ENVIRONMENTAL MANAGEMENT FRAMEWORK FOR THE AMAJUBA DISTRICT MUNICIPALITY

Strategic Environmental Assessment

Institute of Natural Resources

ENVIRONMENTAL MANAGEMENT FRAMEWORK FOR THE AMAJUBA DISTRICT MUNICIPALITY

STRATEGIC ENVIRONMENTAL ASSESSMENT

Submitted to

AMAJUBA DISTRICT MUNICIPALITY

edtea
Department :
Economic Development, Tourism and Environmental Affairs
PROVINCE OF KWAZULU-NATAL

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2019

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1. INTRODUCTION

1.1 BACKGROUND

The Amajuba District Municipality (ADM) has embarked on the development of an Environmental Management Framework (EMF). The ADM EMF was initiated through a concurrent agreement between the national and provincial ministers responsible for environmental affairs in terms of Chapter 5 of the National Environmental Management Act (1998). It was prepared as a joint initiative between the National Department of Environmental Affairs (DEA), the KZN Department of Economic Development, Tourism and Environmental Affairs (EDTEA) and the ADM. The need for the EMF was driven by authority concerns in the District regarding the following environmental issues:

- The decline in air quality,
- The extent of water pollution,
- Land degradation and other environmental issues that may negatively affect local people and the growing economy, as well as
- The lack of adequate information to make more informed decisions.

1.2 PROJECT PURPOSE AND STRUCTURE

The aim of this EMF is to: Guide development within the District towards sustainability by:

- Informing development planning
- Informing the EIA process for specific development applications, and
- Providing management guidance for responding to key sustainability issues.

The EMF regulations (Section 2) list the purpose of the regulation as: Compilation of information and maps specifying the attributes of the environment in a particular geographical area:

a) For such information to inform environmental management, and
b) For such maps and information to be used as environmental management frameworks in the consideration of applications for environmental authorisations in or affecting the geographical areas to which those frameworks apply.

Section 2 (3) further explains that EMFs are aimed at:

- Promoting sustainability.
- Securing environmental protection.
- Promoting cooperative environmental governance.

The project is structured into four phases each of which builds on the outcomes of the preceding phase in working towards the overall outcomes. The objectives and deliverables of each phase are summarised below. The status of each phase is also presented with the SEA phase highlighted to show where we are in the overall project progress.

INCEPTION

Purpose – To document the desired outcomes, how they will be achieved and the mechanisms for managing the process.

- A common understanding and the purpose, nature & format of desired project outcomes for each phase
- The relationship between each phase and the associated outcomes,
- The approach and methods for achieving these outcomes,
- Project management mechanisms required to efficiently and effectively achieve the outcomes.

Output – Inception Report

STATE OF ENVIRONMENT

Purpose - Establish a baseline understanding of the state of the environment within the District and more specifically:

- Map the location and extent of land-use, natural systems and features in the receiving environment.
- Classify the mapped systems and resources within different components of the receiving environment (social, cultural, biophysical).
- Establish the present state (PS) of resources within the different components of the environment.
- Document the factors responsible for the current state of the environment components.

Output – State of Environment Report

STRATEGIC ENVIRONMENTAL ASSESSMENT

Purpose - Establish a desired future state.

- Summarise the state of natural systems and discuss their socio-economic value.
- Identify, analyse and discuss the implications of key environmental issues – how the current state of natural systems is affecting people's well-being and economic prosperity.
- Establish a Desired Future State – objectives, targets and thresholds that will minimise/reverse negative impacts of the current situation and/or enhance positive aspects.

Output – Strategic Environmental Assessment Report

ENVIRONMENTAL MANAGEMENT FRAMEWORK

Purpose – Guide the municipality in planning and implementing sustainable development in the District, through a range of tools that comprise the EMF including:

- Strategic Environmental Management Plan (SEMP) - provides guidance on how to move from the Present to Desired future state by detailing the actions, methods and responsibilities for addressing key environmental issues and maximizing opportunities.
- Environmental Information Management System (EIMS) – spatial tool for data management and decision support.
- Environmental Sensitivity Zones & EIA Guidelines – defines the sensitivity of areas in relation to natural systems and guides the nature and level of investigation during the EIA process.

Output – EMF Products (SEMP and Sensitivity Zone mapping) and EMF summary report

1.3 STUDY AREA

The ADM comprises three local municipalities (LMs) i.e. Newcastle LM, Dannhauser LM, and Emadlangeni LM. The project area is shown in Figure 1. The Newcastle LM[1] is considered the economic hub of the ADM. The key economic activities of the ADM include commercial agriculture, coal mining and industrial manufacturing. As an example, the area constitutes the largest producer of chrome chemicals in Africa. There are transport and nodal links to Johannesburg, Durban and Richards Bay ports. Newcastle is also a retail hub for this and neighbouring districts.

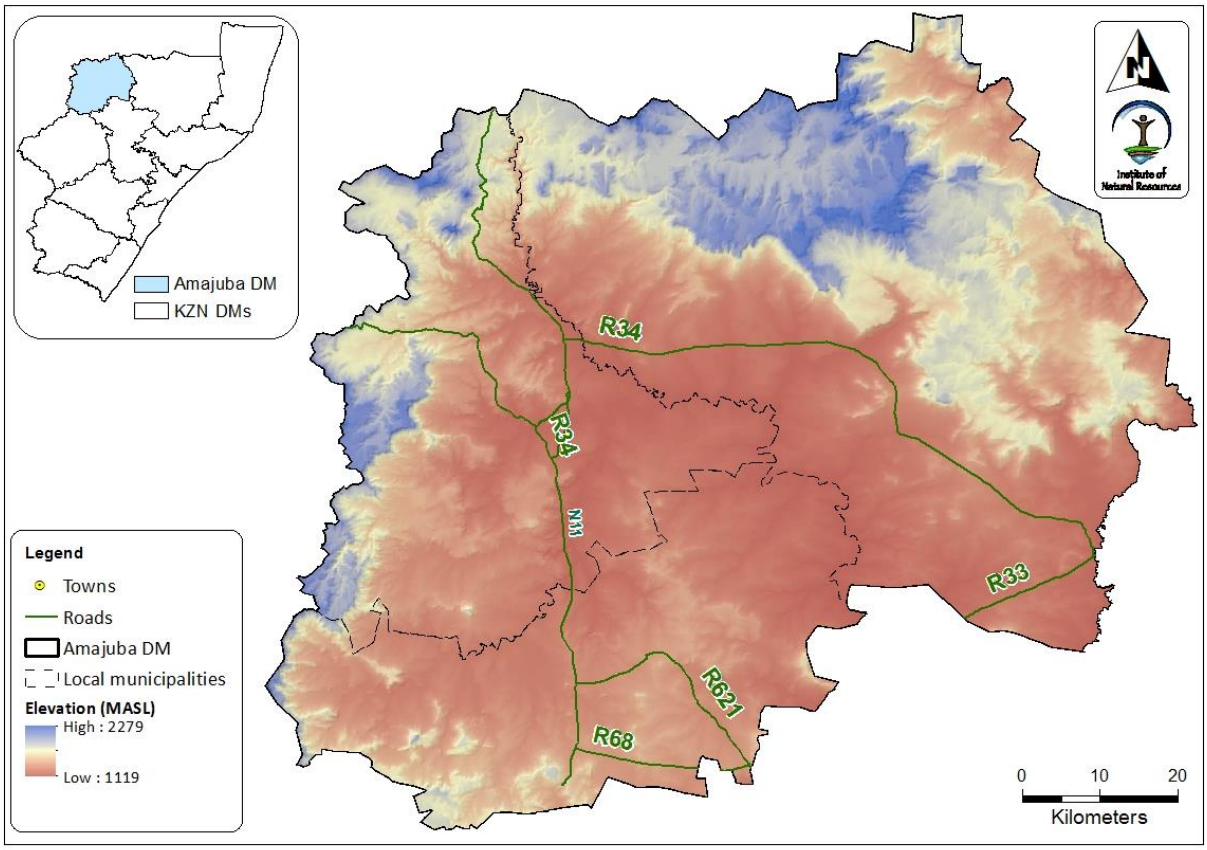

Figure 1: ADM Project area

1.3.1 Topography and Land forms

The ADM is characterised by a horseshoe of high lying western, eastern and northern regions. The western areas comprise a section of the Drakensburg escarpment, while the northern and eastern areas comprise the Balelesberg and the Skurweberg mountains. The Biggarsberg Mountains are located to the south of the District with the majority of this landform falling in neighbouring Districts (Figure 2). These higher regions drain into the Buffalo River basin in the middle of the District supplying water to the lower lying, flat central regions of the ADM. The District ranges from 1042m to 2290m above mean sea level, as listed in Table 1. This range in altitude results in a diverse range of habitats and ecosystems which are the subject of this report.

1 An EMF has been developed for the Newcastle EMF. The EMF has not been gazetted and the information will be integrated with the District EMF where still current and relevant.

Table 1: Topographical variables of the Amajuba District per Local Municipality

Local Municipalities			
	Newcastle	**Dannhauser**	**Emadlangeni**
Area (Square Km)	1855	1516	3539
Min Elevation (meters above mean sea level)	1140	1143	1149
Max Elevation (meters above mean sea level)	2247	2104	2276

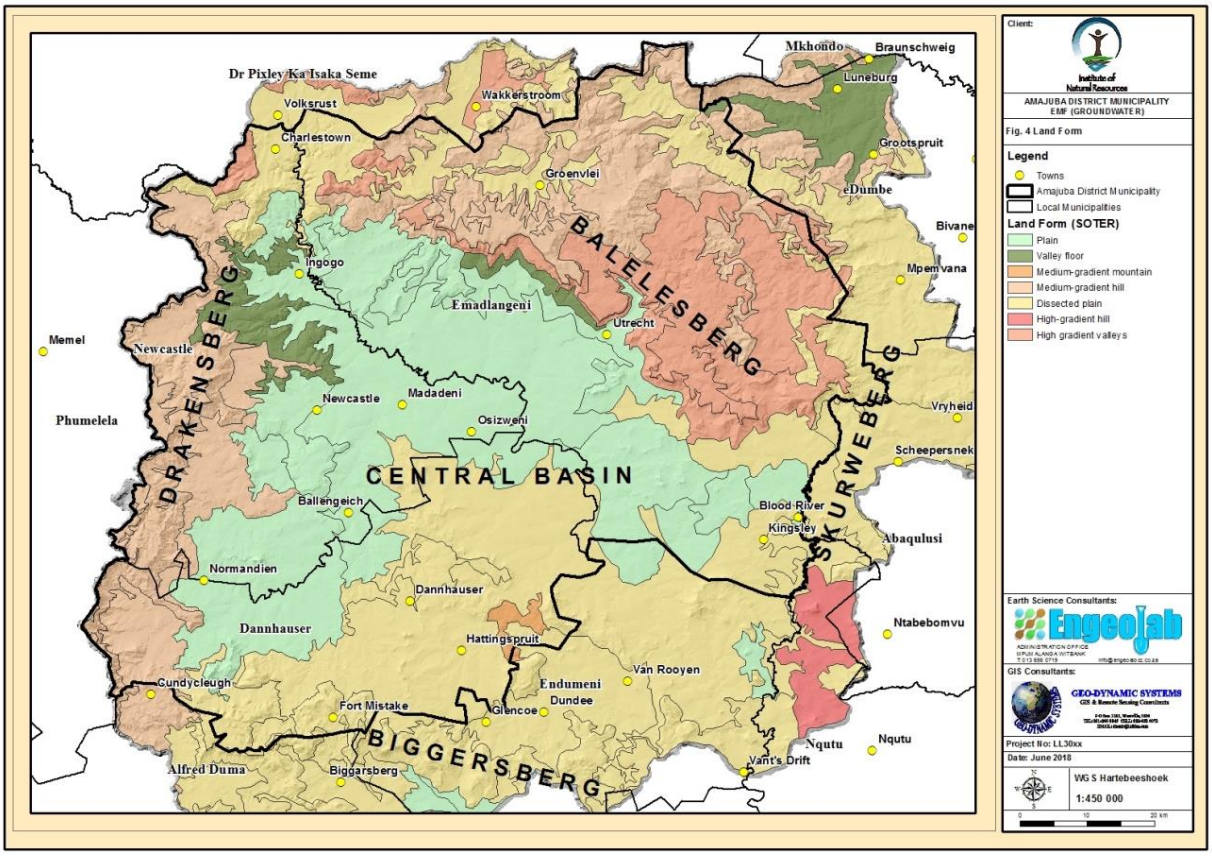

Figure 2: Land forms of the ADM

1.3.2 Climatic Characteristics

There is a substantial difference in temperature between summer and winter months in the ADM. Winter is noticeably cold with temperatures usually dropping below 0 degrees. Frost in the colder autumn and winter months is a common occurrence. Summer is far warmer with temperatures exceeding 30 degrees. An average annual temperature of 17 degrees has been measured across the district. Altitude plays an important role in the varying the mean annual temperature and the average annual rainfall measured across the District (Table 2, Figure 3 and Figure 4). The Mean Annual Precipitation (MAP) for the district varies between 500mm in the low lying areas and 1150mm in the high lying areas, as illustrated in Figure 3.

Table 2: Mean annual rainfall per local municipality

Precipitation (mm)			
	Newcastle	**Dannhauser**	**Emadlangeni**
Annual Min RF	504	587	517
Annual Max RF	1149	1015	1127

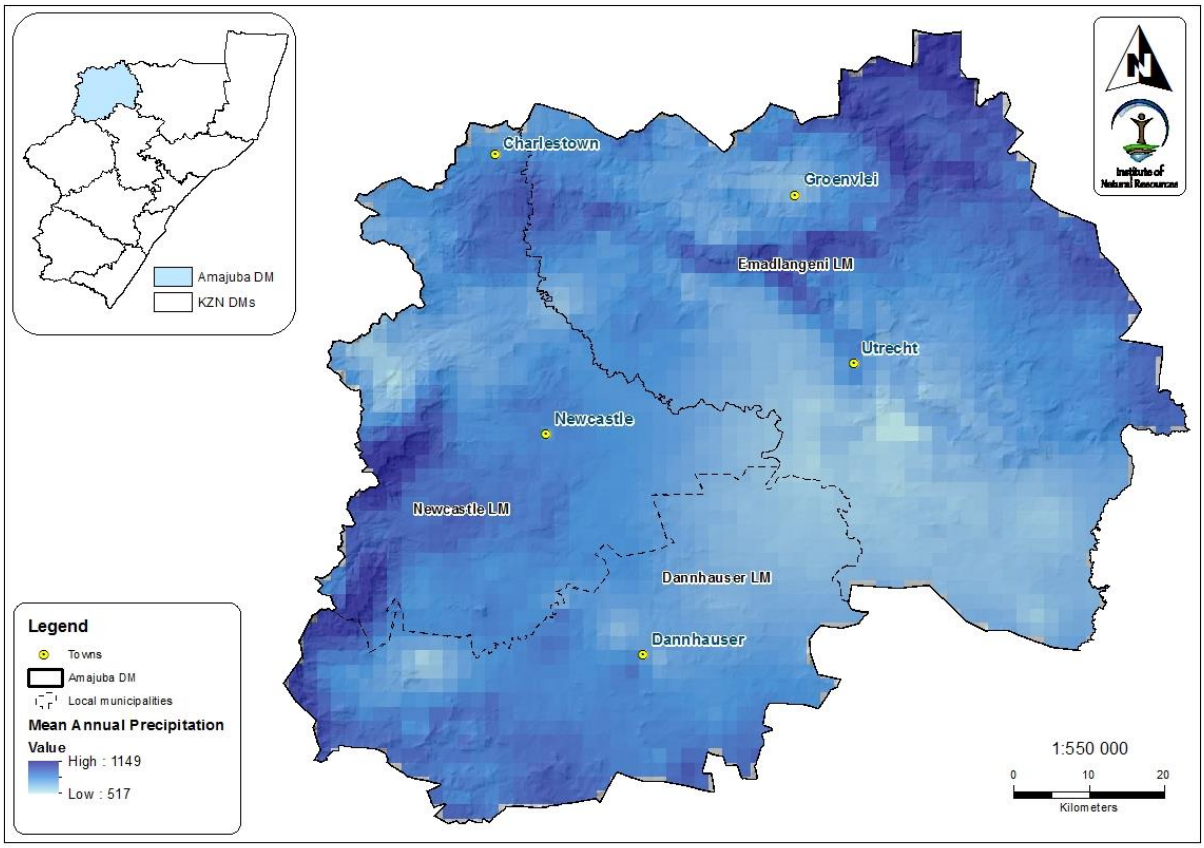

Figure 3: Mean Annual Precipitation for the ADM (Schulze et al 2011)

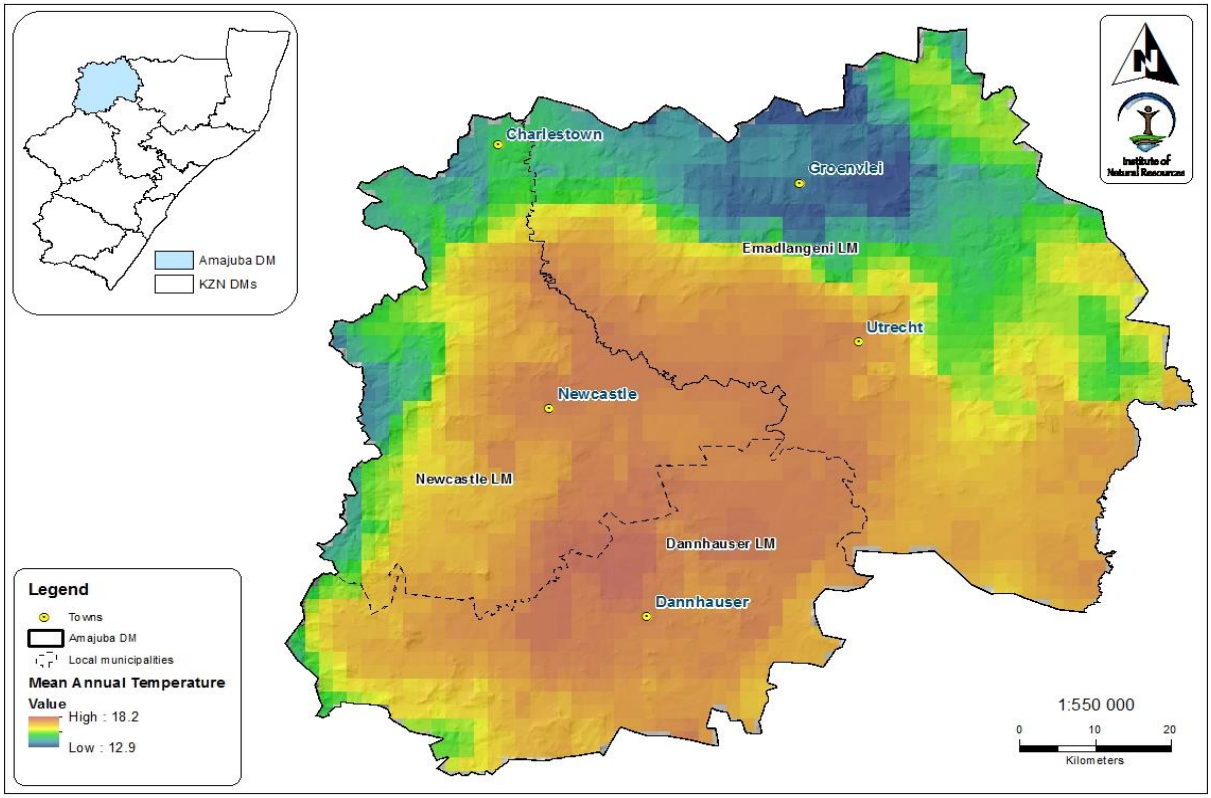

Figure 4: Mean annual temperature for the ADM (Schulze et al 2011)

1.3.3 Geology and soils

The underlying geology of the central portion of the ADM is underlain by Karoo Sequence sediment with higher-lying areas underlain by a combination of geological foundations. Varying soil types occur in the area consisting of Dolerite, Mudstone, Sand and Shale amongst others. The overall texture of the soil appears to be predominantly clay. Due to the numerous wetlands in the area, it is usual for the soils to have an expansive property, meaning that they have the ability to shrink and swell based on their water content (typical of wetland type soils) (Figure 5).

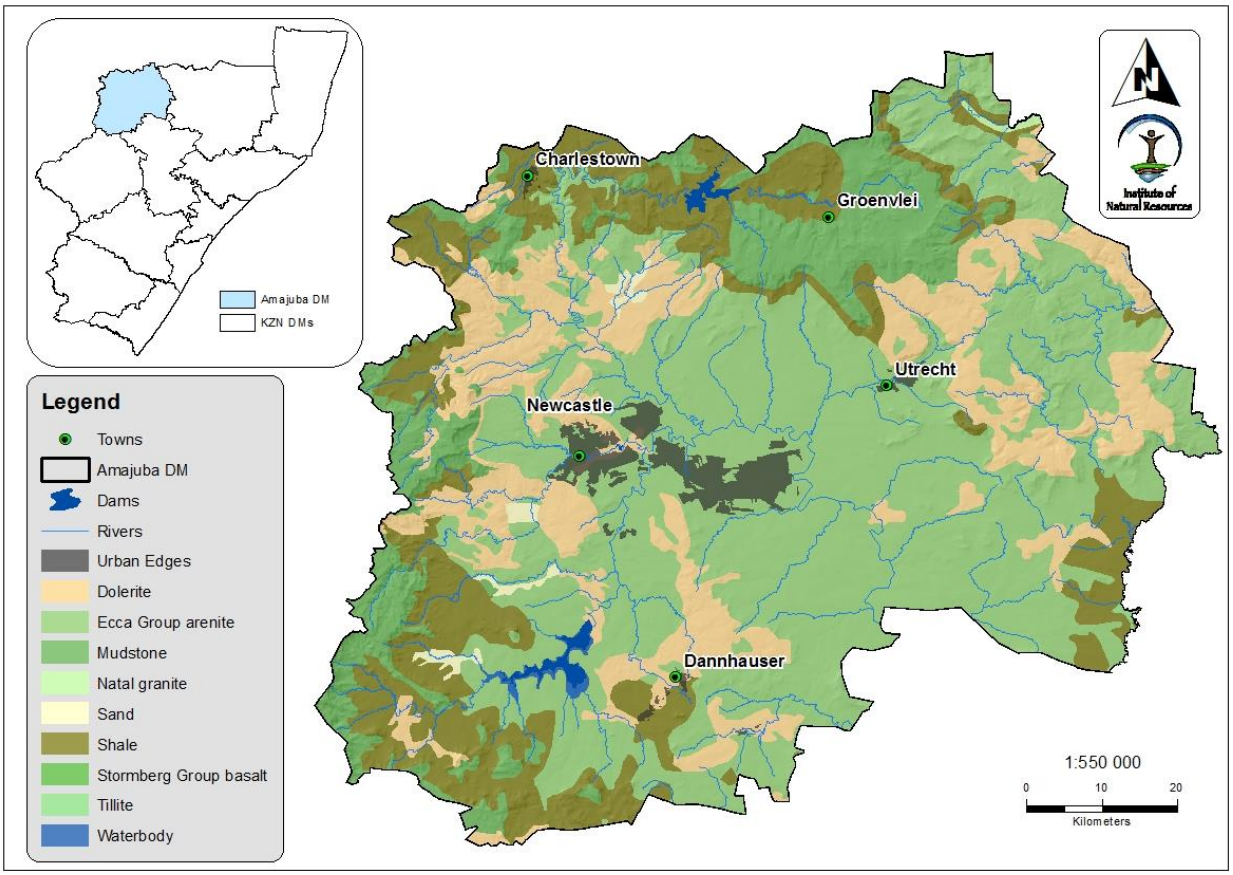

Figure 5: Geology of the Amajuba District

1.3.4 Current use of land

Land use in the ADM consists of an assortment of agriculture (commercial and subsistence), afforestation, industrial uses, mining and high density urban settlements and sparse rural settlements. The vast majority (74%) of the District's land cover consists of natural untransformed vegetation. In almost all areas, this is grassland which is utilised as grazing land for livestock. The more densely populated settlements include Newcastle (central economic hub), Dannhauser, Madadeni, Osizweni and Utrecht. The central and southern portion of the ADM features, to a large degree, highly utilized small holder or subsistence agriculture as seen in Figure 6. Natural areas are dominated by grasslands but significant areas of wetlands and forests exist. Mining occupies a relatively small area of the land on the surface, but underground this area is substantially (orders of magnitude) bigger.

The ADM is reliant on the natural regions for a number of key ecosystem services including water production, biodiversity conservation, and provision of grazing to stimulate the economy. Tourism and agriculture are key beneficiaries of these services and have been highlighted as key sectors for economic growth in the District. The grasslands of the District are particularly important for activities linked to these sectors and their conservation and careful management are critical for sustainable development in the District. A number of indigenous forests and biodiversity hotspots are also formally protected (Chelmsford Nature Reserve, Ncandu Nature/Forest Reserve, Pongola Bush) (Table 3, Figure 6).

Table 3: Areas associated with different land uses in the ADM

Land use	Km^2	%
Dams and Rivers	57.27	0.83
Wetlands	240.43	3.48
Natural Untransformed	5 124.07	74.26
Dryland Commercial Agriculture	615.36	8.92
Irrigated Commercial Agriculture	84.49	1.22
Subsistence Agriculture	193.09	2.80
Plantations	227.60	3.30
Mines and Quarries	21.49	0.31
Natural Degraded	76.14	1.10
Urban Commercial	7.30	0.11
Urban Industrial	6.14	0.09
Urban Residential	72.13	1.05
Urban Open Space	3.69	0.05
Sparse Settlements	170.70	2.47

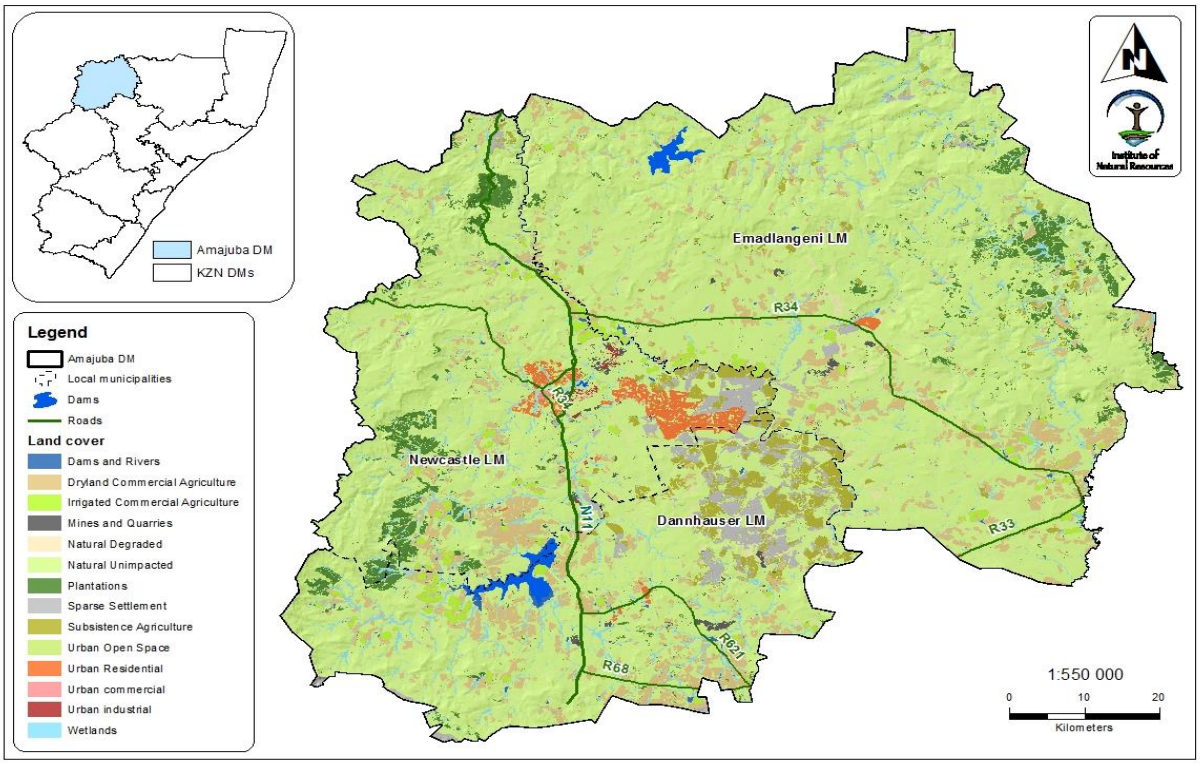

Figure 6: Distribution of land cover categories across the ADM

1.4 DEFINING STRATEGIC ENVIRONMENTAL ASSESSMENT

There are core principles which underpin any SEA (DEAT, 2004). The way in which these principles are accounted for depends on the type of SEA and the approach applied. This chapter explains what SEA is and the role it plays within the process of developing an EMF.

1.4.1 The Purpose of SEA

SEA has developed as a complimentary tool to Environmental Impact Assessment (EIA). A comparison of the two is consequently a useful way of understanding the purpose of SEA. The major differences between EIA and SEA, as summarised by the DEAT (2004) are summarised in Table 4.

Table 4: Summary of the differences between EIA and SEA (DEAT, 2004)

ENVIRONMENTAL IMPACT ASSESSMENT		STRATEGIC ENVIRONMENTAL ASSESSMENT	
i.	**Is reactive to a development proposal.**	i.	Is pro-active and informs development proposals.
ii.	**Is used to assess the effect of a proposed development on the environment and socio-economic conditions.**	ii.	Is used to assess the effect of the existing environmental and socio-economic conditions on development opportunities and constraints.
iii.	**Relates to a specific project**	iii.	Relates to areas, regions or sectors of development
iv.	**Enables the identification of project-specific impacts.**	iv.	Enables the development of a framework against which positive and negative impacts can be measured.
v.	**Has a well-defined beginning and end and focuses on informing a specific decision at a particular point in time.**	v.	Is a process aimed at the development of a sustainability framework to inform continuous decision-making over a period of time.
vi.	**Is focused on the mitigation of negative impacts and the enhancement of positive impacts.**	vi.	Is focused on maintaining a chosen level of environmental quality and socio-economic conditions (e.g. through the identification of sustainability objectives and limits of acceptable change).
vii.	**Has a narrow perspective and includes a high level of detail.**	viii.	Has a wide perspective and includes a low level of detail to provide a vision and overall framework.

The purpose of EIA is to assess the environmental implications of an individual development application at a site specific scale. The intention is for the assessment to inform a decision as to whether the project is acceptable. In terms of NEMA, appropriate development is that which is 'sustainable'. DEAT (2008) concluded that 10 years of practice in South Africa has shown that EIA seldom leads to sustainable outcomes. The study concluded that "The biggest single issue that negatively affects the effectiveness of EIA in South Africa is that it is often executed without taking sufficient account of the broader context within which the application occurs." The study highlights the now common understanding that; the site specific scale, high level of detail, narrow perspective

and reactive nature of EIA limits it to a tool that is best suited to identifying measures to mitigate negative impacts and enhance potential benefits of individual projects.

It is the purpose of SEA to establish this 'broader context' in which sustainability can be defined and thereby inform decision regarding the appropriateness (sustainability) of specific projects in the EIA process. SEA achieves this through a proactive approach to setting a chosen level of environmental quality and socio-economic conditions (e.g. through the identification of sustainability objectives and limits of acceptable change). In summary, the purpose of SEA is 'to integrate sustainability objectives into the policy and planning process, and thereby assist in the implementation of the concept of sustainable development'. The specific role of SEA in the EMF process and the approach adopted in undertaking the SEA is discussed in the remainder of this chapter of the report.

1.4.2 The role of SEA in the EMF Process

The EMF regulations explain the role of an EMF as follows:

1. To inform general environmental management, and
2. To inform the consideration of applications for environmental authorisation for specific projects, in a defined geographical area"

SEA has an important role to play in achieving these two objectives as explained below.

1. Informing Environmental Management

In order to manage the environmental issues in an area it is necessary to understand what they are. It is also necessary to understand what the environmental assets in a region are in order that they can be protected and/or managed and thereby minimise damage and optimise benefits derived from them.

The current state of the environment i.e. socio-economic, biophysical and cultural, and sub components (Biophysical – Aquatic systems – Rivers - Water Quality) was established in the State of Environment Report (SoER) of the EMF process. The strategic assessment takes this understanding to the next level by analysing this information to:

- Understand the nature of specific issues – positive or negative, scale (national, provincial, local), trends (worsening/improving and at what rates these changes are taking place).

- Establish linkages between the issues and the state of different systems e.g. the state of water quality is negatively affecting the value of major water resources for their tourism and recreational value.

- Understand the cumulative impacts and their significance - whether various individual impacts combine to represent cumulative impacts.

- Prioritise issues and systems – identify which resources or systems have significant value and should be prioritised in terms of conserving and, or harnessing their potential.

The understanding generated through the SEA allows the municipality and other role players to select and plan appropriate responses and management interventions. These will be consolidated in the Strategic Environmental Management Plan, which is one of the outputs of the EMF.

Environmental management is a collective responsibility and the implementation of the EMF will therefore not be the sole responsibility of the Municipality. Other role-players including national and provincial government, civil society and constituents also have a role to play. A further benefit of the SEA for the implementation of the EMF is the contribution of the SEA towards the promotion of cooperative governance, which is an essential component of environmental management and one of the aims of an EMF. This is achieved by analysing the governance aspect of the key issues and identifying which institutions are responsible for addressing them.

2. Consideration of Applications for Environmental Authorisation

For environmental management to be effective it needs to be focussed on specific objectives which are defined in terms of sustainability. It is therefore necessary to define sustainability for the geographical area in question which is achieved through the SEA in the following two steps:

- Establishing the Desired Future State (DFS)

The DFS represents a vision towards which the environment should be managed to address the negative issues identified, and to harness the potential benefits derived from natural capital/assets.

- Establishing a Sustainability Framework

The vision is then broken down into a hierarchical framework which includes objectives that give definition to the overall vision, as the first level of the hierarchy. The next level is criteria which are aspects which can represent the objective. The final level are indicators, for which targets are set that relate to the overall objective and need to be met if the sustainability vision is to be achieved. This framework (vision, objectives, and indicators) effectively represent a definition of sustainability. By setting targets for indicators it is also possible to measure success towards the DFS.

Having defined sustainability the EMF can then inform the consideration of applications for environmental authorisation at two levels as described below.

- Development Planning

Sustainability is formalised and spatially represented in the EMF. It is further entrenched in municipal development planning when incorporated in the Integrated Development Plan (IDP) and supporting planning instruments, specifically the sector plans, the Spatial Development Plan (SDF) and the Land Use Management Schemes (LUMS).

- EIA Process

Even where a specific development proposal is considered appropriate when reviewed in terms of the sustainability framework, the nature and scope of the project may still trigger the need for an EIA. The SEA informs this level of decision making by highlighting those issues that require attention during the specific assessment – thereby streamlining the EIA process.

1.4.3 Approach to the SEA

Having established a broad understanding of SEA and its role in the EMF, this section describes the specific approach to the SEA and methods employed to ensure that the SEA contributes to the EMF as described above.

1.4.3.1 Types of SEA

DEAT (2004) make the distinction between two types of SEA described below. These are discussed, with reasons provided for the type of SEA selected to support the EMF process.

1. EIA Based SEA

"SEA is a process to assess the environmental implications of a proposed strategic decision, policy, plan, programme, piece of legislation or major plan (White Paper on Environmental Management Policy for South Africa, 1998: 169), in DEAT, 2004)". The focus of this approach is on determining the environmental implications of a proposed policy, plan or programme.

2. Sustainability Led SEA

SEA is "a process of integrating the concept of sustainability into strategic decision-making" (DEAT and CSIR, 2000). This approach enables the proactive consideration of the objectives of sustainability at the earliest stages of decision-making. It facilitates the development of a sustainability framework to guide the development of plans and programmes and/or to assess an existing plan or programme.

1.4.3.2 Process and Methods

The steps and associated methods undertaken to arrive at the sustainability framework, are described in Figure 7. Establishing the relationship between the three spheres of the environment 'social, economic and natural' forms the basis for the assessment. The assessment reflects the implications of the status quo for the people and economy within the study area. The outcomes will be discussed with stakeholders in obtaining their view of Desired Future State, or sustainability objectives. The final step involves adding criteria and indicators against which the success towards achieving the DFS can be monitored i.e. completing the sustainability framework.

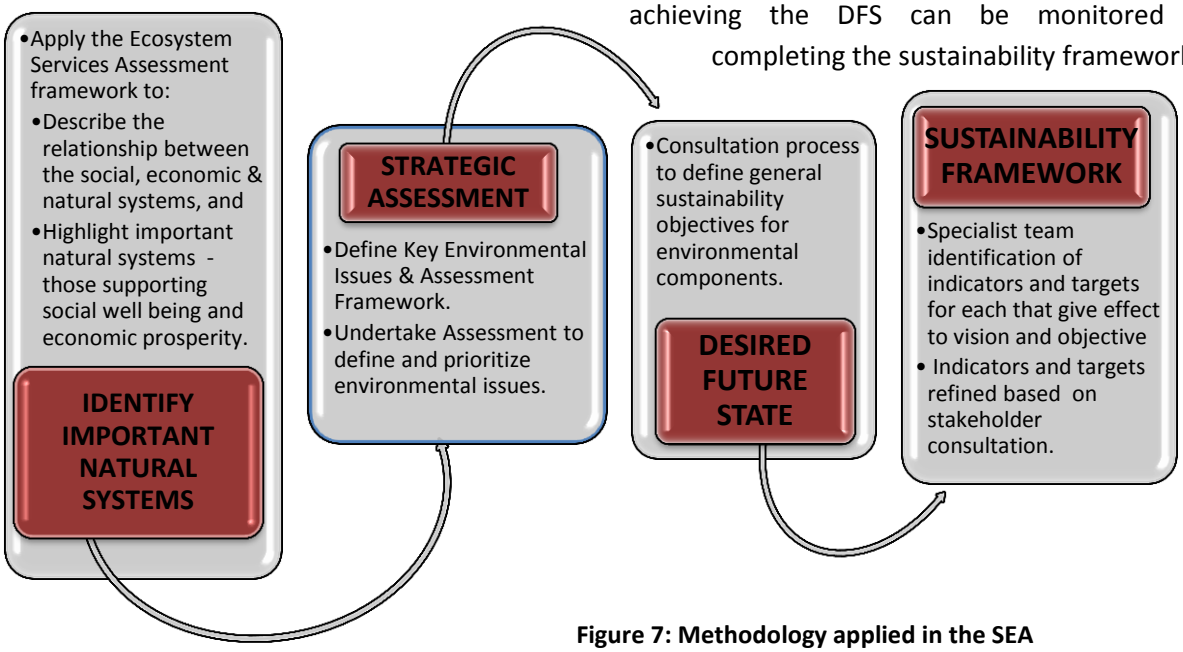

Figure 7: Methodology applied in the SEA

Having defined the SEA and the approach adopted for the EMF, Table 5 summarizes how the SEA principles have been accounted for in the process.

Table 5: SEA principles and their application in the EMF process

SEA PRINCIPLES (CSIR, 2004)	APPLICATION OF SEA PRINCIPLES IN THE EMF PROCESS
i. **SEA is driven by the concept of sustainability.**	A 'sustainability led' approach has been adopted with a focus on defining what sustainability means for the Municipality through the development of the sustainability framework.
ii. **SEA identifies the opportunities and constraints which the environment places on the development of plans and programmes.**	The SEA defines the opportunities and constraints imposed by the current state of natural systems and environmental quality by analysing these in relation to legal targets and ecological thresholds.
iii. **SEA sets the levels of environmental quality or limits of acceptable change.**	The Sustainability Framework puts in place targets which management should work towards in order to achieve the Desired Future State.
iv. **SEA is a flexible process which is adaptable to the planning and sectoral development cycle.**	The analysis in the SEA and outcomes are designed to inform all types of development. Furthermore, recommendations are made for updating the EMF (and therefore the SEA) on a five yearly timeframe in line with the IDP which is the municipal planning framework.
v. **SEA is a strategic process.**	Effective strategy requires the identification of the most important issues and factors (in this case environmental) that affect the ability to achieve a desired outcome. This process has focussed on identifying the most important (strategic) environmental issues by analysing the implications of the present situation and trends, for both people and society within and users outside the study area.
vi. **SEA is part of a tiered approach to environmental assessment and management.**	As a strategic level process, the SEA will inform environmental assessment and development planning at a project specific (EIA level) by: ▪ Integrating cumulative impacts into the sensitivity analysis and guidelines which project level assessment need to take account of. ▪ Environmental impact assessment – The sensitivity zones and EIA guidelines will inform the nature and focus of investigation during EIA.
vii. **SEA is a participative process.**	Stakeholders have contributed throughout the EMF process at the following points: ▪ Establishing the relationship between natural systems and social well-being and economic prosperity (Stakeholder workshop, questionnaires and interviews in SOE phase). ▪ Identifying and validation of key environmental issues in stakeholder workshops in SEA process. ▪ Setting sustainability objectives which form the basis for the sustainability framework. ▪ Stakeholders were also provided with an opportunity to comment on the draft sustainability framework.

viii.	**SEA is set within the context of alternative scenarios.**	This principle is accounted for by integrating environmental constraint features into assessing the spatial extent of suitable areas for development.
ix.	**SEA includes the concepts of precaution and continuous improvement.**	***Precaution***: The targets and thresholds within the sustainability framework are set in relation to legal limits established on the basis of the threat or risk to human health and well-being. ***Continuous Improvement***: The sustainability framework sets in place targets for improving towards the desired Future State. It also includes indicators against which progress towards this DFS can be monitored.

2. UNDERSTANDING SUSTAINABILITY

Given the nature, purpose and the type of SEA approach adopted it is important to understand what sustainability means for the Municipality.

2.1 WHAT IS SUSTAINABILITY

The definition of sustainability in the National Environmental Management Act reads as follows: *''Sustainable development means the integration of social, economic and environmental factors into planning, implementation and decision-making so as to ensure that development serves present and future generations"*

This definition is presented in Figure 8 and illustrates the following about the sustainability model as understood in South Africa:

1. A healthy environment (environmental quality) is necessary for:
    - Social well-being, which is a prerequisite for
    - Economic prosperity.
2. The economic, social and ecological systems are integrated via the governance system, which holds all the other systems together via a legitimate regulatory framework.

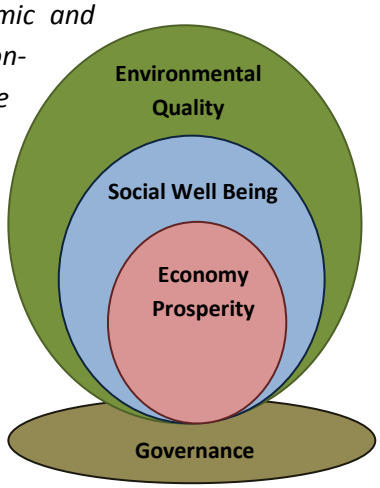

Figure 8: sustainability model in South Africa

In summary, environmental quality underpins a healthy and economically prosperous society

2.2 HOW IS SOUTH AFRICA APPROACHING SUSTAINABILITY

The National Framework on Sustainable Development spells out South Africa's vision for a sustainable society: "South Africa aspires to be a sustainable, economically prosperous and self-reliant nation state that safeguards its democracy by meeting the fundamental human needs of its people, by managing its limited ecological resources responsibly for current and future generations, and by advancing efficient and effective integrated planning and governance through national, regional and global collaboration."

The fundamental principles which are guaranteed in the Constitution of the Republic of South Africa are human dignity and social equality, justice and fairness, democratic governance, and a healthy and safe environment. The substantive principles are based on the following sustainable development principles that are enshrined in South African law and that underscore a systems approach to achieving sustainable development:

- Natural resources must be used sustainably.
- Socioeconomic systems are embedded in and are dependent on ecosystems.
- Basic human needs must be met to ensure that the resources that are necessary for long-term survival are not destroyed for short-term gain.

The National Strategy for Sustainable Development (NSSD 1) outlines five Strategic Priorities, based on the NFSD, in order to ensure development is sustainable in the context of global

issues/challenges such as climate change and economic crisis. NSSD 1 builds on the 2008 National Framework for Sustainable Development. The following five strategic priorities are identified in the NSSD 1:

Priority 1: Enhancing systems for integrated planning and implementation

Priority 2: Sustaining our ecosystems and using natural resources efficiently

Priority 3: Towards a green economy

Priority 4: Building sustainable communities

Priority 5: Responding effectively to climate change

The Environmental Management Framework is seen as a fundamental tool for sustainable development in Amajuba District Municipality. It guides municipal planning and supports decision making for sustainable development. As such the 5 listed priorities form a core element of the Strategic Environmental Management Plan documented in another report in this EMF series.

2.3 WHAT DOES SUSTAINABILITY MEAN FOR MUNICIPALITIES?

As with most municipalities across South Africa, Amajuba District is faced with the challenge of reducing unemployment by stimulating economic growth and improving the quality of life for its constituents. Local government's core mandate is understandably people centred. The route to improving quality of life is more often than not perceived to be achieved by addressing the backlog in basic services and stimulating employment opportunities through Local Economic Development (LED) initiatives. The development focus consequently lies within the socio-economic spheres of the model presented above and success is measured in terms of narrow indicators such as:

1. The % reduction in the backlog of supply of basic services such as potable water, sanitation and housing, or
2. The number of jobs created through local economic development (LED) initiatives.

This narrow view fails to account for the role that the natural environment plays in supporting social wellbeing and economic activity. We depend on ecosystems and the services they deliver to produce our food, regulate water supplies and climate, and breakdown waste products. We also value them in less obvious ways: contact with nature gives pleasure, provides recreation and is known to have a positive impact on long-term health and happiness (UK National Ecosystem Assessment 2011).

Despite being critically important to our social wellbeing and economic prosperity natural systems and the goods and services they generate are consistently undervalued in conventional economic analyses and decision making regarding development options i.e. the environmental sphere of the sustainability model is often disregarded – resulting in unsustainable outcomes. An example is provided in the information box 2 below.

So sustainable development means "***accounting for the impact to the natural environment and the implications (well-being and cost) of this impact for the dependent social and economic systems in the planning and implementation of economic growth"*** i.e. taking a holistic view that integrates the

implications of a decision, plan or development action for other users (environmental, social and economic). The SEA facilitates a sustainable outcome by proactively defining sustainability for an area and setting in place a framework to guide development decision making in line with this definition.

According to DEAT (2004), "***for SEA to assist in the move towards sustainability, it is important that it enables the integration of social, economic and biophysical aspects in the policy and planning process"***. *This is achieved by identifying and evaluating the opportunities and constraints of the environment and socio-economic conditions on development* (CSIR, 1996).

Ecosystem services (ES) are a useful mechanism for achieving this integration because ES highlight the interdependencies between the social, economic and natural systems i.e. it shows which natural systems are currently (and have the potential) to play an important role in sustaining social well-being and economic prosperity in an area. An ES approach has been used in the SEA process and is explained in the next section.

3. THE RELATIONSHIP BETWEEN NATURAL, SOCIAL AND ECONOMIC SYSTEMS

3.1 AN ECOSYSTEM SERVICES UNDERSTANDING

3.1.1 Ecosystem Services

Nature makes vital contributions to people and their mental, spiritual, physical wellbeing, which together embody biodiversity and ecosystem functions and services (IPBES 2019). The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) recognises three broad and overlapping categories of Nature's Contributions to People[2] (NCP):

1. ***Material Contributions:*** Are substances, objects or other material elements from nature that directly sustain people's physical existence and material assets (IPBES 2019). These are direct material contributions such as food and water that we harvest either for home or commercial consumption.

2. ***Non Material Contributions:*** Are nature's effects on subjective or psychological aspects underpinning people's quality of life, both individually and collectively (IPBES 2019). Contributions from organisms or natural habitats which we can't eat or use directly, but which provide us with important social, spiritual and cultural benefits.

3. ***Regulating Contributions:*** Are functional and structural aspects of organisms and ecosystems that modify environmental conditions experienced by people and/or regulate the generation of material and non-material contributions (IPBES 2019).

[2] The IPBES framework has re-framed ecosystem services in terms of nature's contributions to people. This broader definition has also in part allowed for the accommodation of negative contributions which are also important.

These broad categories are comprised of 18 recognised contributions. These, together with their categories are shown in Figure 9.

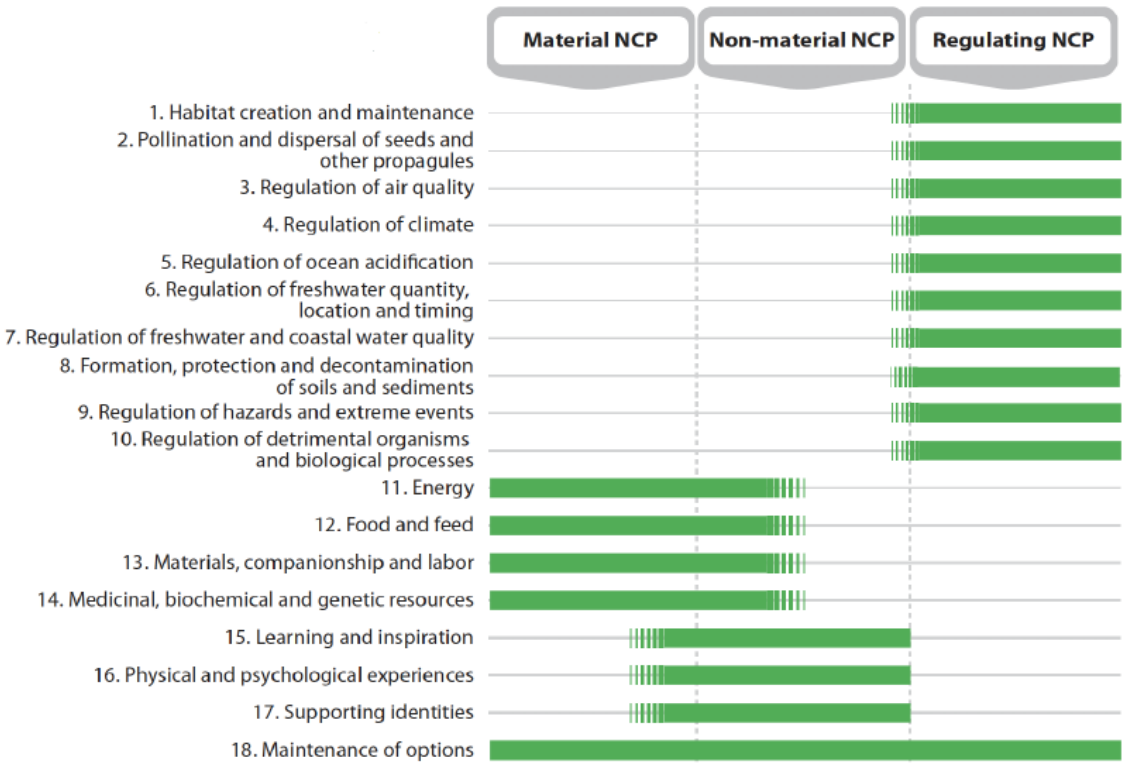

Figure 9: 18 NCP reporting categories used in IPBES assessments showing broad groupings and overlaps (taken from IPBES 2019).

Most NCP accrue to society through interactions between nature and people, anthropogenic infrastructure, machinery and institutions which govern their access, use and distribution of benefits (United Nations, 2014 reported in IPBES, 2019). Importantly in the context of this study, anthropogenic infrastructure and machinery would include water and sanitation infrastructure (such as dams, pipelines and treatment works), roads and other built infrastructure and agricultural equipment.

As such, in most cases, the potential of a natural system to benefit people and the economy is dependent on the investment of effort and infrastructure and machinery employed to harvest such benefits. As an example, high potential agricultural land has the potential to produce food and economic benefits for society, but only if effort, machinery, infrastructure and institutions are employed to harvest these benefits and distribute them. The IPBES framework therefore distinguishes between potential NCP and realised NCP. The consumption of NCP then in turn impacts on the ability of the natural system to provide them through management interventions. This concept is illustrated in Figure 10.

Infrastructure and institutional governance are therefore not isolated from the NCP cycle, but are critical elements in the harvesting of benefits and in the maintenance of natural systems, sustaining or degrading their ability to provide such benefits.

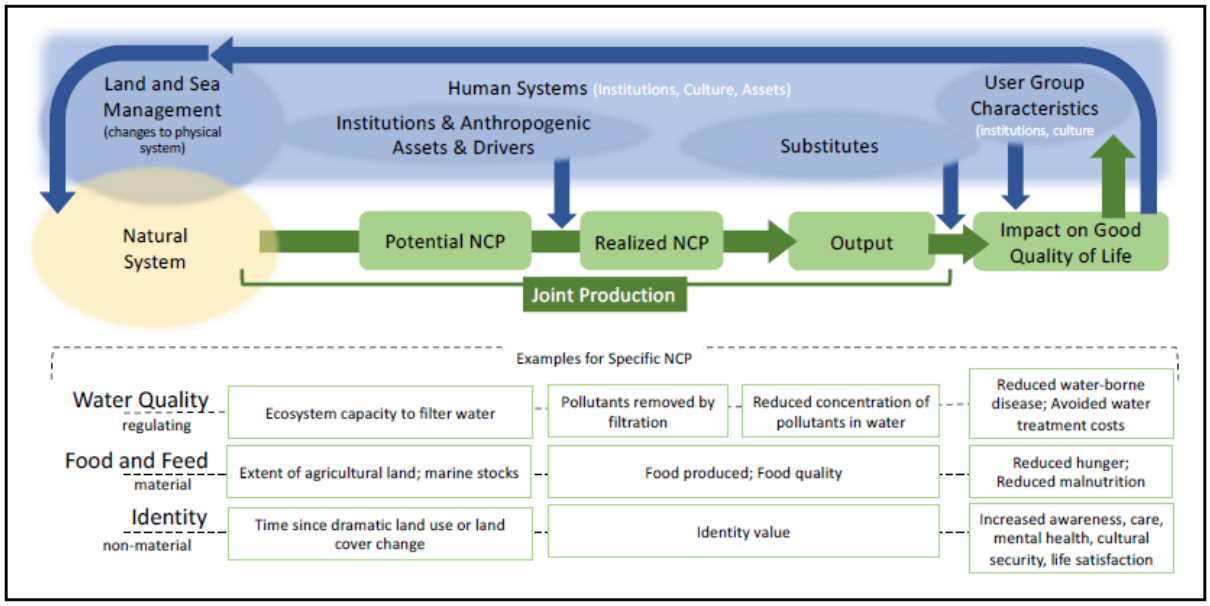

Figure 10: The relationship between Potential NCP, Realised NCP and its impact on Good Quality of Life, together with examples of some specific NCP (taken from IPBES 2019).

Different systems generate certain NCPs or deliver them at different levels to other systems. Figure 11 illustrates which systems generate these different contributions. It is noted that coastal, island, marine and polar systems do not occur within the Amajuba District municipality area and that the grasslands biome is included under dryland systems.

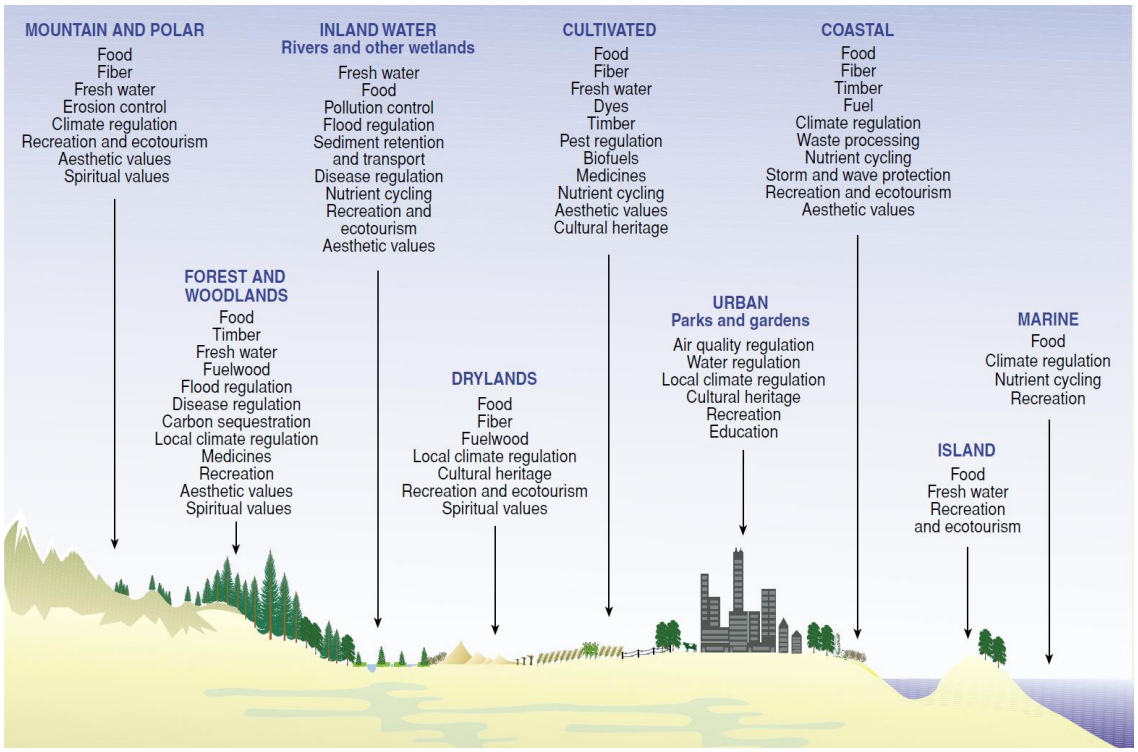

Figure 11: Environmental goods and services provided by different systems

The purpose of the following section is to establish:

- Which NCPs are generated by the systems occurring in the study area, and
- The level of dependence by different sectors of the society and economy, both within and outside the study area on these.

3.2 APPLYING THE ECOSYSTEM SERVICES FRAMEWORK

3.2.1 Establishing Demand for Ecosystem Goods and Services

During the preceding phase of the EMF process, specialists assessed each of the EMF component features. From this work, an assessment has been undertaken of key NCP or ecosystem services to identify which of the NCP provided by the feature:

1. Are important to their social wellbeing, and/or
2. Play an important role in supporting their economic activity.

It is also important to define which natural systems generate or sustain these contributions, so that we can prioritize their management, conservation and restoration, as required. The value of these systems is heightened if:

1. The system generates a service which is in high demand from user groups.
2. The system generates **several** services which are in high demand and / or;
3. The demand for the system's benefits extends to many users within/outside of the study area. The scale at which the services or contributions benefit people is important (this is assessed using the categories in Table 6)

Table 6: Categories of spatial extent applied in the analysis of the demand for ecosystem services

Area	Definition
Local	Local municipalities within the district
Study area / Municipality / District	Amajuba District Municipality
Region	Amajuba and surrounding Districts
Province	KwaZulu-Natal
National	South Africa

The importance of different systems in supplying important contributions to people (as classified by IPBES) is detailed in Table 7. In summary however, many economic activities, livelihoods, lifestyles and associated quality of life are directly connected to the natural resources in this area as one would expect from a predominantly rural and agricultural District with high levels of unemployment and low levels of education. In the Newcastle area, industry and manufacturing are also dependent on natural resources, particularly water, without which economic activity would be stifled.

There is consequently a high dependence on the natural contributions to people across the entire study area and additionally from users at a regional and provincial scale in the case of certain benefits.

Table 7: Summary value of critical ecosystem and their related NCP in the study area

System	Nature's contribution to people
Rivers and their catchment systems	**Nature's Contributions to People:** River Systems are an essential environmental asset at a local, district, regional, provincial and national scale, sustaining the basic needs of the population, biodiversity and economic activity in the Amajuba District Municipal area through the contribution of: 1. 'Regulation of fresh water quantity, location and timing' through providing access to freshwater through wet and dry seasons. This then contributes to 'Food and Feed' through the ability to irrigate crops. 2. 'Regulation of freshwater quality' through the ability they possess to ameliorate pollutants, 3. 'Habitat creation and maintenance' as they create habitats for biota dependent and associated with aquatic environments, 4. 'Energy' through the contribution made to power generation 5. 'Physical and psychological experiences' through providing opportunities for recreational activities such as swimming and fishing, 6. 'Supporting identities' in the sense of place they provide to those who live and work in the catchments.
	Beneficiaries: Local, district and regional scale material and regulating benefits accrue through the use of water for domestic, recreational, agricultural (in combination with other NCP), industrial and mining purposes. Local, provincial and national, economic and food benefits accrue from the rivers of ADM through their support for economic activity and food production in the District, while power generation supports the national economy. Local non-material benefits also accrue to residents in the catchments who associate with these areas.
Dams and water supply infrastructure	**Nature's Contributions to People:** While not natural systems, dams are a significant infrastructural asset especially within the District and form part of the NCP cycle, allowing water related potential NCP to be converted to realised NCP (see Figure 10. They contribute towards 1. 'Regulation of fresh water quantity, location and timing' through their role in harvesting fresh water, 2. 'Regulation of hazards and extreme events' through their role in regulating floods. 3. 'Energy' through the contribution made by water from Zaaihoek Dam to power generation. 4. 'Physical and psychological experiences' through providing opportunities for recreational activities
	Beneficiaries: Beneficiaries of the dams and water infrastructure in the ADM are predominantly at local, district and regional scale through provision of water to supply domestic and economic development needs in the buffalo River and uThukela River catchments. National benefits do however accrue through the role Zaaihoek dam plays in electricity generation and the diversion of water supply to the Vaal River system.

	Dams also play an important role in supporting tourism and recreational activities at a local and regional scale.
Wetlands	**Nature's Contributions to People:** Wetlands provide a range of key environmental services that are in demand from a variety of users throughout the catchment. They contribute towards: 1. 'Regulation of fresh water quantity, location and timing' through their role in regulating the release of fresh water and maintaining dry season flows, 2. 'Regulation of hazards and extreme events' through their role in regulating floods. 3. 'Regulation of Freshwater Quality' through the ability they possess to ameliorate pollutants, 4. 'Habitat creation and maintenance' as they provide habitat for biota with specific requirements for wetland habitat such as cranes, frogs etc.
	Beneficiaries: Given the important role that wetlands play in the hydrological cycle, many of the beneficiaries of the contributions provided by wetlands are much the same as those outlined for rivers and dams. In addition, wetlands provide habitat for a wide diversity of species including some listed as critically endangered (e.g. wattled crane, white winged flufftail). This biodiversity facilitates economic activities such as eco-tourism.
Floodplains	**Nature's Contributions to People:** Floodplains are not just areas to be avoided because of the hazard they represent, but they also provide a number of critical services: 1. 'Regulation of hazards and extreme events' through their role in regulating floods by allowing water to spill out of the channel and absorbing the flood's energy. 2. 'Regulation of Freshwater Quality' through their ability to retain sediments washed down in floods and to ameliorate pollutants, 3. 'Habitat creation and maintenance' as they provide habitat for biota with specific requirements for riparian habitat. 4. 'Food and feed' as they provide an important grazing resource which supports livestock and wildlife and are fertile alluvial areas for cropping. 5. 'Materials, companionship and labour' through their provision of building sand.
	Beneficiaries: Key beneficiaries of the contributions provided by floodplains are local and regional downstream people living in areas at risk of flooding and infrastructure built in floodable areas. These areas also benefit local farming and the local, regional and provincial food value chain through their provision of fertile alluvial soils and grazing. The local building industry benefits directly through being able to mine building sand in these areas.
Arable Soils	**Nature's Contributions to People:** This resource and the regulating and material benefits it contributes to are the foundation of the agricultural economy (both formal and subsistence) in the district.

	They contribute directly to the wellbeing of people through their provision of: 1. 'Food and feed' through cultivation of food crops. 2. 'Materials, companionship and labour' through their ability to support the growth of timber.
	Beneficiaries: The obvious local beneficiaries of fertile arable soils are subsistence and commercial farmers. However through the extended food value chain, benefits are extended into local, regional, provincial and national consumers of food and fibre produce grown in the ADM.
Grasslands	**Nature's Contributions to People:** The ADM is located within the grassland biome and natural vegetation types are dominated by different grassland types. Many livelihoods and much economic activity in the region have thus developed around the contributions of grasslands. 1. 'Food and feed' is perhaps the most important contribution as they provide a critical grazing resource which supports livestock farming and wildlife. 2. 'Regulation of fresh water quantity, location and timing' through their role in the hydrological cycle of promoting infiltration and preventing erosion, particularly in strategic water source areas. 3. 'Habitat creation and maintenance' as they provide habitat for biota with specific requirements for grassland habitat. 4. 'Materials, companionship and labour' through their provision of thatching grass. 5. 'Regulation of climate' as grasslands are vital sinks for carbon sequestration
	Beneficiaries: As with arable soils, the obvious local beneficiaries of the contributions made by the grasslands of ADM are local subsistence and commercial livestock farmers. This again extends to the entire value chain of consumers of meat and dairy products. Importantly this also extends to building materials as thatching grass is harvested for roofing and other uses. Just as critical, are the beneficiaries of the grasslands hydrological contributions as they are the dominant land cover promoting regulation of freshwater supply in the Strategic Water Source Areas of the District. These beneficiaries are distributed across the scale spectrum including local, regional, provincial and national as described in the rivers section above. The grasslands of the ADM are important carbon sinks and thus play a role in regulating climate therefore generating beneficiaries at an international scale.
Woodlands and forests	**Nature's Contributions to People:** As woodlands and forests are differentiated from grasslands by the presence of trees, they provide a different suite of services. The most important of these in the context of the ADM are those related to air quality. 1. 'Regulation of air quality' through their absorption of pollutants. 2. 'Regulation of climate' as habitats which support tree growth are vital sinks for carbon sequestration 3. 'Habitat creation and maintenance' as they provide habitat for biota with specific requirements for woodland and forest habitat. 4. 'Food and feed' is perhaps the most important contribution as they provide a critical grazing resource which supports livestock farming and wildlife.

	5. 'Materials, companionship and labour' through their ability to produce a range of building materials. 6. 'Physical and psychological experiences' through providing opportunities for recreational activities such as swimming and fishing, 7. 'Supporting identities' in the sense of place they provide to those who live and work in the catchments.
	Beneficiaries: The key beneficiaries of the services provided by the trees hosted in woodlands and forests are local residents who benefit from air quality improvement contributions made by these ecosystems. Internationally, any form of carbon sink is important and as such the forests and woodlands of ADM provide an important contribution towards regulating climate. South African forest ecosystems are under threat and biota dependent on forest ecosystems are likewise threatened. The beneficiaries of the habitat creation contribution are the various biota which depend on these areas. This in turn provides additional economic benefits through opportunities to develop eco-tourism enterprises. Woodlands are also important grazing areas and thus contribute to the livestock industry and the associated food value chain. They also produce a range of materials which are used locally for building. These systems provide additional non-material benefits in the form of opportunities for recreation and for supporting local identities and sense of place.

4. STRATEGIC ASSESSMENT

The purpose of the strategic assessment is to identify and describe the key environmental sustainability issues.

4.1 What is a Sustainability Issue?

As context to the assessment it is important to understand what constitutes a "significant sustainability issue". It is defined according to one of the following four scenarios.

1. ***Natural Systems are unable to Supply Ecosystem Services at Levels Required to Sustain Economic Sectors and/or Social Well Being (Ecosystem Services: Demand > Supply).***

   It is a significant issue when the demand (quality and/or quantity) for a service exceeds the level of supply. This occurs when the extent and/or condition of natural system has been negatively impacted to a level where its capacity to supply the ES at the level required by society has been exceeded. In such cases, the situation is unsustainable and represents a significant issue. The ES framework is useful because it makes the links between the state of the natural systems and the dependant user groups.

2. ***There is a Threat to Systems that are Delivering Important Services (Natural Assets)***

   It is a significant issue where the benefits from a natural resource are being optimized by an economic sector and the resource providing the beneficial services that support that sector are under threat. An example would be the loss of highly productive arable land which is sustaining the agricultural sector. Such a situation demands measures to protect these resources.

3. ***Failure to Meet Legal Targets or accepted thresholds***

   The third scenario is where legal targets and/or accepted thresholds are not met. An example is the lack of formal protection for the areas of high value biodiversity in the District as the need to meet conservation targets is a collective responsibility across all levels of government in terms of the Convention on Biological Diversity.

4. ***Combination***

   It is possible, and likely, that an issue is significant due a combination of the scenarios described above.

The identification of issues is founded on the characterisation of the quality of environmental features. This information is drawn from the Status Quo report of this series, and is summarised here.

4.2 Environmental Quality

The various natural systems and features in the study area are analysed in terms of the following factors to understand the environmental quality associated with the system.

a. *Overview of the System* - Summary of the location, type and extent of the system within the study area.

b. *Ecosystem Services Generated and Demand for the Services* - The range of ES generated by the systems is described with an indication of the level of demand - who uses it and how important is the service to sustaining their livelihood, wellbeing or economic activity.
c. *Present Ecological State and Level/Quality of Supply of Ecosystem Services*

The PES determines the level and quality of supply of the services demanded by users. The PES is described in terms of legal standards and ecological thresholds and the implications for the dependant socio-economic systems (Table 9).

Table 8: Categories of present state of natural systems and implications for socio-economic systems

PRESENT STATE	SOCIO-ECONOMIC IMPLICATIONS
System**/environmental parameter is in a** natural/good condition **and** within legislated target**/standards and, or** ecological threshold**.**	PES represents an environmental asset and is generating high levels/quality of Ecosystem Services that support current use and & may provide opportunity for additional utilisation.
System**/environmental parameter is in an** impacted/average condition **but within** the limit of legislated standards **and, or** ecological threshold.	Present state is impacted and presents some opportunity for additional development – with appropriate management.
System**/environmental parameter is** in a highly impacted/poor condition **and exceeds** legislated standards **and or** ecological thresholds**.**	Present state is negatively impacting social-well-being and economic activity (declining value from ecosystem service and increased costs to society). Represents an environmental constraint to development.

4.2.1 Drivers of Environmental Quality

Impacts and threats to natural systems that play important contributing roles in supporting the social and economic components of the environment also represent environmental issues. These drivers of change to natural systems need to be managed if an issue is to be addressed.

Analysis of the the environmental status quo has resulted in the identification of a number of drivers applying various pressures on the environment. These result in a number of important impacts. The key drivers of environmental change within the District include urbanisation, the prevailing socio-economic situation and allied to this, the drive for economic growth/development and climate change. These drivers result in numerous pressures on the environment including increased pressure on infrastructure, the demand for housing, increased demand for water, increased waste volumes and heavier utilisation of land resources. These pressures, when exerted on the environment result in a variety of impacts.

The hierarchical relationship between some of the key drivers, pressures and impacts identified are shown in Figure 12. These relationships are expanded on for each of the components of this EMF study in the tables of Section 4.2.2 which describe the environmental feature, its present state (quality) and the drivers and pressures which are driving change in this state.

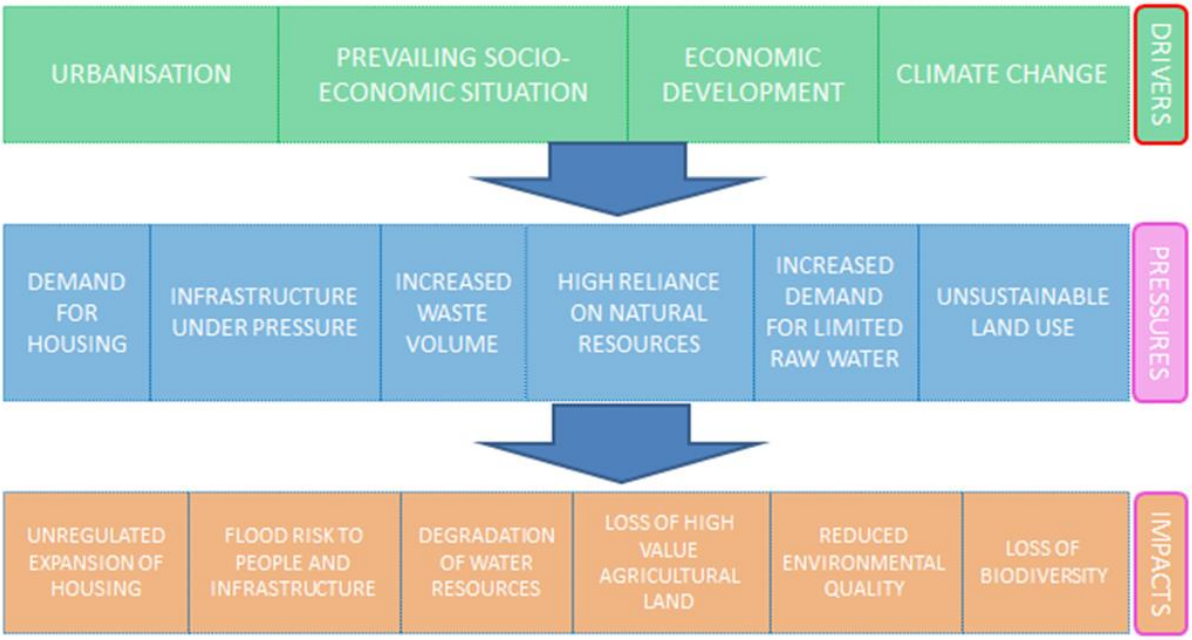

Figure 12: Summary diagram of key drivers, pressures and impacts experienced within the Amajuba District Municipality (not exhaustive).

4.2.2 Amajuba DM environmental quality

4.2.1.1 Agricultural Resources

Agricultural Resources
OVERVIEW OF THE SYSTEM
Agriculture is primarily dependent on the capability of the land on which it is practiced and high potential land is a scarce and non-renewable resource. The land with the greatest cultivation potential is predominately situated in the vicinity of Ntshingwayo Dam and along the Buffalo River. Steep slopes in much of the District restrict cultivation potential, but some high potential grazing land is located in these areas.
PRESENT STATE
Current use of land: Presently, agriculture within the district is represented by 1) commercially cultivated land including irrigated and dryland activities (10.1% of District area), 2) Commercial timber plantations (3.3%), 3) small scale and subsistence cultivation predominantly in areas of communal tenure (2.8%), and 4) vast areas of livestock focused grazing areas (74.2%). Land potential: High value land in the ADM includes both areas with high potential for cultivation as well as high potential rangeland areas (KZN DAARD). Most of the very high potential (A and B categories) cultivatable land is already developed. Areas of lower potential could be cultivated productively given increased availability of irrigation water. Threats: Agricultural land is under threat by the loss (to other land uses) and degradation of agricultural land as a result of poor management. Agricultural productivity is threatened by the slow progress and uncertainty surrounding land claims and land restitution. Economic status: Agriculture is a highly regarded activity within the district, with local, district and

higher level development plans all identifying this sector as a key opportunity for economic growth and rural development. It currently accounts for only about 2.2% of the District's GVA and is reportedly in decline.

DRIVERS AND PRESSURES TOWARDS THE PRESENT STATE

-***Water:*** There is limited water available for further development of agriculture within the district. Any further irrigation development would require the construction of additional dam infrastructure. Water quality problems additionally threaten the water resources that are currently being used. Climate change additionally threatens agriculture through increased variability of rainfall and increased incidence of drought.

-***Land claims and land redistribution:*** The uncertainty around the redistribution of land and the delayed finalisation of land claims are impediments to agricultural growth, and can result in the neglecting of productive land. Redistributed areas are often left without sufficient extension support and often exceed the carrying capacity of the land leading to degradation of the resource.

- Management: Large areas of grassland are heavily utilised to the point of degradation. This is through heavy grazing pressure and incorrect burning practices. There also exist conflicts between fire management interests for forest protection and grazing. Recommended burning schedules for grazing optimisation do not correlate with those implemented for forest protection.

- ***Conflict with alternative land uses:*** The rapid rate of urban population growth in the Newcastle / Madadeni / Osizweni area and the concomitant reduction in the average household size has resulted in a dramatic increase in the number of dwellings in this area and an expansion of the urban edge. This largely unplanned expansion has predominantly taken place on land with good agricultural potential. Mining also threatens agricultural land, both through the destruction of arable and grazing land, as well as through the degradation of water quality.

- ***Invasive aliens:*** Large areas of agricultural land have been invaded by alien woody plants (wattle spp). Many areas developed for forestry plantations have resulted in invasions of nearby water courses and adjacent land. This results in greatly reduced land potential, particularly grazing potential and an increased fire hazard.

GOVERNANCE

Agriculture is included in all District development plans as a key potential economic development driver, however:

- Land reform in the District has been characterised by a stagnation of land reform / restitution projects and a lack of support for emerging farmers.
- The District's agricultural strategy was last amended in 2006, suggesting a review is required to direct investment and prioritise actions.
- The agricultural plans for the district indicate that investment in water resource infrastructure is needed to facilitate any further growth through irrigation.
- The involvement of NGOs is a potential boost for the area as demonstrated by a WWF / land owner stewardship partnership which through the provision of training and other support has resulted in a land reform area with healthy cattle, decreased levels of mortality and proper management of the grazing resource.

SUMMARY

Agriculture is a critical sector in the ADM economy. Water is a key limiting factor to agriculture as

further irrigation is not possible without the further development of water infrastructure. The spread of alien invasive species is the single greatest factor in the loss of agricultural land, followed by the expansion of human settlements. Given the potential of the land in the majority of the district and the limited water available, livestock and game farming should be considered as key agricultural activities.

4.2.1.2 Air Quality

AIR QUALITY

OVERVIEW OF THE SYSTEM

There are numerous registered emitters located in the District, particularly in the Newcastle area. In addition to these registered industrial emissions, impacts are reportedly from vehicular emissions, mining activities and impacts imported from higher lying neighbouring regions.

PRESENT STATE

- Perceptions: There is a perception amongst stakeholders that air quality is bad within the district particularly due to industrial activity.

- Monitoring: Monitoring data for the ADM is very limited. That which is available indicates that air quality in the Newcastle area is compromised, however not to the extent of exceeding national standards.

- Impacts: The limited air quality monitoring data available indicates that NAAQS standards are generally not exceeded. Census data indicates that most high density human settlement areas are located outside the highest impact area for industrial emissions. This does not however take topographic effects into account and full dispersion modelling should be employed to identify critical areas.

Air quality has the potential to be a key constrain to development as continued deterioration of air quality may surpass safe limits.

DRIVERS AND PRESSURES TOWARDS THE PRESENT STATE

- The air quality impacts within the district are attributed to a number of different sources including industrial emissions, biomass burning, domestic fuel burning and transportation. Mining and mine waste additionally contributes to particulate matter pollution.

- EDTEA monitoring data indicates that the gaseous ratio of SO2 to NO2 is biased towards NO2. This suggests that vehicle emissions play a leading role in AQ impacts.

- The 'bowl like' topography of the District means that dispersion of pollutants is relatively poor. In addition, this means that impacts from activities in higher lying neighbouring areas also impact the District.

GOVERNANCE

- There is presently no air quality management plan in place for the District. The development of this plan has been initiated but needs to be completed. A full dispersion model has additionally not been developed for the District.

- Currently there is no monitoring being undertaken by the District to provide a better understanding

of air quality impacts. Air quality monitoring is limited to that carried out by EDTEA passive sampling projects.

- Registered emitters report emissions to SAAQIS, meaning their emissions are monitored.

SUMMARY

Stakeholders perceive air quality to be severely compromised but air quality data within the district is not sufficiently robust to characterise impacts over space and time. According to the limited data available the district does not surpass any of the national air quality limits and human settlements are found outside of the areas of highest air quality problems. Vehicles and Industrial activities are a major source of air pollution in the district.

1.2.1.1 Flood Zones

FLOOD PLAINS

OVERVIEW OF THE SYSTEM

- Floodable areas are generally small in the higher lying areas of the District. As rivers descend in altitude and reduce in gradient down towards the Buffalo River Basin, floodable areas increase in size. Flood plain areas play an important role in dissipating flood energy and absorbing sediment. They also host important ecosystems like wetlands.

PRESENT STATE

Floodplain areas within the district have been subject to a range of development activities. A significant area of flood zone has been cultivated. More importantly, large areas have been transformed to urban and peri-urban landscapes, meaning infrastructure and lives are placed at risk and riparian, wetland and aquatic ecosystems are degraded. Activities associated with this development such as sand mining and brick making also reduce the ecological integrity of these areas.

DRIVERS AND PRESSURES TOWARDS THE PRESENT STATE

-***Urbanisation:*** Over time, urban and peri-urban settlement expansion has occurred in floodplain areas. This has a two way impact especially to the people that live on these flood plain areas and the potential negative impact to their infrastructure and lives should there be a flooding event.
-***Sand mining:*** The flood plain of the lower Ngagane and Buffalo River is affected by sand mining where large areas of flood plain have been stripped of vegetation and the soil below exposed to flood erosion.

GOVERNANCE

-Settlement is currently expanding rapidly over floodable areas. This is occurring outside of regulatory and planning frameworks. This places homes, services infrastructure and lives at risk.
-Sand mining in flood zones of the Buffalo River basin is presently unregulated.

SUMMARY

Flood plain areas are critical areas that reduce the energy of flood waters and allow the deposition of sediment outside of the river channel. The flood plain areas within the district are heavily impacted by urbanisation and to a lesser degree by sand mining.

4.2.1.3 Heritage Resources

HERITAGE RESOURCES
OVERVIEW OF THE SYSTEM
The ADM has a rich heritage resource base, including significant battlefields and associated sites, archaeological sites, significant architecture and sites associated with the anti-apartheid struggle. Heritage resources are seen as an economic opportunity for the district due to their tourism potential, however, there is currently little emphasis on the identification, conservation and maintenance of heritage resources and no marketing of these as tourist attractions.
PRESENT STATE
The majority of identified and formally recognised heritage sites (listed on SAHRIS) in the District are related to colonial history. These are predominantly related to the Anglo-Zulu and Anglo-Boer wars and Voortrekker sites. There is the potential for more recent sites of significance from the anti-apartheid era to be captured and protected. Heritage tourism has a very limited input to the District economically. In the majority of local economic development strategies and plans, tourism related to heritage sites is seen as an important potential driver of economic growth. There is currently however no formalised body responsible for the maintenance and promotion of heritage tourism in the District. There are also no formal agreements with land owners or tourism associations and no heritage tourism operators are based in the District.
DRIVERS AND PRESSURES TOWARDS THE PRESENT STATE
-***Marketing and management of sites:*** Most of the heritage sites in the District with Tourism potential relate to colonial history and battlefields in particular. These areas are not effectively marketed, signposted or maintained. The District competes with other such tourist attractions in neighbouring Districts. -***location:*** Many tour operators are located outside of the District and may therefore not focus on tourism opportunities within the district.
GOVERNANCE
-There is currently no assigned responsibility for heritage resources in the District government structure. A heritage champion is required to drive heritage conservation in the District. -There are currently no local level heritage sites recognised in the District. -There is tourism potential in the district but the impact of tourism on the economy is much less than is perceived. -Areas with potential for tourism are not well maintained and conserved and the potential is not reached.
SUMMARY
Heritage resources in the District are largely neglected. Recognised / protected sites are not maintained or marketed. Many known sites are not graded or otherwise protected. Heritage tourism potential is largely nullified by lack of marketing and maintenance of sites.

4.2.1.4 Infrastructure

INFRASTRUCTURE

OVERVIEW OF THE SYSTEM

- Infrastructure is concentrated in the urban areas and supplies electricity, water, sanitation, storm water management and roads.

PRESENT STATE

Roads have been identified as being in a deteriorating condition. Gravel roads are also noted to not always be constructed correctly resulting in rapid degradation and resultant impacts to vehicles and passenger safety.

Sewerage and waste water treatment systems are ageing and overloaded, particularly by storm water ingress, resulting in discharge of untreated waste water to the environment. Some facilities are also not treating waste to satisfactory standards resulting in water quality impacts to the receiving environment.

The water distribution network is aging and incurs a high rate of water loss (uThukela water estimates 15 Ml per day). Investment in infrastructure is substantially less than is required (uThukela Water gives figures of 2.5 million budgeted in 2017 versus an estimated requirement of R10 Billion).

Electricity networks are also constrained in certain areas meaning few new connections are possible in these areas.

Solid waste facilities are under pressure. The available space at the main Newcastle facility is running out and a new site is in the process of being established. Two other sites in the District are not registered.

DRIVERS AND PRESSURES TOWARDS THE PRESENT STATE

-***Urbanisation and increased demand:*** Recent rapid growth in urban areas (particularly Newcastle/Madadeni/Osizweni) has put increased pressure on all infrastructure categories, but particularly on water and sanitation systems and road networks.

-***Water supply:*** Raw water supplies from existing developed resources in the District are constrained and demand for additional domestic connections adds pressure to this situation. There is currently insufficient water to fuel economic growth in the District. Ageing infrastructure also requires investment to reduce non-revenue water losses.

-***Sanitation:*** Sanitation infrastructure is aging and the increase in urbanisation has put pressure on sanitation systems and has resulted in overloaded waste water treatment works.

GOVERNANCE

-Maintenance of infrastructure is an ongoing concern and poor maintenance results in increasing pressure on the environment.

-Capacity challenges at waste water facilities result in under performance of these facilities which has a direct impact on the receiving environment.

-Investment in water infrastructure has reduced dramatically over 10 years from just over 150 million PA to just over 2.5 million PA in 2017.

SUMMARY

The infrastructure in the district is ageing with very little investment being directed at maintenance and upgrading this. Added pressure is put on infrastructure due to rapid urbanisation, urban densification and urban sprawl. Coupled with this is the limited supply of water available in the District with supply only just meeting current demand. Overloaded and poorly functioning waste water treatment works are a major concern as this exacerbates the shortage of usable water in the District.

1.2.1.2 Terrestrial Biodiversity

TERRESTRIAL BIODIVERSITY

OVERVIEW OF THE SYSTEM

There are significant areas of land containing important biodiversity features located in the ADM. The District consists almost entirely of different Grassland Biome vegetation types spread over a range of altitudes and rainfall bands. Forest and wetlands are also present. Many areas of high terrestrial biodiversity value are located in the higher lying peripheries of the ADM which are also areas with high water production value.

PRESENT STATE

The rate of transformation of terrestrial biodiversity habitats is high, particularly in the grassland biome. Six of the vegetation types are listed as Vulnerable, whilst one is listed as Endangered. Income Sandy Grassland has been heavily transformed through settlement and agricultural expansion and is the most transformed ecosystem within the District.

Irreplaceable CBAs are clustered in the high lying areas of the District and correlate spatially with important water production areas and important agricultural resources. Optimal CBAs are more evenly spread across the District, but are highly fragmented by land use changes.

There is limited protection for terrestrial biodiversity within the district. Chelmsford Nature Reserve and Ncandu Forest reserve are supplemented by the Pongola Bush Protected environment and a number of stewardship sites.

DRIVERS AND PRESSURES TOWARDS THE PRESENT STATE

-***Fragmentation:*** Areas with high biodiversity conservation value within the district are highly fragmented, especially within the low lying areas. This fragmentation is primarily as a result of the expansion of urban and sparse settlement and associated small scale agriculture.

-Urbanisation: In recent years there has been an accelerated conversion of grassland to urban areas. Sparse urban areas themselves have progressively become more dense and open space on the Osizweni and Madadeni peripheries has been developed. Much of this expansion happens outside of the environmental regulatory and municipal planning framework.

-Alien plants: Rapid expansion of alien plants (wattle trees in particular) has resulted in large areas of grassland being lost in a short space of time (40 000 Ha in 20 years)

-Mining: There are conflicts between mining and terrestrial biodiversity within the district. Many mining areas have been developed in areas of high terrestrial biodiversity value.

-Agriculture: There are obvious conflicts between agriculture and terrestrial biodiversity, in some instances however, there is overlap between CBAs and high quality agricultural land where cultivation is not possible. In these cases, agrobiodiversity zones have been defined which describe the protection needs of both biodiversity and agriculture.

GOVERNANCE

- Development of residential areas is occurring at a rate that exceeds planning time frames resulting in settlement apparently driving planning.

-Development of housing areas also appears to be happening outside of the environmental

regulatory framework with no record of environmental authorisation applications or records of decision for large areas of housing development.

-Agrobiodiversity zones describe areas of high potential from both biodiversity and agricultural perspectives. Protection of these areas with appropriate stewardship mechanisms will therefore meet both sectors' requirements for these areas.

-the Mountainous Areas Nodal Development Policy been developed at a district level needs to be included in planning instruments. Currently it does not feature in the ADM SDF.

-Poor management of timber plantations especially on the eastern side of the district has resulted in the spread of invasive wattles within the district. This effectively transforms biodiverse natural ecosystems to mono-specific habitats with high potential for soil erosion and elevated water use.

SUMMARY

There is very limited protection of important terrestrial biodiversity within the district. Most high biodiversity value areas in the lower lying areas are fragmented and under threat by urban settlement expansion as well as agriculture and mining. There is the potential for conflict between biodiversity conservation and other land uses such as agriculture as CBAs are co-located with some high potential agricultural areas and areas with mining potential.

1.2.1.1 Water - Aquatic Ecosystems

AQUATIC ECOSYSTEMS

OVERVIEW OF THE SYSTEM

- The majority of aquatic ecosystems in the upper catchments of the ADM are considered priority conservation areas from a national perspective (they are predominantly classified as National Freshwater Ecosystem Priority Areas). Those in the lower reaches are largely considered important ecological support areas.

PRESENT STATE

The present ecological state (PES) of the rivers of the ADM are given in available data as ranging from a B – "Good: Near Natural" category in higher lying mountainous reaches to a D – "Poor: Largely Modified" in the Ncandu and Horn Rivers and the Dorpspruit through Utrecht. The remaining areas are given as a C – "Fair: Moderately Modified". The majority of the Buffalo River below the confluence with the Ngagane River is given as a B. This is in contradiction with various ecological reports of the river as being highly polluted and in a poor condition.

DRIVERS AND PRESSURES TOWARDS THE PRESENT STATE

-***Water quality:*** The key driver of reductions in biological health in the ADM is poor water quality. Other flow related impacts are present, particularly on the Ngagane River below Ntshingwayo dam and Ngagane abstraction points, but are of less significance.

-Habitat: Riparian habitat in particular is heavily impacted along the mid to lower reaches of the Buffalo River. Here expansion of settlements, agriculture and sand mining has degraded riparian habitats. Heavy grazing pressure has also impacted this stretch of river.

GOVERNANCE

-Monitoring: There is a lack of bio-monitoring data available to provide input to this study. The PES-

EIS study provides a desktop level of information, but no ground-truthed data is available.
-Regulation of land use: The impact of unregulated activities on riparian habitats is significant in the lower Buffalo River basin.

SUMMARY

The aquatic ecosystems of the District are considered important and many are classified as national freshwater ecological priority areas. The condition of these ecosystems closely mirrors that of the water quality classification, with reaches in the higher lying areas in a good condition and those impacted by urban, industrial and mining activities in the mid to lower reaches in a poor condition. In some cases there is poor correlation between PES data and water quality data.

1.2.1.3 Water - Quality

WATER QUALITY

OVERVIEW OF THE SYSTEM

- In the upper reaches of the District's rivers, water quality is good. From mid-catchment and lower, water quality deteriorates, particularly in the Newcastle Dannhauser areas.

PRESENT STATE

Water quality in the high lying areas of the district is generally good. As water moves down the catchments it is impacted by agriculture, active and abandoned mines, industries and urban impacts including waste water discharges.

Key parameters included in monitoring data which indicate the impact of such activities are pH, total dissolved solids, sulphate (a key indicator of acid mine drainage) and nutrients such as soluble reactive phosphate.

Poor water quality reduces the potential to utilise water resources for activities such as crop irrigation. This is critical given that water is already a scarce resource in the District.

DRIVERS AND PRESSURES TOWARDS THE PRESENT STATE

-***Mining:*** One of the biggest drivers of water quality impacts in the district is mining. Mining (active and abandoned) is responsible for the generation of acid mine drainage and mine affected water discharges (high salinity but no pH impact). Abandoned mines are particularly concerning as they are not managed in any way. Water quality results (particularly sulphate) show the impact of such activities on critical catchments such as that of Ntshingwayo Dam and the Ngagane River.
-Industry: Industrial effluent is discharged to the environment via a number of sources, predominantly in the Newcastle area. Indications of groundwater contamination are evident in certain areas.
-Urbanisation: The impacts of a rapidly growing urban population on water quality are two-fold.

- Existing waste water infrastructure is ageing and over loaded and cannot cope with the added pressure of rapid urbanisation and storm water ingress. This results in the discharge of non-compliant effluent to the environment
- Unserviced settlements result in contamination of streams and rivers by faecal matter and solid waste. Pit latrines are also responsible for the contamination of groundwater, particularly in areas where the water table is close to the surface.

- Waste water treatment works: Presently there are 11 registered facilities in ADM shared between the ADM WSP and the Newcastle WSP. Effluent analysis results for the ADM WSP facilities indicate a

failure to consistently reach required standards for microbiological and nutrient parameters. Added to this is the impact of overloading on all facilities. All facilities ultimately impact the Buffalo River system from which water is extracted at the Buffalo river pump station and the Tayside pump station.

GOVERNANCE

-Abandoned mines are a major source of water contamination in the District. There is presently no clear map of the extent of these features and the present locations and volumes of decant. Their impact is not clearly understood.
-Management of WWTWs is a persistent concern in the District. This is highlighted by the non-compliance with standards at several works and the lack of reporting for the national information system.
-Water quality monitoring in the District has poor temporal and spatial resolution (few sites monitored infrequently and poorly distributed) and few determinants are monitored. Key parameters such as phosphate are not analysed to a useable limit of detection.

SUMMARY

Water quality in the district is heavily impacted primarily by mining, industry, agriculture and waste water. Mining is a serious concern causing an increase in salinity, pH changes and increases in various potentially toxic substances. Particularly concerning are abandoned underground mines. Waste water treatment works are not functioning optimally within the district. Regular monitoring of water quality is important to understand and combat water quality problems.

1.2.1.1 Water - Quantity

STRATEGIC WATER SOURCE AREAS

OVERVIEW OF THE SYSTEM

All of the water used in the District is sourced from within the District. The District also makes important contributions of water to external users including power generation, neighbouring districts and users in Gauteng. Regions of the ADM are recognised as nationally important strategic water source areas (SWSAs). Effective catchment management is critical given that the current level of water supply equals demand. Strategic water source areas (SWSA) are located in the high lying areas of the district and correlate with CBAs and high value agricultural areas.

PRESENT STATE

The strategic water source areas (SWSA) of the ADM are presently largely undeveloped due in part to their topographic situation and terrain. Parts of these areas are however reasonably degraded due to over-exploitation by livestock farmers and invasion by alien plants. Although these areas are important because of their high water yield and their spatial correlation with critical biodiversity areas and areas of high agricultural potential, they are not well protected within the district. Protection of these areas will accrue other synergistic benefits such as meeting biodiversity conservation targets, protecting heritage resources and securing opportunities for tourism development in the district.

DRIVERS AND PRESSURES TOWARDS THE PRESENT STATE

- Alien plants: A key factor impacting on the ADM's SWSAs is alien plants (wattle in particular). They degrade the ability of a landscape to regulate water production and reduce the yield of the

catchment through increased evapotranspiration.

-***Agriculture - Livestock:*** Over-utilisation of grasslands by livestock farmers results in reduced health of grasslands which encourages alien plant invasion and reduces the hydrological functioning of the landscape. Areas with reduced vegetation cover are also susceptible to erosion which reduces water quality and increases the rate at which dams fill with sediment.

- Mining: The expansion of mining into natural land cover areas is a source of conflict. Presently, there is limited mining operating in key SWSA's however applications for prospecting and establishment of coal mines are in place. There is conflict between mining and key water provision resources in the Dannhauser area.

GOVERNANCE

-There is generally a lack of formal protection for SWSAs, though the establishment of stewardship sites and protected environments is making progress towards this.

-The development and implementation of the Mountainous Areas Nodal Development Policy is important in restricting developments which may impact SWSAs negatively in upper catchment areas.

- Land owners' and government funded alien plant control is presently not effective in controlling the spread of wattle trees.

SUMMARY

Strategic water source areas are critical to the wellbeing of the District, both economically and socially. The formal recognition and protection of these areas is limited, while their production potential is threatened. They are spatially correlated with Critical Biodiversity Areas and areas of high agricultural potential.

1.2.1.1 Wetlands

WETLANDS
OVERVIEW OF THE SYSTEM
- There are a vast number of wetland systems within the District, which mainly occur in clusters of smaller systems in the higher lying areas of the District. Wetlands in the lower lying areas tend to be larger and fewer in number and concentrated around larger rivers. There are four major systems recognised in the District namely the Blood River Vlei, Boschoffs Vlei, Padda Vlei and Groenvlei.
PRESENT STATE
Wetland systems within the district are distributed unevenly. High concentrations of smaller systems are situated in higher lying areas, particularly in high water production areas such as around Groenvlei. These systems are largely in a relatively good condition. Systems in the lower lying areas tend to be larger and more impacted by anthropogenic activity, such as the Boschoffs Vlei and the systems in the highly transformed agricultural areas to the north of Ntshingwayo Dam.
DRIVERS AND PRESSURES TOWARDS THE PRESENT STATE
-***Sand mining:*** Many of the wetland systems are affected negatively by sand mining especially along river banks where wetland areas are present ***-Urbanisation:*** Many wetland areas are affected by urbanisation as urban sprawl has resulted in building of houses in wetland areas ***-Agriculture:*** Many wetlands within the district have been drained for agricultural purposes, while

irrigation reduces available water for wetlands. Use of pesticides also is likely to impact wetland integrity.

-Alien invasive species: Although they are unlikely to establish within wetlands, alien invasive tree stands in the catchment areas of wetland will have had a significant impact on wetlands through the elevated consumption / evapotranspiration of water, reducing the available supply to wetlands.

GOVERNANCE

-Wetlands are protected by law through the National Water Act and any activity impacting on a wetland requires a water use licence. Implementation of this regulatory legislation at the district level is important, particularly in areas where unregulated development is occurring rapidly.

SUMMARY

Wetland systems within the district are important components of the water production cycle and many wetlands are found in high lying areas in areas of high water production potential. Key threats are transformation of wetland area to other land uses and reduction of available water through abstraction and alien plants. Wetlands are protected by various regulatory instruments but are still heavily impacted in the district by sand mining, urbanisation, agriculture and invasion of catchments by alien tree species.

1.2.1.2 Geotechnical Environment

GEOTECHNICAL CONSTRAINTS

OVERVIEW OF THE SYSTEM

The geology of the District is dominated by Vryheid formation sandstones and Dolerite intrusions / sheets. Parts of the district in the higher lying areas are characterised by steep slopes largely resulting from the slower erosion rates of protective dolerite sheets. The lower lying areas are flatter and present few geotechnical limitations to development. Mining is focused on the coal beds of the Vryheid Formation.

PRESENT STATE

Steep slopes found in the higher lying areas are largely undeveloped due to their topography. Steep slopes and shallow bedrock are some of the reasons for high levels of erosion within the district together with the erodibility of sandstone derived soils.

Undermined areas and wetlands pose constraints to development, and limit the options for the use of land.

DRIVERS AND PRESSURES TOWARDS THE PRESENT STATE

-Slope: The steepness of the area in the highlands has prevented development from occurring while most development, cultivation and mining activity occurs in the flatter lower lying areas.

-Mining: Undermined areas pose significant constraints to development. This is important particularly where the demand for mining and housing are focused on the same land areas. This is the case in areas to the south of Madadeni and Osizweni.

GOVERNANCE

There is limited governance associated with Geotechnical issues. Mining governance is however important, particularly in areas where undermining limits development options of land.

Steep slopes in the high lying areas provide an opportunity for conservation of important water production and biodiversity areas and for economic development through ecotourism.

SUMMARY

There are few geotechnical limitations to development in the District. Steep slopes and wetlands present the only natural development constraints. Undermining of areas represents a serious man-made constraint.

1.2.1.2 Groundwater Resources

GROUNDWATER

OVERVIEW OF THE SYSTEM

The district is characterised by intergranular and fractured aquifers, with yields predominantly between 0.5 – 2 litres per second. The highest yields are associated with fractures occurring along dolerite contact zones and significant water strikes appear to occur at depths greater than 30m but less than 60m. In areas of the Buffalo River basin, the water table is very shallow. Many households in rural areas are supplied with domestic water by boreholes.

PRESENT STATE

Existing data suggest the potential for exploiting groundwater resources in the District is limited, though further investigations are required. This is primarily seen as a resource for domestic supply and for livestock watering. Groundwater quality monitoring data is limited, but elevated salinity is recorded in the area between Dannhauser, Utrecht and Newcastle. Diseases such as cholera have been linked to bacterially contaminated groundwater in certain settlement areas where pit latrines come into contact with the shallow ground water table.

DRIVERS AND PRESSURES TOWARDS THE PRESENT STATE

-Quality: Groundwater resources are under threat from contamination. This is primarily by mining activities (acid mine drainage) and by the expansion of settlements and the associated use of pit latrines over shallow ground water tables. The establishment of graveyards in these areas is also likely to contribute to the contamination of this resource.

GOVERNANCE

- There is a lack of routine monitoring of the quality and yield of groundwater resources in the District. The potential for exploitation of these resources can thus not be adequately assessed.
- There are conflicting opinions on the potential for groundwater abstraction for irrigation purposes.

SUMMARY

Groundwater currently supports a number of households for domestic use and livestock watering in the district. Further development potential is currently understood to be limited. Widespread and consistent monitoring of this resource is not currently undertaken although the resource is under threat from mining, rudimentary sanitation, landfill sites and graveyards. Shallow groundwater tables impose a significant constraint on a variety of development activities.

1.3 Discussion - Key cross cutting drivers of change and strategic issues

1.3.1 Urbanisation and growing urban areas

Rapid urban population growth through urbanisation and biological population growth drives urban densification, increased urban sprawl and the expansion of informal settlements. These pressures are important drivers of change in the ADM and have important impacts on many sectors including agriculture, mining and the environment. There are also socio-economic issues which are generated or exacerbated as a result of rapid urbanisation.

In what is a global phenomenon, economic pull factors result in an influx of people into urbanised areas. In the ADM context, the key drivers of economic activity and employment in the District are industry and manufacturing which are concentrated in Newcastle LM. The greater job opportunities provided by these activities in the Newcastle area has pulled many people from more rural areas to the Newcastle/Madadeni/Osizweni area. The growth in the population in this area has also resulted in an increase in the number of motor vehicles on the District's roads and a concomitant increase in vehicular emissions. This sector is however also a key driver of air quality issues. This has resulted in a situation where the greatest densities of people in the District are also exposed to the most serious impacts of emissions.

In addition, the district as a whole and the economic migrant group in particular are characterised as having a generally vulnerable population that is poor with low education levels and limited adaptive capacity with a large proportion of the population relying on the state for their health and livelihood needs.

Land availability

Urban population growth has taken place at such a rapid rate that existing housing is insufficient or financially inaccessible and land for building additional housing (both formal and informal) is in high demand. Many people are forced to build their houses on land which brings their development into conflict with environmental hazards and sensitivities or with other sectors land use plans. As an example, flood plains are targeted as open, flat land and many houses are built in these areas. Another example is the many areas of the District with a shallow groundwater table which puts the development at risk of flooding and makes the use of pit latrines and sceptic tanks unsuitable. This increases the vulnerability of people in this area as well as those downstream. Added to this, flood plain areas are important agricultural and ecological features.

Fragmentation of critical biodiversity areas

Even though many of the critical biodiversity areas (CBAs) are found in the highlands of the district, there are many located in the lowland areas of the Buffalo River basin. Most of these CBAs are grassland areas and have been fragmented by agricultural activity and peri-urban housing development. This means these areas are constantly under threat from urbanisation and growing settlements. Many of the CBAs are in a vulnerable state or have disappeared altogether.

Unregulated development

In many cases within the district, housing expansion over the last decade has occurred without following necessary legislated processes in terms of environmental legislation. This rapid development has also resulted in increased sand mining, mainly along important flood plain areas and adjacent to wetland systems. Unregulated sand mining is an important threat to biodiversity.

1.3.2 Social and Economic Development Pressure

Social and economic development is a key driver of environmental change across the world. The Amajuba district is relatively undeveloped and is dominated by rural landscapes. Existing development is primarily concentrated in the Newcastle LM including industrial, commercial and residential development. Shrinking populations in the rural areas are juxtaposed with a growing population in the Newcastle/Madadeni/Osizweni area characterised by low levels of education, and income and high levels of unemployment.

There is limited information regarding development in the district from formal development authorisation applications or inclusion in development plans suggesting that presently, development pressure is low. Applications for the authorisation of large formal economic and infrastructural development activities are noted to be minimal, with major economic developments limited to a few mining expansion applications. In some cases the proposed expansion of mining activity is occurring within strategic water source areas. Infrastructural developments are also limited and key activities are the application for a new solid waste disposal facility and limited road infrastructure development projects.

This indication of limited development is however not supported by observations of development on the ground where large areas are noted to have been transformed from grassland and agricultural areas to residential areas in the last 5 years. Most of this development is small scale housing construction in the Newcastle/Madadeni/Osizweni area driven by urbanisation and the growing urban population and resulting in urban densification and urban sprawl. In many instances the development pressure of this type is not fully understood or managed as these developments are happening rapidly and outside of the formal planning and regulatory framework, without relevant authorisations.

This rapid and unregulated development has tremendous impacts on the requirements for infrastructure and service delivery which is unable to keep pace with this development. Infrastructural overloading as a result of this is a key cross cutting concern as this has important environmental implications ranging through water quality impacts, land degradation (through associated activities like sand mining and informal mining of coal) and biodiversity loss impacts.

The unregulated and unplanned nature of this development also has important socio-economic consequences as in many cases homes are constructed in areas unsuitable for such construction, particularly on floodable areas or in areas that are characterised by very shallow ground water tables where contamination of this resource is likely.

1.3.3 Governance and municipal capacity

Lack of, or ineffective governance is often a contributing factor to sustainability issues and is therefore a key cross cutting theme or issue. Governance is also a key cross cutting issue given its role in understanding and managing environmental systems and remedying related issues. Sound environmental governance involves a wide range of institutions including government agencies

responsible for carrying out environmentally relevant legislated mandates (and other relevant legislation) such as the requirement for regulation of activities, environmental monitoring, co-ordination of role-players, and actions (rehabilitation, education, etc.), and other non-governmental role-players such as specialist or non-profit organisations with skills and capacity to deal with technical aspects e.g. wetland rehabilitation or environmental education. Also important is the institutional arrangement of forums and governance structures that exist to deal with issues related to specific aspects of environmental management. Environmental sustainability issues and governance cuts across all municipal functions as follows:

- Technical services (ensuring designs reduce negative impacts),
- Planning (analysing development proposals against sustainability criteria and including appropriate conditions in approvals),
- Service delivery waste collection – implement recycling to reduce pollution.

There are various issues relating to governance in the ADM that were noted during the strategic assessment. Perhaps the most problematic is that of the failure of inter-institutional cooperation. In the ADM, mining is a key economic activity and also an important role player in environmental management given its significant impact on water resources and on biodiversity. A key governance shortcoming in the district is the lack of co-operation by the Department of Mining, Minerals and Energy with the institutions responsible for various environmental management roles in the District. This issue was raised in numerous stakeholder engagements and confirmed by the lack of participation by the Department in the District's environmental forum. Numerous attempts to secure a meeting with the Department as part of this project were unsuccessful. The lack of inter-departmental cooperation has been noted in previous similar studies in the District and this hampers the effectiveness of integrated environmental management.

An additional key governance matter for consideration is the two systems of government that exist in the District (and indeed in KZN Province) which are the formal democratically elected District government, and traditional authority. This dual governance arrangement results in problems dealing with environmental issues such as development planning, service delivery (particularly with respect to water and waste water services) and the regulation of development and its impact on the environment.

Urban areas in the Newcastle / Madadeni / Osizweni area have expanded rapidly in the last 5 years, mostly outside of the planning and environmental regulatory framework. The unplanned and unregulated expansion of urban areas has important consequences for infrastructure. The WWTWs of the ADM are already operating at full capacity. They are also are under increasing pressure from storm water ingress which pushes them beyond their capacity during heavy rainfall. They are therefore unlikely to be able to cope with an increase in the population which they service without additional capacity development. This requires careful spatial, technological and financial planning which is complicated by dual governance arrangements.

This expansion of the urban area is often at the expense of good agricultural land and critical biodiversity areas. The lack of regulation of this development is likely to bring it into conflict with these sectors as well as mining. It will additionally result in increased vulnerability of homes to

flooding, and increased degradation of water resources as waste water and other service infrastructure is unable to keep pace with this development.

The lack of adequately robust monitoring data with respect to air quality, water quality, groundwater metrics and other key environmental features limits the ability of responsible authorities to assess and manage these resources.

A slightly different but nonetheless important governance issue encountered in the ADM is the lack of a designated officer or designated responsibility for heritage resources. Heritage resources therefore receive very little attention and there is no formal governance arrangement or responsibility for protecting, developing and maintaining these resources or for marketing potential tourism opportunities. This limits the ability of the District to realise economic growth opportunities identified in the IDP and other such plans.

1.3.4 Water

Water is perhaps the most important sustainability issue facing the District with the demand for water expected to exceed available supply in the next few years (Uthukela Water 2018). Demand for water stems from all sectors of society and the environment and all economic activity is to a greater or lesser extent ultimately dependant on water. Water availability is presently an economic growth limiting factor which impacts the key sectors in ADM; agriculture, industry, mining and domestic supply.

In addition, available supply is in many cases compromised with respect to quality as a result of various pressures brought to bear on this resource including economic and service delivery activities. This reduces its potential for use and increasing the costs associated with treatment.

Mining has historically driven the area in terms of economic growth and job creation but is on the decline. Water is a significant part of many mining processes. Limited quantities of this resource therefore limits potential mining output. Water resources are also contaminated during mining activities and are directly (via WWTWs) and indirectly (through AMD and MAW) discharged into the environment. Once water has been contaminated by mining activities, it cannot be used for other activities such as agriculture without further treatment. This results in problems not only environmental but economic as well. This creates a knock on economic problem as more monetary resources are used to ensure the water output from waste water treatment works meets these standards.

Significance is placed on agriculture within the District's economy. Agriculture within the district is not only hindered by land availability but by water as well. Surface water resources are limited due to factors such as a growing domestic demand, limited supply and the pressure for economic growth. Poor water quality affects agriculture in particular given that treating contaminated water to irrigation standards is not viable for most agricultural enterprises. The District's agricultural plan has identified the fact that there is presently insufficient water to expand the sector through irrigation interventions. Without additional investment in water resource development, agricultural growth within the district is reliant on livestock or game farming expansion.

Poor water quality has a negative impact on both human and environmental health. In terms of the environment, the present ecological state (PES), is poor within the district, limited correlation can be made between PES and water quality because of a lack of monitoring data. High pollution levels more often than not result in biodiversity loss. Often environmental health is traded for economic development. With regard to human health, poor water quality increase the potential exposure of humans to contaminated water especially as the waste water treatment works within the district are not functioning anywhere near optimally. These exposed people are at a higher risk of infection and water related illnesses. This has a knock on effect in terms of the economy as there are increased health cost which the district inevitably bears and loss of productive days in the local economy due to water borne illnesses.

Most of the District's intact water related ecological infrastructure is located in the higher lying areas. These areas:

1. represent key water production areas with high water yields,
2. represent much of the critically important terrestrial and aquatic biodiversity in the District,
3. have good livestock grazing potential,
4. are largely unspoilt and represent ecotourism opportunities

These areas represent opportunities to ensure the long term flow of benefits to the District including water, grazing and ecotourism while simultaneously protecting important CBAs. In this context, the rapid expansion of thirsty alien vegetation in key catchment areas is a critical issue which is relevant to all sectors.

5. DESIRED FUTURE STATE

5.1 Defining the Desired Future State

The first step in dealing with sustainability issues identified is setting a vision and targets that represent a sustainable future. **This vision is the 'Desired Future State' (DFS) and is understood as a sustainability objective (SO)** which captures what people desire as the future state of the resource. This informs what actions are required to move from the Present to the DFS. There are two factors which need to be considered in establishing the DFS, namely:

1. The needs and wishes of the people who live and work in the area, and
2. Legal standards and ecological thresholds defined in planning and policy instruments.

Figure 13 provides an example of how the two are considered in setting the DFS. In a situation where there is good quality air well within legal limits this represents a natural asset in an area because it is not negatively impacting people's health. It also provides scope for new development that decreases the air quality within or up to the legal limit. Or it supports further 'clean development' that requires good air quality. Under scenario 'a' in Figure 13, if people in an area wish to maintain the good air quality this translates to a high development constraint for polluting activities because it either means that:

- No polluting activities are developed, or
- Polluting activities have to be designed and operated with very effective control measures to remove the pollutants generated from their operations which are costly.

Under scenario 'b' people within an area may agree that the additional development may be allowed so that the state of the air quality declines, up to the legal limit which is set as the threshold. Under scenario 'a', the threshold will be set higher.

PRESENT STATE	LEGISLATED IMPLICATIONS FOR DEVELOPMENT	SOCIETAL AIMS FOR FUTURE STATE	DEVELOPMENT CONSTRAINT
Good Air Quality well within legislated limits.	Provides capacity for addition of polluting industry within an area i.e. limited development constraint.	a. Maintain Present State. b. Allow for decrease in PS to enable development (up to legal limit).	a. No polluting industries permitted. b. Allow for development of polluting industries up to legal limit.

Figure 13: Consideration of legal framework and societal needs in determining the desired future state

5.2 Determining the Desired State for the Study Area

Input from stakeholders into the DFS is established by through a consultation process / workshop at which a broad range of stakeholders within the area contribute to the development of a 'sustainability vision'. The visions are expressed in the form of a **sustainability objective (SO)** for the different features of the main environmental categories (social, economic and biophysical). There may be an express wish to maintain the status quo, improve the situation or even allow for

deterioration in the current state, as long as it does not result in legal limits or ecological thresholds being exceeded i.e. an unsustainable situation.

In addition to the DFS workshop held as part of this EMF, workshops were also carried out as part of the Newcastle EMF and together, these findings have helped develop the DFS for the District. Once the objective has been set it is possible to establish the following elements that together comprise a sustainability framework:

- **Criteria:** The environmental aspect to be measured, for example air quality or level of biodiversity protection.
- **Indicators:** Are the variables or elements that can be measured to track success in achieving the objective for the criteria such as the concentration of different types of pollutants in the case of air quality. As the objective is to avoid levels that threaten human and environmental health different indicators may be appropriate for different users.
- **Targets/Thresholds:** are the levels against which the indicators are measured. The targets are set at levels that give effect to the sustainability objective, so they will be higher where the desire is for an improved situation. For example, if an area is dominated by residential and recreational use then targets for air quality will be set higher than the minimum targets to ensure that people's health is not adversely affected. If, on the other hand the dominant land-use is industry, then the target would be the minimum possible level set in terms of the relevant policy or legislation to allow for as much economic activity as possible.

These following factors have been considered in the development of the sustainability framework and the Strategic Environmental Management Plan:

- **Prioritization** – The SEA has identified the key environmental assets and issues. The risk exists that by including other, less significant issues, that the effort allocated to priority issues is diluted.
- **Measurability** – It is not useful to propose an indicator that is difficult to measure, or unlikely to be measured due to capacity, technology of other limitations.
- **Responsibility** – Development of a framework is meaningless without allocating responsibility to the measuring and or analysis of information, and then indicating who should take appropriate action based on the outcomes of analysis and reporting.
- **Causal Relationship** – The response to the issue should address the cause. It is therefore important to define this relationship upfront.
- **Governance** – Governance issues invariably contribute to the issue and need to be addressed in the case of any environmental aspect through clear consideration in the SEMP.
- **Adaptive Management** – An adaptive approach is required which involves review against targets at an appropriate interval. The frequency of the review will be directed by among other factors, the urgency of the issue and the frequency with which data is collected. The review also needs to take into account whether the indicator is providing the information it is supposed to and changes in the management context, such as new technology or legal standards.

5.3 SUSTAINABILITY FRAMEWORK

5.3.1 Agricultural Resources

Environmental Component	Agricultural Resources	
Strategic Issues	An emphasis is placed on the importance of agriculture within the district for its growth potential however its contribution to the economy is currently low. Agricultural challenges are further exacerbated by: • the loss of agricultural land to different land uses and to alien plants, • by water limitations including availability and quality and • by governance issues surrounding land restitution.	
Sustainability Objective (SO)	**Secure the existing and potential value of the Agricultural Sector to the economy and to national food security.** **Motivation:** Agriculture is seen as a key economic growth sector in the District and Nationally is important for food security. Agricultural resources are critical, non-renewable resources. **Implications for Development:** • *Future Developments*: Future development must not result in the loss or degradation of productive land for primary production. Land-use that is sensitive to impacts from secondary agricultural processing or intensive production activities should be located at a distance from such enterprises in order to limit impact on existing operations and/or expansion. • *Existing Land-use*: Optimise productive land and secondary activities to maximize the economic potential of the sector.	
SO Criteria	**SO Indicators**	**SO Targets**
High value agricultural land	Zoning of high potential agricultural land (both areas with potential but not yet used, and areas currently under production). This should include buffer areas to avoid conflict between agriculture and competing land-uses.	100% of high potential land that is presently undeveloped should be zoned for agriculture
	Optimizing agricultural potential.	100% of the available productive area utilised for agricultural purposes.

5.3.2 Air Quality

Environmental Component	Air Quality
Strategic Issues	There is perception that air quality in certain parts of the District has been compromised, particularly by industry. Limited existing data shows that standards have not been exceeded and that a high proportion of emissions are attributable to vehicles.

	There is a lack of robust monitoring data to confirm perceived poor air quality.	
Sustainability Objective (SO)	**Maintain or improve present air quality and improve the knowledge base by implementing an AQ monitoring programme.** **Motivation:** The present state of air quality in the District cannot be accurately characterised without adequate monitoring data. A precautionary approach (maintain or improve) should therefore be adopted with respect to development and at the very least, the present AQ situation be maintained. **Implications for Development:** Ensure that both current and future development adhere to air quality standards.	
SO Criteria	**SO Indicators**	**SO Targets**
Air Quality	Monitoring data collected	Target - A robust ongoing monitoring programme is in place for the District.
	SANS 1929:2005 guideline ambient air quality: Sulphur Dioxide (SO2), Nitrogen Dioxide (NO2), Carbon Monoxide (CO), Particulate Matter (PM10), Ozone (O3), Lead (Pb), Benzene (C6H6).	Target – Once present AQ is defined, national standards to be met (to be defined through monitoring programme as current levels not defined).

5.3.3 Heritage Resources

Environmental Component	Heritage Resources
Strategic Issues	Heritage sites are poorly documented and not adequately protected or managed across the District. No formal assessment of urban areas has been carried out. Heritage resources have been identified as an important contributor to economic growth through the development of tourism opportunities, however governance and responsibility for heritage resources has not been adequately organised to achieve this goal.
Sustainability Objective (SO)	**To adequately identify, protect and benefit from the District's heritage resources and to ensure their long term management and marketability.** **Motivation:** The heritage resources of ADM are a major element of the character and history of the District. They are also an important economic development opportunity that has been identified in all the District's development plans. There are a number of heritage resources within the district that can be monetised in a manner that boosts the tourism sector. These tourism opportunities need to be identified to determine the most effective method of sustainably preserving these heritage resources. **Implications for Development:** Future developments will need to adhere to heritage protection legislation

	and adequately take heritage resources into account when developing a property, ensuring appropriate identification and protection of these resources. Existing developments may need to amend the management of their properties to take the protection of identified heritage resources into account.	
SO Criteria	**SO Indicators**	**SO Targets**
Heritage resources	Heritage governance	A heritage resources champion is identified and activities relating to the identification and management of these resources are built into their job key performance areas.

5.3.4 Flood zones

Environmental Component	**Flood zones**	
Strategic Issues	Large areas have been transformed to urban and peri-urban landscapes. A significant area of flood zone in the District has also been cultivated. Sand mining and brick making also reduce the ecological integrity of these areas Increased hardened surfaces and loss of infiltration in these areas increases flood volumes and intensity downstream. Climate change is expected to result in increased flooding frequency and intensity Development on floodplains mean infrastructure and lives are placed at risk both at the site concerned and downstream	
Sustainability Objective (SO)	**To protect people and infrastructure from flood hazards and secure the ecosystem service value of floodplains (flood regulation, water quality and habitat).** **Motivation:** Climate change modelling shows that flooding in Amajuba is likely to become more intense and more frequent. Lives and infrastructure are placed at risk when spatially coincided with flood risk zones. Flood plain areas are ecologically significant as they provide habitat to certain species, reduce erosion along river systems or streams and temporary hold flood waters thereby reducing flood peaks. **Implications for Development:** Spatial development tools will be essential in ensuring that development does not take place in flood zones. Compliance and governance will be vital in enforcing this. **Existing land use**: There is an increase in urban and peri-urban developments in flood zones which is transforming the land from being vegetated to solid surfaces, which increases surface run-off. Sand mining is another key issue as it occurs in flood zones.	
SO Criteria	**SO Indicators**	**SO Targets**

Development on floodable areas	Change in area of development on floodable areas	0% increase on previous year

5.3.5 Terrestrial Biodiversity

Environmental Component	**Terrestrial Biodiversity - Species and Ecological Process**	
Strategic Issues	Low levels of biodiversity protection in the District limits the ability to meet conservation targets, secure other key services such as water production and grazing and to benefit from associated tourism and recreational economic opportunities. Critical biodiversity areas (CBAs) found in the highlands of the district are generally irreplaceable CBAs and overlap with high water production areas. These areas are under threat from alien plant expansion, mining and poor rangeland management. CBAs in the lowlands are typically optimal CBAs and are highly fragmented by other land uses such as urbanisation and agriculture. These areas are under threat from unplanned and unregulated urban expansion and small scale agriculture.	
Sustainability Objective (SO)	**Secure formal or stewardship agreement level protection of critical biodiversity areas required to meet provincial targets and ensure appropriate management of these and ecological support areas.** **Motivation:** Conservation of biodiversity is a national and provincial priority and the municipality has a responsibility to contribute to meeting provincial targets. Protection of biodiversity also yields critical ecosystem services including water production, grazing and tourism opportunities. **Implications for Development:** Land-use on areas with high biodiversity value needs to be complimentary to the protection and management objectives of the relevant biodiversity (habitat and species) to ensure targets are met. Such land needs to be secured for biodiversity conservation purposes via an appropriate mechanism such as those offered under the stewardship programme. **Existing economic activity**: Identify and implement management actions to sustain conservation worthy features and species, and manage accordingly.	
SO Criteria	**SO Indicators**	**SO Targets**
Protection Status of Biodiversity	% of CBAs secured for achieving biodiversity targets and processes (corridors) under formal protection or biodiversity stewardship agreements.	Aim to secure 100% of irreplaceable CBAs

5.3.6 Water Resources – Quantity

Environmental Component	Quantity of Water from Water Resources - Rivers, Streams, Dams, Groundwater	
Strategic Issues	Water supply in the area is under extreme pressure and demand currently effectively equals the available supply. This places limitations on economic growth prospects. Climate change is likely to increase rainfall uncertainty and increase drought and flood frequency Priority supply catchments are under threat from land degradation including alien plants, poor land management and mining. The status of groundwater resources in the District is inconclusive due to a lack of monitoring data.	
Sustainability Objective (SO)	**Improve water production security through appropriate catchment management measures and protection to ensure best possible hydrological health of catchments and long term sustained output of water.** **Motivation:** Water is a critical resource for meeting basic human needs and without which the District's economic growth prospects are limited. **Implications for Development:** Development in key water supply catchments must be strictly controlled to restrict any negative impacts of development on water production potential and hydrological functioning. Activities which impact on water quantity and quality in key catchments should be avoided.	
SO Criteria	**SO Indicators**	**SO Targets**
Catchment condition and management	Area of land covered by unmanaged woody alien invasive species	Target – 0%
	Area of strategic water source areas covered by a valid catchment management plan.	Target – 100%
Catchment Protection	Area of critical catchments under formal protection or stewardship agreements.	Target – 30%

5.3.7 Water Resources – Quality

Environmental Component	Water Quality Water Resources - Rivers, Streams, Dams, Groundwater
Strategic Issues	Water quality in the District has been compromised through pollution from mining, industrial, domestic and agricultural sources. Abandoned mines are sources of acid mine drainage and mine affected

	water and responsibility for their remediation is not completely understood or assigned. Water availability is a key constraint in the District and poor water quality constrains the resource further, increasing vulnerability of communities and limiting development potential. There are concerns around the quality of accessible groundwater resources particularly in mining areas and areas with shallow ground water tables. Monitoring data is insufficient to adequately describe water quality issues in many of the District's surface and groundwater resources.	
Sustainability Objective (SO)	**Understand District water quality problems better through improved monitoring and improve water quality to levels which sustain human and economic users/uses and ecological functioning.** **Motivation:** Poor water quality increases the vulnerability of users and limits the economic growth potential of the District. **Implications for Development:** ***Existing land use:*** Need to achieve 100% compliance with established monitoring operational objectives and > 90% compliance with established standards 100% of the time and 100% compliance > 90% of the time. ***Historical activities:*** Detailed monitoring programmes must be established to determine the extent and effect of acid mine drainage and mine affected water emanating from active and abandoned mines. ***Future Developments:*** Developments which are likely to compromise the quality of water in critical areas must be avoided. Any development proposed to discharge to the environment must comply with water use licencing requirements. Water use licencing must aim to improve water quality in critical zones through acknowledgement of the location of discharges within such zones and appropriately strict conditions designed with zero degradation of the resource as their objective.	
SO Criteria	**SO Indicators**	**SO Targets**
Water quality determinands	Raw water monitoring data - South African Water Quality Guidelines for irrigation, aquatic ecosystems and recreational use	Target – SAWQG target water quality range for pH, TDS, soluble reactive phosphate and Faecal Coliforms achieved at all monitoring sites.
Compliance with legal requirements	Water use license compliance	Target – 100% compliance as required by license
	Water use registration and reporting	Target – 100% registration of government water users and reporting compliant with IRIS requirements.

5.3.8 Water Resources - Aquatic ecosystems

Environmental Component	Aquatic ecosystems	
Strategic Issues	Numerous rivers in the ADM are important for achieving targets for the conservation of aquatic ecosystems. These systems are under threat from poor water quality and degradation of catchments. Demand for water to satisfy domestic and economic growth necessitates the development of water resource infrastructure such as dams. Dams are key impactors of aquatic ecological integrity. Although the ecological reserve for rivers in the uThukela basin has been established, this was undertaken in 2004. The Classification of water resources in the uThukela Basin has not yet been undertaken.	
Sustainability Objective (SO)	**Secure the quality, quantity and timing of ecologically important flows in the rivers of the ADM and implement management measures to protect their ecological integrity.** **Motivation:** Aquatic biodiversity is important for securing the suite of ecosystem services provided by a healthy river. Aquatic biodiversity is included in the suite of biodiversity that South Africa is legally obliged to protect through international treaties. **Implications for Development:** ***Existing activities:*** Existing activities must comply with water use licence requirements and must ensure that impacts on water resources are minimalised (e.g. sedimentation) ***Future Developments:*** Future developments will need to comply with RQOs for quality (discharges) and quantity (abstractions). Applications for future development must show how they will contribute to improved state of natural systems.	
SO Criteria	**SO Indicators**	**SO Targets**
Ecological Health of Natural Systems	Percentage of time successfully meeting the ecological reserve or hydrological RQO[3] (flow).	Target – 100%
	Achievement of RQOs for habitat and biota (to be determined) based on Present Ecological State of River health monitoring sites	Target – 100%

[3] Classification and RQO determination for uThukela Catchment still to be undertaken.

5.3.9 Wetlands

Environmental Component	Wetlands	
Strategic Issues	Wetlands provide critical services including water purification, habitat for important species and flow / flood regulation, but little is known regarding the condition of these resources in the District. The vast majority of wetlands occur on private land and very few are located in formally protected areas. Wetland loss and degradation through unregulated activities (informal sand and coal mining), mining, agriculture and unplanned housing expansion has reduced the capacity of these systems to supply services	
Sustainability Objective (SO)	**Secure the long term functioning of wetland systems through accurate mapping, condition assessment and application of wetland buffer areas, and implementation of regulatory instruments.** **Motivation:** Given their role in managing water quality issue and providing habitat for key species, the functional status of all wetland in the area has to be optimized and protected. **Implications for Development:** Net gain of wetland functions through rehabilitation of existing systems as a condition for future development applications and defined management plan to maintain these systems. Improved functional area through rehabilitation of degraded systems and associated management mechanisms (buffers) and plans. **Existing land use**: Ensure that wetlands are kept function at the most optimal level possible	
SO Criteria	**SO Indicators**	**SO Targets**
Wetland protection and Habitat Value	Wetland functional area lost in the last year to development (excluding areas lost with appropriate offsets implemented).	0Ha
	Specific wetland systems supporting high value biodiversity (NFEPA) should be protected through stewardship or other management agreements.	100%

5.3.10 Constraint features - Infrastructure

Environmental Component	Infrastructure	
Strategic Issues	Infrastructure is unevenly distributed across the District (though this is expected). The declining condition of much of this infrastructure additionally places a constraint on development and puts people and the environment at risk. Waste water infrastructure operation is not optimal and resulting in non-compliance with discharge standards and compromised water quality which impacts the District socio-economically. Many are at capacity and often exceed this through storm water intrusion resulting in water resource contamination. Investment in maintenance and development of water infrastructure is rapidly declining as opposed to keeping pace with demand from increasing urbanisation. There is presently insufficient water available to support economic growth such as the development of additional irrigated agriculture, and further water resources infrastructure development is required. Road and water infrastructure is ageing and condition and functionality is declining, impacting on economic activity.The solid waste facilities in the District are either un-registered or are reaching capacity.	
Sustainability Objective (SO)	**To develop infrastructural capacity within the municipality such as water treatment works, storm water infrastructure and transport and electrical infrastructure that is in compliance with national standards without comprising the social and natural environment.** **Motivation:** Proper functioning municipal infrastructure facilitates the collection and use of nature's contribution to people. This supports economic growth and development and will result in better service delivery, a healthier environment and less vulnerable communities. **Implications for Development:** Implications for development are largely positive as functioning and capacitated infrastructure facilitates economic growth, job creation and sustainable communities.	
SO Criteria	**SO Indicators**	**SO Targets**
Infrastructure management, maintenance and development.	Investment in water, sanitation and road infrastructure.	Amounts budgeted for the development and maintenance of infrastructure should at least reflect an increase year on year.
	Compliance with registration, operational and reporting requirements.	All facilities (e.g. solid waste, WWTWs etc.) must be registered with the relevant authority and must be compliant with operational and reporting requirements.

5.3.11 Constraint features - Geotechnical

Environmental Component	Geotechnical constraints	
Strategic Issues	The geotechnical specialist study delineated seven categories of constraint zone based on geotechnical conditions based on a combined analysis of Geology, Slope and Land Type. The constraints imposed by geotechnical consideration relate directly to the cost of constructing in these zones and the risk of damage. For example, it is more costly to construct on steep slopes and unstable geology. Development on steep slopes carries with it an increased risk of soil erosion which poses a threat to terrestrial and aquatic environments and threatens water quality downstream. This work also identifies the potential clash between mining related geotechnical constraints i.e. undermining and the expansion of the urban edge in the Madadeni / Osizweni area.	
Sustainability Objective (SO)	***To protect the developed and natural environments by avoiding developments in areas where geotechnical constraints will result in heightened risk to the development and to the natural environment.***	
SO Criteria	**SO Indicators**	**SO Targets**
Development in geotechnical risk areas.	Area developed in very high constraint areas without an adequate geotechnical assessment and appropriate mitigation	0 Ha

5.3.12 Constraint features - Groundwater

Environmental Component	Geotechnical constraints	
Strategic Issues	Shallow groundwater tables occur over large areas of ADM. This is problematic from two perspectives. 1. Shallow groundwater tables impose significant constraints on construction activities as drainage is poor and excavations and foundations are readily flooded. Certain activities cannot be undertaken due to the interaction of subsurface structures with groundwater. 2. Activities which involve working with hazardous materials or materials which could potentially contaminate groundwater resources cannot be undertaken in areas with shallow groundwater without significant mitigation measures.	
Sustainability Objective (SO)	***Protect potential development and groundwater resources through directing development to appropriate locations***	
SO Criteria	**SO Indicators**	**SO Targets**
Development in groundwater risk areas.	Area developed in very high constraint areas without an adequate geohydrological assessment and appropriate mitigation	0%

5.3.13 Non-spatial components - Governance

Environmental Component	Governance	
Strategic Issues	Governance is the most important strategic non-spatial (not map-able) factor under consideration and failings in this arena have far reaching consequences. Financial, technical, human and infrastructural capacity to fulfil a number of mandates across various sectors in the District is understood to be poor (e.g. water infrastructure, WWTWs, heritage, air quality monitoring etc.). In some cases this also includes the lack of political will. Dual authority arrangement (Democratic and Traditional) results in problems dealing with development planning, service delivery and the regulation of land use activities. Inter-departmental cooperation is critical in managing the environment. The relationship in particular between the Department of Minerals and Energy and all other departments is failing. This is considered a critical failing due to the importance of the mining sector in the District and the impact active and abandoned mines are having on the environment.	
Sustainability Objective (SO)	***Improve the management of the environment through building capacity within and cooperation between government and private sector institutions***	
SO Criteria	**SO Indicators**	**SO Targets**
Inter-departmental cooperation	Level of cooperation is difficult to measure. A softer indicator of movement towards sustainability objective is thus chosen: 1. State of relationship with DME, KZN DARD, DWS and other key environmentally important departments	Good
Human capacity to undertake critical mandates	Number of vacant positions in critical sectors (e.g. WWTW, District Planning and Development Services Department – Environment Section etc.)	Zero

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