



Kwapata: Rubbish being dumped and burned along wetland bank



Manning Avenue during a heavy rainfall event



Masons Mill: Illegal dump site



CLIMATE CHANGE POLICY FOR MSUNDUZI MUNICIPALITY



Dumping along Khan Road

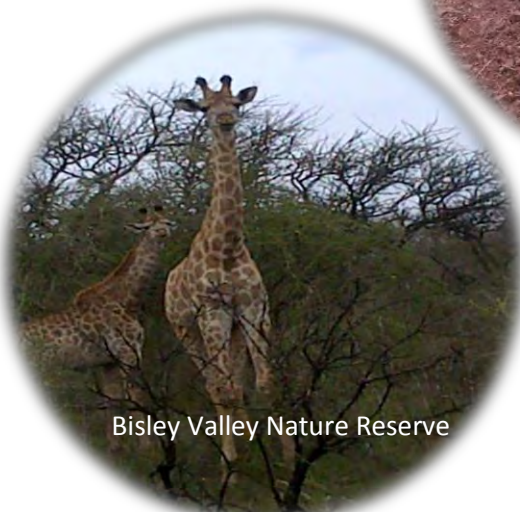
NOVEMBER 2014



Erosion in Clarendon



Ashburton Pump Station



Bisley Valley Nature Reserve

<u>CONTENTS</u>	<u>PAGE</u>
1. ACRONYMS	3
2. GLOSSARY	4
3. INTRODUCTION	6
3.1. Defining Climate Change	
3.2. Climate & Air Quality of Pietermaritzburg	
3.3. Shortcomings	
3.4. Vulnerable Sectors Which Have Been Identified and will be focused on in this	
4. LOCAL GOVERNMENTS LEGAL RESPONSIBILITIES	10
5. NATIONAL CLIMATE CHANGE WHITE PAPER	12
5.1. National Climate Change Response Objectives	
5.2. The Local Government Responding: The Lets Respond Guide and Tool Kit	
6. MSUNDUZI'S IEMP & SEMP	13
7. BACKGROUND	13
4.1. Adaptation	
4.2. Mitigation	
8. GOALS, VISION AND PURPOSE OF THE CLIMATE CHANGE POLICY	15
7.1. Climate change policy goal	
7.2. Climate change Policy Vision	
7.3. Purpose of the climate change policy	
9. POLICY OBJECTIVES	18
10. MSUNDUZI'S STRATEGIC RESPONSE TO CLIMATE CHANGE	19
9.1. Biodiversity	
9.2. Water Resources	
9.3. Food Security & Agriculture	
9.4. Human Health	
9.5. Storm Water	
9.6. Waste	
9.7. Energy Utilisation	
9.8. Transportation	
9.9. Building cooperative governance & improved communication procedures	
9.10. Other relevant action plans which are to be included in the IDP and affect all business units within the municipality	
1. Social	
2. Economic	
3. Governance	
11. REFERENCES	45
LIST OF FIGURES	
1. Figure 1: How climate change affects natural environments and ultimately humans	6
LIST OF TABLES	
1. Table 1: (B6) Climate Change Action Plan. The timeframes indicted relate to the 5 year review period for the SEMP	17

1. ACRONYMS

DEDTEA	Department Of Economic Development, Tourism And Environmental Affairs Previously known as the Department of Agriculture and Environmental Affairs (DAEA)
EIA	Environmental Impact Assessment
EMF	Msunduzi Municipality Environmental Management Framework
GHG	Green House Gases
I&AP's	Interested and Affected Parties
IDP	Integrated Development Plan
IEMP	Msunduzi Municipality Integrated Environmental Management Policy
IPCC	Intergovernmental Panel on Climate Change
KZN	KwaZulu-Natal
LA21	Local Agenda 21
MDGs	Millennium Development Goals
NEMA	National Environmental Management Act (Act 107 of 1998)
NGOs	Non-Governmental Organisations
SEA	Msunduzi Municipality Strategic Environmental Assessment
SEASQ	Msunduzi Municipality Strategic Environmental Assessment Status Quo
SEMP	Msunduzi Municipality Strategic Environmental Management Plan
UNFCCC	United Nations Framework Convention on Climate Change
WESSA	Wildlife and Environment Society of South Africa
WWTW	Waste Water Treatment Works
WWTS	Waste water treatment systems

Foot notes such as; **B7: Action plan for the rehabilitation of land owned by Msunduzi** – refer to Action plans and tasks which are contained in the SEMP (2010).

2. GLOSSARY

Adaptation	In the climate change context, adaptation implies an adjustment in natural or human systems in response to a changing/changed climate. Even if emissions are stabilized relatively soon, climate change and its effects will last many years, and adaptation will be necessary ¹
Adaptive capacity	is the ability to adjust to new climate conditions; for a farmer facing drought, for example, this might mean being able to switch to drought resistant crops, install irrigation systems, or find a different way to make a living (Rattana & Krawanchid, 2012)
Alien Invasive Species	Species that are classified as such by the Conservation Of Agricultural Resources Act (CARA, Act 48 of 1983)
Anthropogenic influences	Human induced impacts which (in this case refers to climate change) result in climate change affects
Carbon Footprint	A measurement used to calculate the impact human activities have in the environment. Measured in terms of the amount of greenhouse gases emitted from each activity and reported in units of CO ₂
Carbon Sequestration	Is the process of removing carbon from the atmosphere and depositing it into a reservoir / sink.
Carbon Reservoirs or sinks	Reservoirs or sinks can be natural or manmade ranging from forests (which naturally absorb and store CO ₂) to underground storage units designed to hold CO ₂ pumped from vents (IPCC AR4 WG3, 2007)
City	Refers to the Msunduzi Municipal area, which comprises of five Area Based Management areas: Vulindlela, Edendale, Imbali, central and northern areas
EIA	A study that determines the direct and indirect impacts of a specific type of development on a specific site. It is used to guide decisions on whether to permit proposed developments, thus avoiding negative impacts on the environment
Exposure	“Refers to the extent of which a community or sector is in contact with climate change impacts. For example, if someone lives in an area affected by drought or in a flood zone” (Rattana & Krawanchid, 2012)
Greenhouse Gases	Atmospheric gases that create a greenhouse effect by increasing the amount of heat retained by the Earth’s atmosphere, thus contributing to an increase in global temperatures
LA21	Local Agenda 21 is an action programme derived from the global plan of action for sustainable development called Agenda 21. It is aimed at achieving sustainable development of local urban and settlement communities by the 21 st century. In 1992, leaders of 179 countries had gathered in Rio de Janeiro for the united nations earth summit to finalise this plan. The following are the seven principles of LA21: <ol style="list-style-type: none"> 1. Multi-sectoral approach 2. Integration of social, economic and environmental issues 3. Concern for the future 4. Equity justice and accountability 5. Recognising and working within ecological limits 6. Developing partnerships with civil society 7. Linking local issues with global impacts
Climate Change Mitigation	Climate change mitigation generally involves reductions in human emissions of greenhouse gases. Mitigation may also be achieved by increasing the capacity of carbon sinks. Climate change mitigation can be referred to as a human intervention which can reduce sources or enhance the sinks of GHG’s (IPCC, 2013)
Offset	According to BBOP (nd), refers to “measures taken to compensate for any residual significant, adverse impacts that cannot be avoided, minimised and / or rehabilitated or restored, in order to achieve no net loss. Offsets can take the form of positive management

¹ UNFCCC Glossary of Climate Change Acronyms http://unfccc.int/essential_background/glossary/items/3666.php

	interventions such as restoration of degraded habitat, arrested degradation or averted risks”. A carbon offset is a reduction in emissions of carbon dioxide or GHGs made in order to compensate for or to „counterbalance“ an emission made elsewhere (Goodward & Kelly, 2010)
Open Space Systems	A linkage of various ecological systems (i.e. marine, terrestrial and freshwater) ensuring that the interaction between plants, animals, energy, water nutrients and genetic material can occur in a dynamic and relatively undisturbed manner. It is both a means to conserve indigenous flora and fauna, and an important step in maintaining ecological balance within the city.
Open Spaces	Consists of two main types namely urban open spaces and natural open spaces. 1. Urban Open Spaces: are the human made or legally designated spaces and areas within the city that are developed for community use. They include parks, sports fields, agricultural fields, streets, town squares, road reserves such as electricity transmission lines, dams, private gardens etc. 2. Natural Open Spaces: are the remaining undisturbed natural and undeveloped areas in the city. They are the areas that contain the core terrestrial, freshwater, estuarine, rivers, wetlands etc.
Riparian Habitat	According to the National Water Act: includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those adjacent areas
Sensitive Environment	An environment that is or contains species that are highly endangered. This could also be an environment that may be easily damaged and whose damage may reflect negative results
Sensitivity	“Is the degree to which a community or system can potentially be affected by climate change; for example, droughts will have a much greater impact on agriculture than on transportation” (Rattana & Krawanchid, 2012).
Sustainable Development	In terms of NEMA (Act 107 of 1998, Section 2), 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. Local Agenda 21 emphasizes the importance of balancing institutional, social, economic and environmental considerations as four balancing pillars of sustainable development
Vulnerability	“Is the degree to which a community or system is actually susceptible to climate change impacts; it increases with exposure and sensitivity, and declines with adaptive capacity” (Rattana & Krawanchid, 2012).
Water Resources	According to National Water Act includes a watercourse, surface water, estuary or aquifer
Watercourse	According to the National Water Act means: a). A river or spring, b). A natural channel in which water flows regularly or intermittently, c). A wetland, lake or dam into which, or from which, water flows and d). Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and reference to a watercourse includes, where relevant, its bed and banks
Wetland	according to the National Water Act means: land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soils

3. INTRODUCTION

3.1. Defining Climate Change

The International Panel on Climate Change (IPCC, 2007: 23) defines climate change as; “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.”

Simply put, climate change refers to the change in climatic conditions, which results in countless direct as well as indirect aspects influencing the natural environment and human populations (as illustrated in Figure 1 below). According to Envirokids (2008, Page 6) “There is no doubt that temperatures are rising and climates are changing, as the last few years have been the hottest on record”. The increased temperatures in the atmosphere create and contribute to unpredictable weather, if this continues; we should expect increased frequencies and intensities in heat waves, droughts, heavy rainfall periods and strong winds (Envirokids, 2008 Page 6-7).

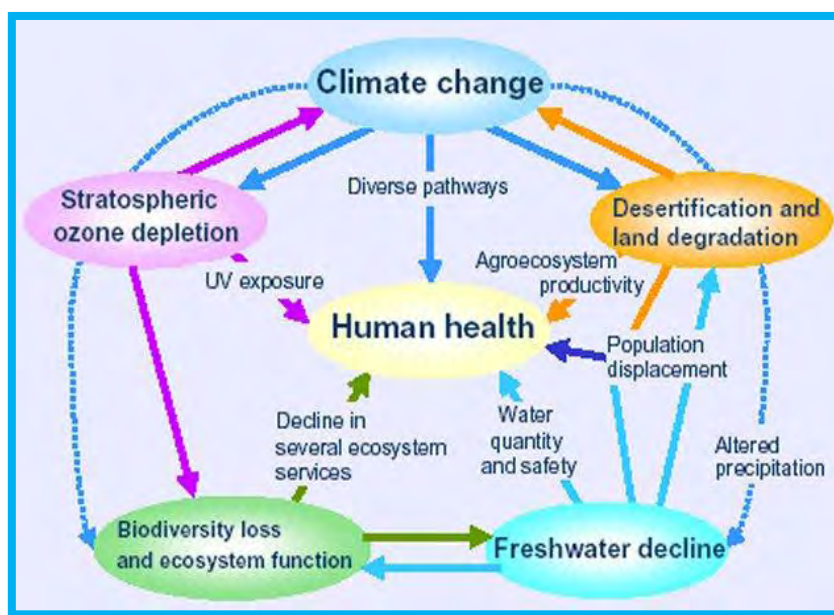


Figure 1: How climate change affects natural environments and ultimately humans (Dissanayake, 2011).

The American Geophysical Union, (AGU, 2013) states that human activities are changing the Earth's climatic conditions drastically and these changes will continue to occur due to the ever increasing levels of atmospheric concentrations of carbon dioxide and other heat trapping GHG's. Anthropogenic influences contribute to climate change by causing changes in Earth's atmosphere in the amounts of GHGs, aerosols (small particles), and cloudiness. The largest known contribution comes from the burning of fossil fuels, which releases carbon dioxide gas to the atmosphere.

AGU (2013), states that anthropogenic increases in “greenhouse gases are responsible for most of the observed global average surface warming of roughly 0.8°C (1.5°F) over the past 140 years. Because natural processes cannot quickly remove some of these gases (notably carbon dioxide) from the atmosphere, our past, present, and future emissions will influence the climate system for millennia”. AGU (2013), “further states that anthropogenic climate change is not expected to be uniform over space or time. Deforestation, urbanization, and particulate pollution can have complex geographical, seasonal, and longer-term effects on temperature, precipitation, and cloud properties. In addition, human-induced climate change may alter atmospheric circulation, dislocating historical patterns of natural variability and storminess”.

The Organisation for Economic Co-Operation and Development (OECD, 2007) states that urgent action is needed to ensure that Climate Change Impacts and GHG emissions are reduced in the imminent years. The OECD (2007), further states that there is “increasing evidence that the overall benefits of strong and early action to reduce GHG emissions outweigh the costs” in the long term. There is a need to reduce emissions at the lowest possible cost to ensure a realistic chance of limiting further climate change.

The World Bank’s paper "*Turn Down the Heat: Why a 4°C Warmer World Must be Avoided*" predicts that there will be increased disruptions from extreme weather events, with more frequent storms and flooding, with more severe droughts and heat waves (The Potsdam Institute for Climate Impact Research and Climate Analytics, 2012). This will result in large scale disturbances of agricultural land and may lead to significant losses in biodiversity. It is suggested that climate projections for the uMgungundlovu District Municipality (UMDM), in KwaZulu-Natal, will experience a warmer future with uncertain changes in mean annual rainfall, with substantial increases of flash flood and storm events due to an increase in short duration rainfall (Adaption Fund, 2014, Page 20). Other issues of concern that are highlighted by the Adaption Fund is that floods, severe storms and wild fires are already being experienced within KZN and projections indicated that these risks may worsen due to climate related impacts (Adaption Fund, 2014, Page 20).

3.2. Climate & Air Quality of Pietermaritzburg

The Strategic Environmental Assessment (SEA) report for the Msunduzi Municipality provides insight on the conditions of Pietermaritzburg’s weather and climatic conditions, stating, “*Msunduzi’s weather and climate are largely influenced by its topography. The higher lying areas of the Msunduzi are cooler and receive more rainfall than other parts of the city*” (SRK, 2009). Average annual temperature varies between 16.3°C and 17.9°C. Msunduzi falls within a summer rainfall area, characterised by dry winters and wet summers, with thunderstorms being common in summer. Average rainfall within the Municipality varies between 748mm and 1017mm per annum².

The city is located within a hollow created by the valleys of the Msunduzi River and its tributaries which contributes to the development of an atmospheric inversion layer, which traps pollutants and does not allow them to escape. This is a major issue of concern, predominantly during winter. The majority of industrial development within Msunduzi have been established below the level at which the inversion layer forms as this land is flat and in close proximity to transportation routes (SRK, 2009). As a result, the city suffers from short-term peaks in pollution despite relatively few heavy industries.

The City's IDP² states that *“Maintaining a „græn“ built environment is important for both the image of the city and the social and environmental health of residents. There is a need to focus on planting programmes in the CBD to replace storm-damaged and old / dangerous trees with indigenous alternatives that are hardy and drought tolerant. There is a need to focus strategies on climate change, paying particular attention to mitigation factors as well as looking at adaption strategies³ which will increase communities” resilience to climate change impacts.”* The Municipal 2030 vision states that *“By 2030 Msunduzi is a city serviced with quality water and sanitation reticulation, uninterrupted, adequate energy supply and regular waste removal – for ALL neighbourhoods, communities and centres of business”. The 2030 vision also goes on to state that one of the focal points is that “of a clean, green city, focusing on renewable energy supplies, public open space creation and urban renewal and greening promotion”.*

3.3. Shortcomings

The Msunduzi's SEA states that strategies and adaptation plans need to be investigated and implemented in order to ensure that natural resources are conserved and utilised in a sustainable manner. For example, a major limiting factor is the absence of adequate response and capacity planning within Municipal Business Units, as well as the lack of strategies to anticipate and predict potential impacts in order to carry out strategic adaptive and mitigative programmes in the event of climate related natural disasters. It is essential that all sectors / spheres of government are involved in climate change planning and policy development in order to ensure that mitigation and adaptation is incorporated into all future municipal policies, response strategies and plans. Other vulnerabilities which have been identified are as follows:

- GHG emissions and Carbon footprints for Msunduzi are not currently being monitored or measured.
- Offsets for loss of biodiversity and open spaces have not formally been drafted, adopted and implemented.
- Municipal owned / used buildings do not measure GHG emissions and Carbon footprints and there are no measures to improve their resilience and environmental performance.

² Msunduzi Municipality Integrated Development Process Plan: The Approved IDP and Budget Plan For The 2014/2015 Financial Year.

³ Msunduzi Municipality's Adaptation and Mitigation Strategy is currently being prepared.

- Absence of adequate response and capacity planning within Municipal Business Units.

3.4. Vulnerable Sectors Which Have Been Identified and will be focused on in this policy

Various sectors have been identified which will be the most impacted on by climate change / climate change related impacts in Msunduzi, these are as follows:

1. Impacts on **biodiversity**, ecosystems and sensitive natural environments
2. Changes and impacts to **water resources** particularly water availability, quality and quantity
3. Impacts on **food provision** and **agricultural** sustainability
4. Impacts on **human health** due to temperature extremes and prevalence / occurrence of vector borne diseases
5. Impacts on **storm water** infrastructure and other infrastructure located in areas of flood potential
6. **Waste** management
7. Increased **energy utilisation** and impacts on electricity infrastructure
8. Impacts on the **transportation** sector and infrastructure

The Climate Change Policy seeks to unpack these core issues and suggests adaptation and mitigation measures in greater detail, to be implemented (i.e. each adaptation and mitigation option would be case / site specific) which would contribute to the reduction of climate change related impacts on each of the sectors mentioned above.

4. LOCAL GOVERNMENTS LEGAL RESPONSIBILITIES

South Africa has various laws, regulations and guidelines, which govern the protection and management of the environment. Relevant legislation which informs this policy includes, but is not limited to the following:

- **The Constitution of the Republic of South Africa**, Act 108 of 1996 (Section 24) guarantees all citizens the right to a safe and healthy environment. It also provides the right for the benefit of present and future generations to an environment that is protected from pollution and degradation through reasonable legislation and other measures. It is the local government's responsibility in terms of the Constitution to ensure that the citizens in their respective areas are not deprived of these constitutional rights.
- **Local Government Municipal Structures Act 117 of 1998** (Municipal Structures Act); **Municipal Systems Act 32 of 1998** (Municipal Systems Act). *There are two wings to local government's responsibilities; the first is concerned with macro level functions such as planning and promotion of integrated development planning, land, economic and environmental development. The second wing is concerned with the sustainable provision of specific services such as health housing water and electricity.*⁴
- This legislation collectively provides a context for municipal planning. It requires that local authorities adopt a single inclusive policy framework that governs the allocation of capacity and resources, namely the IDP. Furthermore, the regulations require that all Spatial Development Frameworks, that form part of the IDP, must be subject to a strategic assessment to determine the environmental sustainability of the developments proposed within the framework.
- **National Climate Change Response White Paper** reiterates the importance of developing and implementing mitigation and adaptation measures at all spheres of government in order to prepare for climate change and climate change related predicaments. This paper informs the provincial and local governments' policies and frameworks regarding climate change management.
- **National Environmental Management Act** (NEMA, 2010) which requires local governments to respect, protect and fulfil all the rights of its people while ensuring the delivery of basic needs especially to the previously disadvantaged communities. NEMA also states that for any sustainable development to occur there must be a balanced integration of social, economic and environmental factors. In addition, the act provides principles that commit every organ of state to prevent pollution, disturbance and any other negative impact on any component of the environment. Where prevention is not possible, the local authority must at least minimise or remedy the impact. Local government has to ensure adherence to

⁴ Report On Environmental Management Mandates And Obligations For Local Governments.

these principles and follow the correct procedures in order to deal with environmental concerns, as laid out in this act.

- **KwaZulu Natal Climate Change Status Quo Report** acknowledges that climate change is an issue of concern, which demands immediate attention and action. It encourages local governments to adopt strategic plans and implement programs, which would contribute to improving levels of sustainability and resilience to climate change impacts.
- **UMgungundlovu Climate Change Response Strategy and Plan** is being undertaken by Golder Associates and has greatly influenced the development of this policy. The results depicted in the **Status Quo Assessment: Climate Trends and Projections** states that “*projections indicate a warmer and wetter future for the UMgungundlovu area, with isolated increases in short duration rainfall and the potential for increases in flash flooding and storm events*”. These results highlight the need for the investigation and development of appropriate mitigation and adaptation strategies to be implemented at a local level in order to circumvent negative impacts of climate change on communities and infrastructure.
- **Msunduzi Municipality Strategic Environmental Assessment** forms part of the greater Msunduzi EMF. The purpose of the SEA component is to bring together the findings of the various specialist studies, which have been undertaken in the Status Quo phase. The SEA has identified development trends and concerns, which should be addressed through the implementation of „Action Plans“ and specific tasks which have been identified. In addition, a sustainability framework contained in the SEA provides the operational framework for implementation of the SEA and associated Action Plans. It includes Goals, Objectives, Criteria and limits of acceptable change for the Biophysical, Social Economic and Governance environment.
- **Msunduzi Municipality Environmental Management Framework Status Quo Report** through specialist studies provides a good indication of the existing environmental conditions within the municipal area. It identifies areas of concern and constraints, which can be improved / addressed by implementing tasks identified in the action plans listed in the SEMP.
- **Msunduzi Municipality Strategic Environmental Management Plan** has been designed to meet Msunduzi’s responsibilities in terms of South Africa’s legislation most notably the Constitution, NEMA and the Municipal Systems Act. The SEMP provides the foundation from which further work will be undertaken in order to improve and refine environmental goals and targets. This will be done by focusing on priority areas of concern; and gaps identified through the EMF / SEA and Public Consultation Processes. The SEMP and associated action plans are therefore a dynamic document that must continue to be expanded on and altered as the understanding of the environment improves.
- **Msunduzi Municipality Integrated Environmental Management Policy**, approved by Msunduzi’s Executive Committee (EXCO) on 07 May 2007, includes an environmental vision for the municipality. General policy principles and environmental management tools support the vision.

- **Millennium Declaration and the United Nations Framework Convention on Climate Change.** The MDGs are the product of international consensus on a framework by which nations can assess tangible progress towards sustainable development. Sustainable development and adaptive capacity for coping with climate change have common determinants. It is easy, therefore, to conclude that climate change has the potential to affect the progress of nations and societies towards sustainability

5. NATIONAL CLIMATE CHANGE WHITE PAPER

5.1. National Climate Change Response Objectives:

- Effectively manage inevitable climate change impacts through interventions that build and sustain South Africa's social, economic and environmental resilience and emergency response capacity (National Climate Change White Paper, Page 11).
- Make a fair contribution to the global effort to stabilise GHG concentrations in the atmosphere at a level that avoids dangerous anthropogenic interference with the climate system within a timeframe that enables economic, social and environmental development to proceed in a sustainable manner (National Climate Change White Paper, Page 11).

5.2. The Local Government Responding: The Lets Respond Guide and Tool Kit

According to *The Local Government Responding: The Lets Respond Guide and Tool Kit* which has been prepared for provincial and local government practitioners to assist with the implementation of climate change plans and strategies (National Climate Change White Paper, Page 37), approaches were developed to guide and encourage municipalities to:

- Align climate response with existing climate and development challenges and deepen existing response capacity.
- Develop links with research institutions and community bodies to improve the flow of information such as early warning systems.
- Incorporate climate change information into sector planning and plan for a wide range of long term changes.
- Improve cross sector integration of management and development planning.
- Move more efficiently on core development objectives, providing both short-term to long term climate response benefits.⁵

⁵ The Local Government Responding: The Lets Respond Guide and Tool Kit (page 3).

6. MSUNDUZI'S IEMP & SEMP

The Msunduzi IEMP and the Msunduzi SEMP informs part of this policy as they were developed to assist / guide the municipality towards achieving sustainable development. Both these documents include numerous key aspects, action plans, strategies and „approaches“ which have been identified for long term implementation, to promote and encourage sustainability and ensure the conservation / preservation of natural resources.

The Climate Change Policy is aimed at ensuring Municipal Business Units are compelled to take environmental impacts of their activities / plans into consideration and ensure that there are suitable strategies in places which enable cooperative and coordinated environmental management throughout Municipal structures and activities.

7. BACKGROUND

This policy builds on the Msunduzi Municipality's existing Environmental Management Framework⁶ (EMF), Environmental Management Framework – Status Quo Report, Strategic Environmental Management Plan⁷ (SEMP) and Final Draft Strategic Environmental Assessment⁸ (SEA); however, the primary aim is to provide a well-defined direction for responding to climate change risks and challenges. The main goal of this policy is to ensure that Msunduzi's Carbon footprint is reduced and the city is able to adapt to climate change related impacts and ensure there are options available when decisions need to be made regarding adaptation and mitigation. The relevance, effectiveness and implementation of this policy will be managed through on-going monitoring, evaluation and review to ensure it reflects the most recent developments in climate change science and technology, and delivers on the Municipality's statutory responsibilities.

7.1. Adaptation

Climate change scientists acknowledged that even if the production of GHGs stopped immediately, there is a level of climate change that is now, simply, irreversible (IPCC, 2007). Durban's Municipal climate protection program states that *“If we want to ensure the sustainability and resiliency of the City, we have to find ways of adapting to this change”*⁹. Adaptation ensures an increased ability to cope with a changing

⁶ SRK Consulting (2008). Msunduzi Environmental Management Framework - Status Quo Report.

⁷ SRK Consulting. (2010). Msunduzi Strategic Environmental Management Plan

⁸ SRK Consulting. (2009). Msunduzi Municipality Environmental Management Framework-Strategic Environmental Assessment

⁹ Durban's Municipal Climate Protection Program. (2010/2011). Climate change adaption planning for a resilient city.

climate, and climate change related issues including its variability and extreme events. Essentially, climate change adaptation involves managing the unavoidable and developing strategies, which are practical and implementable, in order to reduce the impacts of extreme weather events. Even if emissions are stabilized relatively soon, climate change and its effects will last many years, and adaptation will be necessary (Farber, 2007). Climate change adaptation is especially important in developing countries since those countries are predicted to bear the brunt of the effects of climate change (Daniel, 2008).

The types of adaptation measures adopted will depend on the impact of climate change on particular regions and economic sectors, on predicting and quantifying the type and scope of potential impacts, and on increasing the capacity to adapt to these.

7.2. Mitigation

Climate change mitigation focuses on reducing the amount of GHG's that are emitted into the atmosphere. This action will help to avoid future impacts of climate change beyond that which is already projected, and involves implementing strategies, which would reduce and limit the current GHG percentages. An example of such strategies would be the monitoring of harmful gases emitted throughout the city, with investigations being conducted with regards to the strategies which can be implemented in order to reduce these emissions.

In this policy both *adaptive* and *mitigative* measures are identified and are discussed separately in **Section 10**.

The policy is structured around the following mitigation focus areas that would be set by the Msunduzi Municipality:

- *Council mitigation* – investigating methods of measuring and establishing baseline data and levels with regards to GHG emissions. Ensure that methods are established, which look at reduction of GHG emissions from Council's day to day operations, i.e. fleet and buildings, by making staff more environmentally aware of their activities and of the importance of reducing their carbon footprint. Targets, strategies and programs will be developed to help guide the implementation processes (i.e. Standard operating procedures).
- *Community mitigation* – reduction of greenhouse gas emissions arising from residential properties, industrial activities, businesses and transportation sectors (i.e. measuring targets, strategies and programs).
- *Council adaptation* – using the Municipal Corporate Risk Management Approach to respond to governance (i.e. measuring targets, strategies and programs).

- *Leadership and planning challenges* - presented by climate change when delivering services to communities now and in the future (i.e. measuring targets, strategies and programs).
- *New / proposed development applications*– ensure that all new developments consider and address the direct, indirect and cumulative impacts of their proposed activities. Developments must aim at reducing / limiting their carbon footprint and ensure that minimal environmental degradation is caused.
 - Ensure that key decisions in development planning consider the implications of possible climate futures facing the city i.e. climate change predictions are considered and addressed in decision making.
- Ensure that *policies are developed* which would ensure that building regulations and legislation are supported, implemented and refined if necessary.
- Ensure that *carbon sequestration* is taken into account and bylaws are developed which ensure this is built into planning and development.

The policy's development was informed by a comprehensive Climate Change Risk Assessment study, currently being developed by Golder Associates, commissioned by UMgungundlovu District Municipality

8. GOALS, VISION & PURPOSE OF THE CLIMATE CHANGE POLICY

The Msunduzi Municipalities Integrated Environmental Management Policy states that the Municipal vision is “*to be the dynamic, caring capital city of choice in KwaZulu-Natal*”. The Environmental Vision is that by 2020 the city will:

- Be a safe, clean and hygienic environment with an integrated open space system adding balance to the urban and rural environment.
- Have environmentally responsible citizens that are well informed about environmental issues and who will be part of an innovative team that contributes to a sustainable environment.
- Have achieved legislated minimum ambient air quality standards and waste management practices which will ensure that streets, open spaces, rivers and streams of the City are clean and well maintained.
- Develop and implement policies, regulations and measures which will ensure that industries produce minimal pollutants to the environment and ensure that they comply with environmental legislation.
- Have a variety of approaches to ensure environmental sustainability for all citizens and ensure that they benefit from the natural environment.

- Achieve balance between economic, social and environmental factors and a balance between conservation and the use of natural resources which will protect the environment for future generations.
- Fully develop the City's tourism potential, making Pietermaritzburg the trendsetting "*City Of Choice*" whilst ensuring that green economic standards are implemented and followed i.e. tourism hubs should be adapted for changing climatic conditions and be environmentally friendly (green building design, solar heating, rain water harvesting etc.).

8.1. Climate Change Policy Goal

The goal of this policy is to provide a distinct direction for responding to climate change risks and challenges. This policy aims at ensuring that risks associated with climate change impacts are identified, and that mitigation and adaption options are put in place to ensure that negative impacts are reduced. This policy also looks at ensuring that Msunduzi Municipal Business Units are able to incorporate climate change adaptation and mitigation strategies into their day to day operations in order to ultimately ensure that the city is able to adapt to climate change related impacts in the long term.

8.2. Climate Change Policy Vision

Ensure that plans, policies and strategies are in place which aim at reducing risks and vulnerabilities posed by climate change (i.e. direct, indirect and cumulative impacts). Encouraging and supporting the investigation and development of strategies and plans which aim at reducing risks and exploring opportunities posed by climate change on the city, communities and Msunduzi Municipality's operations and in so doing, enable climate change resilience for the future.

This policy is intended to be a comprehensive approach to managing climate change in the City of Pietermaritzburg; setting the direction in which strategies should be established and enabling action by key stakeholders. It is envisaged that the city's leadership and communities will work in partnership toward a resilient city that can respond to impacts and opportunities presented by climate change (SRK, 2008).

8.3. Purpose of The Climate Change Policy

The purpose of this policy is to provide guidance and direction regarding the plans and strategies to be implemented by Municipal Business Units in order to ensure that the Msunduzi Municipality has clear adaptive and mitigative measures in place which adequately address present and future climate change related issues. This policy also aims at encouraging Municipal **stakeholders and key roles-players** towards integrating climate change into all levels of their planning and activities, to ensure the protection

of municipal infrastructure and natural resources and protect communities against anticipated future extreme weather events.

In planning for and managing the concerns mentioned above, the policy also aims at reducing future cost implications by addressing issues before they escalate into major problems which may potentially require large scale intervention and resources.

The development and implementation of a Climate Change Policy was identified as a priority action item (Action Plan B6) in the Msunduzi SEMP and will be operationalized through the IDP. The action plan is detailed below:

Table 4.6: Action Plan To Mainstream Climate Change Into Municipal Functions				
B6: Mainstream Climate Change Into Municipal Functions				
STRATEGIC OUTCOMES	Reduce Msunduzi's Carbon footprint and adapt to climate change	Strategic Objectives	To plan for and facilitate a shift from the use of non-renewable of non-renewable to renewable resources. To accentuate the importance of our finite natural resources that energy production consumption may have on the environment.	
ISSUES ADDRESSED	Risk of climate change and potential impacts to service delivery	Responsible Organisation/s	Msunduzi – Development Services- Environmental Management Branch	
Tasks		Timing	Potential Partners	Estimated Cost
Carbon Foot print Disclosure (CDP) ¹⁰		Short term	<ul style="list-style-type: none"> • eThekweni Metro • MIDI • City of Cape Town • Carbon Disclosure Project (CDP) • UKZN • CSIR • Wildlands Conservation 	In- house
Mainstream Climate Change into EIA (Mitigation & Adaptation)		Long term & On-going		In-house
Climate Change Awareness (Education), i.e. Presentation		Short term & On-going		In-house
Identify businesses / companies / sectors emitting high levels of GHG's and ensure that measures are implemented to ensure this is reduced		Long term & On-going		In-house
Msunduzi Municipality Climate Change Policy		Medium term		In-house
Develop Municipal Adaptation Plans (MAPs) to address climate change risks		Long term & Ongoing		In-house
Total				<i>To be determined</i>
Key Performance Indicator	Climate Change is mainstreamed into Msunduzi Planning/Functions and strategies are in place to mitigate and adapt to climate change		Target	To achieve at least 80% of targets set out in the action plan.

Table 1: (B6) Climate Change Action Plan. The timeframes indicated relate to the 5-year review period for the SEMP (Msunduzi's Strategic Environmental Management Plan, 2010).

¹⁰ Currently Pietermaritzburg is involved in the CDP reporting through the Carbon Disclosure Project undertaken by the United Kingdom.

9. POLICY OBJECTIVES

- Ensure council continues to deliver its services effectively to the community in a changing climate.
- Reduce the vulnerability of the Pietermaritzburg community to potential future impacts of climate change.
- Enable legal obligations and expectations on the Council and community arising from extreme weather events, to be met comprehensively.
- Ensure Councils response to climate change is flexible and that processes are in place to respond and adapt rapidly to changing international protocols, technological advancements, community readiness, South African Environmental Policies and Legislative changes, and improved knowledge (technological advancements) etc.
- Equip Council with a robust framework to pro-actively seek opportunities, knowledge and partners to effectively manage the challenges and opportunities of climate change into the future.
- Build capacity and capability of the Msunduzi Municipality to lead communities in responding to the challenges and opportunities presented by climate change.
- Provide a dynamic and pragmatic action plan that will equip Council with a program of practical and sustainable responses to the current and future projected risks and challenges posed by climate change.
- Integrate climate change considerations into governance and operational structures, functions and consequentially Municipal day-to-day operations.
- Integrate environmental and social considerations into planning, construction and other relevant municipal functions or activities in order to make informed decisions promoting sustainable development.
- Ensure that climate change strategies are considered and implemented within all Municipal Business Units.
- Ensure that Msunduzi Municipality offers a safe, clean and hygienic City that manages all aspects of the environment in a safe and responsible manner in order to enhance resilience to climate change.
- Ensure the implementation of strategies which aim at identifying risks and encourage the monitoring of predicted climate change events.
- Ensure the identification, implementation and development of tools to set targets which have been identified. These tools should also be able to ensure that they are measurable.

10. MSUNDUZI'S STRATEGIC RESPONSE TO CLIMATE CHANGE WITH ADAPTIVE AND MITIGATIVE MEASURES ARISING FROM THE SEMP AND OTHER RESOURCES

This section provides adaptation and mitigation options to be implemented for various sectors which would be impacted on by climate change and related impacts.

This section also highlights all relevant action plans within the SEMP, and focuses on those elements of existing approved action plans which would contribute directly to addressing climate change adaption and mitigation. These elements will be applied as enablers and as already approved priority objectives will support the development of resilience and enable adaptation strategies.

10.1. BIODIVERSITY

Introduction: Climate change affects biodiversity through the various impacts on ecosystem services¹¹. According to the Millennium Ecosystem Assessment, climate change is one of the most significant drivers contributing to biodiversity loss (Convention on Biological Diversity, nd.).

HEADLINE OBJECTIVES:

- To preserve, maintain and rehabilitate the City's biodiversity and open space areas^{12 13}.
- To reduce the percentage of biodiversity lost due to developmental activities within the City.
- To sequester carbon emissions via the implementation of tree / vegetation protection and planting¹⁴.
- To promote environmental and ecological sustainability and support future residential, commercial and industrial development through urban renewal and greening¹⁵.

ADAPTATION OPTIONS

RESPONSIBILITY

<ul style="list-style-type: none"> • Increase the implementation of „greening“ projects / programs²² (including tree planting strategies in accordance with the <i>Msunduzi Tree Planting / Management Policy</i>) to contribute to increasing biodiversity within the City and surrounding areas. 	<ul style="list-style-type: none"> - Manager: Parks & Recreation Unit - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • All new development projects to include and implement environmental landscaping (i.e. landscape plans should ensure that existing indigenous species are retained and the incorporation of additional indigenous species). 	<ul style="list-style-type: none"> - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Ensure that key areas are zoned as open space / public open spaces / conservation and areas already zoned for this purpose are retained and conserved in order to safe guard species and habitats. 	<ul style="list-style-type: none"> - Manager: Environmental Management Unit - Manager: Town Planning Unit
<ul style="list-style-type: none"> • All Municipal owned land is evaluated in terms of species richness (i.e. fauna and flora); areas with high levels of species richness must be conserved in order to safe guard species and habitats. 	<ul style="list-style-type: none"> - Manager: Parks & Recreation Unit - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Ensure that developmental activities / proposals incorporate offset areas for rehabilitation. 	<ul style="list-style-type: none"> - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Msunduzi Municipality adapts a NO NET LOSS of areas <u>zoned</u> open space / public open space / conservation. 	<ul style="list-style-type: none"> - All Business Units
<ul style="list-style-type: none"> • Implement and encourage environmental education and awareness programmes¹³. 	<ul style="list-style-type: none"> - Manager: Environmental Management Unit - Manager: Area Based Management

¹¹ <http://www.cbd.int/climate>

¹² Biophysical Environment-: Page 9 of the Msunduzi Municipalities Final Draft Strategic Environmental Management Plan

¹³ B7: Action plan for the rehabilitation of land owned by Msunduzi

¹⁴ B5: Carbon emissions inventory and offset program

¹⁵ S1: Urban Greening Program

<ul style="list-style-type: none"> • Reduce land degradation and increase water availability by removing alien invasive plant species from municipal owned land¹⁶. 	<ul style="list-style-type: none"> - Manager: Parks & Recreation Unit - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Reduce land degradation and increase water availability by ensuring the removal of alien invasive plant species from privately owned land / land not owned by the municipality¹⁷. 	<ul style="list-style-type: none"> - Manager: Environmental Management Unit - DEDTEA
<ul style="list-style-type: none"> • Rehabilitate Land Owned by Msunduzi to reduce land degradation and maintain and improve ecosystem goods and services thereby creating more opportunities for economic and social development. Formulate a plan which supports resilience¹¹. 	<ul style="list-style-type: none"> - Manager: Parks & Recreation Unit - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Ecosystem Goods and Services Assessments to include the value of ecosystem goods and services when planning developments. This aims at promoting efficient and sustainable usage of resources, which benefits communities, and promotes the conservation of biodiversity¹⁸. 	<ul style="list-style-type: none"> - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Urban Greening Programs to improve amenities, and create green aesthetic appeal in the city. Key / priority areas will be identified within the Msunduzi area which are in need of urban greening¹⁵ (e.g. along busy roads and intersections, the Edendale area, public areas such as parks / open spaces, etc.). 	<ul style="list-style-type: none"> - Manager: Parks & Recreation Unit - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • State Land Rehabilitation¹⁹, aims at reducing land degradation, by maintaining and improving ecosystem goods and services in order to create more opportunities for economic and social development. This action plan and tasks aim at ensuring that biodiversity and areas in need of rehabilitation are maintained and preserved. 	<ul style="list-style-type: none"> - DEDTEA - Manager: Parks & Recreation Unit - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Areas with high grazing potential are to be mapped with possible mitigation / adaptation options to ensure that these areas are managed and maintained²⁰. 	<ul style="list-style-type: none"> - Manager: Environmental Management Unit - Manager: Town Planning Unit
<ul style="list-style-type: none"> • Development pressures on vacant / available land necessitate a need for the protection and conservation of existing open space areas within the municipal area, hence the <i>ESP action plan</i> assists in identifying areas considered as valuable from both an <i>environmental</i> and a <i>social</i> perspective through the use of the Draft Conservation Plan (C-Plan). This Draft C-Plan is being ground-truthed and refined, and includes a process of gathering data in the field to confirm data that was 	<ul style="list-style-type: none"> - Manager: Environment Management Unit (currently being undertaken)

¹⁶ B1: Alien invasive clearing program for Msunduzi owned land

¹⁷ DAEA&RD3: Alien invasive clearing program for land within Msunduzi not owned by the municipality

¹⁸ E2: Ecosystem Goods and Services Assessment.

¹⁹ DAEA&RD1: Land Rehabilitation : will be implemented by the DAEA with the support of Msunduzi Municipality

²⁰ DAEA&RD2: identify areas of grazing importance and implement strategies to support sustainable land use practices: will be implemented by the DAEA with the support of Msunduzi Municipality

<p>captured through desk top evaluation, such as aerial photography. Such refined information would then form part of the SDF and Town Planning Scheme as well as assist land owners and developers in identifying the required management of their properties - thereby ensuring long-term protection of biodiversity and creating a „green city“ with a network of open spaces²¹.</p>	
<p>MITIGATION OPTIONS</p>	<p>RESPONSIBILITY</p>
<ul style="list-style-type: none"> • Increase the implementation of „greening“ projects (including tree planting strategies in accordance with the <i>Msunduzi Tree Planting / Management Policy</i>) to contribute to increasing levels of biodiversity and the sequestering of carbon within the City and surrounding areas. 	<ul style="list-style-type: none"> - Manager: Parks & Recreation Unit - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • All new and proposed development projects to implement green landscaping. 	<ul style="list-style-type: none"> - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Ensure that key areas zoned as open space / public open spaces / conservation are retained and conserved in order to safe guard species and habitats. 	<ul style="list-style-type: none"> - Manager: Environmental Management Unit - Manager: Town Planning Unit
<ul style="list-style-type: none"> • Urban Greening Programs aimed at improving amenities, and creating green aesthetic appeal in the city. Key / priority areas will be identified within the Msunduzi area which are in need of urban greening (e.g. along busy roads and intersections, the Edendale area, public areas such as parks / open spaces, etc.)¹³. 	<ul style="list-style-type: none"> - Manager: Parks & Recreation Unit - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • State Land Rehabilitation¹⁷, aims at reducing land degradation, by maintaining and improving ecosystem goods and services in order to create more opportunities for economic and social development. This action plan and tasks aim at ensuring that biodiversity and areas in need of rehabilitation are maintained and preserved. 	<ul style="list-style-type: none"> - DEDTEA - Manager: Parks & Recreation Unit - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Address issues regarding inappropriate land uses and degradation¹⁷, which contribute to the loss of agriculture and natural resources. Areas with high grazing potential are to be mapped with possible mitigation / adaptation options to ensure that these areas are controlled and maintained. 	<ul style="list-style-type: none"> - Manager: Environmental Management Unit - Manager: Town Planning Unit
<ul style="list-style-type: none"> • Rehabilitate Land Owned by Msunduzi¹¹ to reduce land degradation, maintain and improve ecosystem goods and services thereby creating more opportunities for economic and social development. 	<ul style="list-style-type: none"> - Manager: Environmental Management Unit

²¹ E4: Implementation of the ESP and associated land ownership and management policy.

10.2. WATER RESOURCES

Introduction: The Msunduzi EMF – Draft Status Quo Report identifies that water quality in the Msunduzi catchment varies significantly. The system is relatively healthy in its upper reaches, but surface water and ground water quality declines rapidly as it passes through the City of Pietermaritzburg. The National Water Act (Act 36 of 1988) states that it is imperative that the nation’s water resources are protected, used, developed, conserved, managed and controlled in a sustainable manner.

HEADLINE OBJECTIVES:

- To ensure the quality of water from rivers, streams and wetlands is suitable for the maintenance of biodiversity and the protection of human wellbeing.
- To ensure the quality of potable water meets legislated requirements.
- Ensure adaptation and mitigation measures are identified and incorporated into decision and policy making, in order to adapt to climate change impacts on water sources.
- Monitor developments and emerging stresses, and propose effective ways of addressing them to ensure that water wastage and correct water management is addressed²².
- Invest in monitoring capabilities across a range of disciplines in order to spot trends and understand them as well as track the effectiveness of adaptive strategies²⁰.

ADAPTATION OPTIONS

RESPONSIBILITY

<ul style="list-style-type: none"> • The Implementation and improvement of storm water capture / retention and improved Storm Water Management Plans throughout the Msunduzi Municipal area²³. 	<ul style="list-style-type: none"> - Manager: Infrastructure & Storm Water Management Unit
<ul style="list-style-type: none"> • Create and encourage flood management zones i.e. for water attenuation and retention during periods of excessive rainfall / flooding (Diederichs, Nichols & van Niekerk, 2009). 	<ul style="list-style-type: none"> - Manager: Infrastructure & Storm Water Management Unit - Manager: Environmental Management Unit - Manager: Town Planning Unit
<ul style="list-style-type: none"> • Improve potable water availability by laying new pipelines in and around the City 	<ul style="list-style-type: none"> - Umgeni Water Are Currently Implementing This - Manager: Water & Sanitation Unit
<ul style="list-style-type: none"> • A “future’s demand” profile prepared for the city in terms of water requirements, which would be evaluated in terms of climate / temperature influenced rainfall. 	<ul style="list-style-type: none"> - Manager: Infrastructure & Storm Water Management Unit - Manager: Water & Sanitation Unit - Manager: Environmental Management Unit

²² National Climate Change Response (<http://www.climatechange.co.za/home/gp/5.1>)

²³ B3: Detailed Flood Risk Assessment.

<ul style="list-style-type: none"> • Extreme precipitation events should be considered when developing improved storm water designs, land use planning and zoning to avoid damage to infrastructure and buildings in flood / landslide prone areas. 	<ul style="list-style-type: none"> - Manager: Infrastructure & Storm Water Management Unit - Manager: Town Planning Unit
<ul style="list-style-type: none"> • The formulation of flood evacuation information such as inundation and hazard maps should be generated and this information should be made available to people living in high-risk areas²⁶. 	<ul style="list-style-type: none"> - Manager: Disaster Management Unit
<ul style="list-style-type: none"> • Improving and sustaining the water quality and quantity within the Msunduzi catchment area to support the biodiversity and associated ecosystem goods and services²⁰. 	<ul style="list-style-type: none"> - Manager: Water & Sanitation Unit - Manager: Environmental Health Unit
<ul style="list-style-type: none"> • Detailed Flood Risk Assessment aimed at addressing the impacts of storm water management on the quality of water and risks associated with developments located within floodplains and other sensitive areas²⁶. 	<ul style="list-style-type: none"> - Manager: Water & Sanitation Unit - Manager: Infrastructure & Storm Water Management Unit - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Reducing human vulnerabilities, reducing land degradation and improving economic opportunities, by identifying areas that are prone to flooding (B3 identifies the need to map flood lines and associated flow characteristics i.e. high-risk areas). 	<ul style="list-style-type: none"> - Manager: Water & Sanitation Unit - Manager: Environmental Management Unit - Manager: Human Settlements Unit
<ul style="list-style-type: none"> • Improving water quality by identifying areas of significant pollution levels and ensuring that polluters take responsibility for the environmental degradation / damage that they cause²⁴. 	<ul style="list-style-type: none"> - Manager: Water & Sanitation Unit - Industries
<ul style="list-style-type: none"> • Include greater wetland buffer areas as policy and make wetland / water guideline documents available to residential, commercial and institutional organisations²⁷. 	<ul style="list-style-type: none"> - Manager: Environmental Management Unit - Manager: Infrastructure & Storm Water Management Unit
<ul style="list-style-type: none"> • In order to prevent water - borne diseases and outbreaks e.g. cholera and bilharzia continual monitoring of water resources is required. 	<ul style="list-style-type: none"> - Manager: Environmental Health Unit
<ul style="list-style-type: none"> • Provide information on how to save water by implementing a water use efficiency programme on residential, commercial and institutional properties, i.e.: <i>Water Conservation Guidelines</i> (Price, Ross, Rabé, & Diederichs, 2009). 	<ul style="list-style-type: none"> - Manager: Disaster Management Unit - Manager: Water & Sanitation Unit
<ul style="list-style-type: none"> • Regular review and update of the Disaster Management Plan. 	<ul style="list-style-type: none"> - Manager: Disaster Management Unit

²⁴ B2: Wetland Functionality Assessment

MITIGATION OPTIONS	RESPONSIBILITY
<ul style="list-style-type: none"> • Develop and implement a Storm Water Management Policy. 	<ul style="list-style-type: none"> - Manager: Infrastructure & Storm Water Management Unit - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Develop and implement Storm Water Management Bylaws and Regulations. 	<ul style="list-style-type: none"> - Manager: Infrastructure & Storm Water Management Unit - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Implement improved storm water capture / retention and improved Storm Water Management Plans throughout the Msunduzi Municipal area. 	<ul style="list-style-type: none"> - Manager: Infrastructure & Storm Water Management Unit
<ul style="list-style-type: none"> • Prepare a “future’s demand” profile for the city in terms of water requirements, which would be evaluated in terms of climate / temperature influenced rainfall. 	<ul style="list-style-type: none"> - Manager: Infrastructure & Storm Water Management Unit - Manager: Water & Sanitation Unit - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Increase the water absorption capacity of urban landscapes, and ensure areas such as wetlands, river courses, and riparian areas are conserved and these areas are not disturbed in any manner. 	<ul style="list-style-type: none"> - Manager: Infrastructure & Storm Water Management Unit - Manager: Water & Sanitation Unit - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Improve / upgrade urban drainage systems. 	<ul style="list-style-type: none"> - Manager: Infrastructure & Storm Water Management Unit - Manager: Water & Sanitation Unit
<ul style="list-style-type: none"> • Implement and utilize storm water retention / detention ponds and constructed wetlands, for water storage and to improved water quality 	<ul style="list-style-type: none"> - Manager: Infrastructure & Storm Water Management Unit - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Consider extreme precipitation events when developing improved storm water designs, land use planning and zoning to avoid damage to infrastructure and buildings in flood / landslide prone areas. 	<ul style="list-style-type: none"> - Manager: Infrastructure & Storm Water Management Unit

	<ul style="list-style-type: none"> - Manager: Town Planning Unit - Manager: Human Settlements Unit
<ul style="list-style-type: none"> • The formulation of flood evacuation information such as inundation and hazard maps should be developed and this information should be made available to people living in high-risk areas²⁶. 	<ul style="list-style-type: none"> - Manager: Disaster Management Unit
<ul style="list-style-type: none"> • Improving and sustaining the water quality and quantity within the City, and maintaining biodiversity and associated ecosystem goods and services. 	<ul style="list-style-type: none"> - Manager: Water & Sanitation Unit - Manager: Environmental Health Unit
<ul style="list-style-type: none"> • Detailed Flood Risk Assessment aimed at addressing the impacts of storm water management on the quality of water and risks associated with developments located within floodplains and other sensitive areas²⁶. 	<ul style="list-style-type: none"> - Manager: Water & Sanitation Unit - Manager: Infrastructure & Storm Water Management Unit - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Reducing human vulnerabilities, reducing land degradation and improving economic opportunities, by identifying areas that are prone to flooding (i.e. high-risk areas). 	<ul style="list-style-type: none"> - Manager: Water & Sanitation Unit - Manager: Environmental Management Unit - Manager: Human Settlements Unit
<ul style="list-style-type: none"> • Improving water quality by identifying areas of significant pollution levels and ensuring that polluters take responsibility for the environmental degradation / damage that they cause. 	<ul style="list-style-type: none"> - Manager: Water & Sanitation Unit - Industries
<ul style="list-style-type: none"> • Monitoring of water resources to prevent water - borne diseases and outbreaks e.g. cholera and bilharzia. 	<ul style="list-style-type: none"> - Manager: Environmental Health Unit
<ul style="list-style-type: none"> • Regular review and update of the Disaster Management Plan. 	<ul style="list-style-type: none"> - Manager: Disaster Management Unit
<ul style="list-style-type: none"> • Investigating and incorporating the reuse of water within the Msunduzi area²⁵. 	<ul style="list-style-type: none"> - Manager: Water & Sanitation Unit
<ul style="list-style-type: none"> • Encourage use of water conservation technologies such as rain water harvesting tanks / low flush toilets / low flow shower heads 	<ul style="list-style-type: none"> - All Business Units

According to SANBI “Healthy riparian zones and wetlands help to reduce the impact of floods and droughts. In the western part of the country, where it will become hotter and drier, they will help to curb excessive loss of water through evaporation. In the eastern part of the country, where it will become hotter and wetter, they will help to slow down flood waters. In both cases ecological infrastructure can contribute to water security, and thus to food security. Intact ecosystems also absorb and store carbon, to varying degrees²⁶”.

²⁵ Golder and Associates. (2012). Climate change impact and vulnerability assessment.

²⁶ Ecological Infrastructure: Nature Delivering Services: www.sanbi.org

10.3. FOOD SECURITY & AGRICULTURE

Introduction: Food security is a focal point when addressing the vulnerability of livelihoods. In rural / semi-rural areas especially around Vulindlela and certain areas of Edendale, which in terms of the Msunduzi EMF, have vast opportunities for agricultural production, are vulnerable to climate change impacts and changes in climatic conditions; both directly and indirectly which affects food security.

HEADLINE OBJECTIVES:

- To protect the City's agricultural sectors from climate change risks
- To ensure that communities relying on agricultural sectors are aware of and develop resilience to climate change impacts (building on educational awareness).
- To protect and safely utilise prime and unique agricultural land, the environment and other protected lands (IDP review for 2013/14-2016/17).

ADAPTATION OPTIONS	RESPONSIBILITY
<ul style="list-style-type: none"> • Develop education, training and extension services to prevent land degradation and unsustainable agricultural practices¹¹. 	<ul style="list-style-type: none"> - Manager: Human Resources & Development Unit - Manager: Area Based Management
<ul style="list-style-type: none"> • Introduce alternative agricultural techniques to small-scale farmers regarding information on climate change impacts and possible responses, to ensure climate change resilience. 	<ul style="list-style-type: none"> - Manager: Area Based Management - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Encourage the implementation and utilisation of urban gardens i.e. Green Roofing and Urban Greening Projects¹³. 	<ul style="list-style-type: none"> - Manager: Environmental Management Unit - Manager: Human Settlements Unit
<ul style="list-style-type: none"> • Encourage communities to create sustainable gardens whereby they can grow their own crops. 	<ul style="list-style-type: none"> - Manager: Environmental Management Unit - Manager: Area Based Management
<ul style="list-style-type: none"> • Community based adaptation and assistance should be implemented in communities in order to encourage capacity-building initiatives (Allen, 2006). 	<ul style="list-style-type: none"> - Manager: Area Based Management
<ul style="list-style-type: none"> • Identify and where appropriate, make land available for agricultural production. 	<ul style="list-style-type: none"> - Manager: Town Planning Unit
<ul style="list-style-type: none"> • Rehabilitation of Land Owned by Msunduzi would address the concern regarding the loss of agriculturally productive land and natural resources¹⁷. 	<ul style="list-style-type: none"> - Manager: Environmental Management Unit - Manager: Parks & Recreation
<ul style="list-style-type: none"> • Identify areas of grazing importance and implement strategies to support sustainable land use practices¹⁸ – this action plan and tasks acknowledge the need for improved sustainable agricultural production. 	<ul style="list-style-type: none"> - Manager: Environmental Management Unit - Manager: Town Planning - Manager: Area Based Management

<ul style="list-style-type: none"> • Identification of carrying capacities in order to understand the thresholds of ecosystems in relation to grazing intensities. 	<ul style="list-style-type: none"> - Manager: Environmental Management Unit - Manager: Town Planning
<ul style="list-style-type: none"> • Identify appropriate land use management strategies for particular areas / portions of land. 	<ul style="list-style-type: none"> - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Incorporate biodiversity into agricultural policies, guidelines and decision making. This involves the implementation of interventions to mainstream biodiversity into key aspects of land use planning, government and private sector policies, development programs and production standards 	<ul style="list-style-type: none"> - Manager: Environmental Management Unit
MITIGATION OPTIONS	RESPONSIBILITY
<ul style="list-style-type: none"> • Develop education, training and extension services to prevent land degradation and unsustainable agricultural practices¹¹. 	<ul style="list-style-type: none"> - Manager: Human Resources & Development Unit - Manager: Area Based Management
<ul style="list-style-type: none"> • Introduce alternative agricultural techniques to small-scale farmers regarding information on climate change impacts and possible responses, to ensure climate change resilience. 	<ul style="list-style-type: none"> - Manager: Area Based Management - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Encourage the implementation and utilisation of urban gardens i.e. Green Roofing and Urban Greening Projects¹³. 	<ul style="list-style-type: none"> - Manager: Environmental Management Unit - Manager: Parks & Recreation Unit - Manager: Human Settlements Unit
<ul style="list-style-type: none"> • Encourage poor communities to create sustainable gardens whereby they can grow their own crops and food. 	<ul style="list-style-type: none"> - Manager: Environmental Management Unit - Manager: Area Based Management
<ul style="list-style-type: none"> • Rehabilitation of Land Owned by Msunduzi addresses the concern regarding the loss of agriculturally productive land and natural resources¹⁷. 	<ul style="list-style-type: none"> - Manager: Environmental Management Unit - Manager: Parks & Recreation
<ul style="list-style-type: none"> • Incorporate biodiversity into agricultural policies, guidelines and decision making. This involves the implementation of interventions to mainstream biodiversity into key aspects of land use planning, government and private sector policies, development programs and production standards 	<ul style="list-style-type: none"> - Manager: Environmental Management Unit

10.4. HUMAN HEALTH

Introduction: One of Msunduzi Municipality's priorities is to protect its residents from contracting and spreading severe diseases (i.e. diarrhoeal diseases, dengue, and other vector borne diseases) and suffering from conditions pertaining to malnutrition. The impact of climate change is predicted to have serious implications on human health due to fluctuations in weather, rainfall and temperature levels (i.e. increased heat waves). Poor communities, particularly those living in informal settlements and lack financial resources to deal with the impacts of climate change, would be the most vulnerable. The Msunduzi's Environmental Status Quo Report identifies the lack of evenly distributed health facilities, and the lack of households / individuals being within 2kms of a clinic (as per conditions stipulated in the CSIR Redbook Planning Standards).

HEADLINE OBJECTIVES:

- To ensure that communities are made aware of possible diseases and are aware of the methods of treatment.
- Ensure that Municipal health services are able to respond to high percentages of those infected (i.e. adequate provision of resources, adequately trained staff etc.).
- Ensure adequate provision of medical facilities²⁷.
- Ensure that Occupational Health Staff are equipped, trained and prepared to deal with an increase in those suffering from climate change related health impacts.
- Ensure that Environmental Health Unit is equipped to deal with an increase in diseases²⁸.

ADAPTATION OPTIONS	RESPONSIBILITY
<ul style="list-style-type: none"> • Programs and plans should be implemented, which would seek to educate Municipal staff and the public on how to respond to various climate change related health impacts. 	<ul style="list-style-type: none"> - Manager: Human Resources & Development Unit - Manager: Environmental Management Unit - Manager: Area Based Management
<ul style="list-style-type: none"> • Developing and communicating heat emergency plans when temperature levels are excessively high. 	<ul style="list-style-type: none"> - Manager: Disaster Management Unit - Manager: Area Based Management
<ul style="list-style-type: none"> • Encouraging and motivating for increased street trees along all major roads and intersections (relates to Msunduzi Municipality tree planting policy) in order to reduce heat / temperature levels. 	<ul style="list-style-type: none"> - Manager: Parks & Recreation Unit - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Disaster Management teams have plans / strategies in place which deal with responding to major outbreaks of severe diseases, conditions pertaining to malnutrition, heat stroke, dehydration etc., and are adequately trained and provided with equipment to deal with these impacts in an effective and efficient manner. 	<ul style="list-style-type: none"> - Manager: Disaster Management Unit - Manager: Environmental Health Unit - Manager: Human Resources & Development Unit

²⁷ Hospitals and community clinics are the responsibility of the Provincial Department Of Health

²⁸ Environmental Health is also defined as a Municipal Health Service.

<ul style="list-style-type: none"> • Ensure that clinics / hospitals are provided with information pertaining to impacts of climate change related incidents (i.e. heat stroke / dehydration / increased diseases etc.). 	<ul style="list-style-type: none"> - Manager: Environmental Heath Unit - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Concepts / strategies regarding carbon emission reduction and the improvement of air quality within the Msunduzi area should be investigated. 	<ul style="list-style-type: none"> - Manager: Environmental Heath Unit - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Strategies aimed at improving air quality and reducing risks to human health (i.e. hazardous emissions) should be investigated. 	<ul style="list-style-type: none"> - Manager: Environmental Heath Unit - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Air Quality Management Plans should be developed which would identify areas / sectors, which produce high emissions, as well as identifying emission reduction plans and mechanisms of reporting high emissions²⁹. 	<ul style="list-style-type: none"> - Manager: Environmental Heath Unit - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Ensure that Carbon Emissions and GHG's are monitored and calculated and results made available to the public. 	<ul style="list-style-type: none"> - Manager: Environmental Heath Unit - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Carbon Emissions Inventory and Offset Programs should be investigated in order to identify the need for the implementation of green technologies, strategies and building design in order to create developments, which are more sustainable and environmentally friendly. 	<ul style="list-style-type: none"> - Manager: Environmental Heath Unit - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Climate Change Risk Assessment and Adaptation which would address risks of climate change and the potential impacts, which will be placed on ecosystem services delivery. 	<ul style="list-style-type: none"> - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Ensure that water quality testing is conducted regularly – results should be made available to the public. Measures should be identified and implemented should water quality be of poor conditions. 	<ul style="list-style-type: none"> - Manager: Environmental Heath Unit (this is currently being undertaken at problem areas in Msunduzi)
MITIGATION OPTIONS	RESPONSIBILITY
<ul style="list-style-type: none"> • Encouraging and motivating for increased street trees along all major roads and intersections (relates to Msunduzi Municipality tree planting policy) in order to reduce heat / temperature levels. 	<ul style="list-style-type: none"> - Manager: Parks & Recreation Unit - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Concepts / strategies regarding reducing carbon emissions and improving air quality within the Msunduzi area should be investigated. 	<ul style="list-style-type: none"> - Manager: Environmental Heath Unit - Manager: Environmental Management Unit

²⁹ B4: Air Quality Constraints model action plan as part of the Msunduzi Air Quality Management Plan.

<ul style="list-style-type: none"> • Air Quality Management Plans should be undertaken which would identify areas / sectors, which produce high emissions, as well as identifying emission reduction plans and mechanisms for reporting high emissions. 	<ul style="list-style-type: none"> - Manager: Environmental Heath Unit - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Carbon Emissions Inventory and Offset Programs should be investigated in order to identify the need for the implementation of green technologies, strategies and building design in order to create developments, which are more sustainable and environmentally friendly. 	<ul style="list-style-type: none"> - Manager: Environmental Heath Unit - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Climate Change Risk Assessment and Adaptation which would address risks of climate change and the potential impacts, which will be placed on ecosystem services delivery. 	<ul style="list-style-type: none"> - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Ensure that water quality testing is conducted regularly – results should be made available to the public. Measures should be identified and implemented should water quality be of poor conditions. 	<ul style="list-style-type: none"> - Manager: Environmental Heath Unit (this is currently being undertaken at problem areas in Msunduzi)
<ul style="list-style-type: none"> • Projects which focus on and contribute to reducing carbon emissions through sequestration or „carbon sinks“ must be promoted and encouraged. This would include the reforestation and rehabilitation of forestry areas and areas previously utilised for felling of timber / timber plantations, as forest ecosystems are known to capture and store large amounts / volumes of carbon. 	<ul style="list-style-type: none"> - Manager: Environmental Management Unit - Manager: Real Estate & Investment Opportunities

10.5. STORM WATER

Introduction: Infrastructure is under threat due to excessive and uncontrolled ingress of storm water during and following major rainfall events. The Msunduzi IDP makes specific reference to the lack of service delivery to the outer lying areas and the need to improve on these conditions in future planning. Golder and Associates, in the Climate Change Impact and Vulnerability Assessment for the uMgungundlovu District Municipality (2012, Page 15), states that during high rainfall and flood events, there is an influx of storm water into WWTS. Golder and Associates (2012, Page 15) further states that “*The projected increase in runoff from hardened surfaces, coupled with likely associated increased sediment load due to erosion through mobilisation of sediments by high energy runoff may lead to flooding as a result of inadequate storm water drain maintenance and / or conduit pipe diameter*”.

HEADLINE OBJECTIVES:

- To provide suitable sanitation to all citizens of the city in order to improve the quality of life of all citizens
- To safeguard water sources from contamination³⁰.
- To ensure that sanitation services and infrastructure are up to standard.
- To reduce sanitation service interruptions from 2499 (2011-2012) per annum by 80% to 500 per annum and respond to 100% of sanitation blockages within 8 hours (IDP review for 2013/14 – 2016/17).
- To ensure that future planning takes the lack of service delivery in outer lying areas into account and strategies for improving conditions are identified and implemented.
- To improve and enhance storm water infiltration systems and storm water management / drainage systems.

Layout drawings of Msunduzi can be created for each service sector indicating the following:

- The state of the infrastructure (which is currently being undertaken by the Water & Sanitation Unit).
- Areas in which infrastructure is currently being upgraded or planning to be upgraded.
- Extension of capacity at the Darvill WWTW.
- Monitoring and reduction of storm water inflows to Msunduzi sewer network.

The Final Infiltration Assessment and Reduction Strategy Report (2013) states that storm water inflow / infiltration can significantly disturb the management of municipal sanitation subsystems resulting in excessive financial consequences in the long run. The problems are primarily related to the extent of inflow/infiltration to sewers.

ADAPTATION OPTIONS

RESPONSIBILITY

³⁰This is part of the mandate of the Water and Sanitation Section in the Infrastructure Services Department. The Water and Sanitation Section provides and maintains the sewer collector and trunk infrastructure, whilst the operation of the city’s Darvill Sewage Treatment Works is contracted to Umgeni Water.

<ul style="list-style-type: none"> • Consideration of improved storm drainage where necessary³¹. 	<ul style="list-style-type: none"> - Manager: Infrastructure & Storm Water Management Unit - Manager: Water & Sanitation Unit
<ul style="list-style-type: none"> • Develop and implement a Storm Water Management Policy. 	<ul style="list-style-type: none"> - Manager: Infrastructure & Storm Water Management Unit - Manager: Water & Sanitation Unit - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Develop and implement Storm Water Management Bylaws and Regulations. 	<ul style="list-style-type: none"> - Manager: Infrastructure & Storm Water Management Unit - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Implement improved storm water capture / retention and improved Storm Water Management Plans throughout the Msunduzi Municipal area. 	<ul style="list-style-type: none"> - Manager: Infrastructure & Storm Water Management Unit
<ul style="list-style-type: none"> • Treating the discharge of storm water to sewer as an additional service for which the municipality has the right to charge and has the channel to do so by means of the normal monthly rates and utility statements³² (Final Infiltration Assessment and Reduction Strategy Report Prepared by Royal Haskoning DHV for the Msunduzi Municipality, 2013). 	<ul style="list-style-type: none"> - Manager: Infrastructure & Storm Water Management Unit - Manager: Water & Sanitation Unit
<ul style="list-style-type: none"> • Accepting³³ liquid wastes according to a costing formula that realistically represents the true cost of additional treatment or requiring a necessary level of pre-treatment trade to be maintained to achieve a standard of effluent that is generally acceptable to the WWTW process³⁴ (Final Infiltration Assessment and Reduction Strategy Report Prepared by Royal Haskoning DHV for the Msunduzi Municipality, 2013). 	<ul style="list-style-type: none"> - Manager: Infrastructure & Storm Water Management Unit - Manager: Water & Sanitation Unit
<ul style="list-style-type: none"> • Ensure that domestic waste does not enter storm water drains and, as a result, cause blockages. Litter should be cleared 	<ul style="list-style-type: none"> - Manager: Waste Management Unit

³¹This may apply in housing areas where steep topography and small average ERF size, with a high extent of building coverage, combine to cause impracticable situations with regard to runoff concentration.

³²The solution lies in placing the prerogative of action on the homeowner of the offending property to demonstrate compliance.

³³The disposal of untreated industrial wastes by industrial customers in contravention of trade effluent agreements negatively affects the sewers and wastewater treatment facilities or the receiving water environment directly where the discharge is made into the storm water drainage system. Anecdotal evidence is that the frequency of such discharges is increasing. These discharges often occur at night or over weekends and present high concentrations of problematical constituents usually at a high peak loading factor.

³⁴ In either case the process requires objective validation by means of routine flow and quality measurements backed up by inspections and process audits to prove compliance.

from streets on a regular basis and should be recycled.	
Examples of adaptation strategies, which have been identified by eThekweni Municipality (Durban's Municipal Climate Protection Program, 2010/2011) which may also inform and be implemented through this policy, are the following	
<ul style="list-style-type: none"> • Re-evaluate the design of storm water infrastructure in order to cope with flood levels. 	- Manager: Infrastructure & Storm Water Management Unit
<ul style="list-style-type: none"> • <i>Public Awareness Campaign</i> to raise awareness of the benefits of retrofitting storm water runoff reduction techniques i.e. green roofs, retention / wet basins, detention / dry basins, infiltration basins, rain water harvesting etc. to reduce runoff from existing and future developments. 	<ul style="list-style-type: none"> - Manager: Infrastructure & Storm Water Management Unit - Manager: Human Resources & Development Unit - Manager: Area Based Management
<ul style="list-style-type: none"> • Protect and restore riparian vegetation and wetland / floodplain areas in order to protect the integrity of river banks and retain ecological buffers against flooding 	<ul style="list-style-type: none"> - Manager: Environmental Management Unit - Manager: Parks And Recreation Unit
MITIGATION OPTIONS	RESPONSIBILITY
<ul style="list-style-type: none"> • Improving storm drainage in necessary problem areas. 	- Manager: Infrastructure & Storm Water Management Unit
<ul style="list-style-type: none"> • Treating the discharge of storm water to sewer as an additional service for which the municipality has the right to charge and has the channel to do so by means of the normal monthly rates and utility statements. 	<ul style="list-style-type: none"> - Manager: Infrastructure & Storm Water Management Unit - Manager: Water & Sanitation Unit
<ul style="list-style-type: none"> • Develop and implement a Storm Water Management Policy. 	- Manager: Infrastructure & Storm Water Management Unit
<ul style="list-style-type: none"> • Develop and implement Storm Water Management Bylaws and Regulations. 	- Manager: Infrastructure & Storm Water Management Unit
<ul style="list-style-type: none"> • Implement improved storm water capture / retention and improved Storm Water Management Plans throughout the Msunduzi Municipal area. 	- Manager: Infrastructure & Storm Water Management Unit
<ul style="list-style-type: none"> • Ensure that communities receive education with regards to adequate usages of sanitation facilities and infrastructure. 	<ul style="list-style-type: none"> - Manager: Water & Sanitation Unit - Manager: Area Based Management
<ul style="list-style-type: none"> • Identify pump stations and pipeline routes which are in need of servicing / upgrading. 	- Manager: Water & Sanitation Unit

10.6. WASTE

Introduction: According to the Msunduzi IDP review for 2013/14 – 2016/17 (page 73), weekly refuse removal has declined from 59.5% in 2001 to 53.2% in 2011; this is attributed to the increase in households. The increase in housing (both in rural and urban areas) and housing complexes has resulted in capacity / resource constraints in terms of waste collection and management. The issue of waste is identified in the SEMP as a significant challenge in Msunduzi as this also affects other service sectors such as storm water reticulation and infrastructure. Although the city's waste management actions are driven by regulations, mandates, and policies (namely Waste Management Bylaws and a Draft Integrated Waste Management Plan), staff shortages and the lack of resources are a major concern, which contributes to the lack of adequate service provision and waste removal.

HEADLINE OBJECTIVES:

- To ensure the implementation of improved service delivery, in terms of collecting, cleaning, clearing and waste removal to landfill sites.
- To shift thinking to focus on the waste hierarchy principles such as avoidance, prevention, reduce, re-use, and recycle.
- To investigate opportunities for implementing large scale recycling initiatives.
- Educate communities and the general public on the harmful effects of inadequate waste disposal.
- Implementation of annual upgrade of waste disposal infrastructure, vehicles and equipment.
- Implement and improve the Msunduzi Municipalities Integrated Waste Management Plan.
- Implementation of advanced Waste Management Systems that reflect community values around waste minimisation.
- Facilitation of a council wide budget process focussing on proper resourcing and maximisation of revenue enhancement opportunities.
- Removal of illegal landfill sites – greater emphasis should be placed on recycling initiatives.
- Ensure that burning of waste is prohibited³⁵.

ADAPTATION OPTIONS

RESPONSIBILITY

<ul style="list-style-type: none"> • Increased implementation of recycling initiatives i.e. expansion of the Mondi kerb-side recycling project³⁶ to involve all users and producers of waste coupled with a sustained municipal wide education and awareness campaign. 	<ul style="list-style-type: none"> - Manager: Waste Management Unit - Manager: Area Based Management - Manager: Human Resources & Development Unit
<ul style="list-style-type: none"> • Implement and increase capacity of the Materials Recovery Facility³⁷ (MRF). 	<ul style="list-style-type: none"> - Manager: Waste Management Unit
<ul style="list-style-type: none"> • Increased implementation of composting facilities varying in degree from small scale household facilities to large industrial scale regional facilities. 	<ul style="list-style-type: none"> - Manager: Waste Management Unit

³⁵ As burning of rubbish leads to carcinogenic emissions being released.

³⁶ Msunduzi Local Municipality: Integrated Waste Management Plan: S2 Integrated Waste Management Plan.

³⁷ The Msunduzi Municipality has plans to establish a Materials Recovery Facility (MRF) at the New England Road Landfill. The purpose of this facility would be to sort the incoming general waste and separate the recyclable fraction from waste component in order to reduce the quantity of waste that has to be land filled whilst promoting recycling.

<ul style="list-style-type: none"> • Improved waste collection efficiency by and between the various role players municipal wide, including the private sector. 	<ul style="list-style-type: none"> - Manager: Waste Management Unit
<ul style="list-style-type: none"> • Enforce the Polluter Pays Principle (NEMA, 2010). 	<ul style="list-style-type: none"> - Manager: Waste Management Unit - Manager: Environmental Health Unit
<ul style="list-style-type: none"> • Enforce Municipal Bylaws and Regulations. 	<ul style="list-style-type: none"> - Manager: Waste Management Unit - Manager: Environmental Health Unit
<ul style="list-style-type: none"> • Address illegal roadside / community dumping of waste via sustained public awareness campaigning and sustained law enforcement. 	<ul style="list-style-type: none"> - Manager: Waste Management Unit - Manager: Environmental Health Unit - Manager: Area Based Management - Manager: Human Resources & Development Unit
<ul style="list-style-type: none"> • Creating a Public Awareness Unit within the Waste Management Business Unit - This unit should be a focus on addressing issues such as illegal dumping and littering. - How waste and litter can impact on ecosystems and biodiversity should be highlighted, with information on how to reduce waste and promote recycling. 	<ul style="list-style-type: none"> - Manager: Area Based Management - Manager: Human Resources & Development Unit - Manager: Waste Management Unit
<ul style="list-style-type: none"> • Implementation of the Msunduzi Integrated Waste Management Plan³⁸ which deals with waste reduction and recycling options. 	<ul style="list-style-type: none"> - Manager: Waste Management Unit
<ul style="list-style-type: none"> • Prepare and implement strategies regarding the impacts of industrial effluent, land degradation, poor sewage infrastructure, solid waste and storm water management on the quality of water and aquatic ecosystems. 	<ul style="list-style-type: none"> - Manager: Water & Sanitation Unit - Manager: Waste Management - Manager: Environmental Health Unit
<ul style="list-style-type: none"> • Improve basic service delivery such as; effective waste removal and the provision of appropriate sanitation and water services. 	<ul style="list-style-type: none"> - Manager: Water & Sanitation Unit - Manager: Waste Management
<ul style="list-style-type: none"> • In areas where shop owners are problematic i.e. litter outside of buildings, fines / penalties should be issued until areas are cleared up and litter is removed, as litter blocks up storm water drains, and causes far reaching negative environmental impacts. 	<ul style="list-style-type: none"> - Manager: Waste Management - Manager: Environmental Health Unit
<ul style="list-style-type: none"> • Increase the provision and servicing of refuse bins / skips within the city. 	<ul style="list-style-type: none"> - Manager: Waste Management - Manager: Area Based Management Unit

³⁸S2: Integrated Waste Management Plan.

MITIGATION OPTIONS	RESPONSIBILITY
<ul style="list-style-type: none"> • Increase recycling initiatives i.e. expansion of the Mondi kerb-side recycling project to involve all users and producers of waste coupled with a sustained municipal wide education and awareness campaign. 	<ul style="list-style-type: none"> - Manager: Waste Management Unit - Manager: Area Based Management - Manager: Human Resources & Development Unit - Manager: Environmental Management Unit
<ul style="list-style-type: none"> • Explore options such as: <ul style="list-style-type: none"> - Converting waste to energy (biofuels should only be used if they can be produced / generated with very little carbon emissions and with sustainable agricultural practices). - Landfill gas capture projects / initiatives - Properly facilitate mining of landfill waste 	<ul style="list-style-type: none"> - Manager: Waste Management Unit
<ul style="list-style-type: none"> • Implement and increase capacity of the Materials Recovery Facility (MRF). 	<ul style="list-style-type: none"> - Manager: Waste Management Unit
<ul style="list-style-type: none"> • Increased implementation of composting facilities varying in degree from small scale household facilities to large industrial scale regional facilities. 	<ul style="list-style-type: none"> - Manager: Waste Management Unit
<ul style="list-style-type: none"> • Improved waste collection efficiency by and between the various role players municipal wide, including the private sector. 	<ul style="list-style-type: none"> - Manager: Waste Management Unit
<ul style="list-style-type: none"> • Enforce the Polluter Pays Principle (NEMA, 2010). 	<ul style="list-style-type: none"> - Manager: Waste Management Unit - Manager: Environmental Health Unit
<ul style="list-style-type: none"> • Enforce Municipal Waste Bylaws and Regulations. 	<ul style="list-style-type: none"> - Manager: Waste Management Unit - Manager: Environmental Health Unit
<ul style="list-style-type: none"> • Address illegal roadside / community dumping of waste via sustained public awareness campaigning and sustained law enforcement. 	<ul style="list-style-type: none"> - Manager: Waste Management Unit - Manager: Environmental Health Unit - Manager: Area Based Management - Manager: Human Resources & Development Unit
<ul style="list-style-type: none"> • Creating a Public Awareness Unit within the Waste Management Business Unit <ul style="list-style-type: none"> - This unit should be a focus on addressing issues such as illegal dumping and littering. - How waste and litter can impact on ecosystems and biodiversity should be highlighted, with information on how to reduce waste and promote recycling. 	<ul style="list-style-type: none"> - Manager: Area Based Management - Manager: Human Resources & Development Unit - Manager: Waste Management Unit
<ul style="list-style-type: none"> • Implementation of the Msunduzi Integrated Waste Management Plan which deals with waste reduction and recycling options. 	<ul style="list-style-type: none"> - Manager: Waste Management Unit
<ul style="list-style-type: none"> • Prepare and implement strategies regarding the impacts of industrial effluent, land degradation, poor sewage infrastructure, solid waste and storm water management on the quality of water and aquatic ecosystems. 	<ul style="list-style-type: none"> - Manager: Water & Sanitation Unit - Manager: Waste Management - Manager: Environmental Health Unit
<ul style="list-style-type: none"> • Increase the provision and servicing of refuse bins / skips within the Msunduzi area. 	<ul style="list-style-type: none"> - Manager: Waste Management

10.7. ENERGY UTILISATION

Introduction: Severe and fluctuating weather conditions affect and impact the supply of electricity and electrical infrastructure negatively, as temperature extremes directly affect demand³⁹. Increased intensities in storm events also pose a direct threat to electrical infrastructure resulting in an increased demand for maintenance and upgrades to infrastructure by service providers, placing added strain on resources and staff / personnel.

HEADLINE OBJECTIVES:

- To reduce the Cities overall electricity consumption (reduce energy demand in buildings).
- To retrofit all municipal owned buildings with energy saving technologies to reduce electricity consumption.
- To move towards a more environmentally friendly source of energy (i.e. alternative energy sources such as solar, wind etc.) in order to reduce energy consumption of outdoor lighting.

Targets identified in the IDP⁴⁰ which are required to be met by 2030, are as follows:

- *30% of Msunduzi's electricity demand is met by renewable sources.*
- *20% of liquid energy is derived from bio-fuel.*
- *50% of new commercial or industrial development incorporates some form of renewable energy technology usage in its design and construction.*
- *80% of new human settlement development incorporates some form of renewable energy technology usage in its design and construction.*
- *100% of building plans approved have due consideration for energy efficiency.*

ADAPTATION OPTIONS	RESPONSIBILITY
<ul style="list-style-type: none"> • Increase community awareness regarding appropriate usages of energy and electricity (if not using an appliance switch it off, benefits of implementing energy saving technologies etc.). 	<ul style="list-style-type: none"> - Manager: Electricity Unit - Manager: Area Bases Management Unit - Manager: Human Resources & Development Unit
<ul style="list-style-type: none"> • Introduce rebates and incentives to encourage electricity users to implement renewable energy 	<ul style="list-style-type: none"> - Manager: Electricity Unit
<ul style="list-style-type: none"> • Increased utilisation of alternative energy / powered facilities i.e.: <ul style="list-style-type: none"> - Solar powered streetlights, traffic lights. - Small-scale solar energy / alternative energy projects. - Solar geyser initiatives. - Green Building designs. 	<ul style="list-style-type: none"> - Manager: Electricity Unit - All Business Units

³⁹ <http://newscenter.lbl.gov/feature-stories/2012/12/18/impact-of-climate-change-on-california-electricity-infrastructure-could-be-costly/>

⁴⁰ IDP Review For 2013/14 – 2016/17

MITIGATION OPTIONS	RESPONSIBILITY
<ul style="list-style-type: none"> • Ensure that all municipal buildings are retrofitted with energy saving technologies. 	<ul style="list-style-type: none"> - Manager: Electricity Unit
<ul style="list-style-type: none"> • Increase community awareness regarding appropriate usages of energy and electricity (if not using an appliance switch it off). 	<ul style="list-style-type: none"> - Manager: Electricity Unit - Manager: Area Bases Management Unit - Manager: Human Resources & Development Unit
<ul style="list-style-type: none"> • Introduce rebates and incentives to encourage electricity users to implement renewable energy 	<ul style="list-style-type: none"> - Manager: Electricity Unit
<ul style="list-style-type: none"> • Develop and implement bylaws to support and strengthen the building regulations. 	<ul style="list-style-type: none"> - Manager: Electricity Unit - Manager: Municipality Security
<ul style="list-style-type: none"> • Increased utilisation of alternative energy / powered facilities in all new buildings i.e.: <ul style="list-style-type: none"> - Solar powered streetlights, traffic lights. - Small-scale solar energy / alternative energy projects. - Solar geyser initiatives. - Green Building designs 	<ul style="list-style-type: none"> - Manager: Electricity Unit - All Business Units
<ul style="list-style-type: none"> • Work to ensure that low income households is thermally efficient (ceilings) 	<ul style="list-style-type: none"> - Manager: Electricity Unit - Manager: Building Inspectors

It is stated in the IDP (IDP review for 2013/14-2016-17, page 71) that “*the municipality is also piloting solar powered street lighting and traffic lights in the CBD*”.

10.8. TRANSPORTATION

Introduction: According to the Msunduzi IDP review for 2013/14 – 2016/17 (page 74), “the 2001 census indicated that the daily modal split in the Msunduzi municipality was 62% by public transport and 38% by private vehicles”. It was found that public transport is dominant in the western and southern regions of the municipality, with higher levels of private vehicle usage in the central and north eastern regions³⁹.

“The high dependency on public transport and the high level of pedestrian activity places a focus on the need for high standard public transport services throughout the Municipality, with attention on non-motorised transport (NMT) integrated with the public transport system” Msunduzi IDP review for 2013/14 – 2016/17 (page 74).

HEADLINE OBJECTIVES:

- To ensure that transportation routes and facilities are resilient to the impacts of climate change.
- To ensure that sufficient budget is allocated to deal with roads and traffic management measures that require upgrades and improvements.

ADAPTATION OPTIONS

ADAPTATION OPTIONS	RESPONSIBILITY
<ul style="list-style-type: none"> • In order to decrease the levels of degradation to road and railway networks (i.e. potholes, cracking of roads etc.), the implementation of improved storm water and drainage systems should be investigated. 	<ul style="list-style-type: none"> - Manager: Roads & Transportation - Manager: Infrastructure & Storm Water Management Unit
<ul style="list-style-type: none"> • Increased and efficient public transportation systems i.e. the IRPTN is in the process of being developed and planned for the Msunduzi area 	<ul style="list-style-type: none"> - Manager: Roads & Transportation
<ul style="list-style-type: none"> • Transportation systems which will significantly contribute to the upgrading of interchanges and road networks within and around the CBD as well as contributing to traffic reduction 	<ul style="list-style-type: none"> - Manager: Roads & Transportation
<ul style="list-style-type: none"> • Infrastructure Cost Modelling aimed at improving service delivery and providing basic services. 	<ul style="list-style-type: none"> - Manager: Roads & Transportation

MITIGATION OPTIONS

MITIGATION OPTIONS	RESPONSIBILITY
<ul style="list-style-type: none"> • Transportation systems which will significantly contribute to the upgrading of interchanges and road networks within and around the CBD as well as contributing to traffic reduction. 	<ul style="list-style-type: none"> - Manager: Roads & Transportation
<ul style="list-style-type: none"> • Infrastructure Cost Modelling aimed at improving service delivery and providing basic services. 	<ul style="list-style-type: none"> - Manager: Roads & Transportation
<ul style="list-style-type: none"> • Implement improved and more effective public transportation systems. 	<ul style="list-style-type: none"> - Manager: Roads & Transportation
<ul style="list-style-type: none"> • Implementation of Non-Motorised Transportation (NMT) routes and infrastructure. 	<ul style="list-style-type: none"> - Manager: Roads & Transportation

10.9. BUILDING CO-OPERATIVE GOVERNANCE & IMPROVED COMMUNICATION PROCEDURES

Introduction: This component deals specifically with improving awareness and participation all Municipal Business Units and Municipal officials regarding environmental issues and the associated impacts of climate change thereof.

HEADLINE OBJECTIVES:

- To ensure that all Business Units and Municipal officials are aware of environmental concerns, and mitigation and adaptation measures which could be implemented in order to circumvent / negate impacts pertaining to climate change.
- To increase levels of awareness regarding environmental issues (i.e. this would include the conservation and adequate management of water and terrestrial resources)

ADAPTATION OPTIONS

RESPONSIBILITY

• Environmental Capacity Assessment to ensure that environmental issues are prioritized.	- All Business Units
• Identify existing capacity as well as areas that require further capacity and support within the municipality.	- All Business Units
• LA21 Forum Growth ⁴¹ focuses on addressing issues around the lack of sufficient resources allocated for environmental functions, it also deals with increasing the use of media and public support in order to ensure participation in decision-making.	- Manager: Environmental Management Unit
• Sustainable Development Training which aims at improving communication channels and strategies between decision makers and the public sector in order to ensure a holistic approach to decision making.	- Manager: Area Bases Management Unit - Manager: Human Resources & Development Unit
• In order to ensure that communities are aware of climate change issues it is essential that a <i>Council on Climate Change is established in order to impart practical mitigation and adaptation measures</i> (IDP review for 2013/14-2016-17).	- Manager: Environmental Management Unit

MITIGATION OPTIONS

RESPONSIBILITY

• Environmental Capacity Assessment to ensure that environmental issues are prioritized.	- All Business Units
• Identify existing capacity as well as areas that require further capacity and support within the municipality.	- All Business Units
• In order to ensure that communities are aware of climate change issues it is essential that a <i>Council on Climate Change is established in order to impart practical mitigation and adaptation measures</i> (IDP review for 2013/14-2016-17).	- Manager: Environmental Management Unit

By building and expanding on environmental education and information components, this ensures that a wide basis of individuals (municipal officials and other governmental and NGOs) are informed and aware of the concerns regarding environmental matters and the significance of climate change on the City and its resources. The action plans mentioned above would also benefit from the reimplementation of the LA21 environmental forum³⁷, which would contribute to significant input and participation from all spheres of government regarding environmental and conservation issues / concerns. This would assist in contributing to promoting awareness, and involvement in decision-making procedures and processes.

⁴¹ G2: Grow the LA21 environmental forum.

10.10. RELEVANT ACTION PLANS TO BE INCLUDED IN THE IDP

1. SOCIAL

Introduction: The SEA (2010, Page 2) states that “*sustainable development requires a balance between economic and social development and environmental protection*”. This aims at improving human well-being by seeking a balance between economic, social and environmental changes (SEA, 2010). The SEMP acknowledges that within a social context the aim is to ensure that basic human needs of the Msunduzi residents are met without compromising the resources upon which basic services rely on.

HEADLINE OBJECTIVES:

The objectives of the actions plans within the social context aims at meeting the populations’ needs without compromising the systems from which the services are obtained. These action plans and related tasks also look at the following:

- Protecting the Msunduzi’s landscapes and townscapes in order to ensure the preservation of natural resources / amenities in respect of climate change and related impacts.
- Minimise human vulnerability while ensuring natural resource preservation in respect of climate change impacts.
- A basic level of water supply is provided to all residents without affecting the integrity of natural ecosystems.

ACTION PLANS IDENTIFIED IN THE SEMP WITHIN THE SOCIAL CONTEXT:

- S1: Urban Greening Program
- S2: Integrated Waste Management Plan
- S3: Environmental Vulnerability Assessment
- S4: Noise Monitoring
- AMAFA1: Cultural Heritage Resource Assessment

2. ECONOMIC

Introduction: The SEA (2010, Page iv) states that, “*Weak environmental governance will inevitably lead to further environmental degradation and exacerbate the risks that have been identified in the various themes of this strategic assessment. Inappropriate land use; uncontrolled emissions; and pollution and environmental degradation, compromise the ability of the environment to support socio-economic development. Ecosystem goods and services that are vital for the health and well-being of the municipal residents are compromised. There is therefore a direct link between strong environmental governance and management and the realisation of sustainable social and economic development goals. Further the loss of ecosystem goods and services will result in significant cost implications for the municipality. This is demonstrated by the unplanned and possibly wasteful expenditure incurred to rehabilitate environmental damage that should have been prevented through strong environmental governance and informed decision making at an early stage*”. Climate change would have direct and indirect implications on the economy of Msunduzi. The main objective would be to promote sustainable environmental, social and economic development, and ensure that communities are made aware of the value and importance of ecosystem goods and services and are able to promote efficient and sustainable utilisation of natural resources.

ACTION PLANS IDENTIFIED TO REDUCE IMPACTS ARE AS FOLLOWS:

- Infrastructure and facilities are well-maintained to meet the needs of residents and business in ways that reduce environmental impacts and ensure that air emissions are reduced.
- Ensure that the daily food needs of Msunduzi are sustainably grown, processed and packaged in urban and rural agricultural schemes in the city and surrounding agricultural areas;
- *Green design principles* are used to ensure environmental efficiency and minimise use of resources in order to decrease carbon emissions.
- Clean, renewable and efficient energy sources and transportation options are investigated and implemented in order to reduce fossil fuel dependence, so as to reduce energy costs and produce low greenhouse gas emissions and other air contaminants.
- Sustainability Appraisal of all Municipal Plans, Policies and Programs, this ensures that all decision making processes take into account environmental priorities and responsibilities with regard to implications of climate change impacts.
- Ensure and promote developmental activities which are sustainable and contribute to the social, environmental and economic well-being of the City.
- Implementation of the ESP with associated land ownership and management policy which aims at promoting alternative livelihood strategies, increase economic opportunities, and encouraging green design principles.
- Address issues regarding the increased demands for development in the City in relation to the significance of protecting ecosystem goods and services.
- Implement strategies and plans which ensure that 30% of the municipality is conserved and zoned as open space

ACTION PLANS IDENTIFIED IN THE SEMP WITHIN THE ECONOMIC CONTEXT:

- E1: Integrate EMF into SDF Review and preparation of the LUMS
- E2: Ecosystem Goods and Services Assessment
- E3: Sustainability Appraisal of all Municipal Plans, Policies and Programs
- E4: Implementation of the ESP with associated land ownership and management policy
- E5: Infrastructure Cost Model

3. GOVERNANCE

Introduction: The SEA (2010) states that, it is important to create an enabling environment for on-going dialogue amongst all role players. Good governance is important when considering the future climate change implications which would affect all citizens within Msunduzi. Decision making must be based on sound principles, with an understanding of the cumulative impacts that a decision could result in. There should be an understanding that all Msunduzi's legal and policy prescribed responsibilities are met. Environmental threats arising from climate change impacts should be addresses proactively and timeously

ACTIONS IDENTIFIED ARE AS FOLLOWS:

- Ensure that I&AP's, officials and decision makers are in contact and build partnerships.
- Environmental issues are prioritised and Msunduzi is committed to achieving environmental sustainability and climate change resilience.
- Climate change issues and priorities are embedded in the Performance Management System and Key Performance Areas of all components of the municipality; and, are integrated in municipal planning.
- Decision-making processes are defensible, clear and transparent.

- Participation in LA21 is increased and the public is encouraged to participate in municipal planning initiatives.
- Capital investment projects undertaken or facilitated by the Municipality adhere to legislated requirements and Integrated Environmental Management principles.
- Msunduzi is prepared to respond rapidly and to deal effectively with known and unforeseen hazards / emerging threats, to limit the adverse impacts of events and effectively manage emergencies.
- Access to environmental information is facilitated and encouraged.
- Regular monitoring is undertaken to report on progress towards climate change resilience, so that the city can learn and adapt as needed.
- Communities are informed, empowered and involved in the process of democratic governance to ensure that climate change resilience.

ACTION PLANS IDENTIFIED IN THE SEMP WITHIN THE GOVERNANCE CONTEXT

- G1: Environmental Capacity Assessment
- G2: LA21 Forum Growth
- G3: Web-based EMF
- G4: Sustainable Development Training
- G5: Co-operative Governance.

11. REFERENCES

- Adaption Fund. (2014). *Adaption Fund, Proposal for South Africa. Adaptation Fund Board Secretariat Technical Review of Project/Programme Proposal Building Resilience in the Greater Umngeni Catchment*. Afb/Pprc.15/16.
- Allen, K.M. 2006. *Community-based disaster preparedness and climate adaptation: local capacity building in the Philippines Disasters*. 30(1): 81–101.
- American Geophysical Union. (2013). *Human-Induced Climate Change Requires Urgent Action*. [Retrieved on the 30th of June 2014 from http://sciencepolicy.agu.org/files/2013/07/AGU-Climate-Change-Position-Statement_August-2013.pdf].
- Convention on Biological Diversity. (nd.). *Climate change and biodiversity*. [Retrieved on the 18th of August 2014 from <http://www.cbd.int/climate>].
- Daniel, C. (2008). *Climate change, Adaptation and Development*. UCLA: ENVTL.
- Department of Tourism. (2011). *Draft National Tourism and Climate Change Action Plan*.
- Diederichs, N. Nichols, G, & van Niekerk M. (2009). *Green Landscaping Guideline*. EThekwini Municipality. Durban.
- Dissanayake, R. (2011). *Way I understand the world: climatic changes*. [Retrieved on the 15th of August 2014 from <http://rdissanayake.blogspot.com/2011/05/climatic-changes.html>].
- Draft National Tourism and Climate Change Action Plan. Department of tourism: Republic of South Africa.
- Durban's Municipal Climate Protection Program. (2010/2011). *Climate Change Adaption Planning For A Resilient City*.
- Ecological Infrastructure: Nature Delivering Services: www.sanbi.org.
- Envirokids. (2008). *People and climate change: Climate Change*. Vol. 29 (2).
- Farber, D. A. (2007). *Adapting to Climate Change: Who Should Pay*. 23 FLA. ST. U. J. LAND USE & ENVTL.
- Goodward, J. & Kelly, A. (2010). *Bottom Line on Offsets*. World Resources Institute.
- Information on Climate Change in South Africa: *Greenhouse gas emissions and mitigation options*. [Retrieved on 13th of December 2013 from: <http://www.erc.uct.ac.za>.]
- Intergovernmental Panel on Climate Change (IPCC). (2007). *Fourth Assessment Report*.
- Intergovernmental Panel on Climate Change (IPCC). (2013). *Climate Change 2013: The Physical Science Basis: Working Group 1: Contribution to The Fifth Assessment Report Of The IPCC*. [Retrieved on June 2014 from: http://www.ipcc.ch/report/ar5/wg1/docs/WGIAR5_SPM_brochure_en.pdf].
- International Panel on Climate Change. (1996) *Climate Change 1995. The science of climate change*. Cambridge University Press, Cambridge.

- Integrated Development Plan (IDP) review for 2013/14 – 2016/17.
- Msunduzi Local Municipality Integrated Waste Management Plan.
- Msunduzi Municipality: Integrated Development Plan. 2008 / 2009.
- Msunduzi Municipality Integrated Development Process Plan: *The Approved IDP and Budget Plan For The 2014/2015 Financial Year.*
- National Climate Change Adaptation Research Facility. (nd.) Policy guidance brief 3: *Supporting Decision-making for effective adaptation.*
- Organisation for Economic Co-Operation and Development (OECD). (2007). *Policy brief: Climate Change Policies.* [Retrieved on 30th of June 2014 from <http://www.oecd.org/environment/cc/39111309.pdf>]
- Prepared by Royal Haskoning DHV. Prepared for Msunduzi Municipality 28 June 2013.
Professional Service Provider: Reduction and Monitoring of Storm water Infiltration into Sanitation Systems within the Msunduzi Area of Jurisdiction *Final Infiltration Assessment and Reduction Strategy Report.*
- Price, G. Ross, D. Rabé, M. & Diederichs, N. (2009). *Water Conservation Guideline.* EThekweni Municipality. Durban.
- Rattana, K. & Krawanchid, D. (2012). *Mainstreaming adaptation into local development planning: A case study in Chainat, Thailand.* Partner report series No. 7. Stockholm Environment Institute: Bangkok.
- Report On Environmental Management Mandates And Obligations For Local Governments.
- Riffle, C. & Appleby, K. & Martin, P. (2013). *Wealthier, healthier cities: How climate change action is giving us wealthier, healthier cities:* based on the CDP responses from 110 global cities.
- Sharma, D. & Tomar, S. (2010). *Mainstreaming Climate Change Adaptation in Indian Cities:* Environment and Urbanization.
- SRK Consulting. (2008). *Msunduzi Environmental Management Framework – Status Quo Report.* Prepared on behalf of KZN DAEA, National DAEA and Msunduzi Municipality.
- SRK Consulting (2009). SRK Consulting: *Msunduzi Municipality Environmental Management Framework- Strategic Environmental Assessment.* Prepared on behalf of KZN DAEA, National DAEA and Msunduzi Municipality.
- SRK Consulting (2010). SRK Consulting: *Msunduzi Strategic Environmental Management Plan.* Prepared on behalf of KZN DAEA, National DAEA and Msunduzi Municipality.
- The Potsdam Institute for Climate Impact Research and Climate Analytics. (2012). *Turn Down the Heat: Why a 4°C Warmer World must be Avoided.* Washington DC. [Retrieved on the 21st of August 2014 from http://www.worldbank.org/content/dam/Worldbank/document/Full_Report_Vol_2_Turn_Down_the_Heat_%20Climate_Extremes_Regional_Impacts_Case_for_Resilience_Print%20version_FINAL.pdf].
- United Nations Framework Convention on Climate Change: *Glossary of Climate Change Acronyms.* [Retrieved on the 16 of June 2014 from http://unfccc.int/essential_background/glossary/items/3666.php].

Date: October 2014
Report Prepared By: Kerina Singh
Report Approved By: Rodney Bartholomew

Msunduzi Municipality
Environment Management Unit
P O Box 31
Pietermaritzburg
3200
South Africa

Tel: 033 392 3245 / 033 392 3240
Email: Kerina.Singh@msunduzi.gov.za
Rodney.Bartholomew@msunduzi.gov.za
Website: www.msunduzi.gov.za

Should be referenced as follows:

Singh, K. & Bartholomew, R. C. L. (2014). *Climate Change Policy for the Msunduzi Municipality*. Pietermaritzburg.

*Please note, this policy is **specific** for the Msunduzi Municipality and relevant business units.*

