). It may also receive sub-surface water. An outlet is usually absent, and therefore this type is usually isolated from the stream channel network.	*/ ***	*/ ***

[1] Precipitation is an important water source and evapotranspiration an important output in all of the above settings

Water source: * Contribution usually small

*** Contribution usually large

*/ *** Contribution may be small or important depending on the local circumstances

7.4 Groundwater (Geo-Hydrological)

The geological characteristics of the MDM in accordance with the Dinokeng Hydrogeological Desktop Study (GCS, 2008), forms part of the Selonsriver formation, the Ecca formation, the Wilgeriver formation , the Rayton formation and the Dwyka formation. Table 18 supplied more detail with regards to the geological structures in the MDM.

TABLE 18: GEOLOGICAL FORMATIONS OF THE MDM

Area in MDM	Complex	Sequence	Group	Formation	Lithology
Central Area of MDM			Rooiberg Group	Selonsriver	Sandstone, Quartzite
Central North areas of MDM	Bushveld				Nebo granite
South area of MDM			Waterberg Group	Wilgeriver	Sandstone, Quartzite, Conglomerate
			Pretoria Group	Rayton	Quartzite, Shale, Subgraywacke
		Karoo		Dwyka	Shale
	Diabase intrusions dominate the area				
North area of MDM		Karoo		Ecca	Shale, Sandstone, Conglomerate, Coal
It is said that the area total area of the MDM us characterised by numerous faults and structure zones with lineaments in the form of dolerite/diabase dykes (GCS, 2008).					

TABLE 19: GENERAL HYDROGEOLOGY PER GEOLOGICAL GROUP IN THE MDM

Data reference GCS, 2008

Group	Characteristics
Pretoria Group	Quartzite in this group, if fractured provides potential for groundwater development where as shale is not considered viable for development of aquifer potential. Dolerite and diabase intrusions which create zones of metamorphic alternation and fracturing in the country rock. These zones frequently have secondary permeability and this have a good aquifer potential
Rooiberg Group	No aquifer potential exists for the quartzite and lavas. Deep seated weathering and fracturing may increase the aquifer potential.
Bushveld Complex	The igneous rock in poorly developed as a potential aquifer, however increased weathering of the rock can increase the aquifer yield. Intrusions accelerate the process of decomposition and the potential is increased for aquifer development. Weathering proceeds further in the basic rocks than the acid granites. The Acid granites provide the highest potential for groundwater potential. The granophyres weathers into soft materials close to the fault zones and subsequent movement takes place, resulting in the highest groundwater potential in the entire area.

Group	Characteristics
Waterberg Group	Sandstones associated with this group have a medium porosity and have not suffered the same degree of alteration as the older rock in the group. The groundwater yield in this is subsequently very high and the presence of diabase dykes and sills are known to improve the yield in general
Karoo Sequence	The sandstone members of this sequence, if fractured provide viable aquifers but the groundwater derived from the Dwyka formation is likely to have a poor quality. Good potential from groundwater exists in areas between sandstone and shale. The existing dolerite dukes and sills are known to improve yield in general. The secondary permeability may be impaired to the rock s by weathering, fracturing and faulting.

The Groundwater Resource Directed Measures (GRDM) of the Department of Water Affairs national groundwater database was used during the Hydrogeological Investigations for the Dinokeng Environmental Management Framework (GCS, 2008).

TABLE 20: SUMMARISED QUATERNARY GROUNDWATER DATABASE INFORMATION FOR MDM

Quaternary Catchment	Total Area (km^2)	Recharge (mm per annum)	Current Use (mm^3 per annum)
A23A	691.15	55.89	31.64
A23B	824.70	24.66	3.57
A23C	497.20	9.54	1.58
A23E	496.39	23.35	7.75
B20D	487.09	74.73	0/50
B31A	391.84	54.98	0.14
B31B	390.46	31.37	0.02
B31C	378.45	16.04	0.02
B31D	565.35	20.74	0.01
B31E	1401.29	20.03	28.35
B31F	646.85	15.01	0.00
B31G	439.62	25.04	0.00
Please note that the following quaternary catchment data is not available: A21A, A21B, B20B, B20C, B20F, B20H, B20J, B32G. The role of this investigation is to get a overall status of the groundwater utilise in the MDM.			

The results in Table 20 indicated that there are different recharge and abstraction programmes in different areas of the MDM. The risk for over exploitation of aquifers are not a serious risk for MDM but measures should be taken for protection of the aquifers against pollution though intrusion.

7.5 Discussion

The drivers for Ecological Change, as stated in the River Health Assessment Report for the Olifants Water Management Area (River Health Programme, 2001) is predominantly mining for coal and other industrial activities which contributes directly to poor water quality and poor in-stream and riparian habitat conditions. Acid leachate from mines is a primary contributor to low pH levels in the river as well as high concentrations of dissolved salts. Agricultural activities are concentrated along the streams banks and lead to diversions, transformation of riparian habitats and erosion of both the river bed and banks. The short team management state of the Olifants River Sub-catchment is poor.

The Lower Pienaars management area of the Crocodile (West) Marico Water Management Area is set to be poor (River Health Programme 2005). The main drivers of change include impacts of impoundments on the natural hydrological regime of the river and high levels of urbanisation and industrial discharges impacting on the water quality. Alien vegetation is also a main concern in the riparian zones of the watercourse systems due to overgrazing.

The Upper Pienaars management area of the CWM WMA is largely controlled by the Roodeplaat Dam with alters the natural flow regimes of the river systems. Increased stormwater run-off from the urbanised areas is leading to higher peak flows during summer months and the transformation of riparian zones around natural drainage line. The overall EcoStatus of the sub catchment is poor.

The following activities are also concerning with regards to the overall status of the surface water resources in the MDM:

- Impingement of developments into the riparian zones of the surface water resources
- Solid waste pollution in and around surface water resources
- River bank erosion
- Over grazing in riparian zones
- Water Quality degradation due to increased stormwater run-off and discharges into the river systems and mining run-off
- Alien vegetation

7.6 Development Pressure

The local and district municipal future planning frameworks all address the growth potential of both urban and rural areas in the MDM. Development nodes seems to focus on the southern and south-western regions of the municipal area up to the Roodeplaat Dam. Current development impacts on the state of the surface water resources is MDM is already noted in existing planning frameworks. Such impacts include increased surface run-off and stormwater run-off which leads to erosion, saltation and reduced water quality. In addition, development tends to encroach on to the riparian zones of watercourses which lead to transformation of the riparian zones as well as invasive specie intrusion. Table 17 provides a summary of key issues to be noted in terms of development planning on the water resources in MDM (MDM SDF 2006).

The spatial structure of the MDM characterised as 95 % rural with a number of towns, villages, sub-urban and peri-urban developments scattered along the extent of the municipality. The peri-urban developments are concentrated along the boundary lines of the Metsweding DM, Tshwane Metropolitan Municipality and the Ekurhuleni Metropolitan Municipalities. The connectivity with the Metropolitan municipalities is enhanced due to current major roadway linkages such as the N4 and the R21 corridors, which enchases growth potential. The expansion of metropolitan municipalities seems to be generally towards the MDM.

The typical rural land-uses include natural areas, ecological features, conservation and farming activities. Farming is divided between cultivation, game and livestock farming. The natural features include surface water system with to major dams including the Roodeplaat Dam and the Bronkhorstspruit Dam. The Magaliesberg and Bronberg Mountain ranges acts as buffer zones for developments.

The MDM and associated local municipal governments will cease to exist after the 2011 municipal elections. The municipal entities will be incorporated into the City of Tshwane and Ekurhuleni Metropolitan Municipalities. The collaboration of municipalities will result in an eastern growth span which was historically limited due to the municipal boundaries.

The growth potential for the MDM is largely along the western boundary due to peri-urban growth from the Metropolitan municipalities and connectivity between major centres. Development expansion is observed along the N4 and northwards towards the Roodeplaat Dam settlement areas. The township of Mamelodi is expanding in southern, eastern and northern direction but currently development is hindered by the Magaliesberg Mountain Range and the municipal boundary between TMM and MDM.

The Silverlakes residential expansion areas along the Rietvlei dam are also an area which has the potential of expanding in the future. The Garsfontein Road provides connectivity to the major metropolitans.

Existing urban expansion in the MDM is not foreseen to have a significant growth potential with the exceptions being at the Roodeplaat Dam and the Bronkhorstspruit Dams.

The growth forecast poses a significant treat to the natural surface water systems that surrounds the development centres and special measures should be installed to protect current water resources from further degradation. Increased surface run-off from Urban Areas leads to a wide range of impacts on river systems and its affects can be seen far along and into neighbouring catchments.

7.7 Pressures on water resources from developments

7.7.1 Increased Stormwater Run-off

The MDM is situated in a summer rainfall seasons. Rainfall is generally in the form of late afternoon thunderstorms resulting in flush flooding of roads ways and drainage areas. The impervious surfaces does not allow for the stormwater to be captured and therefore all the water is washed away and in the process being polluted. The stormwater flows towards the drainage lines which characterise the topography of the area and end up in our river systems. The MDM forms part of the headwaters of both the Crocodile (West) Marico and the Olifants Water Management Areas which leads to further pollution and degradation of the entire water management area.

The flush-floods in turn result in the erosion of already narrowed river channels. The rivers do not have the capability to carry the volume of water and result in the destruction of its banks and infrastructures crossing the channels, which is often experienced in the metropolitan municipalities.

7.7.2 Encroachment into river systems

Development encroachment along river systems in urban or build-up areas is generally seen across the metropolitan areas of Gauteng Province. Developments are often placed within the extent of a rivers riparian zone leading to a magnitude of impacts on the riparian zones. When a riparian zone is encroached upon, the subsurface water flow characteristic is destroyed and the area is not capable of retaining subsurface water, as

with natural riparian zones. Alien vegetation is generally a major problem in disturbed riparian zones. The alien vegetation is generally water intensive species such as the black wattle tree.

Disturbances in a riparian zone lead to erosion and degradation of the water quality in the river systems. Encroachment trends are generally river crossings, developments that are situated within the riparian zones and development of recreational along the watercourses.

7.7.3 Increased Discharges into River Systems

Infrastructure services such as waste water treatment, potable water provision, electricity provision and safe environments some of the few critical services in urban or build-up areas. In turn developments generally expand without taking into account the pressures on the current municipal services such as the waste water treatment works that serves specific areas. The result of the mismanagement of the

Waste Water Treatment capacity in the Metsweding MD is already a growing concern. The foreseen development growth will place a growing concern on the waste water treatment service delivery and will indirectly result in the degradation of the surface water and possible groundwater resources. In addition, increased stormwater and rain leads to overflowing waste water treatment works. The untreated or semi-treated waste water flows into surface water systems leading to the pollution of rivers. The pollutants in the rivers are carried beyond the municipal borders into areas of national importance.

In addition, rural communities normally depend directly on surface water resources for drinking, bathing, stock watering and crop harvesting. The pollutants from waste water treatment plants can have extensive social impacts on the rural communities.

It will be the responsibility of the governing municipality to plan for the future services demand of its municipality and great emphasis must be placed on the effective treatment of waste water before being discharged into the water systems.

TABLE 21: SUMMARY OF PROPOSED DEVELOPMENT AREAS AND ASSOCIATED SURFACE WATER IMPACTS

Development Expansion Areas	Associated Resources
Mooikloof Residential Development Areas surrounding Rietvlei Dam	The river systems that will be affected by development include the Hennops and Rietvlei rivers as well as the Rietvlei Dam. The systems flow through the Centurion area and into the Crocodile River.
Mamelodi Expansion	The headwaters of the Pienaars River and the Edendalespruit. The systems flows through existing cultivated lands and farming plots into the Mamelodi extensions. Both river flows into the Roodeplaat dam.
N4 eastward expansions	The headwaters of the Pienaars River and the Edendalespruit. The systems flows through existing cultivated lands and farming plots into the Mamelodi extensions. Both river flows into the Roodeplaat dam.
Conclusion: **The majority of the impacts with regards to proposed development expansions are on the headwaters of the Crocodile River including the Pienaars Spruit and River, Hennops River, Rietvlei River, Edendalespruit, Hartebeespruit as well as the Roodeplaat Dam and the Rietvlei Dam.**	

TABLE 22: SUMMARISED OBJECTIVES FOR WETLANDS AND RIVER MANAGEMENT FOR MDM

Objective	Motivation
Restricting water quality degradation by improving wetland and river integrity and functionality	Wetlands and rivers have the ability to improve water quality through biological, chemical and physical processes (absorption, adsorption, bacterial transformation, etc)
Restricting direct and indirect wetland and river erosion damage and desiccation as a result of advancing gullies, furrows and headcuts	Case sensitive wetland and river resource designs where ecological considerations is taken into account, so as to prevent irreversible eco-system service loss
Conserving wetland and river related biodiversity	This will improve wetland and river functionality, resilience and the sustainable exploitation of services
Addressing anthropogenic mismanagement and impacts to wetlands	Rectification of illegal development on wetlands and rivers will allow for better future management practise of the water resources (floodline management)
Poverty Alleviation	Management considerations should employ local human capacity as well as provide training in relation to eco-system utilisation practise for sustainable living.
Provision of Wetland Status Quo for priority systems in all local municipalities	Wetlands are classified on a national level. The provision of ecosystem status for wetland systems will provide management with a to the point needs analysis and sensitivity ratings for development, as well as focus for prioritisation of mandates

7.8 Summary of impacts and problems

TABLE 23: SUMMARY OF IMPACTS AND CRITICAL PROBLEMS ON WATER RESOURCES IN THE MDM

PRIMARY WATER RESOURCES	SECTORS WHICH IMPACT ON THE WATER RESOURCE	CRITICAL PROBLEMS	ESTABLISHED CONSERVATION AREAS
ROODEPLAAT DAM AREA			
Roodeplaatdam **Pienaars River** **Rooispruit** **Premier mine stream** **Edendalspruit (non-perineal)** **Hartebeespruit (non-perineal)**	Mining: Illegal and Legal Mining Houses Farming: Farming dominated along all major waterways of approximately 10 ha	Determine classification of water resources in area Determine extent of groundwater resources and quality of resources Pollution concerns associated with drainage systems – originate primarily from mines	Kameelsdrift Conservancy Roodeplaat Dam
ELANDSHOEK SUB-MANAGEMENT AREA			
Edendalespruit Groundwater	Residential Settlements: Growth of the Mamelodi township towards to north Mining: Illegal mines present in area Farming: cattle and crop farming present	High ecological and aesthetic value to watercourse High potential for groundwater utilisation Management of alien vegetation along rivers, wetlands and water bodies	Conservation criteria to be developed along the Edendalespruit Cullinan conservancy with rich cultural heritage
KAMEELFONTEIN/ WALLMANSTAL SUB-MANAGEMENT AREA			
Roodeplaatdam **Pienaar River** **Groundwater resources**	Mining: Mining include sand excavation, clay and semi-precious stone mining Farming: Mixed farming activities	Management of mining activities in area High recreational, amenity and aesthetic value of Roodeplaatdam Protection of groundwater resources in southern part of area Mining areas	The De Twee Spruit Conservancy Seringveld Conservancy Buffelsdrift Conservancy Leeuwkloof Conservancy Bobejaansberg Conservancy

PRIMARY WATER RESOURCES	SECTORS WHICH IMPACT ON THE WATER RESOURCE	CRITICAL PROBLEMS	ESTABLISHED CONSERVATION AREAS
		encroaching on sensitive areas	
BRONKHORSTSPRUIT DAM AND SOKHULUMI SUB-MANAGEMENT AREA			
Bronkhorstspruit Dam **Bronkhorstspruit** **Osspruit**	Mining: No significant mining activities in the area Farming: Small scale farming activities	High agricultural potential due to very fertile soils Intensive developments must be discouraged	
DE WAGENDRIFT AND DINOKENG GAME RESERVE SUB-MANAGEMENT AREA			
Pienaars River **Boekenhoutspruit** **Elands Ricer** **Rust de Winter Dam** **Hartebeesspruit**	Residential Development: Development planning in the area Mining: Mines is present in the area Farming: Crop, cattle and game farming present in the area	Protection of ecological importance on the watercourse in the area Existing intrusions of alien vegetation along watercourses should be managed – Critical for water conservation purposes Critical management needed on the growth of informal settlements and expansion of the agricultural sector	Existing private game reserves with their own conservation plans. Framework for conservation targets to be implemented in order to get uniform conservation in the sub management area.

8 SOILS AND AGRICULTURAL POTENTIAL

Metsweding comprises just over 307 000 ha, and consists of undulating topography, generally flattening out towards the north, with altitude above sea level between 950 m and 1 550 m. Parent material comprises mainly quartzite, conglomerate, dolomite and shale in the south, rhyolite in the central portions, and shale in the north and north-east.

The climate of the area varies, becoming both warmer and drier from south to north. The long-term average annual rainfall is around 620-650 mm, while average daily temperatures vary between 16°C and 29°C in summer and between 0°C and 18°C in winter.

As far as existing soil information is concerned, the whole area is covered by land type maps at a scale of 1:250 000, with the portion of the area south of 25°30'S and west of 28°30'E being covered by more semi-detailed (1:50 000 scale) soil information.

There is a great difference between land types in terms of both the soils occurring as well as the associated agricultural potential. There is also a significant difference in the dominance of the agricultural potential classes within each land type.

The only land type where there is a predominance of high potential soils is Ae20, occurring in the north of Metsweding. The land types where moderate potential soils are in the majority include Ba5, Ba6, Ba12, Ba13, Bb6, Bb7, Bb9, Bb12, Bb16, Bb17, Bb18, Dc1 and Fa4, with the percentage varying from 36% to 70%, The lowest potential soils are dominant in land types Bd3, Bd4, Fa5, Fa6, Ib7, Ib8, Ib9, Ib10 and Ib12, again with percentages that vary from 64% to 95%.

From the 1:50 000 soil coverage, the soils also vary greatly. There are areas with deep soils, but these are generally scattered and separated by zones of shallower soils, usually stony. The coverage area is dominated by shallow and/rocky soils.

The Metsweding area is not one where significant zones of erodible soils occur, with few areas of either sandy soils or duplex soils.

The grazing capacity for Metsweding (not for game farming) decreases northwards, from around 7-8 ha/lsu in the south to around 11-12 ha/lsu in the north.

See Maps 9, 10, 11, 19

8.1 Climate

The climate of the area varies, becoming both warmer and drier from south to north, due mainly to the drop in altitude.

The Metsweding District Municipality is located within the temperate South African Highveld and thus experiences warm summers and cold winters. The highest average temperatures occur during the summer season from December to January. The average daily maximum temperatures range between 18°C (in winter) and 27°C (in summer). The average daily minimum temperatures range between 0°C (in winter) and 13°C (in

summer). The coldest temperatures are recorded from June to July. Frost can be expected during winter [Kaulela, 2009].

This region has a typical Highveld rainfall pattern, where the majority of the rain falls from October through to April. An average of approximately 720 mm of rain per year is recorded in the area. During the dry winter months of June, July and August only approximately 3.5% of the rainfall occurs. Hail can be expected occasionally, and usually occurs in October through to December. August is the driest period of the year, usually accompanied by high winds [GDACE, 2004 & Kaulela, 2009].

Winds in the Metsweding District are generally moderate to light but may become gusty and fairly strong towards the end of the winter season. Strong winds are also associated with thunderstorms during the rainy season. Diurnal airflow for the Metsweding District Municipality is characterised mainly by a variation in northerly and easterly winds, with a lower frequency from the westerly to north-westerly sector [Kaulela, 2009].

8.2 Cultivation

Areas of varying land cover are shown on Map 2, as recorded by the National Land-Cover Database (CSIR, 1999). On the map, it can be seen how the areas under cultivation are concentrated towards the south and south-east, corresponding approximately to the areas of better soils, as identified above. Only small areas of irrigation occur, the largest being found in the vicinity of the Roodeplaat Dam, north-east of Pretoria.

8.3 Soil Erosion Hazard

Erosion is a natural, though long-term, process and without it, soil formation would not occur. However, when the process is unnaturally accelerated, usually by human intervention, the results can be severe. The two forms of soil erosion are **wind erosion**, where sandy topsoils that become exposed may be removed in the dry season by the action of wind, and **water erosion**, where topsoils that become exposed can be washed away by water flowing over the soil surface.

Metsweding is not an area where significant zones of erodible soils occur. The topsoils are not significantly sandy, and the rainfall is generally sufficient to ensure a good vegetation coverage, which binds the topsoil together and prevents erosion. Susceptible areas would include soils where sandy topsoils abruptly overly more clayey, usually structured subsoils (“duplex” soils), but areas of such soils in Metsweding are severely restricted and not widespread. This is confirmed by the Land Cover Map (Map 3) in the Appendix, where it can clearly be seen that only isolated small areas in the north-east could be classed as “degraded or eroded”.

8.4 Grazing Capacity

Metsweding lies on the broad boundary zone between highveld and bushveld, and the grazing capacity (measured in hectares required for one large stock unit) decreases northwards, from around 7-8 ha/lsu in the south to around 11-12 ha/lsu in the north (ARC-ISCW, 2004).

This classification does not apply to game farming, where more detailed specialized knowledge is required, mainly in terms of relating plant species composition in both the grass layer and woody layer to the requirements of various grazing and/or browsing species of game.

8.5 Impacts on fauna

Agriculture has been identified as the dominant land use (more than 80%) in Metsweding. Agriculture includes forestry, game farming, fishing, commercial farming, crop and livestock production, including horses, sheep and cattle. The majority of the agricultural produce originates from commercial farms around the Bronkhorstspruit

area that produce primarily maize, beef, groundnuts, cotton, sunflower and sorghum. Subsistence production of vegetables and groundnuts also occurs in this area. Game farming occurs predominantly in the north-eastern section of Metsweding. Agricultural activities results in the transformation and fragmentation of natural habitat, especially grassland regions which are suitable for crop production. Although agricultural activities occur predominantly outside of the conservancies and conservation areas, their wider impacts could affect these areas. The use of chemical fertilizers and pesticides can impact on ground and surface water as well as soil and these impacts are not limited to the extent of the agricultural areas, impacting on the ecosystem and fauna component of the area. Therefore careful management of such activities should be used. Within the agricultural areas, sensitive and secretive fauna species are not expected to occur as it is unlikely for them to survive the in the smaller remnants of natural vegetation. These species are expected to have migrated to natural areas within the vicinity. Smaller fauna species including common rodent species, hares and smaller seed eating birds are expected to occur within the agricultural areas as they benefit from the easy supply of food and are able to survive within the production fields or smaller fragments of natural vegetation. Jackals are also common within agricultural areas due to the occurrence of these smaller fauna species.

9 VEGETATION ASSESMENT

9.1 Vegetation patterns

Vegetation types of the study area are classified according to Mucina and Rutherford (2006). Descriptions of each vegetation type are provided below. The area within the study area occupied by each vegetation type is provided in Table 2. Almost 70% of the study area is occupied by two vegetation types, Rand Highveld Grassland and Central Sandy Bushveld (Table 24).

See Maps 14, 15, 17 and 18

TABLE 24: AREA AND PROPORTION OF EACH VEGETATION TYPES OCCURRING IN THE STUDY AREA.

Vegetation type	Area (ha)	Proportion of Metsweding (%)
Rand Highveld Grassland	165 123	39.60
Central Sandy Bushveld	121 854	29.22
Marikana Thornveld	44 170	10.59
Loskop Mountain Bushveld	35 227	8.45
Springbokvlakte Thornveld	18 911	4.54
Andesite Mountain Bushveld	7 981	1.91
Carletonville Dolomite Grassland	5 171	1.24
Eastern Highveld Grassland	9 360	2.24
Gold Reef Mountain Bushveld	8 629	2.07
Norite Koppies Bushveld	123	0.03
Eastern Temperate Freshwater Wetlands	143	0.03
Subtropical Freshwater Wetlands	299	0.07
TOTAL	416 991	100.00

9.1.1 Rand Highveld Grassland

Across its entire range, Rand Highveld Grassland occurs on a highly variable landscape with extensive sloping plains and a series of ridges slightly elevated over undulating surrounding plains (Mucina et al. 2006). Rand Highveld Grassland occurs on quartzite ridges of the Witwatersrand Supergroup. Soils of various quality are found. It occupies an area of over 165 000 hactares in the southern to south-eastern part of the study area, and is the most commonly found vegetation type in the study aea. The vegetation is described as a species rich, wiry, sour grassland alternating with low, sour shrubland on rocky outcrops and steeper slopes.

9.1.2 Central Sandy Bushveld

This vegetation type occurs in low undulating areas, sometimes between mountains, and on sandy plains and catenas. It occupies an area of almost 122 000 hectares in the northern half of the study area. The vegetation is a tall, deciduous *Terminalia sericea* and *Burkea africana* woodland on deep sandy soils and low, broad-leaved *Combretum* woodland on shallow rocky or gravelly soils. The under-storey is a grass-dominated herbaceous layer with relatively low basal cover. There are two known Central Bushveld endemics in this vegetation (Mucina *et al*. 2006), the grass *Mosdenia leptostachys* and the herb *Oxygonum dregeanum* subsp. *canescens* var. *dissectum*. A list of expected common and dominant species in undisturbed Central Sandy Bushveld includes the following (those with a "d" are considered to be dominant):

9.1.3 Marikana Thornveld

Marikana Thornveld is described as open *Acacia karroo* woodland, occurring in valleys and slightly undulating plains and some lowland hills. Shrubs are denser along drainage lines, on termitaria and on rocky outcrops (Rutherford et al., 2006). The soils are mainly vertic melanic clays. It occupies an area of over 44 000 hectares in the western to south-western part of the study area. A list of expected common and dominant species in undisturbed Marikana Thornveld includes the following (those with a "d" are considered to be dominant):

9.1.4 Loskop Mountain Bushveld

This is an open tree savanna on lower-lying areas and a denser broad-leaved tree savanna on lower slopes and midslopes occurring on low mountains and ridges. Soils include rocky areas with miscellaneous soils ranging from sandy to sandy loams, sandy clays and some clays. There are two known Central Bushveld endemics in this vegetation (Mucina *et al*. 2006), the geophyte *Gladiolus pole-evansii* and the succulent herb *Haworthia koelmaniorum*. This vegetation type occupies an area of over 35 000 hectares in the north-eastern and eastern part of the study area. A list of expected common and dominant species in undisturbed Loskop Mountain Bushveld includes the following (those with a "d" are considered to be dominant):

9.1.5 3.1.5 Springbokvlakte Thornveld

This is an open to dense, low thorn savanna dominated by *Acacia* species or shrubby grassland with a very low shrub layer low karroid shrubland occurring on flat to slightly undulating plains. Soils are red-yellow apedal, freely drained with high base status and self-mulching, black, vertic clays. There is one known Central Bushveld endemic in this vegetation (Mucina *et al*. 2006), the grass *Mosdenia leptostachys*. This vegetation type occupies an area of just under 19 000 hectares in the extreme northern parts of the study area. A list of expected common and dominant species in undisturbed Marikana Thornveld includes the following (those with a "d" are considered to be dominant):

9.1.6 Andesite Mountain Bushveld

This is a dense, medium-tall, thorny bushveld with a well-developed grass layer that occurs on hill slopes and some valleys in undulating landscapes. Soils are shallow, rocky and clayey. This vegetation type is found on a ridge in the south-western part of the study area and occupies and area of just under 8 000 hectares (Table 2). A list of expected common and dominant species in undisturbed Andesite Mountain Bushveld includes the following (those with a "d" are considered to be dominant):

9.1.7 Carletonville Dolomite Grassland

This is a species-rich grassland with a complex mosaic pattern dominated by many species occurring on slightly undulating plains dissected by prominent rocky chert ridges (Mucina *et al*. 2006). Soils are mostly shallow. There is one known endemic species in this vegetation (Mucina *et al*. 2006), the succulent shrub, *Delosperma davyi*.

This vegetation occupies a small area of just over 5 000 hectares in the extreme south-western part of the study area. A list of expected common and dominant species in undisturbed Carletonville Dolomite Grassland includes the following (those with a "d" are considered to be dominant):

9.1.8 Eastern Highveld Grassland

This is short, dense grassland occurring in slightly to moderately undulating plains, including some low hills (Mucina *et al*. 2006). Soils are red to yellow and sandy. This vegetation type occupies an area of just over 9 000 hectares in patches in the southern part of the study area. A list of expected common and dominant species in undisturbed Eastern Highveld Grassland includes the following (those with a "d" are considered to be dominant):

9.1.9 Gold Reef Mountain Bushveld

This is woodland of variable density, usually more dense on south-facing slopes. Tree and shrub layers are often continuous and the herbaceous layer is dominated by grasses. The vegetation occurs on hills and ridges, often east-west trending. Soils are shallow, gravel lithosols. There are two known endemic species in this vegetation (Mucina *et al*. 2006), the succulent shrub, *Aloe peglerae*, and the succulent herb, *Frithia pulchra*. This vegetation type occupies an area of just under 9 000 hectares along the Magaliesberg within the southern half of the study area. A list of expected common and dominant species in undisturbed Gold Reef Mountain Bushveld includes the following (those with a "d" are considered to be dominant):

9.1.10 Norite Koppies Bushveld

Norite Koppies Bushveld is described as a low, semi-open to closed woodland up to 5 m tall, consisting of dense deciduous shrubs and trees with very sparse undergrowth (Rutherford et al., 2006). Tree and shrub layers are continuous. Soils are very shallow and there are large areas of rock that are not covered with vegetation. The vegetation is found on noritic outcrops and koppies, many of which appear as inselbergs above the surrounding plains. Only a small amount of this vegetation type, just over 100 hectares, is found as a single outcrop in the central western part of the study area. A list of expected common and dominant species in undisturbed Norite Koppies Bushveld includes the following (those with a "d" are considered to be dominant):

9.1.11 Eastern Temperate Freshwater Wetlands

This vegetation unit occurs in flat landscapes or shallow depressions filled with (temporary) water bodies supporting zoned systems of aquatic and hygrophilous vegetation or temporarily flooded grasslands and ephemeral herblands (Mucina *et al*. 2006). The vegetation type is mapped as occurring in four pans in the southern part of the study area, occupying an area of 143 hectares. It may, however, occur more extensively within unmapped pans and drainage lines in the southern half of the study area. A list of expected common and dominant species in undisturbed Eastern Temperate Freshwater Wetlands includes the following (those with a "d" are considered to be dominant):

9.1.12 Subtropical Freshwater Wetlands

This vegetation consists of low beds of reeds, sedges and rushes and waterlogged meadows dominated by grasses found in areas of flat topography in waterlogged clay soil. It is found typically along edges of seasonal pools in aeolian depressions as well as fringing alluvial backwater pans or artificial dams (Mucina *et al*. 2006). This vegetation type is indicated as occurring in small patches in the northern half of the study area, occupying an area of almost 300 hectares. It is, however, probably much more widespread and likely to occupy most of the major drainage lines in this part of the study area. A list of expected common and dominant species in

undisturbed Subtropical Freshwater Wetlands includes the following (those with a "d" are considered to be dominant):

9.2 Vegetation conservation status

According to scientific literature (Driver et al. 2005; Mucina *et al*., 2006), four vegetation types occurring in the study area are classified as Endangered and two as Vulnerable (Table 3). The remaining six vegetation types are classified as Least threatened.

The Draft National List of Threatened Ecosystems (GN1477 of 2009), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004), lists four vegetation type as Vulnerable on the basis of irreversible loss of natural habitat (criterion A1). According to section 54 of the National Environmental Management: Biodiversity Act (Act No. 10, 2004), "*a municipality that must adopt an integrated development plan in terms of the Local Government: Municipal Systems Act, 2000 (Act No. 32 of 2000), must take into account the need for the protection of listed ecosystems.*"

TABLE 25: CONSERVATION STATUS OF DIFFERENT VEGETATION TYPES OCCURRING IN THE STUDY AREA, ACCORDING TO DRIVER ET AL. 2005 / MUCINA ET AL. 2005 AND THE DRAFT ECOSYSTEMS LIST OF THE NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT.

Vegetation Type	Conservation status (Mucina et al. 2005)	Status (NEMBA)
Rand Highveld Grassland	Endangered	Vulnerable
Central Sandy Bushveld	Vulnerable	Not listed
Marikana Thornveld	Endangered	Vulnerable
Loskop Mountain Bushveld	Least Threatened	Not listed
Springbokvlakte Thornveld	Endangered	Vulnerable
Andesite Mountain Bushveld	Least Threatened	Not listed
Carletonville Dolomite Grassland	Vulnerable	Not listed
Eastern Highveld Grassland	Endangered	Vulnerable
Gold Reef Mountain Bushveld	Least Threatened	Not listed
Norite Koppies Bushveld	Least Threatened	Not listed
Eastern Temperate Freshwater Wetlands	Least Threatened	Not listed
Subtropical Freshwater Wetlands	Least Threatened	Not listed

9.2.1 Plant species of conservation concern

Ten threatened and thirteen near threatened plant species are confirmed to occur within the study area. There are also nine declining and one rare plant species that have been confirmed to occur there.

- According to the GDARD Threatened Species Policy, conservation of species of conservation concern is prioritized according to the degree of endemism to Gauteng. Any species endemic to the Province are highest priority (A1), species found in Gauteng and one other Province are the next highest priority (A2).

There are three A1 priority threatened species that occur in the study area and one A1 near threatened species. These are as follows:

- *Habenaria mossii*, listed as Endangered. This is an orchid that is found in open grassland on dolomite or in black sandy soil. It has been previously recorded within the quarter degree grid 2528CD. The vegetation types in which it is most likely to be found is Carletonville Dolomite Grassland, which only occurs as two small patches in the south-western part of the study area.
- *Ceropegia decidua* subsp. *pretoriensis*, listed as Vulnerable. This is a twining herb that arises from a fleshy tuber. It grows in direct sunshine or shaded situations, on rocky outcrops of the quartzitic Magaliesberg mountain range. All present National Herbarium collections come from the 2528C and 2528D quarter degree grids. It has been confirmed to occur within the Cullinan Conservancy and is most likely to be found within Gold Reef Mountain Bushveld.
- *Delosperma gautengense*, listed as Vulnerable. This is a small succulent plant that grows among rocks of Magaliesberg quartzite and is most likely to be found within Gold Reef Mountain Bushveld.
- *Searsia gracillima* var. *gracillima*, listed as Near Threatened. This is a dwarf shrub that grows in rocky quartzitic outcrops in bushveld. It is most likely to be found in Central Sandy Bushveld, Loskop Mountain Bushveld or Gold Reef Mountain Bushveld in the study area.

There are four A2 priority threatened species that occur in the study area and four A2 priority near threatened species. These are as follows:

- *Cheilanthes deltoidea* subsp. nov. Gauteng form, listed as Vulnerable. This is a small fern that is found in south-west-facing soil pockets and rock crevices in chert rock. The vegetation type in which it is most likely to be found is Carletonville Dolomite Grassland, which only occurs as two small patches in the south-western part of the study area.
- *Encephalartus lanatus*, listed as Vulnerable. This is a cycad species that is found in open to closed woodland on the slopes of sheltered wooded kloofs or ridges and sheltered rocky ledges. The vegetation types in which it is most likely to be found are Central Sandy Bushveld and Loskop Mountain Bushveld, but only in areas in which the specific habitat requirements are found.
- *Eulophia coddii*, listed as Vulnerable. This is a small orchid that grows in grassland or mixed bush on steep hillsides on soil derived from sandstones. The vegetation type in which it is most likely to be found is Rand Highveld Grassland, but probably only occurs on ridges within this vegetation.
- *Frithia humilis*, listed as Vulnerable. It is a small succulent plant that grows in colonies in sandy flat areas in very shallow soils associated with rough rocky outcrops. It is most likely to occur on ridges in Loskop Mountain Bushveld, Central Sandy Bushveld, Rand Highveld Grassland or Gold Reef Mountain Bushveld.
- *Adromischus umbraticola* subsp. *umbraticola*, listed as Near Threatened. This is a succulent plant that is found in rock crevices on rocky ridges, usually south-facing, or in shallow gravel on top of rocks, but often in the shade of other vegetation. It is likely to only occur on ridges. The distribution of this species indicates that, within the study area, these may be within Loskop Mountain Bushveld, Central Sandy Bushveld, Rand Highveld Grassland or Marikana Thornveld.
- *Delosperma leendertziae*, listed as Near Threatened. This is a succulent plant that is found on rocky ridges on steep, south-facing slopes of quartzite in mountain grassveld. It is likely to only occur on ridges. The distribution of this species indicates that, within the study area, these are most likely to be within Gold Reef Mountain Bushveld.
- *Habenaria barbertoni*, listed as Near Threatened. This is a small orchid that grows in grassland on rocky hillsides. The distribution of this species indicates that it most probably occurs within Carletonville Dolomite Grassland, Eastern Highveld Grassland or Rand Highveld Grassland within the study area, although it may also occur within Andesite Mountain Bushveld or Gold Reef Mountain Bushveld. The presence of ridges may be a good indicator of the potential presence of this species.

- ***Stenostelma umbelluliferum***, listed as Near Threatened. This is a small herbaceous species that is found in deep black turf in open woodland mainly in the vicinity of drainage lines. A key vegetation type is Marikana Thornveld.

There are three threatened species that occur in the study area that are of lower conservation priority in Gauteng (listed as A3 or B priority or no priority provided). Due to the threatened status of these species, they should be considered to be important to conserve, irrespective of the priority given to their conservation in Gauteng. These are as follows:

- *Brachystelma incanum*, listed as Vulnerable. This species occurs in grassland in rocky areas on quartzite hillslopes. It is most likely to be found in Loskop Mountain Bushveld.
- *Bowiea volubilis* subsp. *volubilis,* listed as Vulnerable. This species occurs in shady places, on steep rocky slopes and in open woodland, under large boulders in bush or low forest. Its distribution extends from Gauteng, through the KwaZulu-Natal and into the central parts of the Eastern Cape. Within Gauteng, it occurs on ridges within Andesite Mountain Bushveld or Gold Reef Mountain Bushveld
- *Brachycorythis conica* subsp. *transvaalensis*, listed as Vulnerable. This species occurs in short grasslands, on hillsides, on sandy gravel overlying dolomite, sometimes also on quartzites. It occasionally occurs in open woodland. It is most likely to occur on ridges within Carletonville Dolomite Grassland, Andesite Mountain Bushveld or Gold Reef Mountain Bushveld.

The vegetation types that are of the greatest importance for supporting priority populations of threatened plant species are Gold Reef Mountain Bushveld, Rand Highveld Grassland, Central Sandy Bushveld and Loskop Mountain Bushveld (Table 4). Ridges in different habitats are potential habitat for eleven of the priority species discussed above, which indicates that it is key habitat for threatened plant species.

TABLE 26: VEGETATION TYPES THAT ARE MOST LIKELY TO CONTAIN THREATENED PLANT SPECIES.

Vegetation Type	No. of threatened species
Rand Highveld Grassland	4
Central Sandy Bushveld	4
Marikana Thornveld	2
Loskop Mountain Bushveld	4
Springbokvlakte Thornveld	0
Andesite Mountain Bushveld	3
Carletonville Dolomite Grassland	4
Eastern Highveld Grassland	1
Gold Reef Mountain Bushveld	8
Norite Koppies Bushveld	0
Eastern Temperate Freshwater Wetlands	0
Subtropical Freshwater Wetlands	0

9.3 Remaining natural areas

Based on updated landcover mapping of the study area, almost 38% of the natural vegetation of the study area has been transformed. Most of this transformation is due to cultivation. Areas in a natural state are not uniformly distributed across the study area. The northern half of the study area is mostly in a natural state, whereas the southern half of the study area has been heavily transformed. Extensive fieldwork and mapping of Gauteng (Hoare & Pfab, in prep.) indicates that areas mapped as natural vegetation are often in a degraded state, especially when located close to transformed areas. This suggests that patches of untransformed natural vegetation in the southern half of the study area are probably in a relatively poor condition. This degradation is primarily due to fragmentation and edge effects, which cause species composition change and enhance invasion by alien species. The larger patches of remaining natural vegetation therefore tend to have the highest biodiversity value.

TABLE 27: OVERALL RATES OF TRANSFORMATION OF NATURAL VEGETATION WITHIN THE STUDY AREA.

Landcover status	Area (ha)	Proportion (%)
Natural	259 852	62.3
Transformed	157 138	37.7

Rates of transformation differ from one vegetation type to another. Within the study area, the vegetation types of significant area that have been transformed to the greatest degree are Eastern Highveld Grassland and Rand Highveld Grassland, both of which are listed as Vulnerable (Draft Ecosystem List) / Endangered (Mucina et al. 2006). The vegetation types with the least degree of transformation are Loskop Mountain Bushveld, Springbokvlakte Thornveld, Gold Reef Mountain Bushveld and Central Sandy Bushveld.

TABLE 28: RATES OF TRANSFORMATION OF DIFFERENT VEGETATION TYPES WITHIN THE STUDY AREA.

Landcover status	Total area (ha)	Total area within study area (ha)	Area natural within study area (ha)	Proportion natural within study area (%)
Rand Highveld Grassland	1 026 129	165 124	97 703	59.2
Central Sandy Bushveld	1 724 250	121 854	109 761	90.1
Marikana Thornveld	252 870	44 170	31 749	71.9
Loskop Mountain Bushveld	206 631	35 227	34 794	98.8
Springbokvlakte Thornveld	879 704	18 910	18 097	95.7
Andesite Mountain Bushveld	199 232	7 981	6 208	77.8
Carletonville Dolomite Grassland	911 780	5 171	3 599	69.6
Eastern Highveld Grassland	1 266 903	9 360	3 529	37.7
Gold Reef Mountain	203 098	8 628	7 935	92.0

Bushveld				
Norite Koppies Bushveld	26 009	123	123	100.0
Eastern Temperate Freshwater Wetlands	55 677	143	107	74.8
Subtropical Freshwater Wetlands	65 646	298	276	92.6

9.4 Habitats of high biodiversity importance

See Map 18

9.4.1 Ridges

Ridges are characterized by high spatial heterogeneity due to the range of differing aspects, slopes and altitudes all resulting in differing soil, temperature, elevation, light and hydrological conditions. This variation is an especially important predictor of biodiversity. Ridges are characterized by a particularly high biodiversity and it follows that their protection will contribute significantly to the conservation of biodiversity in Gauteng. An example in relation to plant species of concern is as follows: according to the Gauteng Ridges Policy, the ridges of Gauteng are vital habitat for many threatened plant species. Sixty-five percent of Gauteng's threatened plant species and 71% of Gauteng's endemic plant species have been recorded growing on ridges. Just over 40% of these species are confined solely to this habitat type.

9.4.2 3.5.2 Wetlands and riparian areas

Perennial and non-perennial rivers and streams represent a number of ecological processes including groundwater dynamics, hydrological processes, nutrient cycling and wildlife dispersal. They are also an important and variable habitat for a variety of organisms. They provide a connecting network through the landscape that provides a unique feature for linking dispersed patches of natural habitat, especially in landscapes that have undergone high levels of transformation. Wetlands, rivers and streams are also protected under the National Water Act.

There are a number of rivers, streams, drainage lines and wetlands in the study area. Major rivers and drainage lines in the study area are shown in Figure 5. The main systems are the Pienaars River, Boekenhoutspruit, Elands River and Wilge River.

9.4.3 Areas of biodiversity importance

The sensitivity assessment is a site specific assessment that identifies those parts of the study area that have high conservation value, may contain species of elevated conservation value or that may be sensitive to disturbance. Areas containing untransformed natural vegetation, high diversity or habitat complexity, Red List organisms or systems vital to sustaining ecological functions are considered sensitive. In contrast, any transformed area that has no importance for the functioning of ecosystems is considered to have low sensitivity. The information provided in the preceding sections was used to compile a map of remaining natural habitats and areas important for maintaining ecological processes in the study area. Broad scale mapping was used to provide information on the location of sensitive features. There are a number of features that need to be taken into account in order to evaluate sensitivity in the study area. These include the following:

- vegetation of conservation importance: this is based primarily on the Draft Ecosystem List and the assessment of the conservation value of vegetation types in the scientific literature (Driver et al. 2005; Mucina *et al*., 2006);
- potential occurrence of populations of Red List flora that occur within remaining natural habitats within the study area;
- areas classified as mountains, ridges or steep slopes represent important ecological processes and/or ecological corridors and contain unique biodiversity, including the potential presence of a high proportion of plant species of conservation concern.
- perennial and non-perennial rivers, streams and watercourses this represents a number of ecological processes including groundwater dynamics, hydrological processes, nutrient cycling and wildlife dispersal;

In many cases, buffer zones are required around sensitive features in order to protect them from deleterious impacts of development. These buffer zones are as follows:

- In terms of GDACE requirements, a 30m buffer zone beyond the wetland boundaries must be reserved inside the urban edge;
- In terms of the GDACE Ridges Policy, A 200m buffer zone of low impact development is required around class 1 ridges.
- In terms of the GDACE Plant Red List Policy, all populations of Near Threatened and Threatened plant taxa must be protected with a buffer zone in accordance with guidelines as set out below.
- In urban areas, a minimum buffer zone of 200 (two hundred) meters is required from the edge of a Red List Plant Species population.
- In rural areas, a larger buffer zone width is required to protect populations of Red List Plant Species from detrimental edge effects that are active over distances greater than 200 meters, in accordance with their priority grouping, as follows –
- in respect of an A1 priority grouping, a buffer zone of at least 600 (six hundred) meters from the edge of the Red List Plant Species population must be allowed;
- in respect of an A2 priority grouping, a buffer zone of at least 500 (five hundred) meters from the edge of the Red List Plant Species population must be allowed;
- in respect of an A3 priority grouping, a buffer zone of at least 400 (four hundred) meters from the edge of the Red List Plant Species population must be allowed; and
- in respect of a B priority grouping, a buffer zone of at least 300 (three hundred) meters from the edge of the Red List Plant Species population must be allowed.

9.5 Priority areas

An assessment of threatened plant species that could occur in the study area indicates that a number of these occur in the study area. The distribution of these species in the landscape provides additional support for classifying certain parts of the landscape into higher conservation categories. Ridges are a key habitat for a high proportion of these species in the study area.

Approximately two-thirds of the study area appears to still be in natural condition, although significant parts may be degraded due to commercial livestock farming, cultivation, mining, urbanization and alien plant invasions. Natural vegetation in the southern half of the study area has been more severely impacted upon by transformation and degradation than the northern half of the study area.

Taking all these factors into consideration, it was possible to identify those parts of the study area that have a high ecological or biodiversity value. A summary of the most important of these is as follows:

- Ridges and mountains: a high proportion of the threatened and near threatened priority plant species in the study area occur within this habitat.
- Vegetation of high conservation importance: this area contains a vegetation type of elevated conservation value. In general, these areas have been transformed to a high degree and remaining natural habitat needs to be conserved in order to retain components of these ecosystems and its biodiversity in the landscape. There are some threatened organisms that occur within this area which also require protection.
- Rivers and drainage lines: the main perennial rivers draining the study area are important hydrological features in the landscape and also provide vital ecological corridors through the landscape.

10 FAUNAL ASSESSMENT

10.1 Nature Reserves and Conservancies

There are several nature reserves and conservancies within the Metsweding District Municipality. These areas are currently protected and should remain so. Table 1 provides a list of conservancies and nature reserves located within Metsweding. Nature reserves and conservancies are valuable protectors of environmental resources including natural habitat and secretive and/ or sensitive fauna species. Many of the nature reserves and conservancies within the area provide habitat for a large number of mammal, bird and herpatofauna species and accommodate the larger fauna species which have become absent from the agricultural, industrial, mining and urban areas.

See Map 17

TABLE 29: CONSERVANCIES AND NATURE RESERVES LOCATED WITHIN THE METSWEDING DISTRICT.

Nature Reserve / Conservancy	Details
Kameelsdrift and Roodeplaat Dam Conservancies	These are conservancies within the Roodeplaat Dam area. This conservancy incorporates the ecological, aesthetic and amenity value of portions of the Magaliesberg Mountain and associated ridges and incorporates the Roodeplaat Dam.
Cullinan Conservancy	This conservancy is situated in the Elandshoek area, near De Beers Premier Mines (formerly Cullinan Mine).
De Tweede Spruit, Seringveld; Buffelsdrift; Leeuwkloof Vallei; and Bobejaansberg Conservancies.	These conservancies are all situated in the Kameelfontein/ Waalmanstal area, which has a high concentration of conservancies that should be protected. These conservancies accommodate a large number of aesthetic topographic features such as hills and ridges. However, mining activities are encroaching into the sensitive Kameelfontein/ Waalmanstal area.
Dinokeng Game Reserve **Various other game farms**	The De Wagendrift and Dinokeng Game Reserve area consist of several hills and ridges that form part of the landscape. These areas require protection. The numerous private game farms in the area are managed in terms of conservancy regulations. This area is relatively undisturbed and the aesthetic value of the ridges, gorges and low mountain should be protected.
Other	No conservancies or nature reserves are located within the Sokhulumi and Bronkhorstspruit Dam area.

10.2 Natural Vegetation Areas

The Metsweding District Municipality is divided into two biomes that is the Grassland Biome covering the majority of the Kungwini Local municipality and the Savanna biome which covers the bulk of the Nokeng tsa Taemane Local Municipality. Apart from the conservancies and nature reserves within the municipal area, most of the remaining natural vegetation has been transformed and fragmented due to agricultural and development pressures. Areas which were previously ploughed for agriculture have recovered to some extent but will never recover to their original state of flora diversity and many areas appear to have invader species. However, these areas are valuable as they can still provide habitat for a number of fauna species (providing shelter and food) and function as corridors and buffer zones for sensitive and pristine areas. Please refer to the Vegetation Assessment for further details on vegetation types and natural vegetation areas.

10.3 Mountains/ Rocky Ridges and Hills

The term ridge applies to hills, koppies, mountains, kloofs, gorges and rocky outcrops. The range of different slopes, altitudes, light and hydrological conditions associated with ridges results in a high spatial heterogeneity and therefore a high floral and faunal biodiversity as well as acting as wildlife corridors (GDACE, 2009).

Ridges are found within the municipal area as are various rocky outcrops. Ridges and hills in the northern regions of the area remain relatively untransformed (Loskop area) while other areas in the southern and central regions are transformed by mining practices and urban development's due to the pleasing aesthetic nature of ridges. Ridges and rocky outcrops have high plant diversity and high spatial diversity. They provide suitable habitat for various faunal species including mammals, reptiles, birds and invertebrates, some of which may be classified as Red Data Species. Ridges and rocky outcrops provide microclimates for a large number of invertebrate species as well as roosting, foraging and breeding sites for birds, reptiles and specialized animals such as bats and shrews. Therefore these areas should be maintained in a good condition where ever possible. Where ridges and rocky outcrops have been transformed, they are considered of low value to faunal biodiversity. However, in these areas, wildlife corridors may occur.

10.4 Faunal Species of Conservation Importance in Metsweding District

The International Union for the Conservation of Nature (IUCN, 2008) has developed a list of Red Data Species. Three threatened categories, namely Critically Endangered, Endangered and Vulnerable are considered for species of conservation importance. Vulnerable species are facing a high risk of extinction in the wild, Endangered species, a very high risk and Critically Endangered species an extremely high risk.

Species that have been evaluated according to the IUCN criteria that do not fall into one of the threatened categories can be classified as Least Concern, Near Threatened or Data Deficient. Species classified as Least Concern have been evaluated and do not qualify for the three threatened categories or Near Threatened category. Species that are widespread and abundant are normally included in this category. Species classified as Near Threatened do not meet the criteria for the threatened categories, but are close to classifying as threatened or will likely be classified as threatened in the near future. A species is classified as Data Deficient when there is a lack of appropriate data on the distribution and/ or population status of the species. There is a possibility that the species listed as Data Deficient may be classified into one of the threatened categories in the future (Minter *et al*., 2004) and therefore they are considered to be of conservation concern.

10.4.1 Birds

Birds play an important role within the ecosystem functioning to help regulate smaller animal and insects which they prey on, disperse seeds and pollinate flowering plants. They are also prey for a number of larger species and other faunal groups, such as reptiles.

TABLE 30: LIST OF BIRD SPECIES OF CONSERVATION CONCERN WITHIN THE METSWEDING DISTRICT MUNICIPALITY TOGETHER WITH THEIR IUCN STATUS (IUCN, 2008; SOUTH AFRICAN BIRD ATLAS PROJECT)

Scientific Name	Common Name	Red Data National Status
Gyps coprotheres	Cape Vulture	VU
Anthropoides paradiseus	Blue Crane	VU
Falco naumanni	Lesser Kestrel	VU
Tyto capensis	Grass Owl	(LC) VU
Circus maurus	Black Harrier	VU
Circus ranivorus	African Marsh Harrier	(LC) VU
Gorsachius leuconotus	White Backed Night Heron	(LC) VU
Eupodotis senegalensis	White bellied Korhaan	VU
Polemaetus bellicosus	Martial Eagle	VU
Podica senegalensis	African Finfoot	LC (VU)
Crex crex	Corncrake	VU
Eupodotis cafra White bellied	White Bellied Korhaan	VU
Aquila rapax	Tawny Eagle	VU

10.4.2 Mammals

Mammals are the dominant life form on earth and exploit a large number of ecological niches. The majority of mammal species are nocturnal and secretive. Despite this, the fauna assessment took into account the possibility of mammal species occurring within the municipal area based on available habitat types.

TABLE 31: LIST OF MAMMAL SPECIES WHICH MAY OCCUR WITHIN THE METSWEDING DISTRICT WHICH ARE CONSIDERED AS SPECIES OF CONSERVATION CONCERN

Species Name	Common Name	Red Data National Status
Acinonyx jubatus	Cheetah	Vulnerable
Atelerix frontalis	South African Hedgehog	Near Threatened
Crocidura cyanea	Reddish-grey Musk Shrew	Data deficient
Crocidura fuscomurina	Tiny Musk Shrew	Data deficient
Crocidura mariquensis	Swamp Musk Shrew	Data deficient
Crocidura silacea	Lesser Grey-brown Musk Shrew	Data deficient
Graphiurus platyops	Rock Dormouse	Data deficient
Lemniscomys rosalia	Single-striped Mouse	Data deficient
Lutra maculicollis	Spotted-necked Otter	Near Threatened
Miniopterus schreibersii Schreibers'	Long-fingered Bat	Near Threatened
Myosorex varius	Forest Shrew	Data deficient
Panthera leo	Lion	Vulnerable
Panthera pardus	Leopard	Near Threatened
Pipistrellus rusticus	Rusty Bat	Near Threatened
Poecilogale albinucha	African Weasel	Data deficient
Rhinolophus clivosus	Geoffroy's Horseshoe Bat	Near Threatened
Suncus infinitesimus	Least Dwarf Shrew	Data deficient
Suncus lixus	Greater Dwarf Shrew	Data deficient
Suncus varilla	Lesser Dwarf Shrew	Data deficient
Tatera leucogaster	Bushveld Gerbil	Data deficient

10.4.3 Reptiles

Reptiles are cold-blooded vertebrates which include snakes, lizards, turtles, tortoises, crocodiles and alligators. Reptiles serve as both predator and prey within an ecosystem depending on their size and exist within various habitats. If reptiles were to be removed from a system, the whole ecosystem may collapse. South Africa has a high diversity of reptile species, with more endemic reptile species than mammal species. Reptiles are generally shy and extremely sensitive to habitat destruction and transformation (Branch, 1998).

10.4.4 Amphibians

Amphibians are a unique group of invertebrates which are threatened worldwide with a reported global decline in 43% of amphibian populations in 2004 (Stuart *et al*., 2004). The decline is attributed mainly to habitat destruction, habitat fragmentation, climate change and chemical contaminants.

Amphibians are sensitive indicators of environmental health due to the complex life stages of amphibians (aquatic larval stages to terrestrial adult stages and variations of the two). Most amphibians are associated with fresh water habitats with active conservation efforts directed to the protection of such habitats. However, it is also important to consider the conservation of terrestrial habitats used by amphibians as they are widely dispersed on land (Carruthers, 2001).

Depending on environmental parameters such as rainfall, temperature and humidity, seasonal fluctuations in amphibian populations will occur. Precipitation influences their activity with many species remaining underground or in above-ground refuges until the wet season to avoid desiccation during the drier months. Therefore, high quality aquatic habitats must persist, as well as associated terrestrial habitats protected. Degradation of either ecosystem would cause a disruption in their lifecycle.

10.5 Current State of Fauna Species in Relation to Available Habitats

Habitat loss and transformation are the main threats to fauna assemblages within an area, as are the influences of physical and chemical impacts of urbanisation, mining, industry and agriculture on the environment.

Within the Metsweding District Municipality, agricultural practices, urbanisation, mining and industries has resulted in the transformation and fragmentation on the natural vegetation, aquatic resources and fauna within the area. The mining and industrial areas located within the Metsweding District Municipality offer no support to biodiversity. These areas are void of natural vegetation which has been destroyed through various construction and operation processes. Fauna species found within the industrial and mining areas are either artificially maintained or wandering through the areas and are thus associated with the boundaries of these areas and not the areas themselves. These areas are not suitable for fauna conservation.

Urban and agricultural areas offer more support to biodiversity than mining and industrial areas in that these areas often have some form of vegetation and can provide shelter and food to hardy, opportunistic and common fauna species (common house mouse, rats, seed eating birds, invader species and hares) present within the area. However, these fauna species often congregate in large numbers in these areas and are considered pests. Fumigation, hunting and poisoning have become common practices in these areas and this not only affects the unwanted species but also those that are more secretive and sensitive. Indiscriminate killing of fauna species also occurs in these areas especially with animals that are considered dangerous such as snakes. Urban and agricultural areas are therefore not suitable for fauna conservation of sensitive or secretive fauna species but they can be used as corridors or connectivity channels to sensitive areas of natural vegetation. In addition, the continuing pressure to urbanise areas of sensitivity such as aquatic resources and grassland habitats is resulting in the decline of fauna species, especially mammals, birds and amphibians. Strict management guidelines must be implemented to control the development of sensitive ecological areas.

Rocky areas and termite mounds within agricultural areas have been removed which have impacted on the available habitat for reptile and amphibian species as well as some mammal species that require microclimates or caves to dwell in. Also, many species require termite mounds to provide a food source. Alterations to reptile and amphibian assemblages were expected due to the habitat disturbances caused by human settlements and populations. In addition, the practice of burning crop areas also impacts the survival rate of fauna species which may be burnt with the crop because they cannot out run the fires. This further verifies that agricultural areas are not appropriate for fauna species conservation.

The current state of aquatic resources is of concern. With most water bodies being of poor quality the impacts on fauna assemblages, especially amphibians, is high. The use of pesticides and chemicals, as well as the physical impacts of industries and mining practices have influenced the water quality, sedimentation, water flows and riparian and wetland habitats of rivers, drainage lines, dams and other water bodies. These impacts are making the water bodies unsuitable to biodiversity conservation and survival of fauna assemblages and must be managed more effectively in future.

Within the municipal area, a number of nature reserves and conservancies exist as well as isolated areas of natural vegetation and ridges. Currently, these areas are maintaining a high level of biodiversity with regard to mammal, bird, reptile and amphibian species expected within the municipal district. These areas need to employ strict management measures and guidelines to ensure that they are run with conservation practices in mind and should be linked via corridors to one another. The presence and/ or nature of game fences, especially electric fences, within these areas should be considered as these can contribute to the death of fauna species which are migratory.

10.6 Summary

From the fauna assessment, it was determined that fauna assemblages are not present within the industrial and mining areas unless maintained there artificially or in the event that fauna species wander through the area. In the latter case, these fauna species are associated with the boundaries of these areas and not the actual industrial or mining area. Common, small, hardy and opportunistic fauna species are present with the urban areas and settlements, as well as the agricultural areas. These species are more prevalent in the agricultural regions and are often considered pests. In the agricultural regions, the smaller predatory animals such as jackals may be present as they can survive by preying on the common, hardy and opportunistic fauna species such as rats and hares. The urban areas and agricultural areas can be utilized by fauna species as corridors to areas better suited to them. Sensitive and secretive fauna species, as well as the larger fauna species would not be found in these areas.

The nature reserves and conservancies, as well as their well maintained water resources are excellent areas for fauna conservation. A large number of secretive, sensitive and large fauna species are protected successfully in these areas. These areas should therefore be maintained and managed with the primary objective of conservation in mind. The undisturbed mountains and ridges are also successfully protecting specialist species such as bats, invertebrates, snakes and shrews and conservation efforts should be used to include these areas into conservancies or nature reserves.

11 SUMMARY OF KEY ISSUES

11.1 Socio Economic Summary if the Study Area

The Metsweding District Municipality is divided in two local municipalities namely, the Kungwini Local Municipality (KLM) and the Nokeng Tsa Taemane Local Municipality (NTTLM), both of which are situated in the Gauteng Province. The District Municipality borders the Tshwane Metropolitan Municipality to the west, the Ekurhuleni Metropolitan Municipality to the south and Mpumalanga Province to the north and north east.

The MDM is classified as a category C municipal area with an extent of 4062.86923 km², 26 % of the total area of Gauteng Province. It is stated in the MDM SDF that the socio-economic conditions is relatively poor in comparison to the other municipalities in Gauteng. MDM has an uneven population distribution with the majority of citizens living in the KLM. The major formal towns in MDM are Refilwe/ Cullinan Town, Rayton Town, Zithobeni Town, Ekangala and Bronkhorstspruit Towns. There are a total of 15 informal settlements in MDM.

The major socio economic sectors in MDM are manufacturing, government services and the finance sectors. The agricultural is dominant in the rural areas with crop, meat and game farming and is focused around existing watercourses. Mining activities are dominant in the Nokeng Tsa Taemane Local Municipality and plays a major role in the growth and development of the municipal area. The quartzite sandstone of the Waterberg group provides growth in sand, clay and diamond mining respectfully.

The MDM SDF (2006) indicated a significant backlog in water and sewage services in the Municipality (Figure 3). All water services including provision of potable water and sanitation services are managed by the individual municipalities and associated Water Service Providers in the area. The major problems for the increased backlog in services are due to poor pipeline infrastructure and rapid increase in household developments in the MDM.

The NTTLM is divided into four urban services area namely the Roodeplaat area; the Cullinan/Refilwe/Rayton area, the Moretele Gardens Area and the Village of Onverwacht. There is a number of private Water Service Providers (WSP) in the MDM which supplies potable. The WSP owns water purification plants and associated infrastructure for the supply of water to its clients. In addition, areas such as the Village of Onverwacht make use of boreholes for potable water supply.

Sanitation service provides are divided between the local municipal entities and privately owned services providers. Sanitation infrastructure ranges from pit latrines to flushing toilets. There are increased development pressure for the provision of sanitation services in the MDM. The MDM SDF (2006) mapped the areas of concern with regards to the backlog in water services and infrastructure (Figure 3 indicated in blue).

11.2 Biotic and Ecological Summary of the Study Area

The MDM is situated in the predominantly situated in the Savanna Biome of South Africa with little intrusion into the Grassland Biome according to Mucina & Rutherford (2006). The area is mostly affecting seven individual veld types namely:

- Springbokvlakte Thornveld
- Loskop Mountain Bushveld
- Central Sandy Area
- Marika Thornveld
- Norite Koppies Bushveld

- Goldreef Mountain Bushveld
- Rand Highveld Grassland

TABLE 32 SUMMARISED BIOTIC AND ECOLOGICAL INFORMATION FOR MDM EMF (SANBI BIGS 2011)

Municipality	Biome	Water Management	Ecosystem status
Kungwini	Savanna: Mesic Highveld Grassland	Crocodile (West) Water Management Area and the Olifants Water Management Area	Rand Highveld Grassland Endangered
Nokeng Tsa Taemane	Savanna: Central Sandy Bushveld	Crocodile (West) Water Management Area and the Olifants Water Management Area	Vulnerable ecosystems and Poorly protected

TABLE 33: SUMMARY OF KEY ISSUES WITHIN METSWEDING MUNICIPALITY

The following table provides a summary of the key issues identified in the Status Quo assessment. These issues are categorised according to the various features.

	KEY ISSUES	OPPORTUNITIES	OTHER
HERITAGE	Study area is very large and a detailed heritage survey takes years to complete. Capture of detailed oral history requires several years. Stone Age sites are threatened with development and are vulnerable to damage by tourists who take souvenirs. Iron Age sites with stone walls are threatened by damage as a result of people removing the stones for use in building and landscaping e.g. Iron Age site at Elandshoek 337JR. Penetration of game hunting poses a threat to the black population in the area which supplied labour to the farms. This will have a negative effect on the socio-economy of the area. Cullinan is a good representation of English and mining architecture and therefore needs to be conserved urgently. The flourishing tourism industry needs proper management that is in harmony with the	Comprehensive study is needed to identify important Stone Age and Iron Age sites which need to be conserved. Stone Age sites can be developed as site museums thus contributing to knowledge of the area and its people and as a tourist attraction. Landowners and surrounding communities need to be educated on the importance of preserving archaeological sites. History of the "Oorlamse" people found during the Anglo-Boer war needs to be documented as the area risks being taken over by squatters. Knowledge of traditional medicinal plants and animals and legends and beliefs on animals and plants needs to be recorded. Art of beadwork by the Ndebele people needs to be preserved and	Middle Stone Age implements occur in the area. Few rock art sites and numerous Late Stone Age material are present in the study area. Early Tswana sites which were formed during the Iron Age can be found in the study area particularly on Farm Vlakfontein 523JR west of the Bronkhorstspruit dam. Plenty of Ndebele sites formed during the Iron Age are present on the southern part of Metsweding. The most important site is Komjekejeke found on the Farm Downbern 494JR this is where 5 of their chiefs are buried. Africa has the longest cultural history and is the cradle of mankind. Priority tourism nodes in Metsweding include Dinokeng, Cullinan, Roodeplaat Dam, Willem Prinsloo Agricultural Museum, Rust de Winter Dam and Bronkhorstspruit Dam.

	KEY ISSUES	OPPORTUNITIES	OTHER
	cultural legacy. Non-tangible heritage resources need to be recorded from knowledgeable people before the information is lost forever.	utilized as an income resource. Cullinan mine can be exploited as tourist attraction since it is the world's leading diamond mine and is a protected site. A strategy for the re-utilization of existing buildings with a rich historical background needs to be formulated thus preserving the cultural experience. E.g. farm houses could be turned into places for overnight accommodation for tourists. An African integrated approach where nature is culture needs to be followed in the marketing and tourism strategy of Metsweding. Cullinan needs a management plan prepared by a specialist and all heritage sites must be preserved. Cullinan is unique as it keeps developing.	
MINING	Mining is a major economic activity in the area. Only 43 % of the mines identified during the survey are active and only 38% are	Proper rehabilitation of mined areas has a potential of increasing diversity in the area and habitat creation e.g. seasonal pans created during the wet season are a	The only large and economically significant current mining operations in the Metsweding area are Vergenoeg fluorspar mine and Cullinan diamond mine. Numerous small and commercial mining

KEY ISSUES	OPPORTUNITIES	OTHER
rehabilitated. Extensive sand mining in Metsweding threatens Boekenhoutspruit catchment which flows through the core area of the Dinokeng Game Reserve. In addition, most sand mines are poorly rehabilitated. Sub-division of previously mined areas for residential development is taking place in the area. This is risky because the areas are wetland thus homes could sink or becoming damp. Some un-rehabilitated mines have been converted into 4 by 4 tracks therefore setting of a cycle of other problems. Negative impacts associated with mining in the Metsweding area include: Loss of vegetation cover and habitat. Sand mining is especially destructive to wetlands. Hydrological impacts due to increased sediment load and runoff velocities. Major impacts are changed or altered water courses and damage to water quality Increased sedimentation and erosion as a result of removal of vegetation cover. Pollution including dust, soil, noise, industrial waste, toxic waste and water. Soil	breeding site for waterfowl. Significant mineral resources are still available in the Metsweding area and can be used to the economic benefit of the communities in the area if done correctly.	operations for sand / silica, quarry stone, gravel and clay are present. Extensive sand mining is taking place in the Boekenhoutspruit and Krokodilspruit catchments.

	KEY ISSUES	OPPORTUNITIES	OTHER
	pollution by hydrocarbons (oil & diesel) is widespread on many mining sites. Non-rehabilitated mines e.g. old Edendale mine poses a health risk to the surrounding community due to waste dumps contaminated with lead. Introduction of alien and invader species such as eucalyptus and Acacia (wattle) species. Generally, small informal and illegal mines pose the greatest threat to the area.		
SOILS & AGRICULTURE POTENTIAL	Kungwini has higher potential soils e.g. loam than Nokeng Tsa Taemane municipality. High soil potential areas should be conserved as they are threatened by transformation due to developments such as housing.	High potential soils especially dominant in the south east towards Bronkhorstpruit should be protected and excluded from development plans. Agricultural activities should be developed in these areas which have been earmarked for development.	A variety of land types occur in the study area. The dominant soils are shallow and rocky with fewer scattered areas with deep soils. Agricultural produce from commercial farms in Metsweding mainly are maize, beef, groundnuts, cotton, sunflower and sorghum. Cultivated areas are concentrated to the south and south east of Metsweding. Few isolated areas occurring in the north east are classified as degraded / eroded. Dry land cultivation (rain-fed agriculture) is prevalent with few farms practicing irrigation.

	KEY ISSUES	OPPORTUNITIES	OTHER
FAUNA	Nature reserves and conservancies found in Metsweding district are important channels of protecting habitats and sensitive fauna species. These need to be properly managed and protected for the well being of biodiversity. Development of residential estates, mining, industrial activities and agricultural activities threaten the fauna in the area due to the loss of natural vegetation which forms habitats. These need to be monitored especially for the preservation of riparian habitats and wetlands which maintain fauna assemblages. Rocky ridges and hills in the study area are crucial for maintaining the fauna biodiversity (some are Red Data Species) and are used as wildlife corridors. Use of pesticides for the control of rodents and birds which invade farms is widespread.	Cultivation areas and quarries that have been abandoned can be rehabilitated in order to provide habitat for fauna.	A number of birds and mammals of conservation value are found in Metsweding. Mining areas can only be suitable for fauna conservation if well rehabilitated.
DEVELOPMENT PLANNING	Development has intensified towards the west of the district in the sections bordering the City of Tshwane and it includes both low-income and high-income developments. 6 new regional roads are planned for the area and this will increase the connectivity and accessibility of the southern part of the	Metsweding is largely a rural municipality with moderate to high agricultural and conservation potential which can be properly utilized for the benefit of the entire area. Extra efforts should be made to manage and protect Metsweding's	Metsweding is a transition zone located between the City of Tshwane urban area and the Mpumalanga rural areas. The study area is largely peri-urban and rural in nature, interspersed with a number of towns, villages and suburban / peri-urban settlements.

KEY ISSUES	OPPORTUNITIES	OTHER
district in particular. Existing railway line needs to be upgraded in order to provide transport services for commuters. There is a new railway line (Moloto Rail Corridor) proposed between Moloto on the Gauteng-Mpumalanga provincial boundary and Tshwane. This will ease congestion on the Moloto road and eradicate unsafe travelling conditions by Public Service Vehicles. The spread of informal settlements far from each other and major towns poses the challenge of providing and maintaining services at high cost and creating further pressure on the need for social infrastructure and housing. The scattered location of settlements across Metsweding has a negative impact on the efficient and sustainable spatial development of the municipality, as settlements are not focused around strategic locations that can be incorporated into a network and hierarchy of places and infrastructure. The largest settlement trend in the District is the development of private residential (security) estates predominantly in the western area adjacent to City of Tshwane	natural environment from inappropriate development.	Bronkhorstspruit is the major town in the district, while Cullinan and Rayton are the other formal (smaller) towns. These form the main commercial and administrative centres of the District. Ekandustria which lies north of Bronkhorstspruit is a major industrial area. The district and settlements within are well served and connected by internal road infrastructure, with the main towns located adjacent to major roads. 3.35% of the land area is used for settlements (including agricultural holdings); 1.08% for industrial and mining activities; 16.4% for cultivation; and 95.57% for rural uses and activities such as nature areas, conservation areas. The District has a large number of informal settlements of various sizes scattered across the municipal area. Agricultural holdings are largely concentrated along the western boundary of the District adjacent to the City of Tshwane. Highest population densities are found in previously disadvantaged township E.g. Refilwe Roodeplaat dam nature reserve and

KEY ISSUES	OPPORTUNITIES	OTHER
which gives an unbalanced impression. Larger land subdivisions are allowed in the northern areas while smaller land subdivisions are allowed in the southern areas especially around the existing urban development areas. The proximity of Metsweding to Tshwane and Ekurhuleni metropolitan municipalities attracts migrants in search of employment opportunities in Gauteng. Illegal industrial and commercial land uses on agricultural holdings and farm portions are also widespread throughout the District. The two local municipalities do not have sufficient resources to manage illegal land uses which include residential, industrial and commercial developments. The lack of infrastructure particularly sewage networks restricts significant growth within the municipality and poses a serious threat for the future. The entire north shore of Bronkhorstspruit dam has been developed along with other important heritage sites. Rural land management in the municipality is virtually non-existent in deed.		Dinokeng game reserve are some of the well known conservation areas in the District. A new power station is to be built in the Bronkhorstspruit area.

	KEY ISSUES	OPPORTUNITIES	OTHER
SOCIO-ECONOMIC	Metsweding has been recognized as the district with the least contribution to Gauteng's GDP and with the greatest infrastructural deficits. The population of the District seems to be decreasing mainly due to the HIV/AIDS scourge and rural to urban migration. A healthy, growing and skilled population is required for positive economic growth of the area. The population of Metsweding is composed of a working age group which creates pressure for the provision of more employment opportunities. A large number of dwellings in the District are informal. The levels of education in Metsweding are very low particularly in Nokeng Tsa Taemane local municipality. Social, economic, resource-related, educational, employment and infrastructural redress must take place as the black population (77% of the total population) still has inferior access and provisions for all of these areas. Poor access to refuse removal is a factor which may cause an increase in pollution	Social grants must remain available and/or increase in their value and availability as they are much needed and well utilised in the district. Improvement of facilities such as schools, recreation centres, health care facilities may play a major role in boosting the confidence of the community in governing authorities.	Kungwini local municipality covers an area of 2206 km2 with 14 wards while Nokeng Tsa Taemane local municipality covers an area of 1856 km2 with 6 wards. Metsweding is the smallest municipality in Gauteng in relation to population size, even though it occupies the 2nd greatest total area. Kungwini is largely urbanized while Nokeng Tsa Taemane is more rural with a growing trend of urbanization in the form of conversion of farms to townships. Metsweding has more male individuals than female which may be as a result of male oriented employment opportunities such as mining. A large portion of the population is dominated by working age people (age 15 to 64) majority of whom are male. Black African people comprise a majority of the population (77%), followed by Whites (20%) and very few Coloureds (1%) and Indians (1%). The District has experienced a steady increase in the number of households.

KEY ISSUES	OPPORTUNITIES	OTHER
and disease. Schools need upgrading in both LMs and more tertiary educational options need to be made available so that the skill levels in the whole district may rise. Metsweding has poor air quality due to veld fires, mining, industry, agriculture, landfills and domestic pollution. Metsweding desperately requires a dedicated and fully equipped public hospital as people currently have to travel great distances for specialized and affordable care. Roads in the rural and outlying areas of the district need to be upgraded and maintained well so as to increase and improve accessibility in the District. Crime is a major problem in the District and is hampering development. As long as poverty and low education levels persist, crime will remain a challenge. Funding in the District is low though there are numerous development demands that need to be addressed.		

	KEY ISSUES	OPPORTUNITIES	OTHER
FLORA	Metsweding has three plant species that are threatened and one that is near threatened and endemic to Gauteng province. 38% of natural vegetation in the area has been transformed mainly by cultivation, commercial livestock farming, mining, urbanization and alien plant invasions. The transformation occurs mainly in the southern half of the municipality. Generally, vegetation in the Northern section of the District is intact while the southern section has degraded vegetation with many species being endangered. High habitat loss is being experienced due to cultivation and urbanization with alien vegetation affecting water courses. E.g. Bronberg area is under extreme pressure by mining and construction although it has valuable biodiversity.	Areas that have been identified as containing vegetation types of high conservation value need to be protected. Ridges have high biodiversity and therefore more effort is needed to protect them. Furthermore, ridges are a vital habitat for many (65%) threatened plant species in Gauteng.	Vegetation in Metsweding falls under the grassland and savanna biomes. It is mainly composed of Rand Highveld grassland found in the southern to south-eastern part and Central sandy bushveld found in the northern part. According to the National Environmental Management Biodiversity Act No. 10 of 2004, four vegetation types in the area as classified as vulnerable on the basis of irreversible loss of natural habitat. These are Rand Highveld grassland, Marikana thornveld, Andesite mountain bushveld, and Eastern Highveld grassland. Gold Reef mountain bushveld, Rand Highveld grassland, Central sandy bushveld and Loskop mountain bushveld are fundamental vegetation types for sustaining priority populations of threatened plant species.

	KEY ISSUES	OPPORTUNITIES	OTHER
WATER RESOURCES	Wetlands in Metsweding have been disturbed by the spread of residential developments. The provision of ecosystem goods and services provided by wetlands is under threat from activities like mining, informal and formal settlement developments and invasion by alien vegetation. Some of these services include sediment trapping, toxicant removal and water supply. Other threats to surface water bodies in Metsweding include poor solid waste management; erosion of river banks, and overgrazing in riparian zones. Water supply and demand measures and control of infrastructure development from a groundwater perspective needs to be implemented.	Urgent measures need to be taken to protect aquifers in Metsweding from pollution from sources such as metal leaching from mines, and sewage from developments. Water resource systems function at optimal when representative biota are presented across the respective riparian zones.	The District is located between to major Water Management Areas (WMA) namely the Crocodile (West) and the Olifants WMA. Metsweding is an important water catchment area for the Elands and Pienaars River and there are a number of streams and wetlands. Other important systems are Bronkhorstspruit and Wilge rivers. Other natural features are the Bronkhorstspruit dam and the Roodeplaat dam. The wetlands of Metsweding are made up of riverine corridors, associated floodplains and riparian zones as well as isolated depressions. The most significant natural wetland types found in the study area in terms of surface area are the Floodplain and Valley Bottom systems. They provide the most water in terms of ecosystem services as well as habitat for cosmopolitan biota (birds, frogs, reeds). The geological characteristics of Metsweding in accordance with the Dinokeng Hydrogeological Desktop Study, forms part of the Selonsriver formation, the Ecca formation, the Wilgeriver formation , the Rayton formation and the Dwyka formation.

TABLE 34: MATRIX OF POTENTIAL CONFLICTS IN METSWEDING DISTRICT MUNICIPALITY

It is important to understand the nature of potential conflicts that arise out of the Status Quo assessment. These conflict areas will direct the formulation of the Desired State, and the Strategic Environmental Management Plan in terms of management zones and associated management guidelines.

	FAUNA	FLORA	HERITAGE	MINING	DEVELOPMENT PLANNING	SOCIO-ECONOMIC	SOILS & AGRICULTURE
FAUNA				Environmental Degradation near mining areas will discourage and limit any fauna	Land transformation destroys habitat suitable for fauna		The use of pesticides and chemicals on agricultural lands severely affects fauna
FLORA				Un-rehabilitated areas encourage the invasion of land by alien species thus reducing the quality of natural vegetation in the area. E.g. wattle trees are a nuisance.			Cultivation in Metsweding is a major threat to loss of floral biodiversity.
HERITAGE				Discovery of a kimberlite pipe in Cullinan poses a threat to the numerous cultural historic			

	FAUNA	FLORA	HERITAGE	MINING	DEVELOPMENT PLANNING	SOCIO-ECONOMIC	SOILS & AGRICULTURE
				resources.			
MINING	Mining operations result in stripping the land surface of vegetation leaving it bare or invaded by alien species. The invader vegetation species is not utilized by fauna.						Mining poses a threat to the soils of the area due to exposure which leads soil erosion and destruction of land that is suitable for agriculture.
DEVELOPMENT PLANNING	Urbanization of sensitive habitats such as wetlands and grasslands is causing a decline in fauna species such as mammals, birds and amphibians.	A vast area of natural vegetation has been transformed by housing developments and agricultural activities.				Continuing low standards of living among a majority of the population may hamper efforts to protect and conserve many of the natural resources. This is because the greater need at the moment is to survive.	Urban and agricultural areas are not suitable for fauna conservation of sensitive or secretive species. The sprawl of developments is reducing the area of land that is viable for agriculture.

	FAUNA	FLORA	HERITAGE	MINING	DEVELOPMENT PLANNING	SOCIO-ECONOMIC	SOILS & AGRICULTURE
SOCIO-ECONOMIC	Some recreational activities such as quad biking act as a vector for introduction of alien vegetation due to frequent disturbance.		Poor and widespread socio-economic conditions of the population majority is prompting the vandalism and theft of many cultural-heritage resources.			The rapid growth of settlements in Metsweding has a negative impact on lad due to problems associated with solid waster management since the local municipalities do not have enough resources to provide the service.	
SOILS & AGRICULTURE	The use of chemicals e.g. pesticides could negatively impact water and soil thereby also affecting fauna which are part of the food chain. Eradication of landscape features such as rocky outcrops and termite						

	FAUNA	FLORA	HERITAGE	MINING	DEVELOPMENT PLANNING	SOCIO-ECONOMIC	SOILS & AGRICULTURE
	mounds for cultivation, practices such as burning of land deprives some reptilian, amphibian and mammal species of their habitats.						
WATER RESOURCES	Urbanization on wetlands is having a major negative impact on water quality due to the eradication of ecological functions e.g. water filtration by reeds found in wetlands.			Mining is also a major contributor to decline in water quality since it accelerates processes such as soil erosion and causes contamination from leaching of metals. Additionally activities such as servicing of machinery on the mines, discharge of effluent and diversion of	The sprawl of developments in the district without the provision of sewerage networks is contributing to the decline in ground water quality due to contamination.		The use of chemicals such as pesticides is causing a decline in water quality due to contamination of ground water. Overgrazing and transformation of riparian habitats to farms has a major negative impact on water courses.

	FAUNA	FLORA	HERITAGE	MINING	DEVELOPMENT PLANNING	SOCIO-ECONOMIC	SOILS & AGRICULTURE
				rivers negatively affects water quality.			

12 CONCLUSION

This Status Quo report outlines the current situation in the MDM and is the first component in the EMF compilation process. It has been developed based on a review of literature as well as field work by various specialists. The specialists cover a wide range of areas of expertise including socio-economic, development planning, cultural heritage, agriculture and soils etc. All the specialist reports are attached as Appendix B. The Status Quo report highlights a number of key issues at outlined in Table 33: Summary of key issues within Metsweding Municipality. These key issues will direct the formulation of the Desired State, and the Strategic Environmental Management Plan in terms of management zones and associated management guidelines.

The next stage is the development of the Desired State of Environment for the MDM. This Desired State will be refined in the following phase of the project will incorporate the following:

- Environmentally sensitive areas (particularly rivers, water bodies and ridges)
- Mixed land use areas (particularly along R513 near Roodeplaat, urban areas)
- Recreation and Leisure development areas (areas surrounding the Roodeplaat and Bronkhorstspruit Dams, Cullinan etc)
- Rural development (areas to the south of the Dinokeng Game Reserve, and undeveloped portions of Kungwini)
- Agricultural hubs (in Nokeng and Kungwini)
- Cultural Historical hub (Cullinan and surrounds)
- Major road infrastructure (Moloto Road, R513, N4 etc)
- Built-up areas and informal settlements
- Game Reserves and Conservancies

In the establishment of this Desired State of the Environment, the following will be taken into account:

- Environmental feature management objectives (e.g. objectives for flood dissipation areas along rivers and streams);
- Legal and policy requirements;
- Development needs; and
- General opportunities and constraints.

The Desired State of the Environment assessment will place specific emphasis on the following aspects:

- Sensitive natural environments (specifically ridges, endangered vegetation types, occurrence of Red and Orange Listed species, water courses, remaining high quality vegetation, etc);
- Biodiversity and conservation status of fauna and flora;
- Cultural and heritage issues;
- Any high potential agricultural areas;
- Development needs and desired land uses;
- Infrastructure requirements (roads, services, etc.) and
- Spatial Development Frameworks of the various local authorities.

The Desired State of Environment will form the basis of the Environmental Management Framework. The report will be in a similar format to the Status Quo report. The information contained in these documents will also be

spatially linked in the GIS so that it can be compared in an overlay fashion in order to delineate opportunity and constraint zone areas where specific land uses and developments should take place, as well as developing specific management actions to facilitate this.

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