MALUTI-A-PHOFUNG LOCAL MUNICIPALITY

STRATEGIC ENVIRONMENTAL MANAGEMENT PLAN (SEMP)



PREPARED BY

ROUZYL CONSULTING CC

CHAPTER 1: INTRODUCTION TO STRATEGIC ENVIRONMENTAL MANAGEMENT PLAN

1.1 Introduction

Since the first United Nations (UN) Conference on the Environment, held in Stockholm in 1972, there has been a growing awareness of the impacts of economic development on the environment. This awareness and interest reached a peak in June 1992, with the United Nations Conference on the Environment and Development in Rio (UNCED). At UNCED it was acknowledged that for countries need to find a balance between economic and social demands on the world's ecosystems and the need to conserve the natural resources on which the economic and social systems depend. This balance has been termed sustainable development (CSIR, 2002).

1.2 The Scope of SEMP

The scope of SEMP includes consideration of the environmental aspects of the proposed development and derivation of appropriate environmental performance expectations and outcomes. Environmental mitigation measures would be developed in the context of site characteristics, the nature of the proposed development and relevant regulatory and other requirements. These address the design, construction, operation and decommissioning stages of the proposed development.

Figure 1.1 gives a broad view of the SEMP planning cycles to make sure that sustainable development takes place over the long run and for the descendants. The Strategic Environmental Management Plan (SEMP) can provide the next generation of tools for synthesising economic development activities and environmental protection, which is essential for sustainable development in the future. These tools include environmental management systems, water and pollution prevention, a lot of other related activities (see aspects on pages 14 - 16) activity base cost accounting and life cycle cost assessment, measurement protocols and performance indicators as well as community involvement. The use of these tools by MAP local government in their day to day decision making is the key to achieving increased environmental performance in a "post command and control" area. They are also the key to increase growth while saving costs.

The Strategic Environmental Management Plan integrates environmental management objectives into strategic goals for MAP local municipality to enhance the efficiency and effectiveness of its operations and gain a competitive advantage over other local municipalities. It provides a management framework within which MAP local municipality can identify cost-effective actions that maximise their regulatory flexibility when they strive for zero emissions over time. A Strategic Environmental Management Plan can:

- Improve products and outputs from the area
- Save significant costs
- Improve production and other operational processes
- Reduce liabilities and waste management costs
- Enhance market responsiveness
- Lower insurance premiums
- Improve competitiveness while achieving significant environmental and energy efficiencies.

Figure 1.1: SEMP planning cycles for sustainable development, 2007



The SEMP document is thus a management plan which takes the strategic plan one step farther than the vision and ideology. SEMP documents the specific outcomes that MAP local municipality will strive to achieve over time. These outcomes are organised by area of interest and have timelines for achievement. This SEMP will also identify the measures MAP local municipality will use to track its progress in achieving its objectives and the measures that will be used to evaluate the health and economical viable aspects for the health and economic growth of the area.

1.3 Measuring sustainability

As mentioned before, sustainable development is defined as "development that meets the needs of present generations without compromising the ability of future generations to meet their own needs". UNCED highlighted gaps in man's

understanding of the earth's ecological processes that hinder his / her ability to act in the interests of and take decisions regarding sustainable development.

Access to reliable and up-to-date information is vital for environmental managers, governments and community organisations, to take responsibility for, and action to enhance environmental conditions. Agenda 21, the Global Programme of Action adopted at the conference, called for improved availability of environmental information, specifically:

Strengthening existing mechanisms for information processing and exchange to ensure effective and equitable availability of information generated at the local, provincial, national and international levels; Strengthening national capacities (Governments, NGOs, and the private sector) in information handling and communication; and full participation of developing countries in UN systems of collection, analysis and use of data and information (CSIR, 2002).

The United Nations Commission for Sustainable Development (UNCSD) was established in December 1992 to ensure effective follow-up of UNCED, and to monitor and report on implementation of the UNCED agreements at the local, national, regional and international levels. The UNCSD approved the Programme of Work on Indicators of Sustainable Development in 1995. The main objective of the Work Programme was to make indicators of sustainable development accessible to decision-makers on national levels, by defining them, elucidating their methodologies and providing training and other capacity building activities. As part of the implementation of the Work Programme, a working list of 134 indicators and related methodology sheets were developed and distributed for voluntary testing worldwide.

The South African national Department of Environmental Affairs and Tourism (DEAT) became involved with indicators of sustainability in February 1996, when cooperation with the UNCSD's indicator testing process commenced. The process started early in 1997, and DEAT was involved in testing the 134 indicators of sustainability (55 of these were environmental indicators), and reporting to the UNCSD on the relevance and potential applicability in South Africa (CSIR, 2002). It defines environmental performance objectives and management measures consistent with adopted environmental management principles and relevant regulatory requirements.

In October 1999, DEAT launched the first National State of the Environment (SEMP) report on the Internet for South Africa, together with State of the Environment reports for four South African cities: Cape Town, Durban, Johannesburg and Pretoria (http://www.environment.gov.za). In recent years numerous city and provincial level SEMP reports have been produced, as well as several sector-specific initiatives such as the State of Rivers report, the State of Human Settlements report, the State of Estuaries report, the State of the Coast

report and the development of Criteria and Indicators for Sustainable Forest Management (CSIR, 2002).

The SEMP will provide for a basis for a more comprehensive environmental management planning, to be undertaking at appropriate stages in the site development and regulatory approvals process.

As a living document, it is intended that the SEMP be progressively refined, as information emerges from detailed design processes. It must also be regularly refined as new technology emerges. A range of specialist environmental studies provide key inputs into SEMP in terms of both assessment and in environmental issues.

1.4 National Environmental Indicators Programme

As part of South Africa's ongoing State of the Environment initiative, DEAT initiated a programme to develop a core set of environmental indicators for State of the Environment reporting in South Africa. The programme aims to enhance existing tools for decision making, among which State of the Environment reports. It also aims to eliminate duplication with other national and international reporting obligations, such as reporting on progress regarding implementation of Agenda 21 and various Multilateral Environmental Agreements (e.g. the United Nations Framework Convention on Climate Change, the United Nations Convention on Biological Diversity, and the United Nations Convention to combat desertification in those countries experiencing serious drought and/or desertification, particularly in Africa). Although South Africa is not a signatory to the AARHUS Convention (Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters), the development of environmental indicators for SEMP reporting assists in achieving the aims and objectives of this agreement. In addition to this initiative, there are several other initiatives under way to develop indicators in other sectors in South Africa, including the Department of Provincial and Local Government (DPLG) Key Performance Indicators developed for reporting on Integrated Development Plans (IDPs) and the Department of Water Affairs and Forestry (DWAF) Criteria and Indicators for Sustainable Forest Management (CSIR, 2002).

The purpose of national environmental indicators is to:

- Provide information on the environment in South Africa;
- Promote sharing of information between different organisations;
- Improve access to environmental information;
- Eliminate duplication with other reporting requirements; and
- Promote more informed decision-making.

It is envisaged that the indicators will monitor the following:

- Trends in environmental conditions;
- > Pressures on the environment and causes of environmental change;
- Impacts of environmental change; and
- > The effectiveness of existing and proposed response mechanisms.

It is important to note that the purpose of the National Environmental Indicators Programme is not to provide an absolute measurement to be used religiously in every local authority. Instead it represents a basis from which to start identifying unique and local indicators acknowledging the dynamics of each local community.

1.5 Driving forces of environmental change in Maluti-A-Phofung

In general, environmental change can most often be directly or indirectly attributed to human activities and behaviour and these activities are then seen as the primary driving forces of the environmental change taking place. These driving forces can be local activities or even regional, national and international driving forces relating to the local economy, society and political system.

The major driving forces affecting change throughout the various themes of the Maluti-A-Phofung SEMP report relate to economic, social and political driving forces. It is also important to note that some of these driving forces are not necessarily present today, but due to past pressure, is still responsible for the current environmental status.

Economic driving forces are related to the main economic sectors in Maluti-A-Phofung, namely agriculture (rural areas) and community services, finances, trade, transport and communication (urban areas). The type of agricultural activities and the sustainability thereof will influence the surrounding environment. Over-utilisation of agrochemicals and soil loss due to incorrect crop production will influence not only the land but water and biodiversity in the area as well. Significant to note is the variance in agricultural activities between the eastern and western areas (crop and stock farming, commercial and subsistence farming) of each exerting their own unique pressures on the environment.

The overall poverty levels and distribution of poverty-stricken areas in Maluti-A-Phofung summarises the economic pressures in the area. Poverty leads to economic desperation and in this situation, the conservation of the environment is of lower importance than survival. The resulting degradation of the environment, in turn, leads to increased impoverishment and so on.

Social driving forces are exerted by population growth and distribution and the mobility of groups. Population growth results in a constant increase in human

activity and subsequently environmental pressures. Within Maluti-A-Phofung 94.7% of the population is urbanised and where these urban dwellers are impoverished measurable environmental degradation occurs. Education levels as well as the cultural structure of a society impacts directly on the environment. Unsustainable economic practices due to ignorance and a disregard for traditional knowledge are a major attributing factor, particularly with regard to agricultural activities.

Political driving forces include both the past political actions of resettling people as well as new policies or legislation from national, provincial and local government. The Maluti-A-Phofung Local Municipality will become a driving force for environmental responses and positive change if proper policy, legislation and procedures form an effective environmental management system. The particular driving forces for each of the main themes within the report are discussed separately for particular issues.

1.6 Indicators

The word indicator is defined by the Concise Oxford Dictionary as something that "points out" and "gives information on the current situation". Similarly SoE reports make use of environmental indicators to tell decision-makers, industry and ordinary citizens what is happening in the environment. It is important to note that, in this context, the environment involves our total surroundings and it includes the:

- Biophysical environment (living things and their life support systems);
- > Social environment (people and their cultural interactions);
- Institutional environment (legislation, policy and regulations), and
- Economic environment (employment, industry and trade).

The majority of this report focuses on the biophysical environment, but relates it to influences by and impacts on the social, political and economic environment in order to emphasise the interaction and interdependence between the various aspects of the Maluti-A-Phofung environment. Overall these indicators will help to understand the various issues of the report and how they indicate to us if Maluti-A-Phofung is reaching sustainable development. Furthermore, true overall sustainable development can only occur where there is a balance in the sustainable development of the economic, social and biophysical environments.

The purpose of using indicators in State of the Environment reporting is to provide information on complex environmental realms in an indicator format which is understandable and usable by society, represented by both decision makers and organisations, communities and individuals, which either affects or are affected by the environment, as illustrated by the figure below:



Figure 2.2: The overall purpose of indicators for SEMP for MAP, 2007

In particular the aim of an individual set of indictors is:

- to monitor and assess conditions and trends on a national, regional and global scale;
- to compare situations;
- > to assess the effectiveness of policy-making;
- > to mark progress against a stated benchmark;
- > to track changes in public attitude and behaviour;
- to ensure understanding, participation and transparency in information transfer between interested and affected parties;
- to forecast and project trends; and
- > to provide early warning information (Walmsley & Pretorius, 1996).

1.6.1 Indicator frameworks

Indicators used in state of the environment reporting are often organised into a structured or coherent framework. There are a variety of reasons why indicator frameworks are useful. An indicator framework:

- guides the data and information collection process;
- suggests a logical grouping of related information;
- promotes interpretation and integration; and
- helps identify data collection needs and data gaps (CSIR, 2002).

The environmental indicators developed for MAP were developed according to the DPSIR framework, using environmental issues as a base. The DPSIR framework uses indicators to describe the driving forces, pressures, state, impacts and responses surrounding certain environmental issues. An environmental issue can be defined as a topic of strategic concern that will influence the sustainability of the area. It is important to realise that not all issues are equally important at any given moment, and that the issues being considered will change over time.

Driving forces	Human influences and activities that, when combined with		
	environmental conditions, cause environmental change.		
Pressures	These are exerted on resources and ecosystems as a result of		
	human activities (driving forces).		
State	The condition of the environment resulting from driving forces		
	and pressures.		
Impacts	The consequences or results of pressures on the current state		
	of the environment.		
Responses	These are the societal actions taken collectively or individually		
	to ease or prevent negative environmental impacts, correct		
	environmental damage or conserve natural resources.		

Table 1.1: DPSIR r	eport framework, MAP, 2007
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It should also be noted that not all issues necessarily have one indicator per component of the DPSIR framework. In some cases, there may therefore be fewer than five indicators per issue, while in other cases there may be more. In addition, the framework and ultimately the list of indicators selected should remain flexible and open-ended. This will allow new indicators to be added if necessary, should a new issue become a priority. It is recommended that a large portion of the indicators remain fairly consistent from year to year to allow for the analysis of trends, and to see the effects of decisions taken using the indicators (CSIR, 2002).

1.6.2 Indicator selection criteria

In order for indicators to remain relevant they must meet certain suitability criteria. The criteria may not all be met in each indicator that is proposed, however it is desirable that as many criteria as possible are met in each indicator. The criteria used in this project are as follows (they are not listed in any particular order):

- > The indicator should be relevant to the key local environmental issues;
- The indicator must have credible data that are readily available and cost effective;
- The indicator must be simply presented in a way that is easily understood; and
- > The indicator must display trends or change over time.

1.7 Environmental issues

1.7.1 Vision, Mission and Objectives for Maluti-A-Phofung SEMP

<u>Vision</u>

To be the premier state environment agency in the Free State in balancing the protection of MAP's environment and the health of all its citizens with the productive use of MAP' valuable natural resources

<u>Mission</u>

Responsibly adopt and fairly enforce rules and regulations consistent with statutory authority granted the MAP Environmental Management Commission (MAPEMC) and the Steering Committee to protect and improve the quality of MAP's environment and recommend changes in state laws or revise regulations as needed to respond appropriately to changing environmental conditions as applicable in the total area.

Objectives

MAP Environmental Management Commission (MAPEMC) will:

- make sound decisions to earn the peoples trust
- focus on environmental results rather than programs and procedures
- > use good scientific information to aid in its decision making
- consider the range of environmental benefits and consequences of proposed actions before making final decisions
- > evaluate its performance using meaningful criteria
- do all above mentioned objectives for long term sustainability of the environment for the next generations

1.7.2 Environmental Issues

MAP faces a number of different environmental issues and the measuring of these issues is vital, as it determines the extent of any problem areas and the subsequent response to it. Environmental issues were identified and grouped during a stakeholder workshop according to seven themes and relate both to overall issues as well as some of the eventual indicators used. Indicators were selected for the monitoring and reporting of each various issues and these issues were reaffirmed during various community workshops. Not all of the issues have direct indicators associated with them as some indictors provide a summary of more than one issue. Furthermore, some of the issues could have been addressed under more than one theme. The themes as well as a brief listing of some of the major issues raised are indicated below:

WATER

- Intensity of water use per sector
- Pesticides & herbicides
- Wetland destruction
- Alien fish species
- A gricultural pollution
- Abandoned mines
- Alien plant species
- Water consumption by forestry
- Sulphates
- Stream piracy
- Heavy metals

- Cross-boundary water transfer
- Sand mining in rivers
- Sandstone mining
- Biological pollution
- Payment for water
- Water quality
- Water consumption
- Acid mine drainage
- Access to water
- pH
- Sanitation

AIR QUALITY

- Greenhouse gases
- Air pollution
- Visibility (saw dust, fires, burning)
- Pollen
- Vehicle emissions
- Dirt roads
- Domestic coal use
- Reliance on coal for electricity generation

- Respiratory health problems
- Odours
- Ambient particulate concentration
- Asbestos
- Coal dumps
- Abandoned mines
- Industrial & other emissions

WASTE MANAGEMENT

- Permitting of landfills
- Inadequate land for landfills
- Private waste sites
- Landfill site suitability
- People living near waste sites
- Control of CH4 emissions from landfills
- Contamination of water points
- Illegal dumping

- Hazardous waste transport
- Waste generation
- Hazardous waste
- Sewage facilities
- Waste separation at collection
- Waste minimisation
- Adequate waste collection services

LAND AND LAND USE

- Afforestation
- Increasing industrialisation
- Encroachment of agriculture onto natural land
- Land invasions
- Conflicts over land use
- Degradation of natural resources

- Overgrazing
- Land degradation
- Degradation of soil resources
- Soil erosion
- Soil quality

BIODIVERSITY

- Riparian destruction
- Habitat fragmentation
- Bio-prospecting
- Wetland destruction
- Deforestation
- Resource value of protected areas
- Reduction of resource base
- Decreasing natural vegetation

- Curio trade
- Impacts of tourism on natural resources
- Encroachment of agriculture onto natural land
- Muti trade
- Loss of biodiversity
- Spread of alien species

1.8 South African Situation

1.8.1 Definition

A suite of environmental assessment and management processes are being applied internationally to promote sustainable development. Of these, **Environmental Impact Assessment (EIA)** has been one of the most widely used processes, largely due to EIA becoming a legislated process internationally since the 1970s and in South Africa since 1997.

At the heart of an EIA is a focus on the identification and assessment of predicted impacts, with the management actions to mitigate negative impacts or enhance positive impacts (i.e. benefits) often being described only in illustrative terms in EIA reports, unconnected to the project design (World Bank, 1999). In order to promote effective environmental management throughout the life-cycle of a project, it is therefore important that the management actions arising from EIAs are clearly defined and translated into a **Strategical Environmental Management Plan (SEMP)** for the design, construction, operation and/or decommissioning phases of a project. A SEMP can be defined as follows (adapted from DEAT, 2004b):

A SEMP is an environmental management tool used to ensure that undue or reasonably avoidable adverse impacts of the construction and operation, and decommissioning of a project are prevented; and that the positive benefits of the projects are enhanced.

1.8.2 Need for a Strategic Environmental Management Plan

The need for a Strategic Environmental Management Plan arises from the following factors:

- In South Africa, SEMPs are frequently a condition of approval in environmental authorizations granted by authorities in terms of environmental legislation. The authorities are required to review (and sometimes participate in) SEMP processes, approve SEMP reports and review the effectiveness of the implementation of SEMPs. Consistency in the review and approval of SEMPs is difficult given the absence of appropriate SEMP guidelines.
- Project proponents and their consultants are frequently required to prepare SEMPs, and are looking for guidance from the authorities as to the scope, content and quality of SEMPs, as well as the process to be followed in the preparation, approval and implementation of the SEMP.
- Broadening stakeholder engagement in SEMPs and the emergence of Environmental Monitoring Committees, particularly for larger-scale projects, results in greater scrutiny of the SEMP process and decision-making by authorities. The SEMP is an essential reference document for an Environmental Monitoring Committee (EMC). Guidelines for the formulation and implementation of SEMPs are therefore important to assist an EMC in their monitoring functions.
- Presentation of management actions (to mitigate impacts or enhance benefits) is frequently one of the weaker areas of the EIA process. The statement of these actions is often vague and impractical, and they not formulated for incorporation into the project design. There is a need therefore for environmental management actions to be properly addressed in SEMPs and thereby improve the effectiveness of EIA (University of Manchestor, 2003).

Considering the above factors, this guideline has been developed by the Department of Environmental Affairs and Tourism; Development Planning (DEAT&DP) to describe best practice with regard to SEMPs. The guideline promotes an efficient and effective approach to preparing and implementing SEMPs, as well as providing guidance for their review. In this respect, the guideline supports the Department's overall intent of promoting sustainable development.

1.8.3 Purpose and Scope of the Strategic Environmental Management Plan

SEMPs are usually prepared in the course of applications submitted for the environmental authorization of projects in terms of regulations promulgated under the Environment Conservation Act (Act 73 of 1989) 3. Therefore, the key purpose

of this guideline is to: assist proponents and their consultants in the formulation of SEMPs which effectively address the management actions identified in the EIA process; support the Department in objectively reviewing SEMPs that are processed by the Department; and guide the proponent with respect to the appropriate implementation of the SEMP throughout the project life-cycle. This guideline aims to be applicable to a range of types and scales of development, as well as different biophysical, social, economic and governance contexts. This guideline is focused on SEMPs at the project level, but may also be adapted and applied to higher-level Strategic Environmental Management Plans (SEMP) or Environment Management Frameworks (EMF).

The guideline should not be viewed as a prescriptive and inflexible document; its intention is to provide best practice guidance. Although focused on DEA&DP's requirements, this guideline is sufficiently generic to also apply to diverse situations when an SEMP may be required, outside of an EIA process. Examples of such types of SEMPs are listed in <u>Section 2.3.2.</u> Environmental Monitoring Committees are increasingly being used in South Africa to monitor:

- (i) that the conditions of approval in the Record of Decision arising from an EIA process are implemented effectively; and
- (ii) .the performance and implementation of the EMP. Refer to the document Environmental Monitoring Committees (DEAT, 2005a) for more information.

Three (3) EIA regulations are being revised and will be replaced by regulations promulgated in terms of the National Environmental Management Act (Act No. 107 of 1989).

CHAPTER 2: INTRODUCTION TO MALUTI-A-PHOFUNG LOCAL MUNICIPALITY

2.1 Introduction

The Free State Province is one of nine provinces in South Africa and is centrally located in terms of the geographic distribution of South Africa. The Free State



represents 10.6% of the total land area of South Africa (Census 2001). The Free State is peaceful, with a high quality of life, good infrastructure and a relative low crime rate.

The province covers an area of 129 464 km², and had a population of 2.7 million in 2001,



representing a 2.8% growth from 1996. The Free State population was 6.03% of the national population in 2001 (Census 2001).

The Free State is divided into five main areas namely Thabo Mofutsanyana, Xharip, Motheho Fezile Dabi and Lejwe Leputswa Districts.

Thabo Mofutsanyana District has beautiful hills and fruit farming. This district forms the eastern part of the province, and borders the Kingdom of Lesotho and Kwa-Zulu Natal. The district includes Maluti-a-Phofung, Dihlabeng, Setsoto, Phumelela and Nketoena. Thabo Mofutsanyana is one of the most important tourist destinations in the Free State, mainly because of the spectacular scenic beauty of the Drakensberg and Maluti mountain ranges. The most famous attraction is the Golden Gate Highland National Park, which is well known for spectacular sandstone its



formations. Other attractions include trout fishing, the annual cherry festival at Ficksburg, water sports at the Sterkfontein dam, the BaSotho cultural village in QwaQwa, and Bushmen rock paintings near Fourisburg. Entrepreneurial activities can be helpful to develop this district into a tourism paradise.

2.2 Description of The Study Are [Maluti-a-Phofung]

Maluti-a- Phofung is a local municipality that is comprises of 34 wards and covers approximately 4 421 km² in extent. Phuthaditjhaba is the urban centre of Qwaqwa and serves as the administrative head offices of the Maluti-a- Phofung Municipality. Surrounding Phuthaditjhaba are rural villages of Qwaqwa established on tribal land administered by land affairs. Harrismith is a service center for the surrounding rural areas and a trading belt serving the passing N3 which links the Gauteng and KwaZulu - Natal provinces. Harrismith is surrounded by Tshiame located 12 km to the west and Intabazwe, which is located 1, 5 km to the north. The town is an employment centre for people living in Tshiame, Intabazwe and Qwaqwa.

Kestell is a service center for the surrounding agricultural oriented rural area with Tlholong as the township. Kestell is situated along the N5 road that links Harrismith with Bethlehem. The rural areas of Maluti –a- Phofung comprise commercial farms and major nature conservation centres such as Qwaqwa National Park, Plartberg, the Starkfontein Dam and the Maluti Mountain Range. The area is not only a tourism attraction destination, but also make a big contribution in generating gross agricultural income for the whole of the Province and is also highly regarded for its beef production.

Sector/year	1996	2004	Relative %	Relative
			1996	2004
Agriculture	106,565	113,461	5	5
Mining	12,794	12,498	1	0
Manufacturing	214,456	194,467	10	8
Electricity	135,320	113,637	6	5
Construction	86,760	71,071	4	3
Trade	326, 447	411,215	15	17
Transport	112,569	135,208	5	6
Finance	171,722	229,215	8	10
Community	1,036,082	1,093,986	47	46
services				
TOTAL	2,202,715	2,374,755	100	100

Table 2.1: Sectoral economic contribution in Maluti-a-Phofung, 1996 and2004

According to the Free State Growth and Development Strategy, the Eastern Free State, in which Maluti-a-Phofung is located, is the main tourism venue in the Free State. Obviously, opportunities exist to produce products for this market and cluster enterprises in this cluster.

2.3 Demographics

2.3.1 The Maluti-A-Phofung Local Municipality's Economy

The Free State produces 5,2% of the national GGP. This is less than the population share, which is 6,5%. From 1994 to 1998 there was an increase of 11,2% in the Free State Gross Geographical Product (GGP)1 but a decline of 0,8% in its contribution to the national Gross Domestic Product (GDP)2. In 1990 the GGP was R9 571 million, in 1996 it was R9 058 million, and R12 241 million in 2000.

The following geographic and demographic information of MAP are also very important and can play a role in SEMP and for the positive implementation of it. It is thus necessary to look in more detail to the following information.

- 1. The Gross Geographic Product (GGP) equals the remuneration received by the production factors – land, labour, capital and entrepreneurship – for their participation in production within a defined area (Statistics SA, 1994).
- 2. The Gross Domestic Product (GDP) is the total value of final goods and services produced within the boundaries of the country for a particular period.

Factor	МАР	Free State	South Africa
Population Size: 1996	352 276	2 633 504	40 583 573
Population Size: 2001	360 790	2 706 775	44 819 778
Population growth rate: 1996 – 2001 (%)	1.69	1.76	1.97
Life expectancy: 1996 – 2001 (Years)	55.2	56.6	61.6
% Urban Population (2002)	71.3	69.3	55.0
Population density (people per km2) 1996	38.2	20.3	36.8
Population density (people per km2) 2001	39.4	20.9	36.8

Table 2.2: Spatial and demographic factors, MAP, 2007

Area in Maluti-A-		Black			
Phofung	Total population	African	Coloured	Indian/Asian	White
42nd Hill	16083	15993	87	-	3
Bolata	29936	29924	3	-	9
Harrismith	6339	2763	39	194	3343
Intabazwe	3686	3677	9	-	-
Kestell	898	303	3	-	592
Mabolela	23724	23652	24	30	18
Maluti-A-Phofung	15136	14638	21	-	477
Matsieng	23857	23830	21	-	6
Monontsha	50429	50399	18	-	12
Namahadi	86969	86878	70	15	6
Phomolong	6408	6402	-	6	-
Phuthaditjhaba	53179	52896	118	129	36
Thaba Bosiu	8131	8116	12	3	-
Thaba Tshweu	8872	8869	3	-	-
Thibela	5046	5037	3	-	6
Tlholong	4827	4827	-	-	-
Tshiame	12963	12923	37	3	-
Witsieshoek	4307	4301	-	-	6
Total: Maluti-A- Phofung	360790	355428	468	380	4514

Table 2.3: Population distribution for the different areas in MAP, 2001

Table 2.2 gives the detail of the distribution of the different population groups in the different areas in MAP while table 2.3 gives the distribution of the different population groups per ward. It is clear from the two tables that the ward and the different areas are not the same. Some areas consist of more than one ward or the other way round. As can be seen from figure 2.3, there are some of the wards that have a decline in people since 1996 to 2001. There can be a lot of reasons for the decline, and it is important to know what the specific reasons will be. During phase two, the reasons for the decline has been investigated because the decline can have a major impact on SEMP. The main reason is the lack of housing and that people move to areas where housing are available. This can have a positive effect on water, air and waste management because the formal residential areas have more and better facilities and services available.

Seven wards show a decline in population growth since 1996 to 2001 of more than 2000 people of which ward 21 have the highest figure (Just over 3500). Seven wards show an increase of more than 2000 in their population figure of which ward one have an increase of nearly 10 000. The total increase in the population figure for MAP between 1996 and 2001 is 8 514 (also see table 2.4). This is an increase of 2, 42% over the 5 year period. If the growth rate will remains the same over the next 5 years, the total population of MAP will be around 370 000. Only African and Indian people have a population increase between 1996 and 2001, while there was a decline in the number of white and coloured people in the MAP area.





Wards	Total: 1996	Total: 2001	Increase / Decline
1	10642	20611	9969
2	11953	10465	-1488
3	9031	12409	3378
4	10889	15210	4321
5	6709	6471	-238
6	7316	6925	-391
7	11039	8959	-2080
8	7051	7086	35
9	14923	12342	-2581
10	9878	9948	70
11	9433	8179	-1254
12	13318	13427	109
13	11138	12146	1008
14	7792	7576	-216
15	15032	12798	-2234
16	8748	6627	-2121
17	15651	14338	-1313
18	13975	12217	-1758
19	12038	9875	-2163
20	9374	7587	-1787
21	13463	9944	-3519
22	11025	12043	1018
23	10029	12076	2047
24	8243	7740	-503
25	6415	5767	-648
26	10246	12139	1893
27	8998	6849	-2149
28	9826	12954	3128
29	10513	9500	-1013
30	9063	13484	4421
31	10464	14442	3978
32	8174	7357	-817
33	10473	11761	1288
34	9414	9538	124
Total	352276	360790	8514

Table 2.4: Increase or decline in population growth in the different wards since 1996 to 2001 in MAP



Figure 2.2: Age distribution in MAP, 2001

The age distribution in MAP shows that nearly 40% of the people are between the age of 5 and 18 years. Thereafter there is a rapid decline in the number of people in the other age groups. (See figure 2.2). From a management point of view it is important to keep the people in MAP to gain economic development for the area. If people are just educating in MAP and then leave the area because there is no motivation and opportunities for them to stay in the area, then the local and provincial government must do something to create opportunities. SEMP, as part of economical development and IDP, must look into this matter and SEMP will contribute to it over the long run when implemented in MAP.

Throughout the different wards and areas the gender distribution in MAP looks more or less the same. Figure 2.3 shows the overall gender distribution for MAP. There are 2% more women living in MAP (54%) that the average for South Africa (52%). In comparison with the number of men living in MAP, there are 28 864 more women living in MAP. A inference make from the above mentioned can be that the lack of opportunities in MAP make the men going out and getting job opportunities outside the area while the women stay with their children at their homes. This situation can leads to some positive as well as negative aspects. A positive aspect is that money is coming from the outside areas to MAP when the men are visiting there homes. A negative aspect is the some brain power and entrepreneurial opportunities are lost for MAP. With SEMP and the proper implementation of the report, a lot of these entrepreneurial opportunities can be created for the people living in MAP.



Figure 2.3: Gender distribution in MAP, 2001

Figure 2.4 shows the income of individuals in Maluti-A-Phofung. Seventy four present of people living in the area have no formal source of income. When looking at household income, the situation looks better but not well enough to sit back and do nothing for this area.



Figure 2.4: Individual income in MAP, 2001



Figure 2.5: Household income in MAP, 2001

A comparison between figures 2.4 and 2.5 shows the following:

- > Nearly three-fourths (74%) of individual people in MAP have no income
- > Nearly a third (30%) of households has no income.
- Nearly a quarter (23%) of individuals have an average monthly income up to R1 600
- > About 53% of households had an annual income up to R38 400

As can be seen from the above mentioned figure, the majority of households and individuals are living with an average income that is lower than the norm in South Africa. This relative low income per person has a snowball effect in terms of money earned by local municipalities for delivering household and other service. When looking at some aspects that have an effect on SEMP and the planning and implementation of SEMP in the area, the following are of great importance:

- Water and water quality. There is a direct link between water quality and the cost to deliver that quality
- Waist disposal and waist management is also expensive. To manage it better according to SEMP regulations, the local municipality needs more income to deliver the results
- > Educate people how to look after the environment

The more educated people are, the better they understand how important it is to conserve the environment. One of the main objectives of SEMP is to educate people to conservation. Better education levels will save a lot of money and make the implementation of SEMP more viable. Figure 2.6 shows the education levels in MAP. Just over 55 000 (15, 52%) of people living in MAP have no education.



Figure 2.6: Education levels of individuals in MAP, 2001

Figure 2.7 shows the employment status of individuals in MAP. From the figure it is interesting to mention that only 19% indicated that they are unemployed. Further investigation shows that there are others that stated the following:

- Could not find work (5%)
- Seasonal worker not working presently (1%)
- Does not choose to work (2%)
- Unable to work (2%)
- Home maker or housewife (2%)
- Scholars and students (14%)

Above mentioned are reasons for not working. If the percentages are being added up, it gives a percentage of around 45%. This figure does not include pensioners. From this calculation it becomes clear that the unemployment rate in MAP is very high and it also correlates with the low household income stated in figure 2.5.



Figure 2.7: Employment status of individuals in MAP, 2001

Not a lot of people are employed in different occupations in MAP, according to figure 2.8. When looking at education levels, there is a correlation between low education levels and a lot of people that have no occupation in MAP. Just over 2000 people are in management or professional positions. This is nearly a percent of the total people that are able to work.

From this information it became clear that the need for skilled people and the opportunities for employing those skilled people are enormous. SEMP can play an enormous role in the development of the area in the correct way. With the necessary legislation, rules and proper environmental planning, implementation and control, a lot of new business opportunities can be developed for long term sustainability and economic development. Figure 2.9 give the unemployment rate for the Free State. A comparison between figure 2.8 and 2.9 shows that the situation in terms of unemployment are a lot worse in Maluti-A-Phofung than in the Free State.



Figure 2.8: Occupation status of individuals in MAP, 2001

The official unemployment rate for the Free State province in March 2004 was 26.1%. Unemployment is stratified according to gender and population group, as shown in Figure 2.9.





Source: Statistics South Africa, Labour Force Survey March 2004.

Figure 2.10 represents the relative contribution per economic sector. The graph shows that the most important contributors to the provincial economy are mining (14%), manufacturing (16%) and community services (28%). The graph also shows a number of changes in the structural composition of the provincial economy. The most notable of these structural changes is the decrease in the relative contribution generated by both mining and manufacturing, and the increase in the contribution generated by community services. Furthermore the relative contributions of transport and finance have increased. The situation in Maluti-A-Phofung differs from the Free State in terms of the following:

- No mining activities in MAP;
- Manufacturing lower in MAP;
- Agriculture and the service sector play a more important role in MAP.



Figure 2.10: Relative contribution per economic sector, Free State Province, 2002.

These changes in the structural composition indicate a gradual transfer away from the primary and secondary sectors, towards the tertiary sector. A gradual movement away from the primary sector towards the secondary and tertiary sectors is **normally considered characteristic of a maturing economy**. For an economy like this to grow, it needs a lot of entrepreneurial stimulation to establish new and innovative businesses that can create job opportunities.

Figure 2.11 presents a perspective on the comparative advantages benefited by the various sectors, as expressed in terms of the location quotients. This graph shows that the Free State Province benefits from a considerable comparative advantage in agriculture, and that this advantage is still increasing.



Figure 2.11: Location quotients, Free State Province, 2002.

In contrast, the province experienced a notable loss in the degree of comparative advantage in mining, which used to be the mainstay of the provincial economy and employment. The province is also experiencing a steady increase in its comparative advantage in community services, which mainly comprises the government services.

The Free State has experienced a **steady increase** in the levels of **unemployment**. This increase is illustrated in Figure 2.12. The graph shows that the level of unemployment (expanded definition) has increased from about 30% in 1996, to just over 40% in 2004. As mentioned earlier, this is slightly lower than the average for South Africa, which is estimated at 41.2. This high unemployment rate and maturing economy must be taken care of. One of the main activities to address this situation is by educating and assisting people to start sustainable entrepreneurial ventures.

Economic sectors differ in their inherent capacity to generate employment opportunities, with some sectors being more labour intensive than others. Figure 2.13 presents perspective on the relative distribution of direct employment opportunities generated per sector. Maluti-A-Phofung differs in some of the mentioned sectors (agriculture and services) but in some sectors the trends are the same (manufacturing and construction). To have a successful SEMP in place, it is important to know the trends in the different sectors. The main reason for it is that development can be planned in the sectors that have a high decline rate. It is important for every municipality to keep it's economies in balance between the different sectors and their contribution to the economy of the area.



Figure 2.12: Unemployment levels (expanded definition), Free State Province, 2004.

Figure 2.13 shows that the most important sources of direct employment opportunities are agriculture, trade, community services and households. The household sector mainly involves people working as domestic servants. The relative size of the household sector indicates the importance of this source of employment opportunities.

The graph also shows a number of important trends, such as a drastic decrease in the relative number of employment opportunities generated by mining, whereas both trade and community services have increased the relative number of employment opportunities. There are also a few opportunities where employment can be increased as a result of increasing the economic activities of specific sectors. Examples of these sectors where activities can be increased are manufacturing, construction and trade.



Figure 2.13: Sectoral employment, Free State Province, 2002.



Figure 2.14: Occupation profile, Free State Province, 2001.

Figure 2.13 should also be interpreted in the context of Figure 2.10 to compare the economic profile with the sources of employment. This comparison indicates that agriculture is labour intensive, as the sector contributes only 8% towards the economy, but generates about 16% of all formal employment opportunities.

Similarly, trade contributes 10% towards the economy, but generates about 18% of all formal employment opportunities. In comparison, Mining generates about 15% towards the economy, but generates only 8% of formal employment opportunities.

The income levels of those that are employed are largely determined by the type of employment and their position. Figure 6 presents perspectives on the occupancy profile.

The graph shows that the Free State has fewer people employed in the higher paid managerial and senior positions than the average for South Africa. On the other hand, the Free State has proportionally more people employed in the lower paid semi-skilled type and elementary occupations than the average for South Africa. The direct implication is that proportionally, the workforce of the Free State seems to be occupying positions that in general, pay less than the average for South Africa.

From the above mentioned graphs it is evident that agriculture and the government are the predominant sources of income and employment for the Free State Province. There is an urgent need to broaden the base of income and employment sources to change the economy of the Free State from a mature economy to that of a growing economy.

Table 2.15 represents some of the district economies in the Free State Province. For example, calculations of per capita income for the Thabo Mofutsanyana region indicate that it is one of the lowest of the Free State districts. In the Provincial Profile it is noted that,

The economy of the district is primarily dependent on Agriculture and General Government while very little diversification is taking place. This places the area at tremendous economic risk, especially considering the decline in the agricultural sector during recent years.

The unemployment rates of this district are also the highest in the province, with an average of 36.55%. There is some variation between the local municipalities with respect to unemployment, with Maluti A Phofung having the highest level of unemployment (49.42%). For the district as a whole, 78.9% of households have access to some form of water (including communal standpipes), 41.53% have access to sanitation, and 44.79% have access to electricity.

District	Population	GDP	Unemploym	People in
			ent	poverty
Motheo	26,0	30,9	41,1	61
Lejweleputswa	26,9	26,5	36,6	66
Thabo	26,3	14,0	34,1	72
Mofutsanyana				
Northern Free	16,3	25,5	38,3	62
State				
Xhariep	4,5	3,1	38,3	57

 Table 2.15: District economies (in %) in the Free State Province, 2003

2.4 Conclusion

This chapter gives an overview of Maluti-A-Phofung local municipality in comparison to the Free State province. From a planning and management perspective, it is important to know the different trends of the different sectors as well as the demographic information of the population living in the area.

MAP SEMP has taken these trends and demographic tendencies into consideration when developing a vision, mission and goals for the municipality.

CHAPTER 3: AIR QUALITY

3.1 Introduction

Atmosphere and Climate was selected as one of eight priority themes for environmental reporting by the National Environmental Indicators Programme, which was launched by the Department of Environmental Affairs and Tourism (DEAT). Three different priority issues were selected to address the theme of Atmosphere and Climate at a national level, **namely climate change**, **stratospheric ozone and air quality**. These priority issues are areas of concern that will impact on the environmental sustainability of the country in the long term (DEAT, 2002a).

Although the three priority issues are relevant to sustainable development at a national level, not all of the issues are all necessarily relevant at a municipal planning level. **Climate change** is a global issue and of concern to South Africa as the country is the single largest contributor to carbon dioxide emissions on the African continent (carbon dioxide is implicated in global climate change). Similarly, stratospheric ozone depletion is a cause for concern to South Africa, as the country contributes towards global emissions of ozone depleting substances (DEAT 2002a). However, these two issues are of greater priority at a national level than at a municipal one, as they can be better addressed at a national level in terms of international agreements, such as the Montreal and Kyoto Protocols.

As such, the focus of this report for the purposes of the State of Environment Management Programme for Maluti-A-Phofung Local Municipality (MAP SEMP) is predominantly based on the priority issue of **air quality**. Air quality, and in particular, local air quality can and must be best addressed at a municipal level, where air pollution is targeted and managed.

Air pollution can be defined as:

- The emissions of chemical compounds into the air as a result of anthropogenic and natural activities, which may have the potential to impact negatively on the environment.
- Air pollution may disturb to ecosystems, climatic conditions, biogeochemical cycles and human health (Mpumulanga SOER, 2001).

Sources of anthropogenic-related air pollution exist throughout South Africa, and include contributions from:

- veld fires,
- industrial emissions
- domestic burning,
- agricultural practices,
- fossil fuel burning and
- vehicle use.

Many of these sources can and must be controlled and monitored at a municipal level. This is why it is so important to point the different sources of air pollution out to the different municipalities in the MAP are.

Air quality and climate change are supported by a legal framework in South Africa (Petrie, Burns and Bray, 1996). South Africa is a signatory member of the Montreal Convention on Climate Change, and is thereby committed to reducing greenhouse gases and ozone depleting substances. The SA National Committee on Climate Change is in the process of developing a climate change policy and an inventory on greenhouse gases. Further to this, a variety of Acts and Bills that have implications for air, atmosphere and climate exist in South Africa. Some of the more important Acts and Bills are the following:

- Atmospheric Pollution Prevention Act (45 of 1965)
- National Key Point Act (1980)
- Protection of Information Act (1982)
- Environment Conservation Act (73 of 1989)
- National Environmental Management Act (107 of 1998)
- National Environmental Management Air Quality Bill (2003)
- National Environmental Management: Air Quality Act (No. 39 of 2004)

There is presently no clear policy for monitoring air quality standards. No legally enforceable ambient air quality standards exist in South Africa either, although the South African Government have instituted a number of initiatives aimed at reducing levels of atmospheric pollutants. The DEAT are also developing legislation to address national air quality standards. Stringent air quality standards have been determined through research conducted for the National Environmental Management Air Quality Bill (2003), and are based on widely researched international standards. These standards will become the new South African limit values and will be expected to be enforced at the Local Authority tier of government.

Although there is no clear policy for monitoring air quality, the National Environmental Management: Air Quality Act (No. 39 of 2004) has specific reference to information management and the reporting of this information. The proposed NAQIS will allow to gives effect to these requirements and provides a tool and technical support to all layers of government in the implementation of the following sections of the Act:

Section 7 – National Framework;

Section 8 – National Monitoring and Information Management Standards; and Section 50 – International Air Quality Management.

This description covers the necessary functionality of a fully developed comprehensive **national air quality information system** (NAQIS). It is

recommended going for a phased approach to achieve the completion of the full system, allowing for modification and separate tendering at each phase.

3.1.1 Objective of the NAQIS

The NAQIS shall:

Provide all stakeholders with easy access to all relevant information about air quality in South Africa. Further to provide different stakeholders with different useful on-line applications to support effective and efficient management of the air quality.

Figure 3.1 gives a schematic view of the proposed NAQIS. The tools can comprise different kinds of modules and be built in the different phases.



Figure 3.1: Schematic view of NAQIS, 2007

Air quality is considered a natural resource and will therefore be protected under DEAT, with the legal backing of the new Air Quality Act, once in place.

DESCRIPTION OF ISSUES	INDICATOR(S)
CLIMATE	CHANGES
The emission of various gases and the combustion of fossil fuels are claimed to lead to global climate changes	 Greenhouse gas emissions (oxides of nitrogen) Energy use (fossil fuels) Annual temperature trends (although included as an indicator, annual trends in temperature are not relevant as indicators at present, but are included as a benchmark for future SoE reporting)
AIR	QUALITY
There are areas of poor air quality within the Maluti-A-Phofung Local Municipal area that will require remediation and future monitoring. Further to this, no air quality monitoring has been conducted in previously disadvantaged areas, and the state of air quality in these areas is therefore unknown. The Maluti-A-Phofung Local Municipality has neglected the monitoring and governance of air quality issues in the past. Strategic management procedures are lacking for the control, recording and management of pollution events	 Ambient sulphur dioxide concentration Ambient nitrogen dioxide concentration Smoke & PM10 (not listed by DEAT 2002a, but considered important additional indicators at municipal level

Table 3. 1: Environmental indicators of Atmosphere and Climate

It was determined that the air quality indicators of sulphur dioxide (SO2) and nitrogen dioxide (NO2) would be of most relevance to the Maluti-A-Phofung Local Municipal SoE, although the contribution of nitric oxide (NO) concentrations and fossil fuels to climate change would also be considered. Additional indicators (smoke and PM10) were included for the purpose of investigating air quality for the Maluti-A-Phofung Local Municipal SEMP.

These indicators were omitted from the national guidelines (DEAT 2002a), but authorities have recently reviewed the omission as a shortcoming in the guideline document. As the guideline document is a work in progress, smoke and PM10 concentrations are currently being considered for inclusion as recommended national environmental indicators of air quality.
3.2 Climate change

Climate change refers to a changing trend in global climates (WMO, 2002). Effects of changing climates may be:

- Mean global temperature changes.
- Mean sea-level changes.
- Changes in extreme weather and climate events, such as floods, droughts, and hurricane activities.
- > Global changes in flora and fauna, with implications for species survival.

Changes in climate are known to have occurred periodically in the past. However, climate change has become more drastic and more noticeable with the advent of industrialisation, urbanisation and modern development. For this reason, portion of the scientific community who believe that climate change in recent decades is closely linked to anthropogenic activities such as:

- fossil fuel combustion,
- biomass burning,
- greenhouse gas emissions and
- Industrial activities.

Recent studies in South Africa suggest that the concentration of greenhouse gases in the atmosphere is increasing, and influencing global warming and mean sea level rise, as well as increasing the number of unprecedented extreme weather and climate events (Obasi, 2003). Climate change induced by anthropogenic activities may have implications for human health, such as changes in the ranges of disease vectors (e.g. mosquitoes), water-borne pathogens, and water and air quality.

The potential effects of climate change have been researched thoroughly, and considerable literature regarding possible global effects as a result of climate change exists (WMO, 2002; 2003). However there are many uncertainties about future projections and detailed local or basin-level climate-change predictions are not yet available (Obasi, 2003). Despite these uncertainties, scientific evidence largely supports the belief that anthropogenic sources are contributing towards these changes, and inevitably towards the potentially global effects as well.

The global community has undertaken to reduce emissions of greenhouse gases and the combustion of fossil fuels (WMO, 2002; 2003). South Africa supports these efforts, for example South Africa is a signatory member of the Montreal Convention on Climate Change, and as a party is committed to reducing greenhouse gases and ozone depleting substances. The SA National Committee on Climate Change is in the process of developing a climate change policy and an inventory on greenhouse gases. At a municipal level, monitoring and policing of greenhouse gas emissions and fossil fuel combustion activities are necessary if the efforts of the global community are to be effective. Trends in oxides of nitrogen and fossil fuel emissions need to be identified at a municipal level. Relevant standards must be adhered to, and monitoring needs to be undertaken on a consistent and regular basis, especially in Qwaqwa itself.

The Environmental Indicators for National State of Environment Reporting for South Africa (DEAT 2002a) was used to assist in the selection of indicators of climate change. Of the Climate Change Indicators listed (DEAT 2002a), primary oxides of nitrogen (NO) were selected as indicators of greenhouse gas emissions for the purposes of the Maluti-A-Phofung Local Municipal SEMP. Oxides of nitrogen are very good indicators of vehicle emissions, which are through to make substantial contributions to air pollution and climate change in the Maluti-A-Phofung Local Municipal area. Natural NO and NO produced by jets flying in the stratosphere reduce ozone in the upper stratosphere. Oxides of nitrogen are important indicators as they are precursors to tropospheric ozone, nitric acid and particulate nitrate. Tropospheric ozone affects climate, nitric acid contributes issues related to acid deposition, and particulate nitrate contributes towards climate change (Jacobson, 2002). NO can be monitored using passive sampling techniques, which have become relatively easy, reliable and inexpensive air quality monitoring techniques over recent years.

The guideline list (DEAT 2002a) proposed other indicators of climate change. Of the other indicators proposed, only carbon dioxide (CO2) and methane (CH4) were potentially useful for the Maluti-A-Phofung Local Municipal SEMP report. The remaining indicators were either irrelevant to Maluti-A-Phofung Local Municipal, or were not feasible or practically possible to investigate within this sector at this level.

Carbon dioxide and methane were considered, but were excluded during the workshop process, as:

- Carbon dioxide (CO2), a colourless, odourless, greenhouse gas, is not an important outdoor air pollutant as it does not chemically react to form further products, and is not harmful to health at typical mixing ratios. Although this gas plays a subtle role in acid deposition and stratospheric ozone depletion, it is not considered to be a key contributor to these problems. It is however a key contributor to global warming. Mixing ratios of CO2 are not regulated in any country (Jacobson, 2002).
- Methane (CH4) is the most reduced form of carbon in the air, and the most abundant hydrocarbon and organic gas. Although CH4 enhances ozone formation in photochemical smog to a small degree, it is still a relatively unimportant component of photochemical smog. CH4 therefore has little effect on the ozone layer in the stratosphere. CH4 has no harmful human

Furthermore, CO2 and CH4 are not clear indicators of air quality as they fluctuate considerably between night and day in an entirely natural cycle. It would take a considerable amount of time to determine any trends related to CO2 or CH4, as will require costly monitoring processes and lengthy time periods of measurement.

3.2.1 Driving forces of climate change

Changes in climate have historically not been adequately recorded or documented. Consequently trends have been difficult to establish. Most importantly, little has been done at a municipal level to monitor emissions or promote more environmentally acceptable methods of industrial processing. The driving forces behind the lack of adequate governance at municipal level are that:

- Altering climate change is a task best addressed at a national and international level, as indicators are either irrelevant or not realistic to tackle or access at a municipal level.
- There have previously (and at the moment) insufficient funds being allocated towards climate change issues of municipal concern.
- There are insufficient skills regarding monitoring and policing of greenhouse gas emissions and fossil fuel combustion in many municipalities, with little or no opportunities for staff training and development.

Furthermore, marginal and heavy polluting industries operate in a competitive global economy in South Africa. They are often allowed to operate unhindered in developing countries (like South Africa) as they provide employment and products in critical areas. Many developing countries lack the legislation or the capacity to reduce such emissions. MAP has not such heavy industries that pollute the air in this environment.

3.2.2 Pressures on climatic systems

Unfettered industrial growth contributed to the exploitation of natural resources, and atmospheric pollution from the use of cheap technologies and non-renewable fossil fuels. South Africa has allowed weak legislation to be developed, and non-enforcement of standards owing to lack of capacity to monitor and control. There is also insufficient information on climate change priority areas such as the historical emission of greenhouse gases.

Many municipalities have not recognised climate change as a field of concern at a local level, especially in the more rural parts of South Africa. Municipalities like

MAP, therefore, do not have adequate departments dedicated to addressing greenhouse gas emissions and fossil fuel combustion. The specific responsibilities, expertise and management required of staff members to adequately address these issues have not been recognised, since scheduled process have historically been controlled by the national Department of Environmental Affairs and Tourism under the Atmospheric Pollution Prevention Act (Act 45 of 1965). Municipalities have thus inherited inadequate data on historical emission levels in their geographical areas of jurisdiction.

3.2.3 State of climate systems

3.2.3.1 Governance towards climate systems

The Maluti-A-Phofung Local Municipal does not have a department responsible solely for climate change priority areas, with a specific employee responsible for coordinating and managing air quality issues. The Waste Water Department and the Environmental Health Department are supposed to be both responsible for aspects of air quality and climate change. As a result there is no clear accountability for implementation, enforcement, monitoring, or compliance of air quality in Maluti-A-Phofung. This is not uncommon in smaller municipalities throughout South Africa.

There are no comprehensive or fully inclusive monitoring and control strategies available for the Maluti-A-Phofung Local Municipal area. These are particularly absent for the formerly disadvantaged areas. As a result there exists no conclusive information regarding the historical state of air quality in Maluti-A-Phofung Local Municipal, and no clear understanding of the status of greenhouse gas or fossil fuel combustion emissions within the municipal area. There is therefore no information on whether emission levels are increasing or declining. All that are for sure is that the above mentioned effects are not a problem yet, but there must be some responsibility from the Maluti-A-Phofung Local Municipality to look and measure these levels.

3.2.3.2 Greenhouse gases

Greenhouse gas emissions in Maluti-A-Phofung Local Municipal have not been monitored in the past. Samples were taken for the purposes of the Maluti-A-Phofung Local Municipal SOE exercise in November 2006 and April 2007 this year. The purpose of these samples was to provide a snapshot indication of the levels of NO being emitted in the Maluti-A-Phofung Local Municipal area. Although the findings indicate that greenhouse gas emissions are fairly low, monitoring activities should be implemented to identify future changes in emission levels.

The ambient concentrations of two oxides of nitrogen (NO and NO2) were monitored at the three towns in the Maluti-A-Phofung area strategically chosen.

The three sites surrounding historical pollution contributors were used to monitor air quality (SO2 and smoke), and these sites were therefore reselected for the snapshot monitoring procedures in November 2006 and April 2007 for sake of comparison and validation. Emissions were monitored over a period of one week, and the results of the ambient NOX monitoring activities are shown in Figure 3.2.

Figure 3.2: Ambient NOX concentrations monitored at the three towns within the Maluti-A-Phofung area during November 2006 and April 2007



Figure 3.2 indicates the ambient NOX concentrations (NO + NO2) in micrograms per cubic meter at the three monitoring stations for the two periods (November and April. Research conducted towards the National Environmental Management Air Quality Bill (2003) has determined stringent South African NOX standards in accordance with international standards (WHO, USEPA, European Union etc.), which are to apply as South African standards for NOX concentrations. The annual limit value for NO2 is stricter than the NO standard, and is set at 40 micrograms per cubic meter (depicted as a red line). Both NO and NO2 concentrations at all three monitoring stations are effectively below this standard, and therefore do not currently pose major concern. However the concentrations are sufficient to warrant further investigation and continued monitoring programmes.

3.2.3.3 Fossil fuel combustion

A fossil fuel survey was undertaken to identify fossil fuel combustion activities in the Maluti-A-Phofung municipal area. Twenty-five businesses were identified, and their location, type of fuel used, mass/volume of fuel used per month, type of appliance, type of process, stack heights and emission controls were captured. It would be an extremely worthwhile exercise for Maluti-A-Phofung Local Municipality to continue with the development of a GIS-based air pollution source inventory.

The results of the survey indicate that 85% of the businesses utilise coal, wood, diesel, paraffin, and gas for energy. However monitoring procedures undertaken for the purposes of the Maluti-A-Phofung SoE indicate that industrial emissions are not the most significant contributors to pollution in Maluti-A-Phofung Local Municipality.

3.2.3.4 Annual temperature

Figure 3.3(a): Annual maximum temperature trends for Maluti-A-Phofung. (South African Weather Service, April 2007)



The temperature trends have been included in this report a benchmark for the use of future SEMP assessments. Figure 3.3 (a), (b) and (c) indicates the mean maximum, mean minimum and mean average annual temperatures for Maluti-A-Phofung area recorded at the automatic weather station in the area over the past five years. It is an insufficient time span to identify long-term climatic trends, as establishment of static climate parameters requires at least 20 years of data and it is argued by many scientists that climate change cannot even be accurately determined with over 100 years of data (because of the complex cyclical nature of climate trends). However, the information presented is sufficient to offer a state against which comparisons can be made in future SEMP reports to continually assess anticipated climate change, along with other relevant indicators.

As can be seen from the figures, there are a definite change in the temperatures during 2005 and 2006. The summer and winter temperatures of the mentioned two years are a little warmer in some months as the other temperatures.





Figure 3.3(c): Annual average temperature trends for Maluti-A-Phofung. (South African Weather Service, April 2007)



3.2.4 Impacts of climate change

Impacts associated with climate change may greatly affect municipalities, where the impacts may be felt at a local level. However municipalities may have little influence in curbing global climate change independently, other than to monitor, minimise and control greenhouse gases and fossil fuel combustion within their area of jurisdiction.

The scientific community believes that climate change in South Africa can be observed by an increase in average temperatures, which influences on rainfall patterns, although it is uncertain how the annual rainfall will change. South Africa's industrial, domestic and agricultural users are highly dependent on a reliable supply of water. Variability of reduction in rainfall, or increases in evaporation rates, will further strain already limited water resources. An increase in rainfall or a reduction in plant water use (because of higher atmospheric concentrations of carbon dioxide) would relieve the pressures on South African water resources. Human and animal health in South Africa may be affected by climate change. There are several important insect-borne diseases which occur in humans and livestock are sensitive to climate. For example, an increase in average temperatures might allow malaria-carrying mosquitoes to move into previously malaria-free areas.

Agricultural activities could also suffer from climate change. For example, a 10% increase in rainfall coupled with an increase in carbon dioxide would lead to a 10% to 20% increase in maize and wheat production, while a 10% decrease in rainfall would be balanced by rising carbon dioxide levels in the atmosphere. Slightly warmer temperatures may lead to a small reduction in wheat yields, but would have little effect on maize. Animal production could also suffer as grasses and feeds may contain less protein as a result of higher carbon dioxide levels. Biodiversity may be jeopardised by climate change in South Africa, where certain species may become extinct as a result of increased temperatures.

Although Maluti-A-Phofung's contribution to greenhouse gas and fossil fuel combustion emissions are relatively low, impacts of climate change (discussed above) may indeed be felt at a local level. It is thus important for the municipality to monitor the rainfall and temperature changes over the long run to make people aware of these changes. If there will be a significant change over the next 5 to 10 years, the municipality in conjunction with other knowledgeable people must seek for some solutions in the agriculture sector but also in other sectors.

3.2.5 Responses to climate change

As a result of insufficient attention given to air quality and climate change at a municipal level in the past, there has been little response to issues of climate change. However the Maluti-A-Phofung Local Municipality are currently investigating the state of the environment within the municipal area, with a chapter dedicated to climate change and air quality issues. The Maluti-A-Phofung Local Municipality SEMP is an important response that will allow the municipality to effectively identify, plan for, monitor and manage these issues in the future.

3.3 Air pollution related to health issue

Health risks associated with poor air quality are widely documented in literature, and are well understood. However, the occurrence of air pollution-related health issues in the Maluti-A-Phofung municipal area is relatively unknown. A major contributing factor to the lack of information regarding air pollution-related health issues in Maluti-A-Phofung is the current inadequate governance of air quality and climate change issues at a municipal level. There is no formal department specifically dedicated to investigating air quality and climate change within the municipality, and there is therefore no framework for investigating into air pollution-related health issues. Further to this, there is insufficient information regarding the current air quality status of much of the Maluti-A-Phofung municipal area. As a result, there is little means of identifying air quality problems.

The monitoring procedure undertaken for the exercise of developing the Maluti-A-Phofung SEMP indicated that the issue of air quality might have some priority areas. "Hotspots" of poorer air quality in the Maluti-A-Phofung municipal area were identified; these spots may potentially have a negative impact on the health of communities and the environment. The pockets of declining air quality result from a variety of anthropogenic and natural factors. Industrial activities, vehicle emissions, local climate and land use zoning may all contribute to 'hotspots' of poor air quality developing. The industrial contributors in the Maluti-A-Phofung area are predominantly light industries, and there is little indication that the levels of industrial emissions are currently cause for concern. However, it is evident from the results of the indicator monitoring procedure (NOX) (refer to Figure 3.1) that vehicle emission levels are of greatest concern and previously unmonitored.

A further priority area within the issue of air quality is the potential for pollution episodes and incidents. Pollution episodes and incidents are short-term accidents and events that affect the immediate air quality of an area. Although of short duration, these events, if they are not managed correctly, may have severe and possibly long-term effects on immediate and surrounding communities and ecosystems.

The Environmental Indicators for National State of Environment Reporting, South Africa, (DEAT 2002a) was used to assist in the selection of indicators of air quality. Both of the Air Quality Indicators listed (DEAT 2002a) have been selected for the purposes of the Maluti-A-Phofung SEMP:

- Sulphur Dioxide (SO2) is colourless, although it exhibits taste and odour at certain levels. SO2 is a precursor to sulphuric acid, which is an aerosol particulate component that contributes towards acid deposition, and affects global climate and the global ozone layer. Anthropogenic sources of SO2 include coal-fired power plants, industrial boilers and diesel vehicle emissions. Health effects of high concentrations of SO2 include bronchiolar constrictions and respiratory infections. The United States has set standards for six air pollutants, one of which is SO2, which is also regulated in many countries throughout the world (Jacobson, 2002). SO2 has historically been monitored using bubblers and titration to measure the acid radical and can now be monitored using simple yet more accurate and cost-effective passive sampling techniques.
- Nitrogen Dioxide (NO2) is a brown gas with a strong odour. NO2 is an intermediary between NO and O3 formation, reduces ozone in the upper stratosphere, and is a precursor to nitric acid, which is a component of acid deposition. High mixing ratios of NO2 can lead to respiratory infections, and may trigger asthma and allergies. Minor anthropogenic sources of NO2

include fossil fuel combustion and biomass burning. NO2 is one of six air pollutants for which the United States has set standards, and is regulated in many countries (Jacobson, 2002). NO2 has not been monitored historically in South Africa owing to relatively complex monitoring techniques, but can now also be monitored using simple, cost effective passive samplers.

In addition to SO2 and NO2, smoke and dust were also selected as indicators for the purposes of the Maluti-A-Phofung SEMP. Dust and smoke are atmospheric particles that can cause human health problems such as respiratory diseases. Dust refers to particles that fall out of suspension, whereas smoke refers to particles suspended in the atmosphere for more than a few hours. Particles sized below PM10 are particularly harmful to human health, as they are small enough to be inhaled, but remain trapped in the lungs where they are unable to permeate the cell walls. The synergistic effect of the PM10 particles with other gases may therefore be cumulative and toxic, especially to the health of humans over a lifetime of exposure. In combination with the monitoring of gases, particulates are thus considered to be a good indicator of health threats.

3.3.1 Driving forces on air quality change

Changes in air quality have historically not been recorded adequately or documented as a result of the lack of governance at local municipal level. Declining air quality may therefore go undetected. In the absence of identification of potential air quality problems, there has been little interest to investigate air pollution-related health issues. The driving forces of to the lack of adequate governance at a municipal level are that:

- Air quality has not historically been considered of significant concern to many municipalities, and air pollution-related health issues have only recently been recognised.
- Air quality monitoring has historically been a costly and time-consuming process.
- There have previously been insufficient funds allocated towards air quality issues of concern.
- There are insufficient skills in air quality issues in many municipalities, with little or no opportunities for staff training and development.
- Previous town planning schemes have neglected to consider the potential influences of local climate on the land use zoning plans, where air pollution from industrial areas and traffic congestion areas may be displaced over residential and commercial areas by local winds.
- The lack of public transport and the distance between residential and commercial/industrial areas (often a legacy of apartheid planning) have caused an increase in vehicle use in certain areas.

3.3.2 Pressures on air quality

- Many municipalities have not recognised air quality and climate change to be fields requiring specific responsibilities, expertise and management.
- Municipalities do not currently have the capacity to identify and address significant air quality issues, as they have previously not recognised the need for skilled personnel in air quality management.
- Municipalities have inadequate data regarding air quality in their municipal areas, particularly historical data for trend analysis.
- Many health institutions dealing with air pollution-related health issues do not have a municipal department available to them to assist in recording, documenting, investigating or addressing these air quality issues.
- Although air quality is recognised by integrated environmental legislation as a field to be investigated in the Environmental Impact Assessment Procedure, it has been largely neglected in actual Environmental Impact Assessment Reports because of the lack of knowledge surrounding the issues.
- Vehicle emissions have become problematic in certain areas as a result of both the increased use of vehicles and the centralisation of commerce or developed of disjointed cities.

3.3.2.1 Governance in relation to air quality

The Maluti-A-Phofung Municipality does not have a department solely responsible for air quality and climate change, with an employee responsible solely for coordinating and managing air quality issues. The Waste Water Department and the Environmental Health Department are both responsible for aspects of air quality and climate change. As a result:

- There is no clear accountability for implementation, enforcement, monitoring, or compliance regarding air quality in Maluti-A-Phofung.
- There has been inadequate air quality monitoring in the Maluti-A-Phofung municipal area for many years, Dated monitoring techniques and monitoring sites have been used on an intermittent basis, especially in recent years, during which the National Survey has virtually ceased in many areas.
- There are many new growth nodes, as well as previously disadvantaged areas where potential air quality and climate changes are expected, but have not been monitored.
- There is no coordinated recording of air pollution-related health issues or air pollution events.

3.3.2.2 Nitrogen Dioxide

NO2 concentrations were monitored during the month of November 2006 and April 2007 for the purposes of the Maluti-A-Phofung SoE. No historical monitoring data was available as this was probably the first time such monitoring had ever been conducted.

The results of the NO2 monitoring indicate that concentrations are low in the areas surrounding the monitoring stations in Maluti-A-Phofung. The ambient nitrogen oxide concentrations were monitored at three monitoring stations, and are represented in a graph (refer to Figure 3.2). Figure 3.2 indicates the ambient NO and NO2 concentrations in micrograms per cubic meter at all three monitoring stations. Research conducted towards the National Environmental Management Air Quality Bill (2006) has determined stringent South African NO2 standards in accordance with international standards (WHO, USEPA, European Union etc.), which are to apply as South African limit values for NO2 concentrations.

The guideline standard for NO2 is 40 micrograms per cubic meter (depicted as the red lines in Figure 3.2). NO2 concentration at all three of the monitoring stations are below this standard, and therefore not currently of major concern. However the levels of concentrations do indicate that future monitoring is necessary as this statement is based on very limited data.

3.3.2.3 Sulphur Dioxide

Monitoring of SO2 concentrations has not been undertaken by the Maluti-A-Phofung Municipality over the past thirty years, and a snapshot monitoring procedure of this indicator was also undertaken in the month of September 2007 and April 2007.

The historical monitoring of this indicator undertaken by the Department of Environmental Affairs and Tourism, National Survey of Air Pollution in South Africa (DEAT 2002b) was not entirely continuous or consistent, but the results are useful for identifying trends. The results of the historical monitoring activities have represented in Figure 3.3. Furthermore there is no big city to compare the Maluti-A-Phofung area with. The nearest city was Bloemfontein and it is been compared to other South African cities in terms of winter SO2 concentrations over a decade, as depicted in Figure 3.4.

Figure 3.4 indicates the long-term sulphur dioxide concentrations in the Maluti-A-Phofung area. The graph indicates an overall decline of SO2 concentrations over the three decades for all three monitoring areas. There was a marked decline of concentrations in the late 1980's and early 1990's, which corresponds with the closure of some of the bigger factories in the area. Monitoring results since the mid-1990s have been somewhat erratic to date, but nevertheless show negligible concentrations of SO2. This was confirmed by monitoring undertaken in November 2006 and April 2007.

Figure 3.4: Long-term sulphur dioxide concentrations within the Maluti-A-Phofung Local Municipality, 2007



Source: Department of Environmental Affairs and Tourism, National Survey of Air Pollution in South Africa (DEAT 2002b) and new info for 2003 and 2005 from Department of Environmental Affairs and Tourism.

Figure 3.5 indicates the average winter SO2 concentrations in South African cities for the period between 1977 and 1996. The Bloemfontein average is relevant to Maluti-A-Phofung, and is one of the higher averages amongst the SA cities. Note that most of the Bloemfontein winter concentrations would have occurred prior to the closing/dormancy of two of the largest SO2 contributors to the area. Therefore, the average is likely to have reduced significantly in more recent years as evident in Figure 3.4.

The reductions in SO2 at Bloemfontein stations are much larger than reductions at stations in other similar-sized South African cities, with Durban actually recording a negative reduction (increase in SO2 pollution) between the two periods. Figure 3.5: Average SO2 concentrations for South African cities between 1977 and 1996 (winter mean). Data sourced from the Department of Environmental Affairs and Tourism, National Survey of Air Pollution in South Africa (DEAT 2002b).



The results of the short-term SO2 monitoring that was undertaken for the purposes of the Maluti-A-Phofung SEMP further confirms that concentrations are currently very low in the areas surrounding the monitoring stations in Maluti-A-Phofung, Figure 3.6 indicates the ambient SO2 concentrations in micrograms per cubic meter. Research conducted towards the National Environmental Management Air Quality Bill (2003) has determined stringent South African SO2 standards in accordance with international standards (WHO, USEPA, European Union etc.), which are to become the new South African standards for SO2 concentrations. The annual limit value for SO2 is 50 micrograms per cubic meter (depicted as a red line in figure 3.5). SO2 concentrations in the Maluti-A-Phofung area are well below this standard, and therefore not currently of major concern. The reasons for these very low readings are likely to be related to land uses in Maluti-A-Phofung is not an industrial node, and therefore has more handmade and other processing activities than fossil fuel burning industries. Electrification of many residential areas in recent years would also have reduced SO2 emissions from domestic sources.



Figure 3.6: Ambient SO2 concentrations within the Maluti-A-Phofung area, 2007

The current status of SO2 in Maluti-A-Phofung where emissions meet the SA standards may therefore be jeopardised if municipal intervention does not take place.

3.3.2.4 Smoke and PM10

Monitoring of smoke and PM10 concentrations has also not been undertaken by the Maluti-A-Phofung Municipality over the past thirty years, and an instantaneous (ten-minute average) monitoring of PM10 was also undertaken in the month of November 2006 and April 2007. Because there were no consistent and continuous historical monitoring indicators undertaken by the municipality the existing results are useful for identifying trends. The results of the historical monitoring activities are represented in a graph (Figure 3.6). Furthermore, Maluti-A-Phofung was again been compared to other South African cities in terms of winter smoke concentrations over a period of thirty years, and the comparison is depicted in Figure 3.7. Figure 3.7 indicates long-term smoke concentrations in the Maluti-A-Phofung Municipality area. The graph indicates an overall decline of smoke concentrations over the nearly three decades. There was a marked decline of concentrations in the 1990's, which corresponds with the extension of electricity worsening to a lot of the existing and new residential areas. Monitoring results since the mid-1990s have been erratic to date, but show negligible concentrations of smoke. This was confirmed by monitoring undertaken in November 2006 and April 2007 who found respirable dust readings at the three monitoring areas were well below 20 micrograms per cubic meter for all samples.

Figure 3.7: Long-term smoke concentrations (Summer and Winter) within the Maluti-A-Phofung municipal area over the past three decades. Data sourced from the Department of Environmental Affairs and Tourism, National Survey of Air Pollution in South Africa (DEAT 2002b)



Figure 3.8 indicates the average winter smoke concentrations in South African cities for the period between 1977 and 1996. The Bloemfontein average is the

nearest city and can be relevant to Maluti-A-Phofung Municipality, and is the second highest average amongst the South African cities.

Note that most of these relatively high Bloemfontein readings would have occurred prior to the closing/dormancy of two of the larger smoke contributors to the area and is attributed to the intentional proximity of the permanent monitoring stations. Therefore, the average is likely to have reduced in the recent years.

Monitoring and planning is essential from a municipality perspective to protect the relatively good air quality. In Maluti-A-Phofung Municipality there must be some planning to reduce the smoke levels during winter time.

Figure 3.8: Average smoke concentrations for South African cities between 1977 and 1996 (winter mean). Department of Environmental Affairs and Tourism, National Survey of Air Pollution in South Africa (DEAT 2002b)



The state of air quality as experienced and reported by the community of Maluti-A-Phofung Local Municipality is listed in the table below:

Issue	RURAL QWAQWA & PHUTHADITJHABA	HARRISMITH, INTABAZWE, SWINBURN & VAN REENEN	KESTELL & THLOLONG
Smoke pollution in winter from fuel wood and coal fires spread across entire city	Entire area and it even get worst towards the mountains	Entire area	Entire area except for the north westerly side of the town
Heavy cloud from incinerator at landfill sites pollutes areas at certain times	Some refuse dumps and surrounding areas	Main refuse dump and surrounding areas	Main refuse dump and surrounding areas
Burning of plastics and tyres at landfill Dumping sites	Some refuse dumps and surrounding areas	Main refuse dump and surrounding areas	Main refuse dump and surrounding areas
Incorrect storage and prolonged exposure to Benzine at filling stations could cause cancer	All filling stations	All filling stations	One filling station
Odours from sewage treatment plant	No problem	No problem	No problem
At times dust bowls from surrounding farms, as well as unvegetated areas within urban areas, are apparent.	Especially in the Northern and Western areas	Eastern, Northern and Western areas	Eastern and Northern areas
Noise pollution have already seriously reduced the number of bird species within the area	In the centre of Phuthaditjhaba	No problems except near the N5 route from Bethlehem and N3 route to and from Durban. A lot of noise from trucks	No problems
Noxious odours from land uses such as abattoirs, pig farms, brick making, spray painting, where they are to close to the residential areas.	In Phuthaditjhaba near the Thabo Mofutsanyana Municipal offices where they make bricks	No problems	No problems

3.3.2.5 General comments on air pollution

- Air pollution is more concentrated in certain areas as a result of past land use zoning inadequacies, local climate and urbanisation. For example, there is a potential concentration of vehicle emissions in the main centre of Phuthaditjhaba area, near the Taxi ranks of the central business district (CBD).
- Domestic burning in the different towns in the Maluti-A-Phofung Municipality area has contributed to air pollution and it has been reported as an ongoing complaint in public forums.
- As there has been no historical monitoring of the air quality in Maluti-A-Phofung Municipality, there is insufficient information to determine whether air quality is of concern in these areas. However there have been complaints of smoke and odours from previously disadvantaged areas, which have been brought to the Municipality's attention through community forums and workshops hosted for the SEMP.

3.3.3 Impacts of current air quality

There are no comprehensive or fully inclusive monitoring and control strategies available for the Maluti-A-Phofung Municipal area. This applies in particular not only to the formerly disadvantaged areas but to all areas. As a result there is no conclusive information regarding the state of air quality in Maluti-A-Phofung Municipality, and therefore no clear understanding of the status of air pollutionrelated health issues within the Municipality. This needs to be addressed by further research.

It is inevitable that price incentives and the marketing companies in the media, will lead to preference for leaded petrol being converted to preferences for unleaded petrol. Whilst reduction in ambient lead levels is anticipated as a result of this change in consumer behaviour, of burning unleaded fuel in vehicles not fitted with catalytic converters is likely to result in an increased ambient concentration of other indicator pollutants such as NOX. Concerns over health effects resulting from incorrect use of unleaded fuel will therefore continue until such time as all vehicles are fitted with catalytic converters. In this area, there are older model cars than in the average other bigger cities that can contribute to the above mentioned problems.

3.3.4 Responses to current air quality

Due to insufficient attention having been paid to air quality and climate change at a municipal level in the past, there has been little response to issues of air quality. However the Maluti-A-Phofung Municipality is currently investigating the state of the environment within the municipal area, with a chapter dedicated to climate change and air quality issues. The Maluti-A-Phofung Municipality SEMP is an important response that will allow the Municipality to effectively identify, plan for, monitor and manage issues in the future. The government has responded to issues of air quality concern by creating protective legislation such as the National Environmental Management Air Quality Bill (2003). In anticipation of the imminent promulgation of the new Air Quality Bill, a draft Directorate on Economic Development and Planning for the Maluti-A-Phofung Local Municipality focuses on improving and sustaining the environment of the Maluti-A-Phofung Local Municipality. Air quality is considered a natural resource and will therefore be protected under this Directorate with the legal backing of the new Air Quality Act, once in place.

The community raised concerns over issues regarding air quality, and has therefore responded by creating a community and municipal awareness. In particular, Phuthaditjhaba has recognised problems associated with air pollution, noise pollution and odours, and have brought air quality issues to the attention of the Municipality.

3.4 Conclusion

The task of creating a meta-database contributed to determine that historical monitoring and recording of air quality issues in the Maluti-A-Phofung Municipal area are inadequate. It was further established that the governance of air quality at a municipal level was one of the probable causes of the inadequate monitoring and record keeping. It is acknowledged that the significance of air quality and climate change is only recently being recognised at a national level, and only now becoming a municipal responsibility as a result of the anticipated promulgation of the National Air Quality Management Act, which for the first time in 38 years rests accountability with the local municipality for all sources within its geographical boundaries.

As a result of this legacy, there is insufficient information:

- Regarding historical air quality issues in the Maluti-A-Phofung Municipality area.
- To determine air quality trends for some key pollutants in the Maluti-A-Phofung Municipality area.
- To determine potential health effects on the Maluti-A-Phofung Municipality community.

Further to this, the monitoring procedures undertaken by Rouzyl Consulting were "snapshot" monitoring procedures, recording the air quality indicators over two month only, and utilising the historical monitoring sites. However, the findings indicate that air quality in Maluti-A-Phofung Municipality is relatively good compared to similar South African cities, although certain areas, as pointed out in this chapter will require attention. Furthermore, this monitoring exercise proved that modern monitoring techniques can be specific and relatively cost-effective, providing much needed ambient air quality data.

All findings from such a survey of short duration must naturally be viewed with caution, especially as the historical data on such parameters are either are lacking or no longer considered scientifically adequate (as is the case for smoke measured by the soiling index). The air quality of all the areas in Maluti-A-Phofung is still relatively unknown, and many air quality issues may therefore go undetected.

For example, community forums can play an important role in Phuthaditjhaba, Harrismith and Kestell to aired complaints by residents who regard smoke pollution and odours as major environmental issues, possibly caused by domestic burning etc. It is therefore imperative that monitoring programmes are established in these areas and other new growth nodes where the air quality issues are evolving in association with the dynamics of the land use.

CHAPTER 4: FRESH WATER RESOURCES

4.1 Introduction

South Africa is located in a semi-arid part of the world where water resources are scarce and extremely limited in extent. Water, as an important input in the economy, can be a factor limiting economic growth and social development and in some areas in South Africa water scarcity is closely related to hunger, disease and poverty (Basson, 1997).

From a municipal perspective it is important to investigate the present freshwater water balance and management, water quality and ecosystem integrity in a municipal area. Fresh water and the resources are also important for development in an area like Maluti-A-Phofung.

Freshwater Inland Water Systems are affected by two main drivers, natural (e.g. climate) and anthropogenic (e.g. development). These drivers cause certain pressures on inland waters, which result in impacts on freshwater resources, either by changing the quantity of ground and/or surface water, and/or by changing the quality of ground and/or surface water (DEAT, 2002).

The main drivers of change on inland waters and the main areas of impact of these drivers are presented in Figure 4.1 (DEAT, 1999). As from chapter 3, the global warming effect on the area or country can have a great effect on the climate of the environment (refer to figure 3.3 (a), (b) and (c), chapter 3).

The purpose of this chapter is to identify and discuss the relevant indicators which provide an accurate description of the present state of the freshwater and other water resources in the Maluti-A-Phofung Municipal area as indicated in table 4.1.

The available data on the mentioned indicators in figure 4.1 and table 4.1 were collected and summarised in this chapter to show the positive effects but also to identify the gaps where water management can be done in a better way.

Data were collected from various sources such as DWAF, DEAT, Department of Water Affairs, Free State Technikon and Maluti-A-Phofung Municipality. Data were summarised using graphs as well as a short discussion on the present state of the freshwater and other water resources in the Maluti-A-Phofung Municipal district.

Figure 4.1: Main driving forces affecting South Africa's inland water resources (modified from DEAT, 1999)



DESCRIPTION OF ISSUE	INDICATOR(S)		
Water balance	and management		
Water is scarce in the catchments due to limited and variable rainfall, very little runoff potential due to low gradient and destruction of riparian vegetation (DEAT, 2002)	 and management Mean volume of precipitation onto catchments Total water available per capita Intensity of use of surface water resources Intensity of use of ground water resources Total surface water used per sector Total surface water resources available per capita People dependant on ground water resources Surface water affordability (piped water)* 		
	•Total ground water resources per capita		
	•Level of service		
Water	Quality		
Water is scarce in the catchments and	 Surface water salinity 		
this emphasises the need for	•Ground water salinity*		
managing impacts on the water	 Surface water nutrients 		
quality in the area. Water quality has	 Ground water nutrients* 		
an impact on the effectiveness of use,	 Surface water microbiology 		
ecosystem integrity as well as the	•Ground water microbiology*		
cost of purifying water for human	 Surface water toxicity* 		
consumption and use (DEAT, 2002).			
Freshwater	ecosystem integrity		
Changes in flow and or water quality	 Riparian vegetation 		
impact on ecosystem integrity either	 Aquatic macro-invertebrate composition 		
by affecting freshwater habitat and/or	 Fish community health (FAII) 		
the number and diversity of species present (DEAT, 2002)	 Aquatic habitat integrity 		

Table 4.1: Indicators for freshwater resources

* Indicators not included in this report due to lack of data but which should be included for future reference

4.2 Water Balance and Management

Maluti-A-Phofung Municipal area lies within the Drakensberg Water Management Area of South Africa. Water resources are not always situated where the demand is and water transfer schemes are often necessary to augment supply. Limited freshwater resources (surface and ground water) influence various other issues namely flood and drought management of water resources, inadequate and inequitable distribution of services, conflicting interests over water sharing as well as the degradation and loss of freshwater ecosystem integrity (DEAT 2002). All of the above mentioned issues have an influence on the sustainability of the resource.

4.2.1 Driving Forces [water quantity and demand]

Maluti-A-Phofung Municipality lies mainly within a summer rainfall area in South Africa (see figure 4.2) where the mean annual precipitation is 735 mm per annum and the highest rainfall usually occurs during January to March and from October to December. The climate is less dry than the rest of the Free State but sometimes the unpredictable rainfall and high evaporation level of 1 252 mm/a (Basson, 1997) as well as the runoff of 802 x 106 m3. (DWAF, 2002) are the main driving forces of freshwater resources in the area. The limited resource available has an influence on the affordability and availability of freshwater in the area.



Figure 4.2: Rainfall figures for Maluti-A-Phofung, 2000 - 2007

Increasing development, population growth, changing lifestyles as well as increasing demand for water and over abstraction of ground water all have an effect on the availability of water for consumers.

4.2.2 Pressures on water volumes

The total use of surface and ground water as well as the intensity of use of surface and ground water exerts pressure on the freshwater resources in the area. To manage the resource it is necessary to know how it is being distributed between different users. This could lead to more efficient water utilisation, particularly in conditions of limited water resources (DEAT, 2002).

Total surface and ground water used per sector measured in million m3 per annum highlights the distribution of water between users. It is determined by the ratio of estimated total water demand in the area to the total surface or ground water resources available in the same area, expressed as a percentage.

The total surface water used per sector in the Maluti-A-Phofung Municipal area is summarised in figure 4.3.





The dominant water use in the Maluti-A-Phofung Municipality area is for urban use (72%) because irrigation is not a high priority in this area. The second largest requirement for water in the area is for rural use. Very little water is used for mining and industries in the area. (See Figure 4.3).

The intensity of use of surface water in the Maluti-A-Phofung Municipality area is calculated by dividing the estimated demand by the total available resource expressed as a percentage. This gives a clear indication of the water resource utilisation in the specific area.

The estimated total water demand in the Maluti-A-Phofung Municipality area is 42,253 million m3/a (personal communication: Maluti-A-Phofung Municipality) and the estimated total available water resource is 94,310 million m3/annum (based on data for the Catchment areas for 2006). The intensity of use of surface water in the Maluti-A-Phofung Municipality area is 44, 8% which shows that the demand on the available water is not placing strain on the resource at present.

4.2.3 State and impact of current water quantities

The state of an issue (water quantity) refers to the condition of the environment resulting from the pressures i.e. level of total resources available per capita.

Water availability in catchments must be assessed in the light of the demand placed on that water by users. This gives an indication of the stress under which the catchments are placed. Total water available per capita refers to all water which can be available for practical application to desired uses. The total yield available locally includes the water available from both local surface water and ground water resources as well as contributions by usable return flows from the non-consumptive component of upstream water use in the area under consideration. This includes water transferred from elsewhere (DWAF, 2002).

After allowance for the impacts on yield of: ecological component of Reserve, river losses, alien vegetation, dry land agriculture and urban runoff. In Maluti-A-Phofung Municipality area the total local yield of surface water resources is 94.310 million m3/annum (based on data for 2006). This total local yield applies to all the catchment areas in the area. The total local yield of ground water resources is 8 million m3/annum which is also given for the catchment areas (DWAF, 2002).

The local yield of surface water and ground water plus the usable return runoff gives the total local yield of water available in the Maluti-A-Phofung Municipality area = 102 m3/annum. No transfers of water take place on the moment, except for the Tugela water transfer to the Sterkfontein Dam.

4.2.4 Comparison between water requirements and water availability

The total water resources available per capita indicates a level of water stress (Figure 4.3) and a comparison of water available to water required would give a true indication of the actual water stress in the Maluti-A-Phofung Municipality area.

Eleven of the 19 Water Management Areas in South Africa face a water deficit (DWAF, 2002). The local catchment in the Maluti-A-Phofung Municipality area has on this stage more water than the demand for water. Population growth in the area and increasing urbanisation would result in the requirements that may exceed the availability in the near future. This is another reason why SEMP will play an important role in water management in the area.

The state of water balances and management as experienced and reported by the community of Maluti-A-Phofung Municipality area is listed in the table below:

ISSUE	RURAL QWAQWA & PHUTHADITJHABA	HARRISMITH, SWINBURN, VAN REENEN &	KESTELL & THLOLONG
Proper controls needed for extraction volumes from rivers for irrigation	Rivers not in use for irrigation purposes - No serious problems	Yes from the Wilge river	Rivers are used but the but the control measures are proper.
Purposes. Insufficient water runoff infrastructure leading to flooding of residential areas	All the wards in Qwaqwa	Some of the lower lying areas in Harrismith and Tshiame	No problems
Water accumulate in old quarries near residential areas	No problems	No problems	No problems
Families living in storm water channels	Some informal houses in storm water channels	No problems	No problems
Need for protection of vegetation in natural catchment areas to preserve water and prevent erosion	Entire area	Entire area	Entire area
Stealing of water taps and vandalism of water meters	In some wards	In some wards	In some wards

Table 4.2: Community experiences of water balance and management, 2007

4.2.5 Responses to available water quantities

Surface water affordability highlights the economic cost of water to individuals. The affordability of surface water can be calculated by dividing the total available surface water by the disposable income in the area.

Unfortunately Statistics South Africa and also Bureau of Marketing Research have indicated that they do not have any data newer than 2001 regarding disposable income. As no recent data are available for the Maluti-A-Phofung Municipality area at present the surface water affordability could not be calculated, but it should stay as an indicator until data becomes available.

The level of service of Maluti-A-Phofung Municipality area is summarised as follows: 89% of all erven have at least RDP (standards) of water (access within a 200 m radius) but 47% are without water connections on the erf.

Responses to the Water Balance and Management Issue at a National Level is the development of a National Water Resource Strategy, the setting of Ecological Reserves for all rivers in South Africa, and creating water transfer schemes to supplement water where available resources are lower than the demand. The licensing of users ensures equitable and efficient water use.

4.3 Water Quality and Management

Water quality is one of the most important aspects of water management in South Africa. As water quality has an effect on all aspects of water management, namely water quantity, availability of water, affordability of water for consumers etc. it should be researched intensely. Changing water quality results in impacts on the effectiveness of use as well as on the ecosystem integrity (DEAT, 2002). Deteriorating water quality also leads to increased treatment costs and threatens the sustainability of the resource. Water quality in the Maluti-A-Phofung Municipality area was determined by data collection for the salinity and nutrients in the Wilge River, which is the main river in the area.

4.3.1 Driving Forces and pressures affecting water quality

Natural driving forces and pressures are the natural processes such as geology, flow etc. which influence the quality of water in a catchment. The loss of habitat due to anthropogenic as well as natural processes such as drought could also influence the water quality.

Socio-political and economic drivers and pressures are increasing development, which is linked to increasing population. These factors influence the catchment by causing increased discharges, acid mine drainage in some instances, river regulation, changing land use, insufficient or incorrect farming practices, inadequate waste disposal etc. (DEAT, 2002).

4.3.2 State of water quality

Salinity is the extent to which natural water has been enriched by salts, for example Na, Mg, K or Ca combined with SO4 or Cl, expressed as TDS (Total Dissolved Solids) in mg/l. Industrial, chemical and mining activities as well as irrigation are often the factors responsible for elevated salts. Increased salinity reduces the suitability of the resource use for human as well as for ecological purposes (DEAT, 2002).

The surface water salinity in the upper reaches of the Wilge River (UM, UMM) is low compared to the benchmark values provided in the South African Water Quality Guidelines (DWAF, 1996). The water is suitable for irrigation. The surface water salinity has not deteriorated in the upper reaches of the Wilge River for the period 2001 to 2006.

All the rivers (including the Wilge River) have low TDS concentrations in 2001 but this improved in 2002 and 2003. The concentrates, however is low enough which makes the surface water still suitable for irrigation but may be less suitable for domestic use.

The nutrients in surface water expressed as the ratio of total inorganic nitrogen to orthophosphate provides an indication of the enrichment of surface waters with dissolved nutrients. These dissolved nutrients can lead to increased algal growth (eutrophication) which could lead to depletion of oxygen. The suitability of use of freshwater systems is severely affected by eutrophication, with toxic algae, odours, taste and blocked filters being common problems (DEAT, 2002).

Trends over time show either deterioration (reduced ratio) or improvement (increased ratio) in the nutrient concentration. The nutrient concentration in the different rivers stayed relatively constant in the past 5 years, but it is important to keep on monitoring the nutrient concentration for the future.



Figure 4.4 (a): Surface water TDS (mg/l) for the Wilge River from 2001 to 2006.

Surface water – not a problem near the Wilge River, but must be managed in future

Figure 4.4 (b): Surface water TDS (mg/l) for the Kestell environment from 2001 to 2006.



Surface water sanity - must be managed in future

Figure 4.4 (c): Surface water TDS (mg/l) for the Phuthaditjhaba environment from 2001 to 2006.



A high nutrient content of the surface water can be an area of concern as high nutrient levels lead to eutrophication. All the rivers in the area falls out of the eutrophic range which means that these waters display not such high concentrations of nutrients and an associated low biomass production and usually higher levels of species diversity. With higher levels nutrients, a lot more nuisance growth of aquatic plants and blooms of blue-green algae is present, which means that it may include species which are toxic to man, livestock and wildlife.

Surface water microbiology gives an indication of the concentration of Escherichia coli in surface water resources. E.coli, a member of the group of faecal coliform bacteria, has the important feature that it is highly specific to the faeces of humans and other mammals. These bacteria are used as an indicator of faecal pollution. This also gives an indication of the fitness for use of water resources.

Data were received from the National Microbiological Monitoring programme for three sites in the Maluti-A-Phofung Municipality area. An average of E. coli counts per 100 ml of water per year from 2001 to 2007 is given in Figure 4.5.



Figure 4.5: Average E. coli counts/100 ml water per annum for 2001-2006.

As can be seen from figure 4.5, there is no immediate danger about the water quality in Maluti-A-Phofung Municipality area. The guidelines for faecal coliforms note that less than 10 counts per 100 ml may cause infections in some sensitive groups (low potential health risk). Up to 100 counts per ml will commonly cause infections, even after a single consumption (Murray, 1999) so it is clear that the

counts of E. coli for the sites at the three different areas (figure 4.5) are a little bit higher than the guidelines for safe use. It is important that sewerage water must be managed not to contaminate the water in the different streams and rivers.

The state of water quality as experienced and reported by the community of Maluti-A-Phofung Municipality area are listed in the table below:

Tuble 4.0, Community cope	match quality,	2001	
ISSUE	RURAL QWAQWA & PHUTHADITJHABA	HARRISMITH, SWINBURN, VAN REENEN & INTABAZWE	KESTELL & THLOLONG
General pollution of waterways such as the storm water channels or even directly in streams and dams with garden refuse, surface pollution, chemical pollution from factories, washing and vehicle and dead animals	Pollution from factories (in Phuthadithjaba), waste disposals, etc. in all the wards. Waste management must be done more orderly and properly	Pollution from waste.	Pollution from informal settlements
Water pipes bursting collects sewerage waste and transports it down stream	Reported in most areas in Phuthaditjhaba	Reports from some areas in Intabazwe and Harrismith residential areas	Not an every day problem
Absenceofpropersanitationpotentiallycausingpollution ofgroundwatersourcesthrough pitlatrines	Informal settlements	Informal settlements	Informal settlements
Insufficient and/or blocked sewerage systems overflow into water ways such as storm water channels and even rivers and streams	A overall problem on a regular basis	A overall problem on a regular basis	Not a big problem, but at some times

Table 4.3; Community experience of water quality, 2007
4.3.3 Impacts of water quality

As a result of nutrient enrichment of the freshwater system, eutrophication takes place. The impacts on the water purification plants, making purification difficult and more expensive. These costs are then passed on to the consumer who has to pay more for the water he uses. This is why management of water and especially surface water is so important. Better management will save money for both the Municipality and the consumer of water.

4.3.4 Responses to water quality

Several strategies have been developed at national level to deal with the increasing water quality problem in South Africa. A National Water Resource Strategy to help with the identification and solution to pollution problems associated with freshwater systems has been developed. Catchment Management Agencies are being established so the general public as well as other stakeholders have a more hands-on approach to the management of the water resources in the area. Water quality guidelines have been set which helps with the identification of pollution problems by identifying where the standards are not adhered to, and dealing with the problem. Effective implementation, management and monitoring of policy, plans and programmes are essential. The "polluter pays" principle also helps control pollution events.

The National Microbiological Monitoring group as well as the National Eutrophication Monitoring group has been established and they follow a program of monitoring throughout South Africa's freshwater systems. It is thus important for the Maluti-A-Phofung Municipality to make contact with this group and be part of the monitoring system.

Municipalities have the responsibility to upgrade from informal to formal sewerage systems, improve treatment systems and to make provision for increasing urbanisation, which results in added pollution potential.

4.4 Freshwater Ecosystem Integrity

Ecosystem integrity of surface water systems gives an indication of the health of the ecosystem which includes all aspects such as macro-invertebrates, fish, riparian vegetation, habitat available etc.

Bio monitoring of the Wilge and other Rivers and tributaries as part of the River Health Programme provides information on the present state of the ecosystem.

4.4.1 Driving Forces and pressures affecting ecosystem Integrity

The degradation of water chemistry, flow regulation, changes in volume of water, land use and climate change are all drivers which have an influence on the

ecosystem integrity of freshwater. The introduction of exotic species and the presence of microbiological contaminants place pressure on the existing components of an ecosystem.

4.4.2 State of freshwater ecosystems

The loss of ecosystem integrity, that is the loss or degradation of riparian vegetation, available habitat for macro invertebrates and fish and a reduction in the resilience of the ecosystem cause economic and social problems such as an increase in waterborne diseases etc. The price of water for the consumer is also affected as it costs more to purify water from a degraded system.

The Riparian Vegetation Index (RVI) measures the extent of and status of the riparian vegetation of a river system (Kemper, 2001). The riparian vegetation is important to the ecological, geomorphologic as well as the social roles of a river system; it has an influence on flood attenuation, stabilisation of the river channel and banks, provision of habitat, provision of fuels, materials and medicines for the local communities (DWAF, 1999).

The Riparian Vegetation Index is determined by assessing the extent of vegetation cover, and the structural intactness of the riparian vegetation. The percentage cover and recruitment of indigenous riparian species is also assessed. Riparian Vegetation falls in a class (b) at all the sites on the Wilge River for 2006, which means that it is a moderately modified state. A loss of natural habitat and biota has occurred but the ecosystem functions are still predominantly unchanged. There has been some improvement in the Riparian Vegetation at all sites from 2002 to 2006.

SASS5 is the South African Scoring System version 5, which measures macroinvertebrate community diversity and abundance in river systems. Macroinvertebrates are sensitive to various water quality changes and a scoring system was developed to provide a sensitivity rating (1-15) for invertebrate families according to their intolerance (high score) or tolerance (low score) to pollution in the system. The sensitivity scores of all families present at the sampling site at the time of sampling is added and an ecological class is allocated to that particular site. (Table 4.5)

Colour code used in report	Ecological state of the river	Description
BLUE (91 to more than 120)	Natural	No measurable modification
GREEN (71 – 90)	Good	Largely unmodified
YELLOW (61 – 70)	Fair	Moderately modified
RED (30 – 60)	Poor	Largely modified
BLACK (Less than 30)	Severely Modified	Modified beyond rehabilitation to natural

Table 4.4: Ecological state classes according to SASS5 scoring system for
rivers in the Highveld region (adapted from DEAT, 2002)

All the sites in the Wilge River and its tributaries currently present in a good ecological state. This indicates the river is fine with a water quality class that is good enough. No rehabilitation is urgent necessary, but it is important to manage it on a constant basis. Fish Community Health, measured using the FAII (Fish Assemblage Integrity Index) provides an indication of the biological integrity of rivers. The FAII is also used to determine modifications from normal conditions, such as flow modification, water quality changes and the introduction of alien fish.

The FAII categorises indigenous fish populations in a biological river segment according to intolerance rating. This intolerance rating takes into account trophic preference and specialisation, requirement for flowing water during different life-stages, and association with unmodified water quality. Results of the FAII are expressed as a ratio of observed conditions versus conditions that would be expected in the absence of human impacts (Kleynhans, 1999).

The FAII score rates the Wilge Rivers as of good biological integrity, which indicates that the river is not largely modified in these sections. The Habitat Integrity Assessment (IHI) (Kleynhans, 1996) is a qualitative procedure for the assessment of the habitat integrity of a river system. Habitat integrity is assessed according to 9 in stream and 8 riparian criterions, including the following:

In stream criteria	Riparian criteria
Water abstraction	Indigenous vegetation removal
Flow modification	Exotic vegetation encroachment
Bed modification	Bank erosion
Channel modification	Channel modification
Water quality	Water abstraction
Inundation	Inundation
Exotic macrophytes	Flow modification
Exotic fauna	Water quality
Solid waste disposal	

 Table 4.5 Assessment of the habitat integrity of a river system

In stream criteria riparian criteria

Each criterion is assessed according to 6 descriptive classes allocating a score between 0 and 25. Each criterion is weighted according to its specific importance and use to calculate an overall habitat integrity score for both the in stream and riparian zone per predetermined section of the river (usually 5km sectors). The result is presented in 6 descriptive classes ranging from unmodified natural to critically modified (DEAT, 2002).

The Riparian Habitat Integrity of the Wilge River and some of the other rivers are not too poor, which indicates that the river system is not largely modified. A large

loss of natural habitat, biota and basic ecosystem functions has not yet been occurred. Surface water toxicity is a measure of the result of an impact on a surface water resource on people and the ecosystem.

The National Water Resource Strategy and National Environmental Management Act make provision for the identification as well as the mitigation of ecosystem degradation. The setting of an Ecological Reserve and the licensing of water users will improve the ecological integrity of a freshwater ecosystem as it will protect the amount of water needed for the biological or ecological component of the system to function naturally.

4.5 Conclusion

Freshwater resources in the Maluti-A-Phofung Municipality area are threatened by the impacts from urbanisation. The increasing population in the area and facilities such as sewerage works which do not have the capacity to handle the effluent is an area of concern.

The freshwater resources available in the area are not over utilised at present and there are extra water available for urban use. Provision for the future will have to be made to ensure the sustainable use of the resource on the long run.

Although the freshwater resource is not being overexploited at present, the resource is being polluted at a slow rate but it must serve as an alarm for managing these resources. This problem will have to be addressed in the near future as pollution of a resource has economic as well as social impacts. Water purification is more expensive when water is polluted and these costs have to be absorbed by the consumer. Health risks as a result of poor water quality are also increasing in the area at a slow rate.

CHAPTER 5: LAND USE

5.1 Introduction

The Free State province is known as the Big Sky country because of its vast open spaces of land and within Maluti-A-Phofung with its 4421 sq km in area, a dynamic relationship exists between the sustainable preservation of land and the development thereof for social and economic purposes. There is not a lot of farming and industrial activities in this part of the province but any development will depend on the sustainability of the land resource base for their success. For the increasing number of impoverished citizens of Maluti-A-Phofung the land provides means for securing food, fuel, construction material, economic activity and cultural expression. Land degradation in all its forms (erosion, loss of vegetation cover and chemical imbalances) leads to a significant reduction of the productive capacity of the land and is often a precursor to desertification.

The major land uses within the Maluti-A-Phofung area are agriculture, grassland (degraded and unimproved) and urban, built up land. Although agriculture is a key industry of South Africa's economy (NDA, 2000), it is even more so within the rural areas of the Free State province. It is not the most important part of the economy in Maluti-A-Phofung, but a lot of households are in some way directly or indirectly dependent on agriculture and subsequently productive land. This is why it needs to be monitored closely to ensure sustainable utilisation for economic and social development within the Municipality. To measure the long term sustainable use of the land three key issues were identified for investigation, namely the current uses of land and demand for more land, the condition of land and lastly the management of cultural heritage, as indicated in the table below:

DESCRIPTION OF ISSUES	INDICATOR(S)	
Land	Use	
The current land uses and future	 Land use patterns 	
land demand for various uses	 Green space per settlement 	
forms the basis for land	•Land reform	
pressures.	•Land cover	
Land	Condition	
The condition of land determines	Desertification	
its productivity and relative value	•Soil loss	
toward economic development.	Land degradation	
Cultural	Heritage sites	
Cultural heritage sites are under	 Heritage resources available for all wards 	
direct pressure from competing	 Number of Heritage resources in serious 	
land uses.	Need of repair, •% of heritage sites/resources	
	with management plans. Number of buildings	
	demolished or altered .•By-laws formulated and	
	implemented in terms of NHRA	

Table 5.1: Indicators of land issues

Cultural heritage was specifically included in this chapter and although this issue would also relate closely to human well-being it was felt that the major pressures on cultural heritage areas are due to land demand issues. Furthermore the effective current and future management of the municipality's responsibilities under the National Heritage Resources Act would best be integrated within a Planning Unit of the Municipality, which would, in turn, also be responsible for other land related issues.

5.2 Land use and demand

As indicated above, the Maluti-A-Phofung municipal area is still dominated by vast open areas of natural vegetation, but the land is under constant pressure from development activities, degradading agricultural practices and pollution. Urbanisation is estimated at 87%, and the area around Qwaqwa is considered to be the most urbanized part of the Maluti-A-Phofung municipality, except for the Mangaung area (see Chapter 8).

As for most settlements within South Africa, the landscape of Maluti-A-Phofung was shaped by inequitable land and development policies and has resulted in (a) disparities in land development and quality and (b) severe land degradation. This land legacy has resulted in a large proportion of residents still being caught up in subsistence lifestyles, directly dependent on natural resources to meet their nutritional, medicinal, housing and energy needs (Ballance, 2001). Redressing of these historical differences exerts further pressures on the available land resources by demand for development related uses such as housing, social facilities, infrastructure and economic activities.

5.2.1 Driving Forces and pressures for land uses

The key driving force behind land use is increasing competition between various social, economic and natural functions for available land. Although natural habitats and natural species diversification (see Chapter 6) aim to expand natural land use, in these competing human activities mainly dictate use, and apart from undevelopable and inaccessible areas, natural land use only occurs where human activities dictate and decide so.

Thus it is most relevant to distinguish the driving forces behind human land use, as indicated by Table 5.2:

DRIVING FORCES	DESCRIPTION
Natural characteristics	Fertile soils are not evenly spread and
	this drives the locality of
	(Myore 1985) The general
	(Myers, 1903). The general
	effect on land uses (both
	agricultural and economic e.g. coastal
	tourism destinations) and
	urban expansion due to a potentially
	lower concentration of people.
Population growth	Population growth over generations has created a natural demand
	for all human habitation of land, whether for residential, social,
	cultural or economic functions and an
	area with higher population
	growth rate experiences equally higher
	demand for all resources,
Political policies and migration	The past aparthoid policies of
	segregation had a profound impact
	migration on land use patterns in terms
	of unequal access to land, forced
	placement (which created higher
	populations in specific areas) and
	the economic migration system, which
	influenced land uses and
	pressures.
Economic structure	It is evident that the Maluti-A-Photung's
	agriculture and this drives the current
	agricultural uses as well as the demand
	for more agricultural land.
	As the economy diversifies. an
	increase in demand for other economic
	uses exerts pressure on pristine areas
	(e.g. for tourism development) and
	agricultural land.

Table 5.2: Driving forces for land use

5.2.2 State of land use

The land cover for the municipal area is indicated below. It is evident that the main cultivated land parcels are found in the northern and western areas, while the eastern areas are characterised be disturbed vegetation.



Figure 5.1(a): Land Cover and broad land use patterns, Harrismith, 2006



Figure 5.1(b): Land Cover and broad land use patterns, Kestell, 2006



Figure 5.1(c): Land Cover and broad land use patterns, Phuthaditjhaba, 2006

From the maps (figures 5.1 (a), (b) and (c)) it is evident that the broad land uses within the rural areas of the Municipality is characterised by some maize and wheat production in the east, north west and west and stock farming and subsistence farming in the areas around Qwaqwa. Rather than soil condition or

productivity, these patterns were determined by the existence of former homeland areas around Qwaqwa, with extensive areas of small farmers, either on the former Trust lands around the Drakensberg side of Qwaqwa, or newly resettled lands around the eastern and north eastern side of Qwaqwa. All the predominant agricultural uses within the Municipality are dependent on sustained biological productivity of the land and may also adversely affect the quality of the land. In the western areas monocultures and soil salination should be managed, while overgrazing and potential erosion should be monitored in and around Qwaqwa.

Within the urban areas of the Municipality the demand for residential land is currently a major issue within all areas surrounding the three main towns. Although it is extremely difficult to determine the exact housing and land need of the formal markets, the table below provides an overview of the demand for residential land due to the informal settlements within various areas:

Area	Informal housing units – 2001 (growth rate since 1996 = 47%)	Estimate land required (sq meters) for next 5 years
Qwaqwa	9 912	152 850
Harrismith	1875	28 913
Kestell	132	2 037
Total	11 919	183 800

 Table 5.3: Residential land required for informal settlements, 2001

Source: SA Stats 2001

A social housing survey for Maluti-A-Phofung is just completed and from the report it is well known that the Phuthaditjhaba area needed a lot of houses. See detail in the report (available at the Housing Department, Local Municipality). Table 5.2 gives an indication that with a growth percentage of around 47% in the five years since 1996 to 2001, the estimated land required for a five year period is 183 800 squire meters. Apart from the demand for residential functions, the available open spaces and dedicated park areas provide an overview of the quality of residential areas, as open spaces serve as channels of flow for various natural elements within and through the city. The total areas of dedicated parks per urban unit are attached as annexure B.

From the above it should be evident that although the urban areas within the municipality are not highly industrialised, the share of land dedicated to parks (8,86%) is nearly on par with town planning standards which requires that 10% of the urban areas is reserved for park development. In some of the areas (like Phuthaditjhaba) there are a lot of undeveloped open spaces with a number of koppies, natural drainage systems and green areas which form part of an established (but inactive) Metropolitan Open Space System, and which provide a considerable resource as a green lung. This system is being threatened to some extent by development.

5.2.3 Responses of the community towards land use

The state of land uses as experienced and reported by the community of Maluti-A-Phofung Municipality is listed in the table below:

Issue	Qwaqwa	Harrismith	Kestell
Cemeteries are not properly services and are being vandalised and polluted	Entire area	Entire area	Entire area
Open spaces are being invaded by informal settlements and it leads to the eventual loss of the land.	Especially in Bluegumbosc h, but also in other areas	Especially in Tshiame	No reports of such invasion
Children have no safe areas to play because existing playgrounds are not equipped or is being vandalised.	Yes, all over the area	Yes all over the area	Yes, all over the area
Formal townships in areas are situated on a very rocky outcrop, making any form of development very difficult.	Yes, most areas	Yes, most areas	Yes, most areas
Various urban areas have no trees which lead to dust and the urban greening of most areas is a priority.	Yes, all areas	Yes, al areas	No reports
The rehabilitation of degradated land areas by quarrying or pollution should be properly managed.	Yes please	Yes please	Yes please

A brief summary of the most significant responses to land use is listed below:

• Within the Maluti-A-Phofung IDP, extensive attention was given to the development of land and in particular, the Spatial Development Framework of the Municipality provides an overall strategic direction to sustainable land use in various areas. The Spatial Development Framework also includes an environmental evaluation of the proposed land uses and development initiatives.

• In terms of land ownership, much of the area of Maluti-A-Phofung is used for commercial and small farmers in the areas surrounding Phuthaditjhaba. A total of 8 256 ha have been transferred through land reform.

Are their any land reform projects on the go?

The Maluti-A-Phofung Social Housing Sector Plan was formulated in 2007 to ensure more effective housing delivery and to reduce housing backlogs.

- The formulation of a municipal housing policy to address issues of informal settlements, housing allocation, funding etc. is also completed in 2007.
- An integrated waiting list exists within the Housing Service Unit, but needs to be updated and categorized according to the needs of the people as been presented in the Social Housing Business plan available at the Housing Department of the Maluti-A-Phofung Local Municipality.
- The Municipality is currently compiling with an Urban Open Space Framework aimed at determining the most sustainable uses of open land which will in some cases include residential uses.

5.3 Land condition

The Free State is not a water rich province and the residents and economy of the province are dependent on its land. As a result the Province, but not as much the Maluti-A-Phofung area is seen as not so a fragile terrestrial system, but it also needs to be managed carefully.

Specifically the effects of the abovementioned land uses and future demand need to be monitored and managed as further land degradation will result in declining productivity and diversity of all natural and human resources, thereby threatening future human development. Degraded land areas and other ecosystems are less able to cope with external change such as climate change, variable of rainfall and rapid increases in land demand due to poverty.

5.3.1 Driving Forces and pressures of land degradation

The driving forces of land degradation lead to specific activities and conditions which exert direct and constant pressures on the local land resources of the Municipality. These may include:

Driving forces	Pressures		
Poverty	Unsuitable subsistence farming		
	practices such as		
	Overgrazing and deforestation		
Urban development	Formal and informal urban		
	expansion on pristine		
	and buffers areas		
	Urban pollutants dumped on		
	productive soil		
	Storm water collection leading to		
	erosion		
Ignorance	The neglect of traditional		
	knowledge		
	Overgrazing		
	Overuse of inorganic fertilizers		
Unsustainable commercial	Monoculture production		
Agricultural practices	 Increased use of agrochemicals 		
	•Salination of soil		
Lack of monitoring and controls	•Over-extraction of water from rivers		
	and boreholes		
	•Over-utilisation of inorganic fertilizers		

Table 5.5: Driving forces of land degradation

Human activities that contribute to land degradation include unsuitable agricultural land use, poor soil and water management practices, deforestation, removal of natural vegetation, frequent use of heavy machinery, overgrazing, improper crop rotation and poor irrigation practices (UNEP, 2002). Those activities that involve clearing or disturbance of natural vegetation typically create a pathway for alien invasive plant species, impacting on natural species biodiversity (Smith, 1990).

It is evident that the there is higher concentration of stock within the eastern areas of the Municipality, which would firstly be due to more dominant crop farming in the west and secondly determine the type of agricultural pressure exerted on the land. As indicated before, the higher crop farming and associated monocultures in the west could cause soil salination due to extensive use of agrochemicals, while stock farming in the east could cause loss of vegetation as a result of overgrazing and subsequently lead to habitat and soil loss.

5.3.2 State and international communities

South Africa has been a signatory to the United Nations Convention to Combat Desertification (UNCCD) since 1995 and ratified it in September 1997 (Hoffman & Ashwell, 2001). The UNCCD defines desertification as "land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors including

climatic variation and human activities". Desertification therefore, means "land degradation, loss of soil fertility and structure as well as the erosion of biodiversity in drought prone areas" (UNCCD, 2000). This implies that, although constant but varied land degradation occurs everywhere, it is only defined as desertification when it occurs in dry land areas.

Within the Maluti-A-Phofung Municipal Area there is not a great threat of desertification because all the areas surrounding Maluti-A-Phofung is of more or less the same type and climate. In terms of soil loss, erosion can be seen both as a symptom of underdevelopment (i.e. poverty, inequality and exploitation) and as a cause of underdevelopment. From the general erodibility index as measured across the municipal area it is evident that a higher potential for erosion is expected in and around Phuthaditjhaba, where firstly, more subsistent stock farming occurs and secondly, constantly higher poverty rates are measured. The natural topography of the area (following hills and more streams) also contributes to the erosion potential of the area.

The erosion index mainly measures susceptibility of the area to erosion, while the relation between this susceptibility and population pressures would provide a more comprehensive indication of areas where severe pressures are experienced and subsequently where intervention is required. The primary concern with regards to soil loss is clearly in the east and particularly around the peri-urban, areas where the highest poverty levels are present, and the pressure exacerbated by the natural topography of the area and predominant farming activities. The state of soil loss as experienced and reported by the community of Maluti-A-Phofung is listed in the table below:

Issue	Qwaqwa	Harrismith	Kestell
Illegal digging as part of	In the centre of	No reports	No reports
quarrying of building	Phuthaditjhaba,		
activities scars the landscape	where they are		
and hold a health hazard for	making bricks		
especially children			
Soil erosion due to	The total area	Some parts	No reports
unsustainable framing		near the	
practices or deforestation		Wilge river	
leads to the loss of land			
resources			

 Table 5.6: Community experiences of soil loss, Maluti-A-Phofung, 2007

5.3.3 Impacts of land degradation

Land degradation in dry land areas such as Maluti-A-Phofung generally results in increasing amounts of unproductive land. The socio-economic impact could cause social and cultural structures to deteriorate, food security to be lost,

migration may become prevalent as incomes prove increasingly inadequate and debts escalate (UNCCD, 2000).

Land degradation and soil loss either in isolation form or cumulatively leads to a reduction in plant nutrient supply, nutrient cycling and sequestration, and waste material decomposition (Hamblin, 1998). This will lead to a long term reduction in the biological productivity which, in turn, aggravates desertification of the degraded area, which ultimately inhibits the ability of the land to support human livelihoods and commercial activities.

According to the Environmental Protection Atlas of South Africa (ENPAT, 1997) the biological productivity of the land within the Maluti-A-Phofung area varies from east to west. The biological productivity measures on average 4,70 tons per hectare growing season in the west increasing to an average 6,55 tons per hectare growing season in the east.

This reduction in productivity often leads to an increase in the use of fertilizers, in turn leading to even more land degradation. Brady and Weil (2000) indicate that the increased use of fertilizers not only causes significant changes in soil pH, but also has a negative impact on freshwater resources (see Chapter 4).

The total impact on a reduced land quality is a reduced ability to produce food and economic goods, thus increasing poverty and creating more conducive conditions for desertification, drought, floods and famine.

The United Nations Convention to Combat Desertification (UNCCD) requires signatories to develop a National Action Programme (NAP) to combat desertification in order to secure environments, improve food security, reduce poverty and create alternative livelihoods for communities living in dry areas.

5.4 Cultural Heritage

The Maluti-A-Phofung municipality is fortunate to have a variety of cultural heritage. Although many cultural heritage sites and areas, as everywhere in the country, are under constant threat due to urban development and vandalism, various significant sites are protected and managed. Legislation (National Heritage Resources Act) currently provides for the protection of significant sites.

For the purpose of this study, heritage resources were be defined as structures (including buildings) of historical and architectural significance, archaeological and palaeontological sites and material, historical sites, such as battlefields and graves.

5.4.1 Driving forces and pressures on cultural Heritage

The main driving forces behind the current and/or future availability and condition of cultural heritage areas are firstly the general development of land due to economic of residential expansion and secondly the cultural differences in prioritising such areas as indicated in the table below:

Driving Force	Pressure
Economic growth	Economic growth leads to a change in the demand for land and a shift towards economic uses for land currently use for cultural heritage sites as well as the alteration and demolition of heritage structures.
Cultural differences	Where a cultural variety of people , due to sensitivity to past political differences, hold the importance of a site in different regard, a lack of commitment and common management principles could arise. Opinions are often divided along cultural and political lines about what part of South African history should be conserved or not.
National Priorities	The national priorities of reconstruction and development has caused the constant reduction in finances and resources allocated to cultural heritage management to maintain all historical sites. These sites are also not being used effectively to generate an income for their own upkeep.

Table 5.7 forces and pressures on cultural Heritage

Source: SAHRA, 2003

Where the current cultural use of land has to compete with economic and residential functions, the latter frequently dominate the priority list of planning processes.

5.4.2 Cultural heritage sites

The identification of historical sites in South Africa remains a sensitive issue due to its past political history. These assets are not properly exploited in terms of tourist, educational and recreational potential. Once buildings have been declared national monuments the implications of their upkeep, restoration, and constraints to future development or upgrading of the site may make it unsustainable for the site to retain its status. The list below represents provincial heritage sites within the Maluti-A-Phofung area which were declared as national monuments in terms of the previous National Monuments Act, 1969 (No. 28 of 1969). When previous legislation was replaced in 2000 by the National Heritage Resources Act, 1999 (No. 25 of 1999) all previously declared national monuments obtained the status of provincial heritage sites in terms of the new Act (SAHRA, 2003).

Nr.	Heritage site	Locality
1	Groenkop	Kestell
2	Kerkenberg	Harrismith
3	Paulus Mopeli Statue	Phuthaditjhaba
3	Botlokwa Monument	Phuthaditjhaba
4	Voortrekker Monument	Kestell
5	Nazereth Mission Church	Bethlehem
6	Dutch Reformed Church	Kestell

 Table 5.8: List of registered cultural heritage sites

The table below provides a summary of the listed heritage sites. It is evident that very few cultural heritage resources have been identified within Maluti-A-Phofung and there is no management plan in place for any of the identified sites.

Heritage type	Phuthaditjhaba	Harrismith	Kestell		
Historic or period	Morena Wetsi	Town Hall	Dithako		
Buildings	Cave	San paintings	NGK [sand stone		
U U	San paintings		building - church1		
	1 5		San paintings		
Historic dwelling	Matswakeng	Market Hall	Pops Station		
houses or hostels	(Chief Koos Mota				
	kraal)				
Monuments and	Jwala-Boholo	President Brand	Graves Not		
Structures	(mouintains and	Bridge	Declared		
	graves)	5	monuments		
	Sefika sa Botlokoa				
	(Monument				
Natural land areas	Caves in the	Botanical Garden	None		
	mountains	Purified Tree			

Table 5.9: Summary of cultural heritage sites

5.4.3 The state of cultural heritage resources

The state of cultural heritage resources as experienced and reported by the community of Maluti-A-Phofung is listed in the table below:

Table 5.10: Community experiences of cultural heritage resources

Issue	Qwaqwa		Harrismith			Kestell			
Most cultural	Yes	through	the	Yes	through	the	Yes	through	the
heritage resources	total	area		total	area		total	area	
are being									
vandalised and									
should be									
protected.									

5.4.4 Impact of cultural heritage

Historical sites in Maluti-A-Phofung area have a great impact on the surrounding areas, including:

- Land Values: The values of residential areas generally benefit from well maintained historical sites or buildings, and promotes further investment by home owners;
- Development and activities: Business development would be constrained by building or traffic restrictions, but other uses would benefit, e.g. a church; and
- District character: The main street area creates an atmosphere of civic formality that is carried on to the surrounding area forming a distinct precinct.

The loss of the municipality's cultural resources will impact on the social cohesiveness of the area and the quality of life of residents. It could also result in the loss of economic opportunities available through the growing international market in cultural tourism.

5.4.5 Responses of community towards cultural heritage

The main recent response to the pressures on cultural heritage resources has been the proclamation of the National Heritage Resources Act, 1999 (Act no. 25 of 1999) as it sets principles, assessment criteria and responsibilities to various role players. Although the abovementioned list of heritage resources are currently protected in terms of Section 34, 35, 36 and 38 of the Act (General Protections), there are direct responsibilities envisaged for local municipalities.

The responsibilities of a local authority regarding heritage resources management are set out in Sections 30 and 31 of the Act and include:

The compilation of an inventory of heritage resources which fall within its area of jurisdiction and its submission to the relevant Provincial Heritage Resources Authority; and The protection of heritage resources, placed on the Heritage Register and areas designated as Heritage Areas, through provisions in its town planning scheme, or bylaws, issued under the National Heritage Resources Act.

None of these responsibilities are currently being met and currently the re-use of cultural resources is becoming a popular option for the protection and conservation of resources. The reuse of historical buildings in Phuthaditjhaba for office developments serves as a practical example.

5.5 Conclusion

The study of the land indicators found that land in Maluti-A-Phofung is in a satisfactory condition. There is still a high percentage of natural vegetation in the area and the extent of transformed land and/or degraded land is relatively small and stable. Nevertheless the entire area can, based on its climatic conditions and vegetation, classified as "affected dry lands" and therefore susceptible to desertification, especially in the south west areas.

In terms of land use (especially urban land use) there is serious and immediate pressure on the Municipality to land available for residential development, especially to accommodate informal settlements. According to census data the backlog of housing and concurrently land required has proportionally increased between 1996 and 2001.

Agricultural pressures exerted on rural soil resources suggest that a strategy to prevent land degradation is formulated and implemented across the area, as the current and potential land-related concerns differ from the east to the west due to topography, agricultural practices and poverty.

As land degradation and poverty are causes as well as symptoms of each other, it is important to view any attempt to address the one as a vital contribution to addressing the other.

The classification of heritage sites under the National Monuments Act was previously a provincial responsibility and there are 23 such sites within Maluti-A-Phofung. The National Heritage Resources Act requires all local municipalities to take proper and detailed stock of all the heritage sites and to ensure the establishment of proper management plans for each. This is currently lacking and will require intervention.

CHAPTER 6: BIODIVERSITY AND NATURAL HERITAGE

6.1 Introduction

The environment involves everything that affects a living organism. Biological diversity (biodiversity) is defined as "the variability among living organisms from all sources including, inter alia terrestrial, marine, and other aquatic ecosystems, and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems" (UNCBD 1992). According to Miller (2002) biodiversity refers to the variety of different species (species diversity), genetic variability among individuals within a species (genetic diversity) and the variety of ecosystems (ecological diversity) and functions such as energy flow and nutrient cycling needed for the survival of species and biological communities (functional diversity). The conservation of biodiversity is important on a global scale but also on a local scale, such as within the boundaries of the Maluti-A-Phofung because wild species, natural ecosystems and the earth's overall biodiversity have two types of value namely:

Instrumental value:

Species and ecosystems are useful to man. Some species have an ecological value. Wild species and ecosystems are key factors in sustaining the earth's biodiversity and ecological functions (photosynthesis, pollination of crops, soil formation and maintenance, nutrient cycling, etc.) that support human economies and human health. Species and ecosystems are also sources of information. We obtain educational or scientific information by studying genes, species and ecosystems. We value recreational pleasure provided by wild plants and animals and natural ecosystems. A normally non-consumptive use of nature is called eco-tourism. Ecotourism should not cause ecological damage, should provide income for local people to motivate them to preserve wildlife and should generate funds for maintenance of research and conservation programmes (Miller 2002).

Intrinsic value:

Species and ecosystems exist, regardless of whether they are of any use to man. Man has an ethical responsibility to protect species from becoming prematurely extinct as a result of human activities and prevent the degradation of ecosystems and biodiversity (Miller 2002). All the abovementioned reasons to protect species diversity and ecosystems on a global scale are also applicable to the Maluti-A-Phofung area. Each and every individual living within the boundaries of the Maluti-A-Phofung area has a responsibility to, as Robert Cahn stated, "live each day so as to leave the lightest possible footprints on this planet" (Miller 2002).

6.1.1 Loss of biodiversity:

Humans pose the ultimate threat to biodiversity through their increasing population growth, high levels of consumption and inefficient use of resources. Man's activities threaten biodiversity in four main ways, namely land and urban development, waste and pollutant production, over-exploitation of resources and the introduction of alien species (UNEP 2002; WRI 2000).

In developing counties the economic, social, and political setting is usually the root cause of poverty, which is often blamed for environmental degradation and biodiversity loss (Fakir 2002; Miller 2002).

Table 6.1: Summary of identified issues and indicators affecting the biodiversity of the Maluti-A-Phofung area, 2007.

DESCRIPTION OF ISSUES	INDICATORS
SPECIES DIVERSITY AND HABITAT	
CHANGE	
Species diversity is the variety of	 Threatened and extinct species per
species	taxonomic group
in a specific area.	 Endemic species per taxonomic group
Habitat diversity encompasses the	 Alien (non-indigenous) species per
variety	taxonomic group
of ecosystems (habitats) as well as the	 Population trends of selected species
relationships and interdependencies	•Distribution and abundance of selected alien
between them.	species
Habitat change is the change of the	 Disease-borne vectors
habitat character from a natural state to	Poisonous species
a degraded condition.	•Extent of conserved areas
	 Extent of natural areas remaining
	Disturbance regimes
RESOURCE VALUE	
Resource value is the value obtained	 Contribution to job creation: Conservation
from	 Contribution to job creation: Eradication of
the living and non-living environment to	alien vegetation
meet human needs and wants.	•Economic contribution of commercially
	utilized indigenous species
	 Economic contribution of commercially
	utilized fresh water species
	 Economic contribution of commercially
	utilized terrestrial species
NATURAL HERITAGE RESOURCES	
Natural heritage resources are areas of	 Status of natural resources
ecological and/or historical value in	 Investment in natural resources
terms	 Visitors to natural resources
of ecotourism.	

6.2 Species diversity and habitat change

Biodiversity contains the accumulated wisdom of nature and the key to the future. Nature's "knowledge" is contained in the DNA within living cells. The variety of genetic information is the driving force of evolution and the source of adaptability.

The main driving forces of biodiversity is, firstly, speciation which is a very slow process caused by natural selection, mutations, migration and genetic drift. Secondly the habitat diversity of an area offers a variety of niches for different species to occupy.

6.2.1 factors influencing driving forces on species diversity

The main driving forces driving species to speciate are natural selection, mutations, gene flow and genetic drift. The factors influencing these driving forces are listed in the table bellow.

Table	6.2:	Main	forces	driving	species	to	speciate	(speciation	increases
biodiv	ersit	y), Ma	luti-A-P	'hofung,	2007				

	BASIC PRINCIPLES DRIVING NATURAL SELECTION
1 Natural Selection	Overpopulation
	Struggle for existence
	Inheritance and accumulation of favourable variations
	Survival and reproduction of the fittest
2. Mutations	Causes of mutations:
	Deletion
	Translocation
	Inversion
3.Gene flow:	Cause of gene exchange Migration of gametes between
	populations (E.g. Cross
	pollination, seed dispersal, migration of animals etc)
	The extent of migration depends on the size of the
	populations and the extent to which they may be
	isolated
	from one another
4.Genetic drift	Cause of changes in genetic makeup:
	Genetic drift is the change in the genetic makeup of a
	population due to random events
	Genetic drift may take place as a given gene fluctuates
	from its statistical average in any generation due to the
	events that occur during meiosis and the production of
	gametes.

Two of the main driving forces responsible for the loss in biodiversity are firstly habitat destruction & fragmentation and secondly over exploitation of resources. Both of these driving forces contain social and economic factors that are listed in the table below.

DRIVING FORCE	FACTORS (SOCIAL AND
	ECONOMICAL)
Habitat destruction & fragmentation	a) Urban expansion
	b) Damming of rivers and streams
	c) Pollution
	d) Road construction through sensitive
	habitats
	e) Preparing fields for crop production
	f) Overgrazing & trampling of natural
	veld
	g) Erosion
	h) Uncontrolled veld fires
	i) Wood collection, especially of
	indigenous species
	j) Spread of alien species
	k) Pesticide application
	I) Mining (borrow pits, sand mines, rock
	quarries)
	m) Poverty
Over-exploitation of resources	a) Illegal trade in animals and plants
	b) Uncontrolled collection of medicinal
	plants
	c) Illegal and over-collection of
	succulents and other
	protected plants

 Table 6.3: Broad driving forces causing loss in biodiversity

6.2.2 Pressures that lead to loss of species diversity

Most people have a human-centred world view. All species and parts of nature are seen as having only instrumental value based on how useful they are to humans. This world view results in the formation of forces, causing numerous pressures that lead to loss of species diversity and ecosystems.

Typical pressures that are exhorted on biodiversity by humans as well as the result of these pressures are listed in the table below.

PRESSURE	PRESSURE EXERTED
Habitat destruction &	
fragmentation	
a) Urban expansion	Natural habitats are being destroyed, causing
	degradation of ecosystems with subsequent
	species loss. (Cross reference to land use)
b) Damming of rivers and	Ecological reserve of river are being changed
streams	Upstream migration of aquatic organisms (e.g. fish
	crabs, etc) is prevented. (See Chapter 4)
c) Pollution	Toxic pollutants (e.g. heavy metals, acids, etc) end
	up in ecosystems causing disruption of food chains
	by killing organisms, causing degradation of
	ecosystems with subsequent species loss. (see
d) Deed construction	Chapter 7)
d) Road construction	Road construction normally leads to destruction of
through sensitive	bio-diversity hence EIA a re always recommended
A Droporing fields for grop	Traditional forming methods loads to big diversity
production	destruction
f) Overgrazing & trampling	Eroo rango grazing by farmors in proclaimed aroas
of natural veld	does not take environmental issues into
	consideration. Farmers need advice
a) Frasion	Poor traditional farming methods and commercial
	farming contribute to erosion
h) Uncontrolled veld fires	This is a very serious problem in the municipality
i) Wood collection.	The provision of electricity to the rural areas will
especially of indigenous	help minimize the problem
species	
j) Spread of alien species	This affects ground water levels and loss of bio-
<i></i>	diversity
k) Pesticide application	Now minimized with reduction of commercial
	farming activities in the area
I) Mining (borrow pits, sand	Brick making, and sand mining are big problems in
mines, rock quarries)	the area and legislation has been proposed for the
	municipality as part of the final document
Over-exploitation of	
resources	
a) Illegal trade in animals	
and plants	
b) Uncontrolled collection	
of medicinal plants	
c) illegal and over-	
collection of succulents and	
other protected plants	

Table 6.4: Main causes of loss of biodiversity in Maluti-A-Phofung, 2007 PRESSURE PRESSURE

6.2.3 Threatened and extinct species per taxonomic group plants

Within the Maluti-A-Phofung area's boundaries a rich variety of different species exist. Some are very common and dominate the landscape. Others, such as declared weeds, cause problems in disturbed places, in particular. The overall state of the Maluti-A-Phofung area's species and ecosystem diversity is reasonable. According to available data no species have become extinct in the past 25 years, but due to the above-mentioned pressures there is an increasing threat and several species are becoming more vulnerable over time. The following tables indicate the present status of the higher species. Also listed are the declared weeds and undesirable plants. Scientists are monitoring the status of these species and the lists are being updated on a regular basis. These lists for the Maluti-A-Phofung area should also be updated on a regular basis to monitor the status of the environment.

6.2.3.1 Extinct (EX)

A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), through its historic range has failed to record an individual. Surveys should be conducted over a time frame appropriate to the taxon's life cycle and life form.

6.2.3.2 Extinct in the wild (EW)

A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as (a) naturalised population(s) well outside the past range. A taxon is presumed extinct in the wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), through its historic range has failed to record an individual. Surveys should be conducted over a time frame appropriate to the taxon's life cycle and life form.

6.2.3.3 Critically endangered (CR)

A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Section V), and it is therefore considered to be facing an extremely high risk of extinction in the wild.

6.2.3.4 Endangered (EN)

A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Section V), and it is therefore considered to be facing a very high risk of extinction in the wild.

6.2.3.5 Vulnerable (VU)

A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see Section V), and it is therefore considered to be facing a high risk of extinction in the wild.

6.2.3.6 Near threatened (NT)

A taxon is Near Threatened when it has been evaluated against criteria but does not qualify for Critically Endangered, and the best available evidence indicates that it meets any of the criteria A to E for Endangered, Endangered or Vulnerable at present, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

6.2.3.7 Least concern (LC)

A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.

6.2.3.8 Data deficient (DD)

A taxon is Data Deficient when there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has lapsed since the last record, threatened status may well be justified.

6.2.3.9 Not evaluated (NE)

A taxon is Not Evaluated when it has not yet been evaluated against the criteria. The following table explains the acronyms used to describe the current state of bird species in terms of vulnerability and threat of survival.

 Table 6.5: Abbreviations used for the bird list

GTS = Globally Threatened Species NNS = Nationally Threatened Species GNS = Globally Near Threatened Species NNS = Nationally Near Threatened Species There are more than 3000 plant species present in the Free State Province (National Museum & UFS Databases). It is uncertain what number of plant species occurs in the Maluti-A-Phofung area. These plants occupy almost every possible habitat in the area and together with the abiotic factors such as soil, moisture and climate contribute to create various habitats for insects, reptiles, mammals, birds and even fish species. The Red Data species are listed due to habitat destruction (agricultural activities, urbanisation, etc.). Many species, especially medicinal plants, are on the brink of becoming listed as rare endangered due to over-exploitation of the resource (Van Wyk, Van Oudtshoorn and Gericke, 1997)

The following table lists the plant species in Maluti-A-Phofung area occurring on the list of threatened, endangered and extinct plant species. It is clear from the table that both species falls within the Vulnerable (VU) IUCN category. A taxon that is deemed Vulnerable is facing a high risk of extinction in the wild.

Common name	Scientific name	IUCN red list Category					
Brachystelma	Brachystelma dimorphum	VU					
	subsp. gratum						
Brachystelma	Brachystelma dimorphum	VU					
	subsp. gratum						

Table 6.6: List of plant species and IUCN category

Source: Hilton-Taylor (1996); Golding (2002)

Mammals

About 34 terrestrial mammal species were recorded in the Maluti-A-Phofung area (Lynch, 1983). Most of these species prefer natural habitats away from the urban environment. Some species are listed on a Red Data list due to habitat destruction (agricultural activities, pollution, etc.), (National Museum Database)

The following table lists the mammal species in Maluti-A-Phofung area occurring on the list of threatened, endangered and extinct plant species. It is clear from the table that all the mammal species listed, like the plants, falls within the Vulnerable (VU) IUCN category. A taxon that is deemed Vulnerable is facing a high risk of extinction in the wild.

Birds

Out of a total of 932 bird species recorded for Southern Africa, about 303 birds were recorded in the MLM area (Harrison, Allen, Underhill, Herremans, Tree, Parler and Brown, 1997). The variety of habitats in the Maluti-A-Phofung area contributes greatly to attract and accommodate these birds. Even the urban environment contributes to attract birds, which would not occur here if the gardens did not exist. A few are the: Black-collared Barbet (Lybius torquatus), Garden Warbler (Sylvia borin), Grey Hornbill (Tockus nasutus) and Cape

Sugarbird (Promerops cafer). Some species are listed on a Red Data list due to habitat destruction (agricultural activities, pollution, etc.), (Harrison, et al. 1997)

The species that occur on the so-called red data list are indicated in table below relative to their IUCN category.

common name	Scientific name	IUCN RED CATEGORY		LIST
African March Harrier	Circus ranivorus	NNS		
Black Harrier	Circus maurus	NNS		
Black Stock	Ciconia nigra	NNS		
Black- winged Pranticole	Glareola nordmanni	GTS		
Blue Crain	Anthropoid's paradiseus	GTS		
Blue Korhaan	Eupodotis caerulescens	NNS		
Cape Griffon	Gyps corroders	VU		
Caspian Tern	Hydroprogne casita	NTS		
Chestnutbanded plover	Charadrius pallidus	NNS		
Grass owl	Tyto caspia	VU		
Greater Flamingo	Phoenicopterus ruber	NTS		
Kori Bustard	Ardeotis kori	NTS		
Lanner	Falco biarmicus	NNS		
Meloudious Lark	Marafra cheniana	NTS		
Lesser Flamingo	Phoenicopterus minor	GTS		
Lesser Kestrel	Falco biarmicus	VU		
Ludwig's Bustard	Neotis ludwigii	NNS		
Southern Crowned Crain	Balearica regulorum	VU		
Marabou Stock	Letoptilos crumeniferus	NNS		
Martial Eagle	Polemaetus bellicosus	NTS		
Painted Snipe	Rostratula benghalensis	NNS		
Pallid Harrier	Circus macrourus	NNS		
Paregrine Falcon	Falco pergrinus	NNS		
Pink-Backed Palican	Polecanus rufescens	NNS		
Secretarybird	Sagittarius serpentiarus	NNS		

Free State Bird Club database

Reptiles

The diversity of reptiles is not very high and most of these species are well adapted to the changed environment due to agricultural activities. Only one Red Data Species is noted for the Maluti-A-Phofung area. The snake is listed as Least Concern (LC) in terms of the IUCN categories. The snake is perceived as abundant and widespread within the context of the IUCN categories.

Table 6.8: List of fish species and IUCN category

Common name	Scientific Name	Urcn Red List Category		
Striped Harlequin Snake	Homoroselaps dorsalis	LC		
Source: National Museum database - List of references				

Source: National Museum database – List of references

Fish

The diversity of fish in the Maluti-A-Phofung area is relatively low. A total of 12 species have been recorded for the Wilge River (Seaman and Roos, 2001). Of these, two are regarded as rare. The cause for this decline is habitat destruction (damming of streams, pollution, encroachment of reed beds, etc), over-fishing etc. (Seaman et. al., 2001).

Both fish are listed as Least Concern (LC) in terms of the IUCN categories. The fish are perceived as abundant and widespread within the context of the IUCN categories.

Table 6.9: List of fish species and IUCN category

COMMON NAME	SCIENTIFIC NAME	IUCN	RED	LIST
		CATER	GORY	
Large mouth Yellow Fish	Abiobarbus kimberlyensis	LC		
Rock barb	Austroglanis sclateri	LC		

Source: Centre for Environmental Management database– List of references

Amphibians

The diversity of amphibians in the MLM area is relatively low. Only one is regarded as vulnerable. The cause for this decline is habitat destruction and pollution (Du Preez 1996). The giant Bull Frog falls within the Vulnerable (VU) IUCN category, as indicated in the table bellow. A taxon that is deemed Vulnerable is facing a high risk of extinction in the wild.

Table 6.10: List of amphibian species and IUCN category

COMMON NAME	SCIENTIFIC NAME	IUCN	RED	LIST	
		CATERGORY			
Giant Bull FROG	Pixycephalus adspersus	VU			
Our search Martin and Martin and Database					

Source: National Museum Database

Invertebrates

No invertebrates that are present in the Maluti-A-Phofung area are listed (National Museum Database).

Unique plant communities in the Maluti-A-Phofung area:

A very important aspect which is usually overlooked, is the association of species

forming in a community within a specific habitat. Usually scientists look only at the presence or absence of protected and Red Data Species as an indication of uniqueness of a specific habitat (Bredenkamp & Brown 2002; Du Preez & Dingaan 2002)

A group of associated plant species together with its particular habitat forms a plant community and the interrelationship between plants and physical environment represents an ecosystem at community level of organisation. On this level the association of species is also a very important aspect. A unique community could contain common species but the uniqueness of the habitat could cause a very rare association of species, which must also be conserved.

It is clear that vegetation is much more than a mere list of plant species. Plant communities practically summarise the entire floristic diversity and integrate the environment variables, including distribution and occurrence of rare and endangered species.

There are a number of unique plant communities in the Maluti-A-Phofung area (Mucina & Rutherford, 2004), which deserve special mention, as these are sensitive to destruction due to urban expansion, change in species composition and destruction by pollution.

As a response to the pressures upon species and habitats, certain conservation actions have been taken over the years. There are three provincial nature reserves in the Maluti-A-Phofung area, one private nature reserve, and twentythree conservancies have been registered since 1993. Several associations are also active in the fields of conservation and environmental education.

6.2.4 Factors that decreases biodiversity

Factors that tend to decrease biodiversity are, according to Miller (2002):

- a) environnemental stress,
- b) large environnemental disturbance,
- c) extreme environnemental conditions,
- d) severe limitation of an essential nutrients or other resources,
- e) introduction of alien species, and
- f) geographic isolation

The figure bellow illustrates the connections between human activities and the earth's biodiversity. It is clear from the figure that there are an interrelationship between biodiversity, climate change, food supply and demand, freshwater supply and demand and forest product supply and demand.



Figure 6.1: Summary of major connections between human activities and the earth's biodiversity.

Due to pressures being exerted on the environment, impacts are causing a decline in species diversity. Habitats in several areas are being destroyed or fragmented resulting in the loss of habitat integrity and species. Habitats in areas located around urban nodes and arable land, in particular, are being destroyed at an alarming rate. Areas around point source pollution are also under pressure.

The state of biodiversity as experienced and reported by the community of Maluti-A-Phofung is listed in the table below:

		11	17 (. 11
Issue	Rural Qwaqwa	Harrismith	Kestell
	&	Intabazwe	&
	Phuthaditihaba	Swinburn	Thiolong
	· · · · · · · · · · · · · · · · · · ·	Van	j
		Reenen	
Alien vegetation is threatening water life	Total area	Total area	Total area
at various parts of the Wilge River and			
impacts on the nutrients in the water.			
Chopping down of trees by initiation	Total area	Total area	Total area
schools, informal settlements leads to		i olai ai oa	
loss of			
urban green areas as well as autural			
habitat for various birds spices			
The conservation of sensitive areas	Total area	Total area	Total area
should be increased to protect the			
community depend upon for daily living			
Epidemic of rats and mice in open velds	Total area	Total area	Total area
serve as disease borne vectors and			
threaten the health of residents			
Various foreign tree species occur	Total area	Total area	Total area
throughout the area and in certain areas	i otal alea	i otal alea	i otal alea
threatened not only biodiversity but also			
human activities			
Various plant species are being over	Total area	Total area	Total area
extracted for medicinal purposes and this			
leads to loss of biodiversity and reduction			
in sources to the healers			
The protection of bio natural buffer zones	Total area	Total area	Total area
between built up areas and the sensitive		i otal alca	
areas should be regarded as			
Important as the sensitive area itself.	Total area	Total area	Total area
Human activities such as pollution.		i otal alca	
uncontrolled 4x4 driving and recreation			
threatens plant and animal species in			
specific localities.			
Uncontrolled veld fires cause severe loss	Total area	Total area	Total area
of plant and animal biodiversity and there			
is a need for fire prevention measures.			

Table 6.11: Community experiences of biodiversity

6.3 Resource value

Biodiversity has both an instrumental and an intrinsic value. Its instrumental value is its use value to humans and includes the goods (fuel wood), services (pollination), information (drug development) and psycho-spiritual (tourism) value of biodiversity. The intrinsic value of biodiversity is its inherent value, a value that exists there simply because that biodiversity exists and it is not dependent on its use by human beings. This can be compared to the intrinsic value of human life. Attempts have been made to calculate the full economic value of the different types of values that biodiversity possesses. This is a very difficult task to accomplish and can be quite contentious.

This biodiversity stock is however not well protected, with South Africa's protected areas covering less than 6% of the land surface area (Reyers et al., 2001). The human population size and its consumptive demands place increasing pressure on these biodiversity stocks, and thus the development of indicators with which to monitor and safeguard these stocks is essential.

This issue addresses the economic value associated with each of the resources available to man. The resource value has been assessed in two different ways – firstly through the number of jobs created, and secondly through the actual economic contribution of that particular resource to the economy.

6.3.1 Driving forces towards conservation

Resources such as provincial nature reserves, private nature reserves and public open spaces play an important role in conserving the ecosystems of the area. These areas are important ecotourism destinations and generate revenue, which flows back into the economy or is being used to improve the particular ecotourism destination. Secondly it helps to protect the habitat and species diversity. It is difficult to calculate a resource's value in terms of sustainable utilisation and conservation of these areas as they play an invaluable role in preventing habitat change.

6.3.2 Pressures on protected areas

South Africa's protected areas cover less than 6% of the land surface area. Therefore our biodiversity stock is not well protected. There is a need for more areas to be conserved and secondly, ecotourism can help to alleviate poverty by generating more conservation-related jobs.

6.3.3 Conservation towards biodiversity

There is no national park within the boundaries of the area, but there are six provincial nature reserves, one private nature reserve and twenty three conservancies. Besides the conservation value of these areas they also have a recreational value and people visit these areas for angling, picnics, guides tours, bush camps, etc. To maintain the infrastructure of these areas jobs were created. Table 6.21 gives some information on the number of jobs that were created. Table 6.20 gives an indication of the average number of visitors to the nature reserves and the amount of revenue earned per annum (a)

6.3.4 Impacts towards communities

The creation of more eco-tourism related jobs could contribute to alleviating poverty. Poverty is one of the major driving forces that destroy species diversity and contributes significantly to habitat fragmentation and habitat loss.

6.3.5 Responses of the community towards conservation

It is a very expensive and slow process to acquire land for conservation. The concept of conservancies, where the public and landowners apply conservation principles on their land, is an effective way of conserving land and to encourage the general public to become involved in conservation. Furthermore, it creates numerous jobs.

6.4 Natural Heritage Resources

Natural heritage is complex term to define, and broadly includes all South Africa's geological formations, landscapes, plants and animals (Pearson, Johnson, Lennon, McBryde, Marshall, Nash and Wellington, 1998). The Natural Heritage Act also includes South Africa's rich variety of peoples and their cultural and historical heritage as heritage resources. The Department of Environment Affairs and Tourism maintains information on the natural heritage areas, which are listed under the World Heritage Convention. They also maintain data on the privately owned sites listed under the National Heritage Programme.

Natural heritage is defined as an outstanding physical, biological or geological feature, including habitats of threatened plants or animal species and areas of value on scientific or aesthetic grounds or for conservation. South Africa currently has four world heritage sites: Greater St Lucia Wetland Park; Robben Island; Fossil Hominid Sites of Sterkfontein, Swartkrans, Kromdraai and Environs; and uKhahlamba/Drakensberg Park. South Africa also has a Natural Heritage Programme, which allows private landowners to designate areas of land as Natural Heritage sites. The site has to meet certain criteria listed in SANHP (2000).

6.4.1 Driving forces towards natural resources

Resources such as provincial nature reserves, private nature reserves, and public open spaces play an important role in conserving the ecosystems of the area. These areas are important ecotourism destinations and generate revenue, which flows back into the economy or is used to improve a particular eco-tourism destination. Secondly it helps to protect habitat and species diversity. It is difficult to calculate a resource's value in terms of sustainable utilisation and conservation for these areas as they play an invaluable role in preventing habitat change and loss of biodiversity.

6.4.2 Pressures on natural resources

South Africa's protected areas cover less than 6% of the land surface area. And therefore biodiversity stock is not well protected. There is a need for more areas to be conserved.

6.4.3 State and natural resource in MAP area

There are no Natural Heritage Sites present in the MAP area.

6.4.4 Impacts of Natural resources

Due to the pressures being exerted on the environment, several factors are causing a decline in species diversity. Habitats in several areas are being destroyed or fragmented resulting in the loss of habitat integrity and species. Habitats in certain areas, especially around urban nodes and arable land, are being destroyed at an alarming rate. Areas around point source pollution are also under pressure.

6.4.5 Responses of communities

to acquire land for conservation is a very expensive and slow process. The concept of Natural Heritage Sites where the public and landowners apply conservation principles on their land and where the area is being registered on a National register and Data Base is an effective way of conserving land and to get the general public involved in conservation.

Suitable potential Natural Heritage Sites exist in the MAP area. They should be identified, registered and conserved for future generations.

6.5 Conclusion

The natural environment in the MAP area has undergone significant changes since man settled in the area. Man has the ability to transform the environment to suit his needs. Along the drainage lines (rivers and streams) erosion is taking its toll on the destruction of the vegetation. Overgrazing, dams, urban expansion, collection of firewood, etc are but a few impacts caused by man.

This study further revealed that in the MAP area there are:

- 13 Medically important animals present
- 24 Poisonous plants species (to human & animals)
- 41 Medicinal plants species

As a response to the pressures upon species and habitats, certain conservation actions have been taken over the years. There are six provincial nature reserves in the MLM area, one private nature reserve, and twenty three conservancies have been registered since 1993. Several associations are also active in the fields of conservation and environmental education.

It is concluded that the environment under the control of the MLM could be in a much better condition than it is at present. The natural areas are not in a pristine
condition as several activities such as overgrazing, trampling, damming of streams, pollution, spraying of pesticides, over collection of medicinal plants, uncontrolled veldfires, encroachment of alien species, etc impact on the ecosystems.

The spread of alien plants such as Satansbos (Solanum elaegnifolium) and Small round-leaved Cactus (Opuntia lindheimeri) is a major cause for concern. There are a number of introduced bird species in the MAP area but the increase of two particular species, namely the European Starling (Sturnus vulgaris) and the Indian Mynah (Acridotheres tristis), is a cause for concern because they are very aggressive competitors which drive indigenous species out of their territories and take over their nests. These exotic birds exert pressure on indigenous birds' reproductive cycle.

There are several activities taking place to improve environmental awareness but much more must be done to encourage the public to become involved, especially people from previously disadvantaged communities.

There is a lack of:

- 1. Law enforcement regarding the following:
 - a) Eradication of category 1 alien plants
 - b) Illegal collection of medicinal plants
- 2. Environmental awareness under the general public Natural resources are mostly limited. Special care should be taken to resources them in a sustainable way.

Certain strategies must be developed and implemented to ensure that the biodiversity of the MAP area is conserved in a sustainable way. Some of the strategies could involve an environmental education strategy, a biodiversity strategy, a catchment and storm water management strategy, a litter and illegal dumping strategy, an air pollution strategy, e.t.c.

Several actions are still lacking, such as to previously disadvantaged people in environmental education, to eradicate category 1 plants in the MAP area, to prevent erosion and to rehabilitate the existing erosion and to lower the impact of pollution by commerning to recycle at the source of pollution.

CHAPTER 7: WASTE MANAGEMENT

7.1 Introduction

The Environment Conservation Act (73/1989) defines Waste as any matter, whether gaseous, liquid or solid or any combination thereof, which is from time to time designated by the Minister by notice in the Gazette as an undesirable or superfluous by-product, emission, residue or remainder of any process or activity.

Waste as defined by Government Gazette No. 12703 (August 1990) is an undesirable or superfluous by-product, emission, or residue of any process or activity which has been discarded, accumulated or stored for the purpose of discarding or processing. It may be gaseous, liquid or solid or any combination thereof and may originate from a residential, commercial or industrial area. This definition excludes waste water, sewage, radioactive substances, and mining, metallurgical and power generation waste.

Government has indicated through the National Waste Management Strategy (NWMS) and the White Paper on Integrated Pollution and Waste Management for South Africa (IP&WM) that it will adopt a functional approach to integrated pollution and waste management. The approach is based on the Waste Hierarchy, which is internationally accepted as a rigorous approach to integrated waste management.

7.2 Waste production

The landfill site in Kestell is filled up and closed therefore waste removed from Kestell is dumped at the Qwaqwa landfill site. This is done twice a week. Household refuse are removed once a week while business waste are carried twice a week

The common types of waste produced and removed in Maluti-A-Phofung are household refuse, business waste including factories which are basically paper, cut materials, saw dust and plastics, garden refuse and building rubble. In terms In Harrismith the total waste removed is 220 tons which give and annual tonnage of 2620 ton.

Medical waste are managed by individual medical establishments and do not form part of the waste removed by the council.

7.3 Waste removal

Currently waste removal has been outsourced to contractors.

7.4 Challenges faces MAP

1. Illegal dumping

People dump their refuse at street corners and the municipality does not have well – equipped machinery (tipper trucks and front loaders) to collect all the refuse.

2. Size of waste removed

In Phuthaditjhaba 220 tons of various waste are removed monthly which give an annual waste removed to a total of 3196 ton s a year.

CHAPTER 8: ENVIRONMENTAL MANAGEMENT AND GOVERNANCE

8.1 Introduction

The challenge of creating and maintaining a sustainable environment is probably the single most pressing issue that will confront people throughout their lives in future. Events of the past two decades such as the Chernobyl nuclear rector meltdown, Bhopal accident, Exxon Valdez oil spill, etc. to name a few, have accelerated a steady growing concern for the environment (Raven, Berg & Johnson 1995).

Environmental Management is a field that is rapidly growing in importance as a discipline of its own. It is "the process of administering, supervising or handling the environment in order to achieve a desired outcome" (Juggle & Rabie 1999). As the natural services provided to humans by the environment, such as clean water, clean air, sustainable energy and waste purification are increasingly threatened, and as humanity edges ever closer to the ultimate carrying capacity of the earth, so environmental management will become increasingly necessary.

Two important concepts of corporate responsibility for the environment are being applied with growing frequency in Europe. The first is a simple but powerful term: "duty of care" It implies that individuals, corporations and institutions have a duty to protect the environment, whether the law requires it or not (Raven et al., 1995).

The second concept is known as the "precautionary principle". It is written into international laws regarding the dumping of toxic waste at sea, it infers that a lack of scientific evidence is no excuse to avoid protecting the environment if meaningful evidence of damage exists (Raven et al., 1995).

According to Miller (2002) it is vital to develop more environmentally sustainable societies by shifting our efforts from:

- Pollution cleanup to pollution prevention
- Waste disposal to waste prevention and reduction
- Protecting the species to protecting the habitat where they live
- Environmental degradation to environmental restoration
- Increased resource use to more efficient resource use
- Population growth to population stabilization

In South Africa the Constitution of the Republic of South Africa ensures that the environment of South Africa is protected, ultimately for the benefit of the people of South Africa.

Chapter 2, section 24 of the Constitution of the Republic of South Africa (RSA, 1996) states that:

"Everyone has the right to an environment that is not harmful to their health or wellbeing; and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that

- (i) prevent pollution and ecological degradation;
- (ii) promote conservation; and
- (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."

Chapter 3 of the Constitution (RSA, 1996) deals with Co-operative Government, as outlined below:

"All spheres of government and all organs of state must provide effective, transparent, accountable and coherent government for the Republic as a whole"

Environmental governance can be described as a number of tools that are used to manage the environment towards achieving communal goals. Governance typically involves government, the private sector, non-government and community-based organisations, and will take place at more than one level, typically ranging from:

. Principles and societal values regarding the environment;

- . National policy underpinning societal values;
- . Legislation for implementing policy; and
- . Regulations dealing with specific legislation;
- . Internal organisational policies to ensure adherence to regulations;
- . Institutional structures to fulfil policy mandates; and
- . Implementation strategies to ensure compliance with policy (Ramasar, 2002 pers comm.; Cloete & Wissink, 2000).

Furthermore the United Nations Development Program (UNDP) reflects on propagated characteristics of cooperative or good governance, including participation, the rule of law, transparency, equity, effective and efficient government, accountability and having a strategic vision (UNDP, 2002).

Good environmental management and governance are key factors in ensuring sustainable development within Maluti-A-Phofung. In South Africa, policy failures for environmental management mainly relate to constraints of implementation, such as lack of financial resources and a lack of political commitment (Ramasar, 2002).

According to (Du Plessis & Nel 2001), in general integrated environmental management and governance can be seen as the integration of government

instruments and multiple environmental policy as well as management tools to ultimately achieve sustainability. Management tools can be classified in four general disciplines as indicted in figure 9.1.





Source: Du Plessis & Nel (2001)

Integrated environmental management is moving away from the command and control approach to environmental governance, towards a hybrid approach of multiple instruments and tools. This movement towards a hybrid approach is illustrated in Figure 8.2 (Du Plessis & Nel 2001).

Environmental management legislation should make provision for multi policy instruments and environmental management tools in line with the progress illustrated in figure 9.2. The generic classes of environmental management and governance instruments are classified in terms of four classes indicated in table 9.1, the environmental management tools are on the other hand classified in terms of the Demming Plan-Do-Check-Act (PDCA) cycle illustrated in table 8.2 (Du Plessis & Nel 2001). The environmental management tools reletive to environmental governance strategies are illustrated in the table below.

Figure 8.2: Shift from command and control to hybrid use of multiple instruments



Source: Du Plessis & Nel (2001)

Table 8.1: Environmental Governance Instruments

ENVIRONMENT	4L	ENVIRONMENTAL MANAGEMENT TOOLS
STRATEGIES		
		•Environmental law, Inspections, Requests for
		more information, Audits, Prosecutions and
		interdicts
ENVIRONMENT	۹L	ENVIRONMENTAL MANAGEMENT
GOVERNANCE		TOOLS
STRATEGIES		
Command ar	nd Control	•Restraint orders, Commissions of inquiry
instruments		Authorisations, permits, licenses.
		Etc; Directives, Penalties, Orders, Liability
		reforms, Statutory record-keeping and
		Reporting, Environmental standards, Mobile
		bylaws, Environmental restoration orders,
		Education, Public awareness, Access to
		information, Public participation Increase locus
		standi, •Class action Private prosecution

Civil based instruments	 Beneficial cost awards
	•Green rights
	 Protection of whistle blowers
	 Protection of workers
	•Eco-labelling
	•Public waste and pollution
	inventories
	 Incentives and awards
	•Demand-side management
	•Disincentives
	•Tradable/marketable permits
	•Depository return schemes
	•Security deposits
	•Environmental charge
Economic instruments	•Trade restrictions
	•Pricing policies
	Differential indirect taxes
	•Tax concessions
	•Subsidies (investment, research
	and development activity)
	Product charges/taxes
	Posourco charges/taxes
	•Emission charges
	•Flocess charges/laxes
	•Deposit refund systems
	•Croop purchasing
	•User rees
	•National environmental
	Internetional agreements
	•International agreements;
	•Covenant and co-operative agreements
	•Environmental management
	TUULS
STRATEGIES	
Dispute settlement	•Mediation
	•Arbitration
	•Ombudsperson
	•Environmental tribunals/courts
	•Revision
	•Appeal

Source: Du Plessis & Nel (2001)

PLAN	PLAN	DO	CHECK	ACT
ANALYTICAL TOOLS & PLANNING	CRITERIA AND STANDARDS	MANAGEMENT TOOLS	CHECKS & BALANCES	REPORT AND COMMUNICA- TION
Environmental Impact Assessment	Sectoral environmental performance standards	ISO 14001	Environmental monitoring	Environmental reporting
Strategic Environmental Assessment	ISO 14000 family of management standards	Cleaner Technology	Inspection, analysis and record	Environmental communicatio n
Social Impact Assessment		Integrated waste management	Environmental auditing	State of the Environment Reports
Environmental planning		Pollution prevention		Public participation
Emergency planning		Emergency detection and response plans		Improvement plans
Life cycle assessment				

Table 8.2: Environmental Management Tools

Source: Du Plessis & Nel (2001)

Until these issues are addressed, environmental management policies will continue to be a failure and our basic human right to a healthy environment may be jeopardised. Indicators of environmental management and governance tend to be integrated indicators that reflect aspects of the political, economic, social and biophysical environments. These integrated indicators help us to understand the drivers of environmental change. Most importantly, management and policy decisions about the biophysical environment cannot be made without considering the economic, social and political context. Similarly, economic, political and social decisions cannot be made without some impact on the biophysical environment is often governed by capacity and resource factors in the political, economic and social spheres. The capacity and resource factors affecting environmental management in Maluti-A-Phofung are measured through the environmental management and governance indicators presented in this chapter.

Similar acts, as well as many others such as the Water Act, have the role of guarding against backsliding. We can have the best intentions in the world, but a law, as well as other levels of legal devices (ordinances, regulations, treaties, conventions and others) have the advantage of being fixed.

In terms of the Integrated Development Program (IDP), the wheel diagram (see Figure 9.1) is a good place to start. It brings together the aspects of Economic

Growth, Community Resilience and Self Reliance, as well as Service Excellence and Sustainability in the greater aim of Civic Leadership and Common Purpose.



Figure 8.3 Wheel diagram

The approach of this study has been to examine the issue of environmental management via a number of indicators. However, it should be borne in mind that this is a field in its infancy in the Maluti-A-Phofung area. Therefore information is not readily available. Consequently, much of the assessment of this issue will be based on conceptual trends, rather than hard facts. It is expected that hard facts will emerge and be available for updates of the SOE report.

DESCRIPTION OF ISSUES	INDICATOR(S)							
ENVIRONMENTAL	MANAGEMENT							
The process of	•Number of EIAs evaluated & Reconciliation							
administering, supervising or	Cases							
handling the environment in	 Budgetary allocation to environmental 							
order to achieve a	management & Budgetary allocation to							
desired outcome	environmental research							
	•Multi-lateral environmental agreements							
	•EMCAS &Number of EMS							
	•Number of memos of understanding							
	•Budgetary allocation to environmental							
	education & Level of public awareness							

Table 8.3: A brief summary of the issues and indicators:

Within the issue of Environmental Management there are ten indicators. Under the following DPSIR headings, the first two indicators are dealt with as State indicators, while the rest will be dealt with under Responses. This is because of the integrated nature of this issue.

Environmental Management, as an issue, is an overarching one. It therefore is an integrating issue that is influenced by all other themes. The Environmental Management indicators are covered entirely under State and Responses. Impacts are measurable only by the changing states of the other issues.

8.2 State of environmental management

Establishing a Service Unit to monitor the environment and to develop plans around the critical areas of the environment is the highest priority for every municipality, and also for MAP.

The functions of a Service Unit must be based primarily on, but not restricted to:

- The Constitution of South Africa, Act 108 of 1996
- Environmental Conservation Act, Act 73 of 1989
- National Environmental Management Act, Act 107 of 1998
- Municipal Systems Act
- Municipal Structures Act
- Environmental Implementation Plan of Free State Province
- Integrated Development Plan of Maluti-A-Phofung Local Municipality
- White Paper on Environmental Management
- White Paper on Integrated Pollution & Waste Management
- National Waste Management Strategy
- Air Quality Management Bill
- Waste Management Bill
- Protected Areas Bill

8.3 Strategic objectives

The strategic objectives of a Service Unit must be to:

- Evaluate new developments that can have a negative impact on the environment through the EIA process
- Develop strategic policies and plans to promote sustainable development in all the areas but particularly the previously disadvantaged areas
- Promote Local Agenda 21
- Manage Air & Water Quality as well as other environmental aspects in Maluti-A-Phofung Local Municipality

The above objectives are to be achieved by the following units:

- Environmental Quality & Impact Management (EQM)
- Environmental Policy & Co-ordination (EPC)

It is envisaged that the following activities will form part of the functions of the Environmental Management Unit, but might be amended slightly as legislation and requirements may differ form local government to local government.

8. 4 Environmental Quality & Impact Management (EGM)

Environment Impact Assessment is one of the major aspects that will determine the environmental quality in an area.

8.5 Environmental Impact Assessment (EIA)

The following are some of the more important aspects of an EIA:

- Training of Staff & Ensure that municipality is compliant to EIA regulations
- Lobby for devolution to municipality of provincial powers as well as relevant funding in terms of identified listed activities
- To evaluate applications for the undertaking of relevant listed activities according to the procedures set out in the relevant legislation, guidelines and departmental manuals, and issue authorizations or exemptions where applicable.
- To evaluate Environmental Management Plans (EMP) for relevant activities according to Integrated Environmental standards where such EMP's have been requested by and/or submitted to the Maluti-A-Phofung Local Municipality for comments and/or authorization, and issue comments and/or authorizations where applicable.
- To subscribe to the principles of co-operative governance by co-operating with and involving other directorates, government departments and other environmental stakeholders, in the functions of the impact management sub-directorate.
- To evaluate all relevant SEA's, Spatial Plans & other relevant plans prepared in the Maluti-A-Phofung Local Municipality.
- To evaluate the environmental and legal compliance and/or performance of activities authorized by the Maluti-A-Phofung Local Municipality.
- To investigate complaints received at the Maluti-A-Phofung Local Municipality by evaluating the relevant activities and to make recommendations on the correct course of action to be taken.
- To facilitate the rehabilitation of environmentally disturbed areas in the Maluti-A-Phofung Local Municipality through the implementation of relevant legislation and cooperation with other relevant role players.
- To develop EIA reports on behalf of MAP as well as other developers outside

8.6 MAP Air & Water Quality Management (AWQ)

- Training of Staff & Compilation and implementation of air quality management policies as part of the Integrated Development Plans
- Implementation of public awareness campaigns in air quality management issues
- Development and implementation of air quality management programmes to monitor ambient air quality
- Assessment of exercises for ambient air integrity
- Issuance of commencement authorisations and emission licenses for Controlled Processes
- Enforcement of compliance with all applicable legislation;
- Development and implementation of local guidelines and bi-laws in line with the national framework of air quality management policy and within the provincial legalisation and policies
- Ensuring that the national information system and protocols are adhered to and reported accordingly to provincial government
- Promote local research and development programmes in line with the national air quality framework
- Identify and evaluate noise nuisances and disturbing noises in the municipal area
- Development and implementation of local guidelines and bi-laws in line with the provincial framework of noise regulations and policies
- Monitor levels of "disturbing" environmental noise emanating from places of entertainment (discos, night clubs, pubs, etc) or other sources
- Consider applications for temporary exemption or relaxation of the Noise Control Regulations
- Investigate environmental noise complaints and take steps to abate reported noise nuisances / disturbing noise in collaboration with the SA Police Service and the municipal Security personnel (City Police) and other role players

8.7 Environmental Policy & Co-ordination (EPC)

8.7.1 Strategic Environmental Management (SEM)

- • Training of Staff & Co-ordinate the review & dissemination of Environmental Policies and Agreements
- Initiate the development of an Integrated Environmental Policy for the Maluti-A-Phofung Local Municipality
- • Develop Environmental Implementation Plan (EIP) for the Maluti-A-Phofung Local Municipality
- Co-ordinate the support of the developments of relevant policies (Authorisations, Inspections, Wetlands, etc.)

- Initiate the drafting of new legislation in support of the policies
- Co-ordinate the development of minimum standards for the Maluti-A-Phofung Local Municipality
- Co-ordinate the development of environmental economic instruments for the Maluti-A-Phofung Local Municipality
- Co-ordinate the development of air quality standards for the Maluti-A-Phofung Local Municipality
- Co-ordinate the development, promotion & adoption of EMS such as ISO14001 in industry and SMME's
- Promote ISO 14001 in the Maluti-A-Phofung Local Municipality
- Develop co-operative agreements between organs of state (MOUs)
- Co-ordinate the development of Environmental Management Co-operative Agreements with Industry
- Facilitate Environmental Conciliation
- Facilitate the declaration of specially demarcated areas
- To develop and implement the Strategic Environmental Management Plan (SEMP) for the Maluti-A-Phofung Local Municipality
- To assist on the development of the Sector Plans and the driving of the process
 Co-ordinate and compile State of the Environment Reports (SER) on a regular basis
- Co-ordinate the compilation of Strategic Environmental Assessments (SEA) for the Maluti-A-Phofung Local Municipality

8.7.2 Environmental Awareness (EA)

- Training of Staff
- Co-ordinate the promotion & adoption of local agenda 21 in the Maluti-A-Phofung Local Municipality
- Co-ordinate and prepare Municipal Report on Sustainable Development
- Establish the Environmental committee in the Maluti-A-Phofung Local Municipality
- Assist the Maluti-A-Phofung Local Municipality to incorporate environmental issues in planning
- Co-ordinate & facilitate Access to Environmental Information
- Ensure encouragement of the use of energy saving devises in existing, new and upgraded developments
- Ensure education of the public on energy conservation
- Ensure encouragement of the use of water saving devises in existing, new and upgraded developments
- Ensure support of environmental interest groups and clubs
- Ensure development of environmental education resource material
- Co-ordinate relevant training & capacity building of officials in the Maluti-A-Phofung Local Municipality
- Celebrate environmental commemorative days

 Develop and implement school and community environmental policies (SCEP)

Based on the above, it is clear that the MAP can position itself for sustainability through responsible environmental management.

The number of EIAs in the MAP is less than in some other districts but an EIA is simply a reflection of development in the area and not of a degree of compliance. It is apparent that EIAs for all new developments, which require EIAs by law, are carried out to the satisfaction of the provincial DTEEA.

8.7.3 IDP commitment to the environment

This state indicator measures local level commitment to the environment displayed by local environmental strategies included within the long-term development of the Municipality.

From the Integrated Development Plan (MAP, 2006) for the Maluti-A-Phofung Local Municipality, there are certain environmental management guidelines for promoting economic growth in Maluti-A-Phofung, as well as promoting community resilience and self-reliance:

- The development of an Environmental Management Plan.
- To increase the volume of waste collected by weekly collections so that by 2006, 10% will be recycled.
- To establish an environmental education system that will also address personal and community involvement to ensure a clean environment.
- To reduce pollution from coal fires and dust, especially during winter.
- To promote clean energy sources, like electricity.
- To reduce pollution from industrial and hazardous waste (on land and in streams) to safe levels.
- To provide adequate public sanitation facilities in places where people congregate, like sports fields, parks and shopping centres.
- To reduce levels of water pollution through sewage contamination.
- To reduce the levels of animal waste in suburbs, particularly from pigs and dogs.
- To revise the standards and methods of park classification to allow parks to be of the kind that is useful and can be maintained.
- To develop five new parks in Phuthaditjhaba, Harrismith and Kestell townships.
- To ensure that roads and other supporting infrastructure are maintained in a good condition.
- To develop an efficient and safe public transport system.
- Enforcement of by-laws to ensure a clean environment.

In this way, environmental management becomes an important part of governance.

Within the Spatial Development Framework of the IDP, a conceptual environmental analysis was done for each spatial node as a measure of incorporating environmental management thinking in all spatial development activities.

The state of environmental management as experienced and reported by the community of Maluti-A-Phofung is listed in the table below:

Issue	Rural Qwqwa & Phuthaditjhaba	Harrismith Intabazwe Swinburn Van Reenen	Kestell & Thiolong
Calls for protection of all conservation areas as well as the effective integration of these areas with each other in a Open Space System	Entire area	Entire area	No reports
Various previous environmental health projects were abandoned and discontinued due to mismanagement or effective management and proper planning and management of future project are vital	Entire area	Entire area	Entire area
Call for structured public- private partnerships in all natural resource management will save resources, educate communities and ensure environmental ownership	Entire area	No reports	No reports

 Table 8.4: Community experiences of environmental management

8.7.4 Key indicators of responses

Key indicators of responses to the issue of Environmental management are:

- budgetary allocation to environmental management
- budgetary allocation to environmental research
- budgetary allocation to environmental education

- multilateral environmental agreements
- Environmental Management Cooporative Aggreements (EMCAs)
- Number of Environmental Management Systems (EMSs)
- Number of Memos of Understanding
- Level of public awareness

8.7.5 Budgetary allocation to environmental management, education and awareness per capita

This indicator is a response indicator that reports on the financial commitment of provincial government to environmental management, education and awareness raising. The provision of adequate financial resources to these issues shows political commitment to them. Expenditure on environmental education and awareness, in particular, may lead to increased involvement and empowerment of people in environmental issues (DEAT, 2002).

The budget indicators are response indicators of the financial commitment, which in turn reflect political commitment, of local government to environmental management, research and education. The provision of adequate financial resources to these issues shows political commitment to them. According to DEAT (2005), expenditure on environmental education and awareness, in particular, may lead to increased involvement and empowerment of people in environmental issues.

Budgetary allocation to environmental management, as distinct discipline, is therefore growing from a zero base in 2002, to an interim sum in 2006, and further to a sum yet to be defined.

The existing budget is to establish the Environmental Management Unit at MAP and environmental education, among others, must be addressed in future budgets.

8.7.6 Voluntary adoption of environmental management systems

Private sector commitment to environmental management can be gauged through this indicator. It reflects corporate institutional support for environmental management, and highlights corporate accountability and transparency. By adopting environmental management systems (EMS) as part of their business processes, companies are investing in environmental management. EMSs promote operating practices that protect the environment (or at least afford it greater protection than it currently has) and strive for continuous improvement. The voluntary adoption of these systems reflects a commitment to the protection of the environment by the private sector (DEAT, 2002).

The environmental management systems included in reporting on this indicator include:

- . ISO 14001;
- . Eco-Management and Audit Scheme (EMAS);
- . British Standard 7750 (BS 7750);
- . Responsible Care ©; and
- . Forest Stewardship Council (FSC).

Although a detailed list of industries complying with these standards was not available as no local database exists, it is expected that many of the larger industries in Maluti-A-Phofung subscribe to some sort of environmental management system, with ISO 14001 being the most common. It is likely that this trend is due to parent companies being required to have an EMS of some kind due to environmental policy and legislation in the parent companies' home country.

Companies trading in goods and services in an international market are already complying with the ISO14001 guidelines, as provided in South Africa by the South African Bureau of Standards (SABS). However, some of these firms have chosen at this early stage not to register with the SABS. Electrical service provider Eskom as well as mobile telecommunication service provider Vodacom, has a well-developed and integrated EMS, and the water service provider is in the process of implementation. Most private firms are clearly not compliant as yet.

It is important to note that the MAP also does not have an EMS in place but is in the process of complying with the necessary standards.

It is not known how many of the medium, small and micro industries in the Province have environmental management systems. It is doubtful that any of these medium, small and micro enterprises will have an environmental management system of international recognition. Regardless of whether or not an industry has an EMS in place, all are still required to adhere to national and provincial legislation and local by-laws.

8.7.7 Multilateral environmental agreements, Environmental Management Cooperative Agreements (EMCAs)

As far could be determined there are no multilateral environmental agreements, Environmental Management Cooperative Agreements (EMCAs) and memos of understanding in place within the Municipality, but it is expected that it will develop as the new Environmental Management unit is properly established.

8.7.8 Level of public awareness Level of public awareness of environmental management is difficult to assess.

Unfortunately, much of environmental education is concentrated on the softer "nice" aspects or "green issues" of the environment, whereas the critical importance of the environment as service provider is not given the necessary attention. As simple example, there are almost 400 thousand people in the MAP area, each of which might reasonably consume (in the economic sense) one kg of organic matter (food, peels, containers etc.) per day. This amounts to 400 tons of organic matter per day that needs to be processed by its environmental services (sewerage works, rivers etc.) in order to allow the community to function properly and on a sustainable level. Such facts need to be used to stress the importance of environmental services.

8.8 Conclusion

Environmental management plays a vital role in shifting the emphasis from environmental degradation to environmental restoration. This paradigm shift pivots around the key concept of sustainable utilisation of the Earth's resources.

The Environmental Management Service Unit in MAP will be established at the start of 2008. Certain mechanisms have already been put in place in order to allow for a structured approached to environmental management in MAP.

The level of Environmental Management in Maluti-A-Phofung is at a reassuring level of development with the creation of a Department of Environmental Management. Future SEMP's will be able to measure the capacity, growth in capability and stature of this field and department.

- Pollution cleanup to pollution prevention
- Waste disposal to waste prevention and reduction
- Protecting the species to protecting the habitat where they live
- Environmental degradation to environmental restoration
- Increased resource use to more efficient resource use

• Population growth to population stabilisation In South Africa the Constitution of the Republic of South Africa ensures that the environment of South Africa is protected, ultimately for the benefit of the people of South Africa.

Chapter 2, section 24 of the Constitution of the Republic of South Africa (RSA, 1996) states that: "Everyone has the right to an environment that is not harmful to their health or wellbeing; and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that

- (i) prevent pollution and ecological degradation;
- (ii) promote conservation; and
- (iii) secure ecologically sustainable development and use of natural resources

while promoting justifiable economic and social development."

Chapter 3 of the Constitution (RSA, 1996) deals with Co-operative Government, as outlined below:

"All spheres of government and all organs of state must

. . .

d) provide effective, transparent, accountable and coherent government for the Republicans a whole

Environmental governance can be described as a number of tools that are used to manage the environment towards achieving communal goals. Governance typically involves government, the private sector, non-government and community-based organisations, and will take place at more than one level, typically ranging from:

- Principles and societal values regarding the environment;
- National policy underpinning societal values;
- Legislation for implementing policy; and
- Regulations dealing with specific legislation;
- Internal organisational policies to ensure adherence to regulations;
- Institutional structures to fulfil policy mandates; and Implementation strategies to ensure compliance with policy (Ramasar, 2002 pers comm.; Cloete & Wissink, 2000). Furthermore the United Nations Development Program (UNDP) reflects on propagated characteristics of cooperative or good governance, including participation, the rule of law, transparency, equity, effective and efficient government, accountability and having a strategic vision (UNDP, 2002).

Good environmental management and governance are key factors in ensuring sustainable development within Maluti-A-Phofung. In South Africa, policy failures for environmental management mainly relate to constraints of implementation, such as lack of financial resources and a lack of political commitment (Ramasar, 2002).

According to (Du Plessis & Nel 2001), in general integrated environmental management and governance can be seen as the integration of government instruments and multiple environmental policy as well as management tools to ultimately achieve sustainability.

CHAPTER 9 RECOMMENDATIONS (GAP ANALYSIS)

9.1 Introduction

The scope of SEMP for Maluti-A-Phofung includes the consideration of all the environmental aspects of the proposed development and derivation of appropriate environmental performance expectations and outcomes. Emanating from the analysis of the various themes within this document, the following practical recommendations could be suggested. These are discussed primarily under three heading (Municipal intervention, Future in depth research required and Practical activities for citizens, as listed below:

9.2 Municipal intervention

The following are some GAP analysis resulting from the SEMP analysis in the Maluti-A-Phofung Local Municipality. If the municipality wants to implement the plan successfully, there are a few aspects to attend to.

9.2.1 Atmosphere and Climate

- A single department within the Municipality should be made responsible for all air quality and climate issues within the Maluti-A-Phofung area. An Environmental Officer should be appointed to undertake all municipal air quality and climate change responsibilities. This department (Environmental officer) must also report on a regular basis (maybe twice a year) to the municipal board about their progress and actions as well as any changes in air quality and climate issues.
- Monitoring of all indicators should be prioritised. Monitoring procedures should be ongoing, consistent and in accordance with the relevant monitoring procedure standards in South Africa. Monitoring should be the responsibility of the Environmental Officer in charge of air quality and climate change issues, and should be under the authority of a single department.
- Existing monitoring stations should be reviewed and upgraded if they are to be utilised, and new monitoring stations should be established in and around growth nodes and areas of potentially polluting land uses. These stations should also be established in the formally disadvantaged areas such as Phuthaditjhaba and Tsiame.
- Areas where potential "hotspots" of poorer air quality have already been detected should be made a priority when determining a strategic management procedure for air quality. Phuthaditjhaba as a whole is a very big problem, getting bigger and the air quality needs to be addressed, especially during winter months.
- An environmental management strategy for the Maluti-A-Phofung Local Municipality should be developed for dealing with issues regarding air quality

and climate change. Part of establishing an Environmental department, there must be a budget attached to it.

9.2.2 Freshwater resources

- Upgrading of all the sewerage works to accommodate increasing urbanisation and prevent pollution of waterways.
- Effective management and management actions of sewerage works to minimise pollution events. Responsible people must also report twice a year to the municipality board to outline all the actions and to report on the actions to minimize pollution...
- Upgrading and cleaning of storm water runoff channels in the urban centres to minimise pollution of water.
- Fixing broken pipes and blocked manholes as an urgent matte as this leads to water pollution and contamination.
- Protecting urban streams from contamination by humans and domestic animals, including faeces and other waste through proper management standards and procedures.
- Municipal intervention is required to protect water sources from pollution by the excrement of people and animals. A key problem in this regard was identified at all the streams and small dams in the area and the serious degradation of these areas is threatening water life in.

9.2.3 Land

- Development of an urbanisation strategy is essential for all areas but especially for Phuthaditjhaba where current trends are projected for a growth rate of around 40% to 50% in 5 years time. Land needs to be identified and bought to accommodate these household trends, and a plan to upgrade these areas incrementally must also be developed.
- Formulation of a Land Use Management System to municipal management for urban and rural land uses in compliment of each other.
- Calculation of carrying capacity of farmlands and controlling of animal numbers, especially in degraded areas around QwaQwa.
- Constant co-operation between the municipality and agricultural role players, as these parties affect each others resource quality.
- Formulation of a comprehensive management plan for all the cultural heritage resources within the municipal area to market it to tourists.

9.2.4 Biodiversity and natural heritage

- Long term and systematic environmental awareness and education campaign to all sectors of society need to address it very urgently.
- Better control over illegal trade in animal and plant species through corporate governance with other tiers of government.

- Eradication of alien vegetation through national programmes combined with the planting of more indigenous trees on all public open spaces in the different areas.
- Management of proper rehabilitation of degraded areas, as shown in the report.
- By-laws must be promulgated to protect MAP's biodiversity.
- A master plan should be compiled for the municipality on the protection and management of sensitive areas in the MAP area, like the current game farms and other nature conservation areas.

9.2.5 Waste management

- Drafting and promulgation of regulations and guidelines as well as the formulation of waste management plans for all the areas as part of an Integrated Waste Management process.
- Education programmes for the consumer and encouraging general and hazardous domestic waste minimization through pamphlets, and other sources.
- Systematic development of a recycling programme (for all types of products) within all urban areas as well as the promotion of recycling to all residents.
 A better and more effective refuse removal service provision to all areas.

9.2.6 Human well-being

- The relationship between providing of housing and infrastructure should be integrated to a larger extent. Housing should not be constructed if infrastructure cannot be provided, while more attention can be devoted to housing that is more energy efficient, for example, the fronting of the house towards the north. This is an area that a lot of research has already been done. See the Social Housing report for more detail at the Maluti-A-Phofung Local municipality offices.
- The only recommendation in terms of economic development is that MAP should proceed with the development of the economic development plan. In addition it is essential to ensure that the environmental impact thereof is limited. Furthermore, effective monitoring and evaluation systems need to be developed in this regard. Extensive research could assist in making the programme sustainable. Another indicator that could be used is the income generated from district municipal levies.

9.2.7 Environmental management

- The proper establishment of resourcing of the Environmental Management Unit should be the main priority toward environmental management.
- Formulation of effective standards and procedures for the environmental monitoring and management of key issues such as air and water quality within the municipality.
- Establishment of public-private-partnerships with role players in the environment for the effective conservation of sensitive area.

9.3 Future in depth research required

9.3.1 Air quality

- Research should be undertaken to identify the status of community health with regard to air pollution-related illnesses and diseases. Coordination between clinics, hospitals, health practitioners and the Municipality is essential for developing a health database. This is especially important for the Qwaqwa area.
- Pollution episodes and incidents require a management strategy. A community complaints line should be established to record smoke, odour and other pollution events. Records such as this can be useful for determining the source of pollution events. One major source of pollution during winter time is smoke from firewood from informal and RDP houses.

9.3.2 Freshwater resources

- Continued water quality measurement and monitoring at key points within the catchment area of the municipality of both groundwater and surface water sources.
- A waste management plan in conjunction with a fresh water management plan will be of good value.

9.3.3 Land

- Continued planning and research into the projected future land requirements of future land functions as well as the locality thereof.
- Long term mapping in the change of land uses within urban and rural areas.
- The salinity of soil resources should be monitored to measure the productive quality of land.
- Proper environmental and economic feasibility studies should be conducted for all community based agricultural projects or land reform initiatives.
- Compilation of a cultural heritage resources register through an inventory to the specification of the National Heritage Resources Act.

9.3.4 Biodiversity

- Identification and mapping of sensitive areas and species under threat. Management of all these sensitive species are very important and research can be done on reasons why these species are under threat.
- Identifying and registering sites as conservancies and Natural Heritage Sites, with proper management plans.

• The Spatial Development Framework map of MAP on sensitive areas must be reviewed to address combined sensitive areas.

9.3.5 Waste Management

• A Waste Management information system will produce the most significant results over short the term. Once the problems have been identified and quantified, appropriate steps can be taken to rectify the situation.

9.3.6 Human well-being

- Regular, comprehensive and reliable data on the socio-economic state and wellbeing of young men and women are a necessary condition if development projects in the municipal area are to be aligned with the objectives and strategies of the International Conference on Population and Development (Cairo, 1994) and the PPSA. Such up-to-date data is crucial to inform current and future information and development programmes in MAP.
- An assessment of the success and impact of all existing health information programmes should be a priority, and if necessary such information programmes should be re-aligned to ensure that the most vulnerable sectors are targeted and that the necessary impacts, specifically those aimed at a change of behaviour, are made indeed.
- A proper demographic analysis and, more specifically, an extrapolation of estimated Aids deaths in MAP for the next 5, 10 and 15 years is urgently needed not only to inform development policy and strategic planning, but also to advise planners and mangers on appropriate intervention and mitigation actions. Current policies and programmes have to rely mainly on historic trends and recent impacts; seen from a human well-being perspective, however, the very essence of sustainable development calls for a projection of these trends and impacts in order to direct policy and intervention strategies.
- Consideration should also be given to studying the relationship between health, poor access to housing and infrastructure, the environment, as well as the economy of the city.

9.3.7 Environmental management

- Comprehensive listing of all public and private environmental management resources or tools within the municipality.
- Continued monitoring and measurement of the indicators of the State of the Environment Report to measure the overall progress of the municipality towards sustainable development. It must be done at least every 2 – 3 years.

9.4 Practical activities for people living in the areas

9.4.1 Atmosphere and climate

- Develop a plan to reduce the energy consumption and the burning of fuel wood which pollutes the air and lead to respiratory diseases.
- Reducing the number of vehicle trips by coordinating family travelling and so doing reducing fuel emissions - use lift clubs, public transport, bicycles or our feet for transport.
- When purchasing new air-conditioners or refrigerators, ensuring that they do not use CFC's. Hydrofluoracarbons (HFC's) are suitable alternative because they do not destroy ozone molecules. Public lobbying for a reduction in products containing CFCs.
- Prevent open fire by law.

9.4.2 Freshwater resources

- Reducing the use of detergents to a minimum and especially not directly in rivers and other streams.
- Preventing refuse dumping in unauthorized areas as this leads to pollution of groundwater resources and other related problems
- Preventing blockage of drainage pipes and storm water drains by doing refuge removal regularly.
- Preventing removal of trees and increased trampling of riverbanks and in the riparian zone of a river for firewood as this leads to erosion and an increased pollution of the rivers.
- Preventing the catching of fish with shade nets, traps, gill nets or seine nets.
- Alerting the local land use authority regarding misuse of water catchment areas.
- Starting a catchment conservation project for a river in your area. Show peoples where they are allowed to catch fish and where it is prohibited.
- Getting to know the water catchment in your area and listing the plants and animals living there. Monitor the changes with this area with seasonal change.

9.4.3 Land use

- Bring overgrazing and land mismanagement to the attention of the municipality. Give in some cases a reward system in place to help people not do overgrazing.
- Taking part in the activities of conservation groups in your area aimed at the protection of land and heritage resources.
- Educating all the people by means of training course in the concepts of desertification, erosion and soil degradation to prevent it in MAP area.

9.4.4 Biodiversity and natural heritage

- Visit and support conservancies near or in the municipal area and become a volunteer in the maintenance of such an area.
- Taking part in the eradication of alien vegetation.
- Cleaning up (on a regular basis) of polluted areas such as streams and dams.
- An erosion damage plan must be drawn up. Erosion could be restored by construction of gambions and of bare areas could be revegetated. These actions are also ideal opportunities to create jobs. In such a way the state of the environment will improve and poverty be alleviated.

9.4.5 Human well-being

- Respecting the rights of other to a clean and healthy environment and taking part in campaigns to save water and electricity.
- Volunteer at social facilities and projects to care for the impoverished and disadvantaged in your area.
- Develop a skills training programme for people in the areas, because educated people conserve an environment more and better.

9.4.6 Environmental management

- Citizens can contribute by demanding action from their political representatives, and by realising that it is they (the citizens) who have ultimate ownership and responsibility for the conditions of environmental services and for the level of environmental management.
- Empower people by let them know how the environment works and show them there role and importance in it. Develop a strategic environmental citizen plan to educate people.

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ANNEXURE A: SEMP ACTION PLAN

ACT	ACTION PLAN FOR SEMP										
/e		То	be com	pleted o	end of y	ear:					
ectiv	Action	1	2	3	4	5	Responsible	Budget	Performance Indicator		
Obj		2007	2008	2009	2010	2011	Institution				
nentation	Environmental Policy	x					MAP [TOURISM DIVISION]	N/A	Environmental policy in place		
Impler	Environmental By-Laws	x	x				MAP [TOURISM DIVISION]	N/A	Number of By-Laws formulated and implemented		
	Review and monitor the MAP SEMP	X	X	X	X	X	MAP [TOURISM DIVISION]	N/A	SEM reviewed		
Implementation	Awareness Campaigns	X	X	X	X	X	MAP [TOURISM DIVISION]	R500 000	Numbers of campaigns organized and implemented - Campaigns on Air pollution - Biodiversity - Water management - land use management - Sanitation /health management		

	Land use management	X	X	X	X	X	MAP [LED & TOURISM DIVISION	R 5 M	Number of projects implemented – Quarrying – Sand and Sand Stone Mining – Brick Making – Donga Rehabilitation
	Agricultural Land Use	X	X	X	X	X	MAP [LED & [TOURISM DIVISION	R 850 000	Numbers of control measures put in place e.g - Pest and insecticide controls - Soil erosion control - Irrigation - Management of Alian crops - Domestic animals e.g caws, pigs etc
	Aquatic management	X	X	X	x	X	MAP [TOURISM DIVISION]	R5M	Number of projects implemented - Wet land management - Fish farming - Fishing (Fly Fishing)
	Water management	X	X	X	X	X	MAP [TOURISM DIVISION] & MALUTI - WATER	R500 000	 Number of control measures put in place Awareness campaigns Resource management plan Introduce small vegetable irrigation farms Back yard gardening

Waste Management	X	X	X	X	X	MAP [TOURISM DIVISION] & COMMUNITY SERVICES	R2M	 Number projects implemented Awareness campaigns (Reduce Reuses and Recycle) Recycling projects Metal and aluminum depots Number of control measures put in place
Biodiversity management	X	X	X	X	X	MAP TOURISM DEVISION &PUBLIC SAFETY	R3M	Number of programmes put in place - Conservation (protected areas) - Number of conservancies established (NGOs) - Indigenous plants projects - Vekld Fires
Sanitation & Health	X	X	Х	X	X	MAP & TDM	R 40 000	Re enforcing and reestablishment of health inspectors Encourage HIV/AIDS activists
Environmental celebrations	X	X	X	X	X	MAP, TDM, DEAT & DTEEA	R 1M	Number of events /celebrations implemented on the environmental calendar Number of e-mails sent
Solicit interest from the private sector to develop new projects aligned to the SEMP	X	X	X	X	X	MAP TOURISM DIVISION	N/A	Tenders received

Oversee the development of new environmental projects	X	x	X	X	X	MAP TOURISM DIVISION	N/A	Development of sustainable new environmental projects according to recommendations of SEMP
Facilitate protection of natural, historical, cultural and heritage assets	X	X	X	X	X	MAP, DEAT, DEPARTMEN T OF SPORTS, ARTS and CULTURE	R5M	Number of National Monuments declared and protected
Advise other resorts in the area to include guidelines from SEMP when redeveloping	X	X	X			MAP TOURISM DIVISION	N/A	Development of other resorts according to recommendations SEMP
Establish the Entrepreneurial Support Function	x					MAP TOURISM DIVISION	N/A	Support Function Established
Provide assistance to entrepreneurs	x	x	X	X	X	MAP TOURISM DIVISION	N/A	Number of entrepreneurs assisted

Conduct Environmental Education programs	X	X	X	X	x	MAP TOURISM DIVISION	R500 000	Number of programmes presented
Facilitate HR Development	x	x	x	x	X	MAP TOURISM DIVISION	N/A	Number of learners assisted
Main streets in Maluti-a- Phofung to be cleaned up	X					MAP TOURISM DIVISION & COMMUNITY SERVICES	Operational budget	Main streets neat and tidy
Facilitate environmental programs	X	x	X	x	X	MAP TOURISM DIVISION	N/A	Number of environmental programs facilitated
Facilitate HR & Entrepreneurial Development	x	x	x	x	x	MAP TOURISM DIVISION	N/A	Number of entrepreneurs and training programmes facilitated
Employ a Environmental officer		X				MAP TOURISM DIVISION]	N/A	Staff employed