Overberg District Municipality

Climate Change Adaptation Summary Report

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Version 2

Developed through the Local Government Climate Change Support Program

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On behalf of:
Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety
of the Federal Republic of Germany

SOUTH AFRICAN LOCAL GOVERNMENT ASSOCIATION
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Report Submitted to

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

On behalf of:

Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety

of the Federal Republic of Germany

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Version Control

Version	Date Submitted	Comments
1	1 November 2017	Draft version with desktop review information.
2	15 March 2017	Methodology, Key District Indicators and Sector Snapshots moved from the main body of the report to Annexures.

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1 Executive Summary

Overberg District Municipality recognises climate change as a threat to the environment, its residents, and to future development. Therefore, measures should be implemented to reduce or eliminate carbon emissions or enhance greenhouse gas sinks (mitigation) (Böckmann 2015). However, due to lag times in the climate and biophysical systems, the positive impacts of past and current mitigation will only be noticeable in the next 25 years (Jiri 2016). In the meanwhile, adaptation is regarded as inevitable and a necessary response to the changes that are projected to take place in the District. Overberg District Municipality therefore prioritised the development of the Overberg Climate Change Response Framework in 2017. This Climate Change Adaption Summary Report builds on that framework document by providing more detail at a sector level on key Climate Change Vulnerabilities and Responses.

The Climate Change Adaption Summary Report was developed through the Local Government Climate Change Support (LGCCS) program (http://www.letsrespondtoolkit.org/) in partnership with the Western Cape Climate Change Municipal Support Programme. The LGCCS is led by the Department of Environmental Affairs and is part of the International Climate Initiative (IKI) and is supported by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on behalf of The Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB).

Through this program key climate change vulnerability indicators for the Overberg District Municipality were identified. These indicators demonstrate areas that may be at high risk of climate change impacts.

A summary of the key vulnerability indicators is provided in the table below.

Table 1: Key Vulnerability indicators for Overberg District Municipality

No	Sector	Indicator Title	Exposure Answer	Sensitivity Answer	Adaptive Capacity Answer
11	Agriculture	Reduced food security	Yes	High	Low
13	Biodiversity and Environment	Increased impacts on threatened ecosystems	Yes	High	Low
14	Biodiversity and Environment	Increased impacts on environment due to land-use change	Yes	High	Low
19	Coastal and Marine	Loss of land due to sea level rise	Yes	High	Low
20	Coastal and Marine	Increased damage to property from sea level rise	Yes	High	Low
22	Human Health	Increased heat stress	Yes	High	Low
29	Human Settlements, Infrastructure and Disaster Management	Increased impacts on strategic infrastructure	Yes	High	Low
33	Human Settlements, Infrastructure and Disaster Management	Increased risk of wildfires	Yes	High	Low
36	Water	Decreased water quality in ecosystem due to floods and droughts	Yes	High	Low

No	Sector	Indicator Title	Exposure Answer	Sensitivity Answer	Adaptive Capacity Answer
37	Water	Less water available for irrigation and drinking	Yes	High	Low

Based on the key indicators identified in the table above, the following objectives and projects are prioritised as a response to each of the indicators.

1.1 Biodiversity and Environment

Climate change predictions include the shifting of biome across South Africa. In the Overberg District Municipality, it is projected that, with the changes in climate, the Succulent Karoo biome will replace large areas of the Fynbos biome. Terrestrial, wetland, and river ecosystems and their associated species will be negatively impacted. Furthermore, development and changes in land use will impact negatively on the environment in the District.

The following key biodiversity objectives and projects were identified:

Objective	Project	Priority
Manage Increased impacts on threatened ecosystems	Town Planning Department in the LMs to be guided by existing information provided by WC Biodiversity Spatial Plan on Critical Biodiversity Area (CBA) and ensure appropriate development takes place on an ongoing basis.	Priority
Manage Increased impacts on environment due to land-use change	Town Planning Department in LMs to consider appropriate development parameters specifically in relation to land reclamation from water bodies on an ongoing basis.	Priority

1.2 Coastal and Marine

In the Overberg District Municipality, changes in precipitation and freshwater flow, sea-level rise, increased temperatures, and coastal storminess are predicted to negatively impact on coastal, marine and estuarine ecosystems. These ecosystem impacts are likely to result in changes in species availability and distribution impacting largely on fisheries. This could result in significant adverse impacts on subsistence fishing markets and community livelihoods in the District. Rising sea levels and increased coastal storms will pose potential risks to coastal infrastructure and communities in the District.

The following key coastal and marine objectives and projects were identified:

Objective	Project	Priority
Manage loss of land due to sea level rise	Develop and implement coastal management programme and get feedback on roles and responsibilities linked to CMP. Lines then to be incorporated into SDFs.	Priority
Manage increased damage to property from sea level rise	Disaster Management to Identify key infrastructure and communities under threat from extreme coastal events and include coastal precautionary zones in the Disaster Management Plan and District and Local SDFs.	Priority
Manage Increased damage to property and loss of land from sea level rise	Town planning in the LMs to incorporate coastal management lines and flood lines in the SDF on ongoing basis.	Priority

1.3 Human Health

Climate change impacts affect the social and environmental determinants of health and will therefore affect human health in several ways in the Overberg District Municipality. Projected temperature increases due to climate change will negatively affect the young and elderly population of the district. People working in the informal sector usually work outdoors and are therefore exposed to all weather elements and are particularly vulnerable to temperature increases.

The following key human health objectives and projects were identified:

Objective	Project	Priority
Manage health impacts from increased storm events.	Disaster Management in collaboration with LMs and others to map areas that are at high risk from fires, flooding, extreme winds, sea level rise / sea storm surge on an annual basis.	Priority

1.4 Disaster Management, Infrastructure and Human Settlements

Climate change impacts will affect Disaster Management, Infrastructure and Human Settlements in several ways in Overberg District Municipality. Increases in the severity of storm events and increase in flooding will damage infrastructure which may result in a loss of industrial productivity and service delivery disruptions. The impacts of storm events will particularly affect communities located in informal settlements, on flood plains and where there is poor drainage infrastructure. In addition, communities in rural areas that depend on subsistence farming may be unable to grow crops that they have grown in the past due to the changing climate. It is predicted that there will therefore be an increase in rates of rural-urban migration. Rural communities may also become more physically isolated due to extreme events impacting on key infrastructure.

The following key human settlement objectives and projects were identified:

No	Objective	Project	Priority
29		Technical Services in LMs to compile and implement a stormwater system maintenance plan (if not in existence) that take into account new risks from climate change on an annual basis.	Priority
30	**Manage increased impacts on traditional and informal dwellings**	Disaster Management Unit to draft a report on increased risk from intense weather events (heat waves, rainfall, fires) in informal shack dwellings within urban area on an annual basis.	Priority
33	**Manage potential increased risk of wildfires**	LMs to develop Alien Control Plans for Municipal Owned Lands, that include general alien clearing and clearing of fire-prone alien plant species.	Priority
		Improve awareness raising and mainstreaming of fire and flood awareness through municipal communications platforms.	Priority

1.5 Water

Water resources are the primary medium through which climate change impacts will be felt by South Africans (Schulze et al., 2014). Climate change will affect Overberg District Municipality's water accessibility, quantity, and quality (Parikh 2007). Drought, reduced runoff, increased evaporation, and an increase in flood events will impact on both water quality and quantity.

The following key water objectives and projects were identified:

Objective	Project	Priority
Manage the quantity of water available for irrigation and drinking.	Technical Services in each LM to Develop/Update water loss management plan to address water reticulation losses on annual basis	Priority
	Technical Department in each LM to investigate alternative water sources and water re-use options by 2019/2020 financial year	Priority
	District to Develop drought management plans for areas that don't already have such plans.	Priority

1.6 Cross Cutting

A cross-cutting co-ordinated approach is required to adapt to climate change. Overberg District Municipality requires coordination across different departments, as well as the integration of climate change into different sectors and strategic plans.

The following key cross-cutting objectives and projects were identified:

Objective	Project	Priority
Coordinate climate change response in the Municipality	Apply to EEDSM for municipal retrofits of EE technologies (for municipalities that distribute electricity)	Priority
Generate knowledge and disseminate information on climate change	Develop a communication protocol for early warning systems with public alerts (risk communication). Must reach all community members.	Priority
	Increase public awareness on what to do during emergencies / disasters (including if cut off from help / supplies).	Priority
	Environmental Management in DM and LMs to coordinate information to communications teams to increase public awareness on the impacts of climate change and benefits of best practice environmental management.	Priority

2 Introduction

This document outlines key climate change vulnerabilities and responses to address these vulnerabilities for Overberg District Municipality. This Climate Change Adaption Summary Report was developed through the Local Government Climate Change Support (LGCCS) program (http://www.letsrespondtoolkit.org/) in partnership with the Western Cape Climate Change Municipal Support Programme. The LGCCS is an initiative of the National Department of Environmental Affairs and the International Climate Initiative (IKI) and is supported by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on behalf of The Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB).

The three primary objectives of the LGCCS are to:

- A desktop analysis of the municipality to provide context on change vulnerabilities and responses;
- Undertake district municipal specific engagements to draft climate change vulnerabilities and responses;
- Facilitate capacity building and knowledge-transfer throughout the program to enhance implementation of prioritised climate change adaptation options.

For more details on the LGCCSP please visit the website: http://www.letsrespondtoolkit.org/.

Through the LGCCSP, a Climate Change Vulnerability Assessment Toolkit was developed to assist municipalities to identify and prioritise climate change indicators to facilitate the assessment of adaptive capacity. Indicators are a range of potential impacts which have been developed using the Long Term Adaptation Scenario (LTAS) reports (Department of Environmental Affairs 2013g). Indicators are grouped into the following themes:

- Agriculture
- Biodiversity and Environment
- Coastal and Marine
- Human Health
- Disaster Management, Infrastructure and Human Settlements
- Water

The LGCCS Toolkit was applied to the Overberg District Municipality to assist with the development of its Climate Change Response Plan.

2.1 Climate Change Introduction

2.1.1 Climate change defined

Climate change is a natural phenomenon that takes place over geological time. However, over the past few decades the rate of climate change has been more rapid and the magnitude of global warming has increased dramatically (Warburton and Schulze 2006; Warburton 2012). This change has been attributed to increased anthropogenic greenhouse gas emissions (Koske and Ochieng 2013). For example, the burning of coal to generate electricity, the burning of petrol in cars, some chemical processes in industries, and many farming activities all contribute to the increased concentration of greenhouse gasses in the atmosphere.

Climate change is not just an increase in average global temperatures but changes in regional climate characteristics such as rainfall, relative humidity and severe weather extremes (Davis 2011). Climate change can manifest as a shock or a stress (Ziervogel and Calder 2003). Shocks are defined

as discrete, extreme events (rapid onset) such as floods, while gradual change (slow onset) such as long-term climate variability is classified as a stress (Ziervogel and Calder 2003). The negative impacts of climate change "are already felt in many areas, including in relation to, *inter alia*, agriculture, and food security; biodiversity and ecosystems; water resources; human health; human settlements and migration patterns; and energy, transport and industry" (United Nations WomenWatch 2009, 1).

2.1.2 Climate Change Policy Context in South Africa

Climate change is a relatively new area of policy development in South Africa. As policies and structures are developed, it is necessary to ensure that they are evidence-based, coordinated and coherent. This section introduces international and national climate change policies and structures, which are listed below:

- The United Nations Framework Convention on Climate Change (UNFCCC). This international treaty provides guidance on setting agreements pertaining to the reduction of greenhouse gas emissions.

- The Paris Agreement, came into effect on 4 November 2016. This is the first agreement all countries have committed to and stipulates that all countries must reduce carbon emissions to limit global temperature increase to 1.5 degrees Celsius above pre-industrial levels.

- South Africa's Nationally Determined Contributions, came into effect after the Paris Agreement was signed. South Africa is therefore required to report on mitigation and adaptation efforts. Concerning mitigation, South Africa is to reduce emissions by a range between 398 and 614 million metric tons of carbon equivalent by 2025 and 2030. There are several instruments to ensure reduction in carbon emissions including car tax and company carbon budgets among other instruments. With reference to adaptation a National Adaptation Plan is currently being developed, and climate change is to be incorporated in all policy frameworks, institutional capacity is to be enhanced, vulnerability and adaptation monitoring systems are to be in place, vulnerability assessment and adaptation needs framework are to be developed and there needs to be communication of past investments in adaptation for education and awareness.

- The National Climate Change Response White Paper (NCCRWP) was adopted in 2011 and presents the South African Government's vision for an effective climate change response in the long-term, to transition to a climate-resilient and lower-carbon economy and society.

- The National Development Plan, focuses on eliminating poverty and reducing inequality by 2030 and creating an environmentally sustainable country through mitigation and adaptation efforts.

- Long Term Mitigation Scenarios, outline different scenarios of mitigation action for South Africa.

- Long Term Adaptation Scenarios, consist of two phases. Phase one, was the identification of climate change trends and projections as well as impacts and responses for the main

sectors. Phase two focussed on integrating issues such as climate information and early warning systems, disaster risk reduction, human settlements and food security.

2.1.3 Climate Change Impacts in South Africa

South Africa's temperature is expected to increase to 1.2° C by 2020, 2.4° C by 2050 and 4.2° C by 2080 (Kruger and Shongwe 2004). Contrary to the global increase in rainfall, South Africa's rainfall is expected to decrease by 5.4% by 2020, 6.3% by 2050 and 9.5% by 2080 (Kruger and Shongwe 2004). The frequency and intensity of climate extremes, *inter alia,* droughts, floods, storms and wild fires will increase (Davis 2011; Böckmann 2015). Climate change evidence indicates the changes in frequency and intensity of flood and prolonged drought events at small scales (Meyiwa et al. 2014). Furthermore, the sea level will continue rising and ocean acidification will get worse (Böckmann 2015).

There are however uncertainties associated with climate projections because they are based on the potential rates of resource use in the future, and associated greenhouse gas emissions (Nicholson-Cole 2005).

To assist with assessing the potential impacts from climate change, the country has been divided into six hydrological zones (Figure 1 below). These hydrological zones not only reflect water management areas but have been grouped according to common climatic and hydrological characteristics (Department of Environmental Affairs 2013a). Based on a range of data and projections, four possible climate scenarios have been identified for South Africa:

- Warmer/wetter (with greater frequency in extreme rainfall events),
- Warmer/drier (with an increase in frequency of drought and somewhat increased frequency of extreme rainfall events),
- Hotter/wetter (with substantially greater frequency of extreme rainfall events), and,
- Hotter/drier (with a substantial increase in the frequency of drought events and greater frequency of extreme rainfall events).

Projections on rainfall have also been developed for each of the hydrological zones (Department of Environmental Affairs 2013a). The following four climate change scenarios have been described for the Breede-Gouritz-Berg Hydrological Zone (the dominant zone in the Western Cape) in the Department of Environmental Affairs' Long Term Adaptation Scenarios Reports. These are:

- Warmer wetter scenario - Decreased rain in autumn & increased in winter & spring
- Hotter drier scenario - Decreased rain in all seasons & strongly decreased in west
- Hotter wetter scenario - Decreased rain in autumn & increased in winter & spring
- Warmer drier scenario - Decreased rain in all seasons & strongly decreased in west

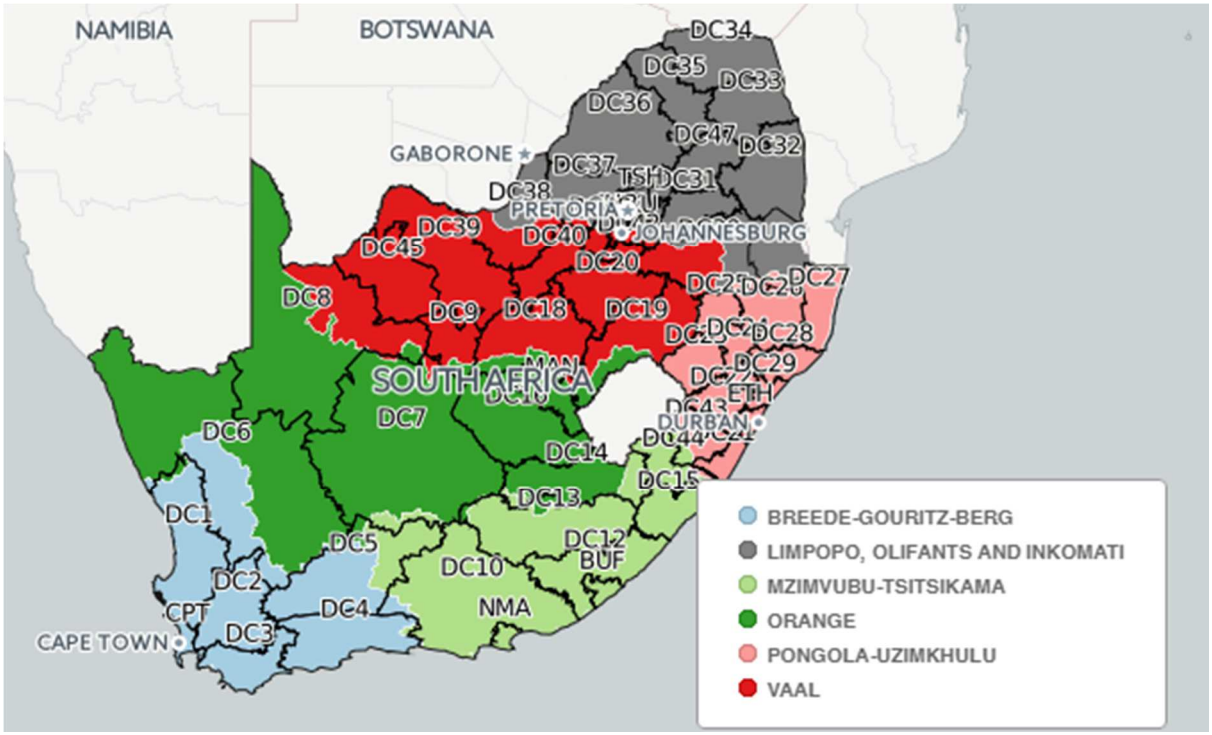

Figure 1: Hydrological Zones of South Africa

2.1.4 Provincial Climate Change Context

The Western Cape has a well-developed climate change policy environment. In 2005, the Western Cape government carried out a study titled the "Status Quo, Vulnerability and Adaptation Assessment of the Physical and Socio-economic Effects of Climate Change in the Western Cape" and in the same year, the Western Cape government signed the Montreal Accord to protect the Ozone layer (Department of Environmental Affairs and Development Planning, Western Cape 2008). The Western Cape Climate Change Strategy and Action Plan was then developed in 2008 (Department of Environmental Affairs and Development Planning, Western Cape 2008; Coastal & Environmental Services 2011). The Climate Change Strategy and Action Plan placed a lot of emphasise on adaptation to allow for developmental prioritises (Coastal & Environmental Services 2011). The Climate Change Strategy was then updated in 2014 to align with the National Climate Change Response Policy and is "geared to strategically direct and mainstream climate change actions and related issues throughout relevant Provincial transversal agendas" (Western Cape Government: Environmental Affairs and Development Planning 2014).

The province experiences drought and flood events with significant adverse impacts (Pasquini, Cowling, and Ziervogel 2013). Historically the province has been the most disaster prone in the country (Western Cape Government 2015). Increased temperatures in the future are certain for the Western Cape (Western Cape Government 2015). Rainfall projections are less certain, some projections reveal increased while others reveal decreased rainfall in the future, decreased rainfall has the most adverse impacts in comparison to increased rainfall (Western Cape Government 2015).

The City of Cape Town local sea level rise scenarios range from 2m to 6.5m (Coastal & Environmental Services 2011; Pasquini, Cowling, and Ziervogel 2013). Concerning wildfire, the frequency and intensity is expected to increase with climate change (Pasquini, Cowling, and Ziervogel 2013). The frequency and intensity of extreme events is expected to increase as well (Department of Environmental Affairs and Development Planning, Western Cape 2008).

The table below is a summary of the key climate change impacts in the province as outlined in the climate change strategy and action plan for the Western Cape.

Table 2: Climate change impacts for the Western Cape province

Change to climate variable	Vulnerability Details
Higher mean temperatures	• Increased evaporation and decreased water balance; • Increase wild fire danger (frequency and intensity).
Higher maximum temperatures, more hot days and more heat waves	• Heat stress on humans and livestock; • Increased incidence of heat-related illnesses; • Increased incidence of death and serious illness, particularly in older age groups; • Increased heat stress in livestock and wildlife; • Decreased crop yields and rangeland productivity; • Extended range and activity of some pests and disease vectors; • Increased threat to infrastructure exceeding design specifications relating to temperature (e.g. traffic lights, road surfaces, electrical equipment, etc.); • Increased electric cooling demand increasing pressure on already stretched energy supply reliability; • Exacerbation of urban heat island effect.
Higher minimum temperatures, fewer cold days and frost days	• Decreased risk of damage to some crops and increased risk to others such as deciduous fruits that rely on cooling period in autumn; • Reduced heating energy demand; • Extended range and activity of some pests and disease vectors; • Reduced risk of cold-related deaths and illnesses.
General drying trend in western part of the country	• Decreased average runoff, stream flow; • Decreased water resources and potential increases in cost of water resources; • Decreased water quality; • Decrease in shoulder season length threatening the • Western Cape fruit crops; • Increased fire danger (drying factor); • Impacts on rivers and wetland ecosystems.
Intensification of rainfall events	• Increased flooding; • Increased challenge to stormwater systems in urban settlements; • Increased soil erosion; • Increased river bank erosion and demands for protection structures; • Increased pressure of disaster relief systems; • Increased risk to human lives and health; • Negative impact on agriculture such as lower productivity levels and loss of harvest.

Change to climate variable	Vulnerability Details
Increased mean sea level and associated storm surges	• Salt water intrusion into ground water and coastal wetlands; • Increased storm surges leading to coastal flooding, coastal erosion and damage to coastal infrastructure; • Increased impact on estuaries and associated impacts on fish and other marine species.

The provincial climate change strategy also lists a number of priority responses in each of the key sectors. These are summarised in the table below

Table 3: Priority Climate Change Adaptation Responses for the Western Cape province

Adaptation Category	Adaptation Responses
Water Security and Efficiency	• Invasive alien vegetation clearing; • Prioritisation, valuation, mapping, protection, and restoration of ecological infrastructure in catchments; • Effective utilisation of irrigation water; • Resource nexus 18 decision support; • Develop ecosystem goods and services (EGS) investment opportunities.
Biodiversity and Ecosystem Goods and Services	• Prioritisation, valuation, mapping, protection, and restoration of ecological infrastructure; • Landscape initiatives/biodiversity corridors and identification of requirements for climate change adaptation corridors; • Biodiversity stewardship; • Mainstreaming of conservation planning into decision making.
Coastal and Estuary Management	• Establishment of coastal hazard overlay zones and setback lines; • Research best practice regarding responding to repeated coastal inundation in high risk areas; • Protecting and rehabilitating existing dune fields as coastal buffers / ecological infrastructure; • Monitor possible linkages between climate change and fisheries industry; • Ensure Estuary Management Plans take cognisance of climate change.
Food Security	• Farming practices that are in harmony with nature, i.e. 'conservation farming'; • Climate smart agriculture; • Agricultural water technologies that reduce consumption and increase efficiency; • Research on climate resilient and alternative crops and livestock applicable to the Western Cape; • Addressing climate vulnerability through the Municipal Support Programme; • Assessing food security in the context of the resource nexus.
Managing the effects of increased temperature on human lives	• Societal adaptation to human health impacts from temperature increases associated with climate change.

Adaptation Category	Adaptation Responses
Healthy Communities	• Monitoring health trends in relation to climate trends; • Research linkages between human health and climate change in the WC context. These include: Air quality, Water quality, Food security, Heat stress, Disease vectors

3 District Snapshot Overberg District Municipality

The Overberg District Municipality is one of five district municipalities within the Western Cape Province. The District is situated along the southern coast of the province, where the Atlantic and Indian Oceans meet. The Overberg District Municipal Area comprises of the following five local municipalities: Cape Agulhas, Overstrand, Swellendam and Theewaterskloof Local Municipality. The District Municipal Area had a total population of approximately 286,786 in 2016, which was equal to less than 5% of the Western Cape Province's total population (Overberg District Municipality 2017). The Theewaterskloof Local Municipality is home to the biggest proportion of the District's population, while the Cape Agulhas Local Municipality is home to the smallest proportion of the District's population. The majority of the District's population live in urban or peri-urban areas (Overberg District Municipality 2017).

The Long Term Adaptation Scenarios Flagship Research Programme (LTAS) has forecast that climate change is predicted to increase temperatures and rainfall variability, while decreasing the total average rainfall in the west of South Africa (Department of Environmental Affairs 2013c).

The predicted increases in mean average temperature (Figure 2) in the Overberg District Municipal Area, show that mean average temperatures are projected to increase in bands from 'low range warming' in most parts of the District to 'medium to high range warming' in the far northeast tip of the District Municipal Area (Western Cape Department of Agriculture 2017).

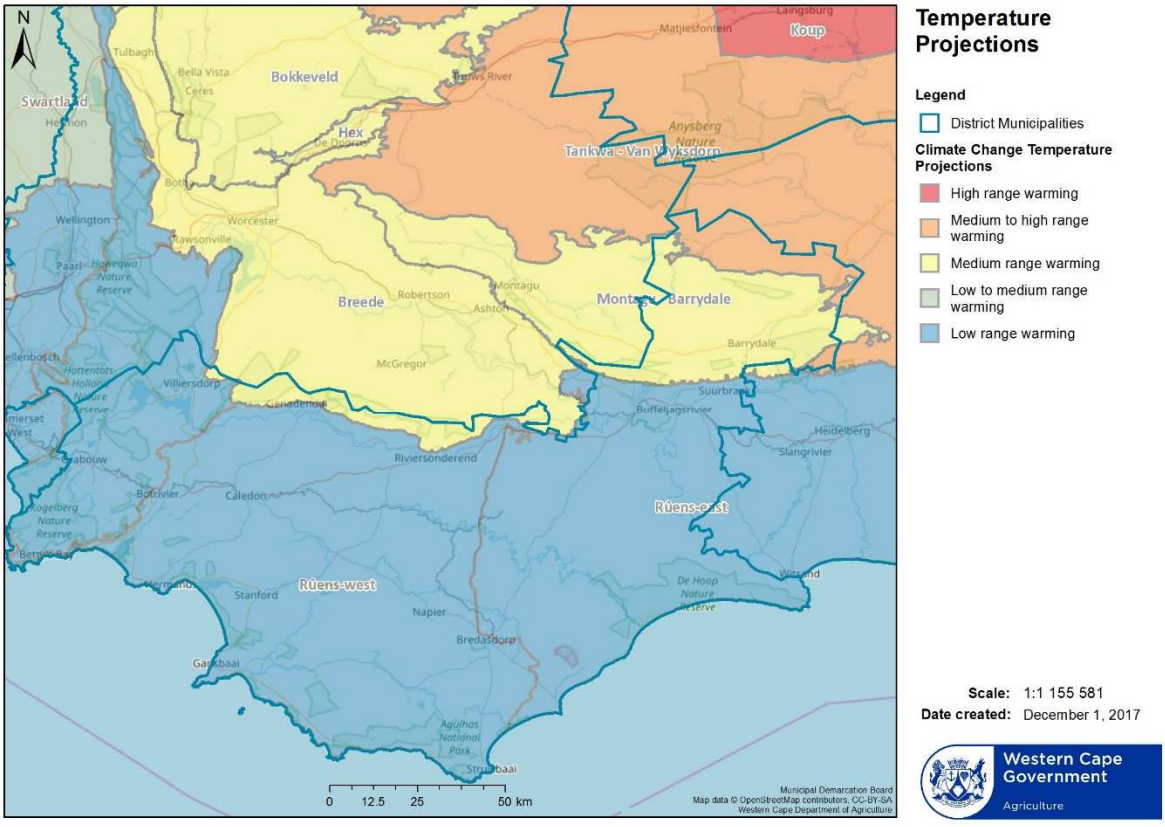

Figure 2: Temperature projections in the District Municipal Area (Western Cape Department of Agriculture 2017).

Additionally, the mean annual rainfall (average rainfall per year) is highest in the northwest of the Overberg District Municipal Area (Figure 3) and is lowest in the far north eastern tip of the District (Western Cape Department of Agriculture 2017). Mean annual rainfall in parts of the northwest areas of the District Municipality are more than double the South African average (approximately

450 millimetres per year) for mean annual rainfall (Department of Water Affairs 2013). However, if the mean annual rainfall is considered with the projected increases in average temperature, it is apparent that evaporation rates are expected to increase, which will increase water insecurity in the District Municipal Area (Western Cape Department of Agriculture 2017).

Furthermore, most of the aquifers in the Overberg District Municipal Area are already either highly or moderately vulnerable to contamination by pollution (Figure 4) (Western Cape Department of Agriculture 2017). If these aquifers were to become polluted or over-utilised, then water security in the District Municipal Area would diminish and the vulnerability of people who rely on groundwater would increase (Western Cape Department of Agriculture 2017).

In addition, groundwater quality in the Overberg District Municipal Area, in 2012, was mostly in the lower categories of electrical connectivity in the western parts of the District (Figure 5). However, groundwater in the central areas of the District Municipal Area already had very high levels of electrical connectivity (Western Cape Department of Agriculture 2017). These electrical connectivity categories represent how salty the groundwater is, which is one way of measuring the water quality in the aquifers (Western Cape Department of Agriculture 2017). The higher the level of salts in the water, the poorer the quality of the groundwater (Western Cape Department of Agriculture 2017).

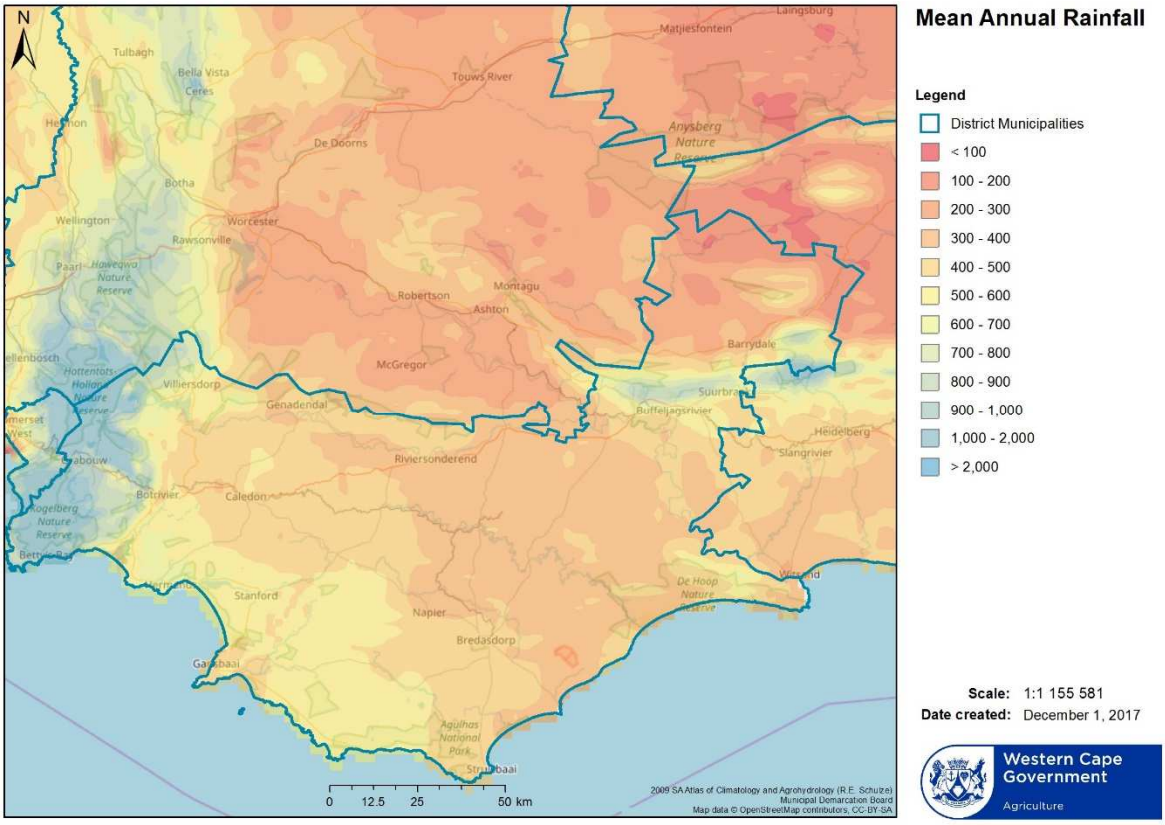

Figure 3: Mean Annual Rainfall in the District Municipal Area (Western Cape Department of Agriculture 2017)

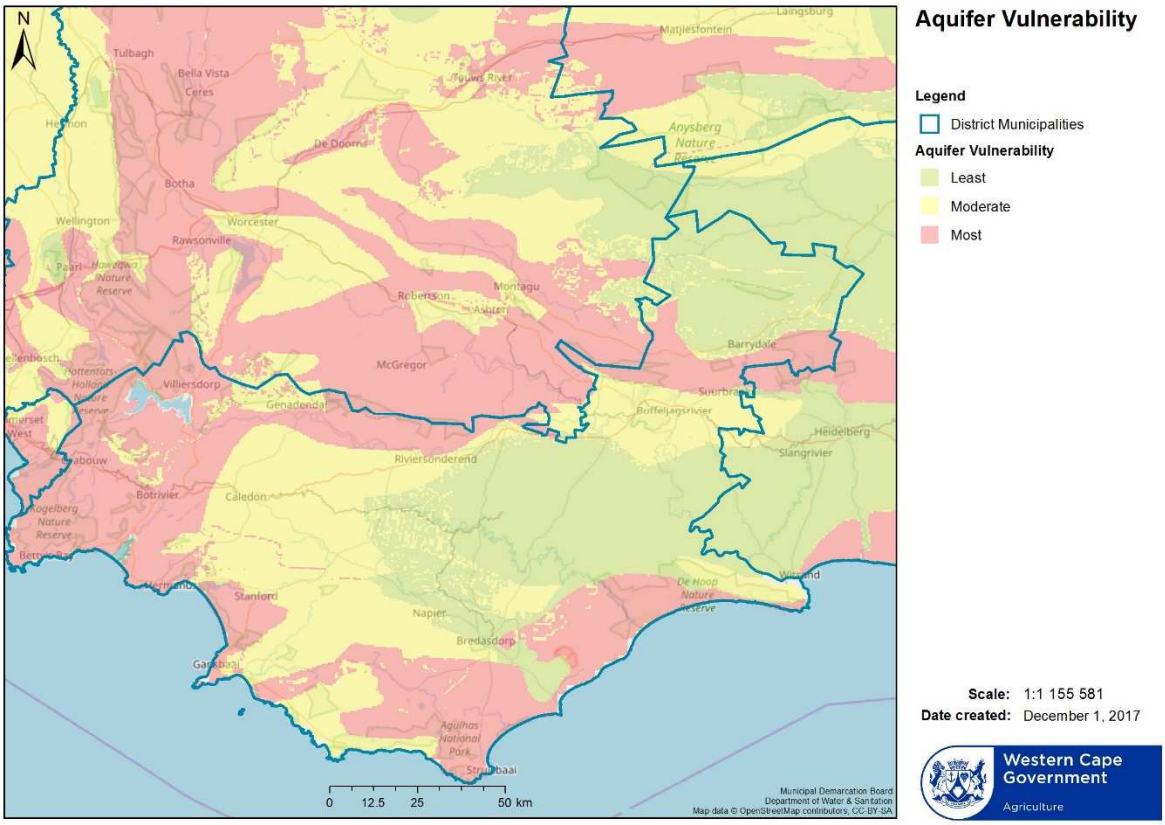

Figure 4: Aquifer vulnerability in the District Municipal Area (Western Cape Department of Agriculture 2017)

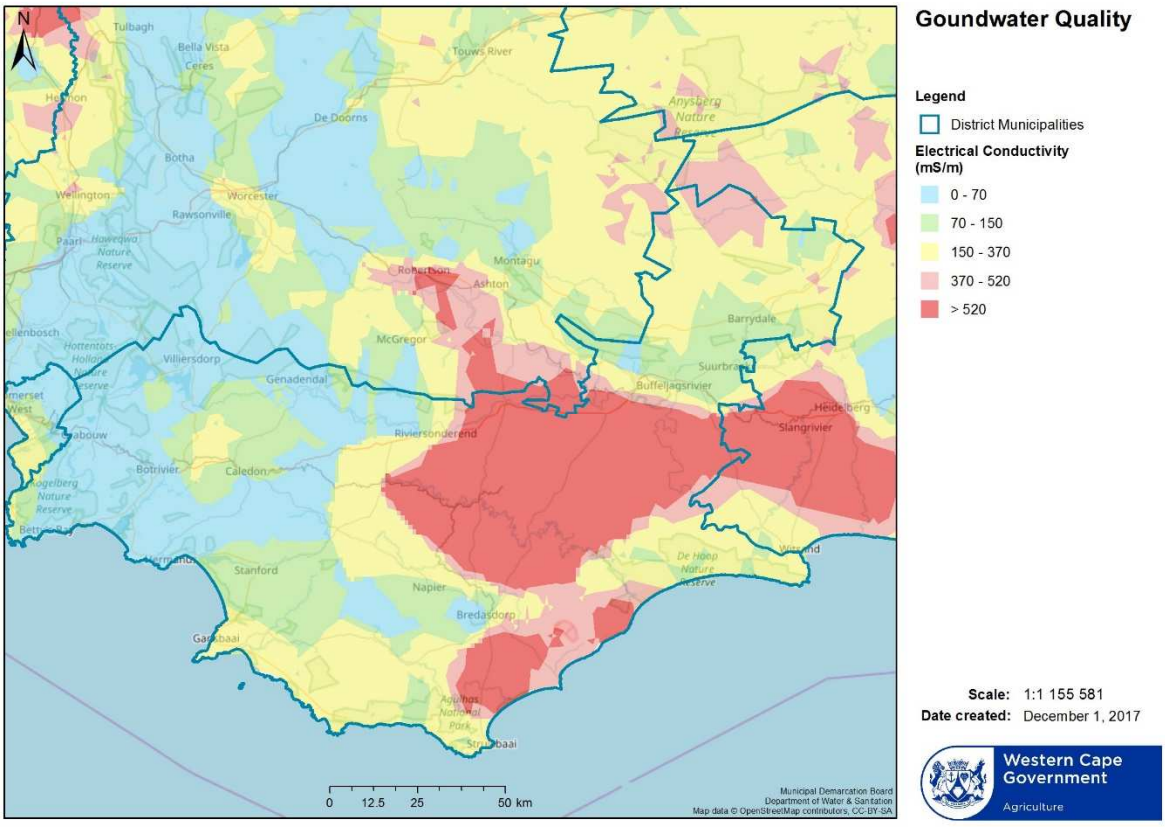

Figure 5: Groundwater quality in the District Municipal Area (Western Cape Department of Agriculture 2017)

3.1 Overberg District Municipality Framework for a Draft Climate Change Response Strategy

In the Overberg District Municipal Area, it is predicted that climate change will increase average temperatures, increase the variability of rainfall, aggravate sea level rise and related storm surges, and also exacerbate the risk and frequency of severe weather events such as floods, droughts, veld fires and damaging storms (Overberg District Municipality 2017, 2016b).

Climate change has been identified as a key issue for the Overberg District Municipality (Overberg District Municipality 2017, 2016b). In the *Overberg District Municipality 4th Generation Integrated Development Plan 2017/18 - 2021/22*, the Overberg District Municipality has stated that they have partnered with the Provincial Department of Environmental Affairs and Development Planning (DEA&DP) to produce a climate change response framework (Overberg District Municipality 2017). The climate change response framework is in the process of being finalised and approved (Overberg District Municipality 2017).

The Overberg District Municipality has stated that key barriers to responding to climate change in the Overberg District Municipal Area include a lack of capacity and financial resources as well as the difficulty in complying with existing legislation and identifying their environmental management mandate (Overberg District Municipality 2017). There is thus a need to increase institutional capacity and capacity-building at both district and local municipality levels. The Overberg District Municipality has also stressed the need for the increased mainstreaming of climate change adaptation and mitigation into municipal planning (Overberg District Municipality 2017). Furthermore, awareness campaigns and education programmes are needed, in the Overberg District Municipal Area, regarding environmental health, waste management, and climate change and its predicted effects (Overberg District Municipality 2017).

4 Vulnerability Assessment Results

The following section provides a summary of the Vulnerability Assessment conducted for Overberg District Municipality.

4.1 Agriculture

Table 4: Agriculture Vulnerability Indicator Table Overberg District Municipality

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
1	Change in grain (maize, wheat & barley) production	Areas towards the west of RSA are likely to become less suitable for grain production.	Do you grow or have potential to grow grains in your area?	Yes	TWK Swellendam Cape Agulhas	How important is grain to the local economy and livelihoods? High Priority Crop = High; Medium Priority Crop = Medium; Low/No Priority Crop = Low	High	The Overberg District Municipality is known for its barley production and accounts for 79.2% of the provincial barley production	Medium	Department of Agriculture Rural Development Smart Agri/Agri Parks District Municipalities Farmers Unions
2	Change in Sorghum production	Sorghum yields are projected to increase in parts of western KZN, inland areas of the Eastern Cape and the eastern Free State, with some areas in the north registering losses compared with present climatic conditions.	Do you grow or have potential to grow Sorghum in your area?	No		How important is sorghum to the local economy and livelihoods? High Priority Crop = High; Medium Priority Crop = Medium; Low/No Priority Crop = Low				

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
3	Change in Soya Bean Production	Areas in the east of RSA lost to potential production, with an expansion of suitable areas inland towards the central/west or RSA.	Do you grow or have potential to grow Soya Bean in your area?	No		How important is soya bean to the local economy and livelihoods? High Priority Crop = High; Medium Priority Crop = Medium; Low/No Priority Crop = Low			Medium	
4	Change in Sugarcane Production	Increase in <10% in many parts of the present cane growing areas, but by up to 30% in new growth areas further inland.	Do you grow or have potential to grow Sugarcane in your area?	No		How important is sugarcane to the local economy and livelihoods? High Priority Crop = High; Medium Priority Crop = Medium; Low/No Priority Crop = Low				

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
5	Change in viticulture (grapes) production	Areas suitable for viticulture could be substantially reduced or shift to higher altitudes and currently cooler, more southerly locations.	Do you grow or have potential to grow grapes in your area?	Yes	Overstrand Cape Agulhas	How important is viticulture (grapes) to the local economy and livelihoods? High Priority Crop = High; Medium Priority Crop = Medium; Low /No Priority Crop = Low	High	Viticulture is important for the District Municipality	Medium	Department of Agriculture Rural Development Smart Agri/Agri Parks District Municipalities Farmers Unions
6	Change in fruit production	Projected reduction of the area suitable for fruit production (e.g. 28% reduction in apple and pears) by as early as 2020.	Do you grow or have potential to grow fruit in your area?	Yes	TWK Swellendam	How important is fruit to the local economy and livelihoods? High Priority Crop = High; Medium Priority Crop = Medium; Low/No Priority Crop = Low	High	Fruit such as apples are an important commodity for the District	Medium	Department of Agriculture Rural Development Smart Agri/Agri Parks District Municipalities Farmers Unions
7	Change in other crop production areas (e.g. vegetables, nuts, etc.)	Crop production may vary depending on a warmer wetter or warmer drier climate.	Do you grow or have potential to grow other crops in your area?	Yes	TWK - Greyton Genadendal Villiersdorp Swellendam	How important are other crops to the local economy and livelihoods? High Priority Crop = High; Medium Priority Crop = Medium; Low/No Priority Crop = Low	Medium	More fruit is produced rather than vegetables. Lucerne Canola	Medium	Department of Agriculture Rural Development Smart Agri/Agri Parks District Municipalities Farmers Unions

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
8	Increased areas for commercial plantations	The total area suitable for commercial forestry plantations would increase along the eastern seaboard and adjacent areas.	Do you have or have potential for commercial forestry plantations in your area?	Yes	TWK Localised - Grabouw	Is there capacity for commercial plantation expansion (water use licence, land availability, demand for plantation products)? High Potential for Expansion = High; Medium Potential for Expansion = Medium; Low/No Potential for Expansion = Low	Medium		Medium	DAFF

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
9	Increased exposure to pests such as eldana, chilo and codling moth	Exposure to eldana would increase in areas suitable for sugarcane by ~10% to > 30%. The area subject to damage by chilo would increase substantially (sugarcane). The area subject to damage by codling moth would increase substantially (apples, pears, walnuts and quince).	Are you or will you be exposed to agricultural pests in your area?	Yes	Grabouw/Elgin Swellendam	How important are crops that are vulnerable to pests to the local economy and livelihoods? High Priority Crop = High; Medium Priority Crop = Medium; Low/No Priority Crop = Low	Medium	The current droughts in the District bring about new pest that destroy agricultural production that is already under threat to lack of water in the entire province	Medium	Department of Agriculture
10	Increased risks to livestock	Projected decreases in rainfall and hence herbage yields would result in negative health impacts for livestock.	Do you or will you have livestock in your area?	Yes	Cattle density levels are at their highest in the central areas of the District Municipality with Ostrich and Bovine in other areas of the District.	How important is livestock farming to the local economy and livelihoods? High Priority = High; Medium Priority = Medium; Low/No Priority = Low	High	Droughts impact on feed availability for livestock.	Medium	Smart Agri (DOA), Risk Register DAFF Farmers Association. DEDAT Local and District Municipalities

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
11	Reduced food security	Reduced food security, particularly of subsistence farmers, and resultant increase in malnutrition.	Do you or will you have food insecurity in your area?	Yes	Elim Genadendal Suurbraak	Percentage households involved in agricultural activities More than 20% = High; Between 20% & 10% = Medium; Less than 10% = Low	High	Recent droughts have caused food price increase with some households unable to afford to sustain their livelihoods.	Low	Agri Parks DAFF DSD

4.2 Biodiversity and Environment

Table 5: Biodiversity Vulnerability Indicator Table Overberg District Municipality

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
12	Loss of High Priority Biomes	High Priority Biomes (including Grasslands, Nama-Karoo, Indian Ocean Coastal Belt, Fynbos, Forest) to be replaced by other biomes such as savanna and desert.	Do you currently have high priority biomes in your area?	Yes	Overberg Fynbos Renosterveld Succulent Karoo	How much of this High Priority Biome will be lost due to climate change? A significant amount= High; A moderate amount= Medium; None/a low amount = Low	High	The Fynbos Biome will be reduced by the Succulent Karoo, Albany Thicket, Nama-Karoo, and Desert Biomes.	Medium	CapeNature SANBI DEA NGO's - ICLEI, ABI - KBRC SANParks Farmers SDF IDPs SD Plan

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
13	Increased impacts on threatened ecosystems	Loss of threatened ecosystems due to changes in climate.	Do you currently have threatened ecosystems in your area? (Classified as critically endangered, endangered or vulnerable)	Yes	Overberg Fynbos Renosterveld Succulent Karoo	How much of your Municipality is covered by threatened ecosystems? A significant amount= High; A moderate amount= Medium; None/a low amount = Low	High	The District is covered by a substantial number of threatened ecosystems. The 'Kogelberg Sandstone Fynbos', 'Elgin Shale Fynbos', 'Western Ruens Shale Renosterveld', 'Elim Ferricrete Fynbos', 'Overberg Sandstone Fynbos', 'Central Ruens Shale Renosterveld', 'Eastern Ruens Shale Renosterveld', 'Ruens Silcrete Renosterveld' and 'Cape Lowland Alluvial Vegetation' are all categorised as critically endangered ecosystem types	Medium	CapeNature SANBI DEA NGO's - ICLEI, ABI - KBRC Sanparks Farmers SDF IDPs SD Plan
14	Increased impacts on environment due to land-use change	Loss of biodiversity and degradation of natural habitat due to significant land use change (such as alien invasion, soil erosion and urbanisation) which impacts on ability to respond to climate change	Are you currently experiencing land use change?	Yes	Invasive alien species Development Farming Practices	Have you experienced significant loss of habitat since 1990? Above 10% = High; Between 5-10% = Medium; Under 5%= Low	High	Land use change in the District is due to increase spread of invasive alien species, land degradation, soil erosion, coastal erosion, unsustainable harvesting of natural resources, increased pollution, poor waste management, poor stormwater management, population growth, spatial development.	Medium	DEA/ Conservation Entities Municipalities - Town Planning Farmers

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
15	Loss of Priority Wetlands and River ecosystems	Changes in rainfall patterns and temperature are likely to impact on wetlands and the ecosystem services they provide.	Do you have priority wetlands and river ecosystems in your area?	Yes	Agulhas Plain Overstrand RAMSAR (De Hoop Vlei, De Mond, Bot River)	How important are wetlands and river ecosystems in providing ecosystem services in your Municipality? A significant amount= High; A moderate amount= Medium; None/a low amount = Low	High	Most wetlands in the District are classified as 'heavily to critically modified	Medium	ICLEI DEA CN SANP Municipalities Farmers NGO's - ABI

4.3 Coastal and Marine

Table 6: Coastal and Marine Vulnerability Indicator Table Overberg District Municipality

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
16	Impacts on Marine and Benthic Ecosystems	Changes in precipitation and freshwater flow; sea-level rise; increased temperatures and coastal storminess have led to changes in physical processes and biological responses which impacts marine and benthic ecosystems.	Does this or will this take place in your area?	Yes	Cape Agulhas Struisbaai - Sandy Shores Arniston Overstrand Wind-blown sand Betty's Bay / Pringle Bay	What is the Benthic Coastal Threat Status of the area? Critically Endangered and Endangered = High; Vulnerable = Medium; Least Threatened = low	High	There are several threatened ecosystem types in the coastal zone of the Overberg District Municipality Area	Medium	Municipalities DEA Nature

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
17	Impacts on estuary ecosystems	Changes in precipitation and freshwater flow; sea-level rise; increased temperatures and coastal storminess have led to changes in physical processes and biological responses which impacts on estuarine ecosystems.	Does this or will this take place in your area?	Yes	Most Estuaries Reduced flow Sand build up Mouth migration	Have estuaries in the area been modified? Critically or Seriously Modified = High; Largely or Moderately Modified = Medium; Unmodified or Natural = Low	Medium	The health condition of the estuaries in the Overberg District Municipal Area is varied. There are no estuaries in the Overberg District Municipal Area that are classified as 'unmodified, natural' or 'critically/extremely modified'	Medium	Nature Municipalities Farmers Water and Sanitation Department Western Cape Estuary Programme
18	Impacts on Coastal Livelihoods	An increase in the intensity and frequency of extreme weather events is likely to impact on fishing activity by reducing the number of viable sea fishing days, affecting catches.	Does this or will this take place in your area?	Yes	Fishery communities Arniston/Struisbaai Gansbaai Buffeljadits Hawston Kleinmond	How important is fishing to the local economy and livelihoods? High Priority = High; Medium Priority = Medium; Low/No Priority = Low	High	Increased climate change will impact on those dependent on coastal economies.	Medium	Municipalities DEA - Oceans of coast DAFF

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
19	Loss of land due to sea level rise	Increased loss of land due to sea level rise and storm surges	Does this or will this take place in your area?	Yes	Struisbaai Cape Agulhas Agulhas Plain Heuningnes System	Do you have significant areas below 5m elevation? Significant areas = High; Some areas = Medium; Few or no areas = Low	High	At 260 km2 in total, the Overberg District Municipal Area contains the second largest area of coastal land with less than a 5.5 m elevation in South Africa	Medium	Cape Agulhas DEA DAFF Land Owners
20	Increased damage to property from sea level rise	Increased damage to property and damage to infrastructure (including coastal roads and railways, small fishing ports and harbours, and critical infrastructure such as Koeberg nuclear power station) as a result of rising sea-levels and storm surges.	Does this or will this take place in your area?	Yes	Cape Agulhas Overstrand Erosion Windblown Sand	Do you have significant areas below 5m elevation? Significant areas = High; Some areas = Medium; Few or no areas = Low	High	Coastal property along the coast line is bound to be damaged due to sea level rise.	Medium	Cape Agulhas DEA DAFF Land Owners

4.4 Human Health

Table 7: Health Vulnerability Indicator Table Overberg District Municipality

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
21	Health impacts from increased storm events	Increased storms will result increased risk of drowning, injuries and population displacement impacts.	Are you or will you experience increased storm events in your area?	No		How populated are areas vulnerable to storms events (e.g. flood zones)? Densely populated = High; Partially populated = Medium; Sparsely or not populated = Low				
22	Increased heat stress	Increases in average temperatures and extreme events (such as heat waves) are projected to induce heat stress, increase morbidity, and result in respiratory and cardiovascular diseases.	Are you or will you experience increased heat waves in your area?	Yes	Grootstrand Elderly concentrated	Is there a high percentage of young and elderly in the area? More than 20% = high; Between 15% & 20% = Medium; Less than 15% = low	Medium	The young (<5yrs age group) and elderly (>64yrs age group) constitute 17.17% of the total population	Medium	District and local Municipalities Department of Health Disaster Management

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
23	Increased vector borne diseases from spread of mosquitoes, ticks, sandflies, and blackflies	Vector borne diseases such as malaria is projected to spread within regions bordering current malaria areas, which are presently too cold for transmission.	Are vector borne diseases present or likely in your area?	No		Are you in or neighbouring an area with vector borne diseases (e.g. malaria)? Already in a vector borne disease area = High; Neighbouring a vector borne disease area = Medium; Not near a vector borne disease area = Low				
24	Increased water borne and communicable diseases (e.g. typhoid fever, cholera and hepatitis)	Favourable conditions for the incubation and transmission of waterborne diseases may be created by increasing air and water temperatures.	Are waterborne and communicable diseases present or likely in your area?	Yes	Overberg District	Have you had an incidence of waterborne and communicable diseases (e.g. typhoid fever, cholera and hepatitis) in the past 3 years Yes = High: No = Low	Low	6.41% of the Overberg District Municipal Area's households do not source water from piped water schemes and are vulnerable to waterborne diseases.	Medium	District Municipality, Municipality Health DWS

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
25	Increased malnutrition and hunger as a result of food insecurity	Climate Change will affect food systems, compromising food availability, access and utilisation, leading to food insecurity (particularly of subsistence farmers).	Do you or will you have food insecurity in your area?	Yes	Overberg Genadendal Suurbraak Elim	Child under 5 years severe acute malnutrition case fatality rate More than 10% = high; Between 5% & 10% = Medium; Less than 5% = low	Low	0% malnutrition cases during the 2015/16 period for the Overberg District.	High	Department of Social Development DAFF Municipalities
26	Increased air pollution	Health impacts in resulting from exposure to air pollutants include eye irritation, acute respiratory infection, chronic respiratory diseases and TB, and sometimes death.	Do you or will you have air pollution in your area?	Yes	Farming areas Crap spraying - pollen Blue gums/Fynbos/Canola	Would you consider your area a high priority in terms of air pollution (e.g. SAAQIS Priority Areas)? Yes = High; Somewhat = Medium; No = Low	Medium	Various farming activities within the District contribute to increased air pollution.	Medium	Department of Health District Municipality DAFF

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
27	Increased Occupational health problems	Temperature is a common climatic factor that affects occupational health (for example, agricultural labourer's productivity) by causing heat stress and dehydration.	Do people work outside or are in conditions that cannot be cooled in your area?	Yes	All farming communities	Do a significant percentage of people work outside or are in conditions that cannot be cooled? Significant = High; Some = Medium; Low/No = Low	Medium	15.8% of the working population are employed within the informal sector, exposed to extreme weather conditions.	Medium	Department of Labour DAFF Rural Development Agriculture

4.5 Disaster Management, Infrastructure and Human Settlements

Table 8: Disaster Management, Infrastructure and Human Settlements Vulnerability Indicator Table Overberg District Municipality

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
28	Loss of industrial and labour productivity	Direct impacts of weather on construction, electricity generation and other industries, resulting in loss of productivity.	Do you have industrial activities in your area?	No	Small industries locally	How significant is the Mining/Industrial/Manufacturing sector for the local economy? Significant = High; Somewhat = Medium; Low/No = Low				
29	Increased impacts on strategic infrastructure	Increased disruptions to key strategic infrastructure (e.g. WWTW, storm water, roads, rail, bridges) as a result of extreme weather events.	Do you have strategic infrastructure in your area?	Yes	There are several strategic infrastructures found within the District Municipality	How important is this strategic infrastructure to the functioning of your municipality? Significant amount = High; Moderate amount = Medium; Minimal or no = Low	Medium	N2, R43 and R44 Air Force base in Overberg Two harbours	Medium	Defence District and its local municipalities Disaster Management Town planners

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
30	Increased impacts on traditional and informal dwellings	Increased risk of extreme weather events to already vulnerable traditional and informal dwellings, that are often unplanned, and without extensive service or infrastructure.	Do you have traditional and informal dwellings in your area?	Yes	In all towns TWK - Grabouw	What percentage of households are in traditional and informal dwellings in your area? More than 15% = high; Between 15% & 10% = Medium; Less than 10% = low	Low	14.2% of the dwellings are informal	Medium	Municipalities Department of Rural Development and Land Reform
31	Increased isolation of rural communities	Physical isolation of rural communities as a result poor rural roads and increased flooding and erosion.	Do you have isolated rural communities in your area?	No		Is your area predominantly Rural? Mostly Rural = High Equally Urban and Rural = Medium Mostly Urban = Low				
32	Increased migration to urban and peri-urban areas	Increased migration from rural settlements to urban and peri-urban settlements.	Do you have rural urban migration in your area?	Yes	TWK - Grabouw	Is there a strong rural economy? Low opportunities in rural areas = High; Some opportunities in rural areas = Medium; Strong rural economy = Low	Medium	83% of the population resides in the major towns of the District: Hermanus, Caledon, Bredasdorp, Grabouw and Swellendam.	Medium	Human Settlements Department, Department of Economic Development Tourism sector Rural Development

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
33	Increased risk of wildfires	Increased risk of wildfires linked to higher ambient temperatures, dry spells and more frequent lightning storms.	Is this or will this take place in your area?	Yes	Increased biomass due to invasive species High wind Dry periods	What is the Veld Fire Risk Status of the area? Extreme or High = High; Medium; Low	High	The Districts' veld fire risk is high. Veld fire prevalence is high during the summer months in the district.	Medium	District Municipality Farmers C Nature DEA and DP Disaster Management
34	Decreased income from tourism	Reduced income from tourism as a result of reduced recreational opportunities and increased impact on tourism-supporting infrastructure, such as conservation area access roads.	Do you have tourism assets that can be impacted by climate change in your area?	Yes	Coastal areas Coastal flats Catchments - flooding	How significant is tourism to the local economy? Significant contributor = High; Some contribution = Medium; Low/No contribution = Low	Medium	There are numerous tourist attractions are within the District because of its cosmic and dramatic landscapes	Medium	Municipalities DEA and DP Department of Economic Development and Tourism LTO's

4.6 Water

Table 9: Water Vulnerability Indicator Table Overberg District Municipality

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
35	Decreased quality of drinking water	Deterioration in water quality due to increased salt concentrations in dams, wetlands and soil/plant systems from enhanced evaporation rates.	Is this or will this take place in your area?	Yes	Cape Agulhas Coastal Plains	What is the Blue Drop Score for the area (2012 Report)? Less than 50% = high; Between 50% & 90% = Medium; More than 90% = low	Medium	2014 Blue drop scores for the Districts' local municipalities: Cape Agulhas Local Municipality scored 86.64%, The Overstrand Local Municipality scored 96.82%, the Swellendam Municipality scored 85.16% and the Theewaterskloof Local Municipality scored 71.50%.	Medium	Cape Agulhas Municipality DWA Overberg District Municipality
36	Decreased water quality in ecosystem due to floods and droughts	More frequent floods result in increased effluent overflow into rivers. Increased drought means less water is available to dilute wastewater discharges and irrigation return flows to rivers.	Is this or will this take place in your area?	Yes	Rivers - (Swellendam, TWK) Estuaries (Overstrand)	What is the Green Drop Score for the area? Less than 50% = high; Between 50% & 90% = Medium; More than 90% = low	Medium	2011 Green Drop scores of each local municipality within the Overberg District Municipality: The Cape Agulhas Local Municipality scored 51.90%, the Overstrand Local Municipality scored 43.30%, the Swellendam Municipality scored 26.60% and the Theewaterskloof Local Municipality scored 31.20%	Medium	The District and local municipalities Water and Sanitation BGCMA Coastal Areas

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
37	Less water available for irrigation and drinking	Increased periods of drought mean less water is available.	Is this or will this take place in your area?	Yes	TWK - Dam 25% All dams	Years of drought over the past 20 years More than 7 incidence = High; Between 7 & 2 incidence = Medium; Less than 2 incidence = Low;	High	The entire Western Cape is and has been experiencing severe drought cases.	Low	Municipalities CMA Water and Sanitation DAFF
38	Increased impacts of flooding from litter blocking storm water and sewer systems	Human health and ecosystem impacts, associated with increased rainfall intensities, flash floods and regional flooding resulting in litter and washed-off debris blocking water and sanitation systems.	Is this or will this take place in your area?	Yes	Mostly in towns.	Percentage of Households using no rubbish disposal More than 10% = High; Between 10% & 5% = Medium; Less than 5% = Low	Low	84.06% of households have their refuse removed by local authority/private company in the Overberg District Municipal Area	Medium	All Municipalities and District Municipality

No	Indicator Title	Indicator Description	Exposure Question	Exposure Answer	Exposure Comment	Sensitivity Question	Sensitivity Answer	Sensitivity Comment	Adaptive Capacity Answer	Adaptive Capacity Comment
39	Increased fish mortality	Increased freshwater fish mortality due to reduced oxygen concentrations in aquatic environments and mortality of temperature-sensitive fish species.	Do you have fresh water fish in your area?	No	Not experienced to date.	How significant is fresh water fish to livelihoods? Significant to livelihoods = High; Some dependence = Medium; Low/No dependence = Low				

4.7 Vulnerability Assessment Summary

The tables below list the high and medium priority climate change indicators for the municipality.

4.7.1 High Priority Climate Change Indicators

Based on the above vulnerability assessment the following indicators were identified as high priority climate change vulnerabilities for the municipality. These were shortlisted by answering "yes" to exposure, "high" to sensitivity and "low" to adaptive capacity.

Table 10: High Priority Indicators Overberg District Municipality

No	Sector	Indicator Title	Exposure Answer	Sensitivity Answer	Adaptive Capacity Answer
11	Agriculture	Reduced food security	Yes	High	Low
37	Water	Less water available for irrigation and drinking	Yes	High	Low

4.7.2 Medium Priority Climate Change Indicators

Based on the above vulnerability assessment the following indicators were identified as medium priority climate change vulnerabilities for the municipality. These were shortlisted by answering "yes" to exposure, "medium" or "high" to sensitivity and "low" or "medium" to adaptive capacity.

Table 11: Medium Priority Indicators Overberg District Municipality

No	Sector	Indicator Title	Exposure Answer	Sensitivity Answer	Adaptive Capacity Answer
1	Agriculture	Change in grain (maize, wheat & barley) production	Yes	High	Medium
5	Agriculture	Change in viticulture (grapes) production	Yes	High	Medium
6	Agriculture	Change in fruit production	Yes	High	Medium
7	Agriculture	Change in other crop production areas (e.g. vegetables, nuts, etc.)	Yes	Medium	Medium
8	Agriculture	Increased areas for commercial plantations	Yes	Medium	Medium
9	Agriculture	Increased exposure to pests such as eldana, chilo and codling moth	Yes	Medium	Medium
10	Agriculture	Increased risks to livestock	Yes	High	Medium

No	Sector	Indicator Title	Exposure Answer	Sensitivity Answer	Adaptive Capacity Answer
12	Biodiversity and Environment	Loss of High Priority Biomes	Yes	High	Medium
13	Biodiversity and Environment	Increased impacts on threatened ecosystems	Yes	High	Medium
14	Biodiversity and Environment	Increased impacts on environment due to land-use change	Yes	High	Medium
15	Biodiversity and Environment	Loss of Priority Wetlands and River ecosystems	Yes	High	Medium
16	Coastal and Marine	Impacts on Marine and Benthic Ecosystems	Yes	High	Medium
17	Coastal and Marine	Impacts on estuary ecosystems	Yes	Medium	Medium
18	Coastal and Marine	Impacts on Coastal Livelihoods	Yes	High	Medium
19	Coastal and Marine	Loss of land due to sea level rise	Yes	High	Medium
20	Coastal and Marine	Increased damage to property from sea level rise	Yes	High	Medium
22	Human Health	Increased heat stress	Yes	Medium	Medium
24	Human Health	Increased water borne and communicable diseases (e.g. typhoid fever, cholera and hepatitis)	Yes	Low	Medium
25	Human Health	Increased malnutrition and hunger as a result of food insecurity	Yes	Low	High
26	Human Health	Increased air pollution	Yes	Medium	Medium
27	Human Health	Increased Occupational health problems	Yes	Medium	Medium
29	Human Settlements, Infrastructure and Disaster Management	Increased impacts on strategic infrastructure	Yes	Medium	Medium
30	Human Settlements, Infrastructure and Disaster Management	Increased impacts on traditional and informal dwellings	Yes	Low	Medium
32	Human Settlements, Infrastructure and Disaster Management	Increased migration to urban and peri-urban areas	Yes	Medium	Medium
33	Human Settlements, Infrastructure and Disaster Management	Increased risk of wildfires	Yes	High	Medium

No	Sector	Indicator Title	Exposure Answer	Sensitivity Answer	Adaptive Capacity Answer
34	Human Settlements, Infrastructure and Disaster Management	Decreased income from tourism	Yes	Medium	Medium
35	Water	Decreased quality of drinking water	Yes	Medium	Medium
36	Water	Decreased water quality in ecosystem due to floods and droughts	Yes	Medium	Medium
38	Water	Increased impacts of flooding from litter blocking storm water and sewer systems	Yes	Low	Medium

4.8 Biodiversity and Environment

4.8.1 Introduction

Programme Name
Biodiversity and Environment Sector Adaptation to Climate Change
Overview of Key Issues
Biodiversity is crucial to ecosystem health, and healthy ecosystems are central to human well-being. Healthy ecosystems interlinked with working landscapes and other open spaces form the ecological infrastructure of the country and are the foundation for clean air and water, fertile soil and food. All South Africans depend on healthy ecosystems for economic and livelihood activities, including agriculture, tourism and a number of income generating and subsistence level activities. These natural ecosystems are under pressure from land use change and related processes causing degradation, as well as invasive alien species. Accelerated climate change (resulting in increasing temperature, rising atmospheric CO2 and changing rainfall patterns) is exacerbating these existing pressures. Well-functioning ecosystems provide natural solutions that build resilience and help society adapt to the adverse impacts of climate change. This includes, for example, buffering communities from extreme weather events such as floods and droughts, reducing erosion and trapping sediment, increasing natural resources for diversifying local livelihoods, providing food and fibre, and providing habitats for animals and plants which provide safety nets for communities during times of hardship. Sustainably managed and/or restored ecosystems help in adapting to climate change at local or landscape level. In the Western Cape the current priority areas have been identified in the WCCCRS for the biodiversity and ecosystem goods and services sector 1. Prioritisation, valuation, mapping, protection, and restoration of ecological infrastructure; 2. Landscape initiatives / biodiversity corridors and identification of requirements for climate change adaptation corridors; 3. Biodiversity stewardship; and 4. Mainstreaming of conservation planning into decision making. Furthermore, the following opportunities, gaps and recommendations have been identified in the Western Cape Climate Change Response Strategy Biennial Monitoring & Evaluation Report 2015/16 (Birch et al., n.d.) for the biodiversity and ecosystem goods and services sector: 1. Better data sharing is needed between government entities 2. Finding comprehensive information on the numbers/hectares of aliens cleared is problematic 3. Informally protected areas are hard to track, as the data is often patchy or outdated. 4. Set fact-based climate change targets for this focus area. 5. There is a need to expand the conservation estate within these corridors.

	6. Local community stewardship over corridors and unprotected areas should be promoted.
	Objectives
	The following objectives have been identified through the LGCCSP as priority area for the Biodiversity and Environment sector in the District Municipality
13	Manage Increased impacts on threatened ecosystems
14	Manage Increased impacts on environment due to land-use change

4.8.2 Responses

No	Objective	Project	Priority	Activity Manager	Annual Target	Q1 Target	Q2 Target	Q3 Target	Q4 Target	Budget
13	**Manage Increased impacts on threatened ecosystems**	Town Planning Department in the LMs to be guided by existing information provided by WC Biodiversity Spatial Plan on Critical Biodiversity Area (CBA) and ensure appropriate development takes place on an ongoing basis.	Priority			25%	50%	75%	100%	TBC
14	**Manage Increased impacts on environment due to land-use change**	Standard environmental approval linked to agricultural use needs to take the impact of climate change into account (DM and LMs are a commenting authority for EIAs).				25%	50%	75%	100%	TBC
		Town Planning Department in LMs to consider appropriate development parameters specifically in relation to land reclamation from water bodies on an ongoing basis.	Priority			25%	50%	75%	100%	TBC
		Rehabilitation of degraded natural areas or old / abandoned farmland, replanting of indigenous forests / vegetation.				25%	50%	75%	100%	TBC
		Identifying land that could be used for solar and wind installations.				25%	50%	75%	100%	TBC

4.9 Coastal and Marine

4.9.1 Introduction

Programme Name
Coastal and Marine Sector Adaptation to Climate Change
Overview of Key Issues
Climate change will affect the Coastal and Marine Environment, having various impacts on productivity and diversity of South Africa's coastal, marine and estuarine ecosystems. A changing climate is likely to result in changes in species availability and distribution impacting largely on fisheries. This could result in significant adverse impacts on subsistence fishing markets, community livelihoods as well as commercial industries. Changes in sea surface temperature, rising sea levels and increasing storm frequency will have adverse effects on coastal communities and infrastructure. To develop appropriate adaptation responses a more nuanced understanding of the challenges and options for the Coastal and Marine Sector is required, building on the insights of the existing coastal and marine plans. This understanding needs to consider the importance of associated ecological infrastructure in sustaining local economies and livelihoods as well and building resilient communities. In the Western Cape the current priority areas have been identified in the WCCCRS for the coastal sector 5. Establishment of coastal risk overlays and coastal management lines; 6. Research best practice regarding responding to repeated coastal inundation in high risk areas; 7. Protecting and rehabilitating existing dune fields as coastal buffers /ecological infrastructure; 8. Monitor possible linkages between climate change and fisheries industry; and 9. Ensure Estuary Management Plans take cognisance of climate change Furthermore, the following opportunities, gaps and recommendations have been identified in the Western Cape Climate Change Response Strategy Biennial Monitoring & Evaluation Report 2015/16 (Birch et al., n.d.) for the coastal sector: 1. Case studies and cost benefit analyses on optimal approaches to coastal protection should be developed for the Western Cape. 2. Fact-based climate change targets for this focus area need to be set out. 3. A better understanding of the fisheries sector and the impact of climate change on the sector in the Western Cape is required. 4. Monitoring standards need to be implemented for estuaries, possibly through the incorporation of a monitoring and evaluation component in all EMPs.
Objectives

	The following objectives have been identified through the LGCCSP as priority areas for the Coastal and Marine sector in the District Municipality.
19	Manage loss of land due to sea level rise
20	Manage increased damage to property from sea level rise
57	Manage Increased damage to property and loss of land from sea level rise
58	Manage increased impacts on Marine, Coastal and Estuary Ecosystems

4.9.2 Responses

No	Objective	Project	Priority	Activity Manager	Annual Target	Q1 Target	Q2 Target	Q3 Target	Q4 Target	Budget
19	**Manage loss of land due to sea level rise**	Develop and implement coastal management programme and get feedback on roles and responsibilities linked to CMP. Lines then to be incorporated into SDFs.	Priority			25%	50%	75%	100%	TBC
20	**Manage increased damage to property from sea level rise**	Disaster Management to Identify key infrastructure and communities under threat from extreme coastal events and include coastal precautionary zones in the Disaster Management Plan and District and Local SDFs.	Priority			25%	50%	75%	100%	TBC
		Incorporate climate change into harbour Spatial Economic Development Frameworks.				25%	50%	75%	100%	TBC
57	**Manage Increased damage to property and loss of land from sea level rise**	Town planning in the LMs to incorporate coastal management lines and flood lines in the SDF on ongoing basis.	Priority			25%	50%	75%	100%	TBC
58	**Manage increased impacts on Marine, Coastal and Estuary Ecosystems**	Wetland / flood plain / estuary / kelp beds / dune cordon rehabilitation on municipal owned land				25%	50%	75%	100%	TBC

4.10 Human Health

4.10.1 Introduction

	Programme Name
	Human Health Sector Adaptation to Climate Change
	Overview of Key Issues
	South Africa faces complex and pressing public health challenges exacerbated by adverse socio-economic conditions including dense informal settlements which constrain effective service delivery. These health challenges include a disease complex with the highest global prevalence of Human Immunodeficiency Virus (HIV) and tuberculosis (TB), complicated by water-borne and chronic respiratory disease. Under-nutrition and socio-economic stress are important contributors to poor human resilience and contribute to conditions that facilitate the emergence and propagation of disease. Malnutrition and disease interact strongly, and there is a key relationship between environmental quality, food security, and the disease burden of communities. Adaptation to the potential effects of climate change on human health is viewed in this context. However, significant knowledge and information gaps are preventing well supported quantitative projections of human health impacts in South Africa. In the Western Cape, the current priority area has been identified in the WCCCRS for the human health sector 1. Monitoring health trends in relation to climate trends, including the linkages between human health and climate change in the Western Cape context. Furthermore, the following opportunities, gaps and recommendations have been identified in the Western Cape Climate Change Response Strategy Biennial Monitoring & Evaluation Report 2015/16 (Birch et al., n.d.) for the health sector: 1. Develop a Climate Change Response Plan for the Health sector in the Western Cape aligned with the national responses. 2. Collaborate across sectors for specific groups of vulnerable people who will be impacted by specific climate change impacts 3. Co-ordinate integrated plans and health surveillance with the Western Cape Disaster Management Centre. 4. Continue to partner with research organisations and entities to undertake critical research and surveillance and monitoring as identified in the Health Climate Change Response Plan.
	Objectives
21	The following objectives have been identified through the LGCCSP as priority areas for the Health sector in the District Municipality. Manage health impacts from increased storm events.

22	Manage the impacts of increased heat stress.
23	Manage the increasing vector borne diseases from spread of mosquitoes, ticks, sandflies, and blackflies.
26	Manage health impacts of increased air pollution.

4.10.2 Responses

No	Objective	Project	Priority	Activity Manager	Annual Target	Q1 Target	Q2 Target	Q3 Target	Q4 Target	Budget
21	**Manage health impacts from increased storm events.**	Increase the capacity of stormwater systems.				25%	50%	75%	100%	TBC
		Disaster Management in collaboration with LMs and others to map areas that are at high risk from fires, flooding, extreme winds, sea level rise / sea storm surge on an annual basis.	Priority			25%	50%	75%	100%	TBC
22	**Manage the impacts of increased heat stress.**	District DSM and Municipal Health to develop and implement an awareness raising program on health impacts from extreme weather events.				25%	50%	75%	100%	TBC
23	**Manage the increasing vector borne diseases from spread of mosquitoes, ticks, sandflies, and blackflies.**	Research and increase medical preparedness and rapid response as well as general awareness on potential changes in disease incidence / vectors due to climate changes.				25%	50%	75%	100%	TBC
26	**Manage health impacts of increased air pollution.**	Develop and implement air quality management plans that take climate change into account (incl. dust reduction; air quality monitoring; enforce strict emissions standards for all industrial development; air quality public awareness campaigns; emission monitoring and reporting; clarify roles and responsibilities between departments/ spheres of government).				25%	50%	75%	100%	TBC

4.11 Disaster Management, Infrastructure and Human Settlements

4.11.1 Introduction

	Programme Name
	Human Settlements, Infrastructure and Disaster Management Sector Adaptation to Climate Change
	Overview of Key Issues
	South Africa is a diverse country, not just in terms of populations and biodiversity, but also in terms of its human settlements. These settlements face severe challenges, even before climate change is taken into account. The implications of the compounding impacts of climate change will be profound, and human settlements therefore represent a crucial part of national adaptation strategies. The overarching strategic framework for the development of human settlements is described in the National Development Plan (NDP) and, more specifically in relation to the implications for climate change, in the National Climate Change Response (NCCR). However, to develop appropriate adaptation responses a more nuanced understanding of the challenges and options for human settlements is required, building on the insights of the NCCR. This understanding needs to take into account the unusually diverse urban forms of human settlement in the South African context, and the importance of ecological infrastructure in supporting service delivery and building resilient communities. In the Western Cape the current priority areas have been identified in the WCCCRS for the human settlements sector 1. Mainstreaming climate change into human settlement developments; 2. Implementation of energy efficiency interventions in low income houses and communities; and 3. Improving the resilience and adaptive capacity of informal settlements. Furthermore, the following recommendation has been identified in the Western Cape Climate Change Response Strategy Biennial Monitoring & Evaluation Report 2015/16 (Birch et al., n.d.) for the human settlements sector for the province: 1. Clearer understanding of what resilience means for humans settlements.
	Objectives
	The following objective has been identified through the LGCCSP as a priority area for the Disaster Management, Infrastructure and Human Settlements sector in the District Municipality.
29	Manage potential increased impacts on strategic infrastructure.
30	Manage increased impacts on traditional and informal dwellings

33	Manage potential increased risk of wildfires
56	Manage Increased impacts on infrastructure

4.11.2 Responses

No	Objective	Project	Priority	Activity Manager	Annual Target	Q1 Target	Q2 Target	Q3 Target	Q4 Target	Budget
29	**Manage potential increased impacts on strategic infrastructure.**	Update standards for at-risk infrastructure (may need to prepare the necessary paperwork / permissions beforehand in order to act when the opportunity presents itself). Include increased flood risk in the management / design parameters of wastewater treatment works.				25%	50%	75%	100%	TBC
		Update engineering specifications for road surface and bridge specifications to deal with flooding and higher temperatures (consider alternative heat-resistant paving materials); update building regulations; and, include climate change resilience into tendering documents for all infrastructure (incl. planning for wind, increased temperatures, flooding, droughts, etc.).				25%	50%	75%	100%	TBC
		Consider moving line infrastructure underground where appropriate.				25%	50%	75%	100%	TBC
		Relocate infrastructure away from flood plains / areas prone to flooding / other risk areas (e.g. estuaries), instead of rebuilding / exposed to coastal processes (incl. storm surge, sea level rise, sand movement), e.g. sewage pump stations, Hermanus (Incl. coastal retreat).				25%	50%	75%	100%	TBC
		Decentralise strategic infrastructure.				25%	50%	75%	100%	TBC
		Replace damaged / destroyed infrastructure with more climate change resilient infrastructure that will require less maintenance / replacement in future.				25%	50%	75%	100%	TBC
		Build defensive infrastructure (e.g. sea-walls, groynes, barrages and barriers, dolosse and gabions, offshore reefs, stabilise river banks, etc.) with the understanding that this is only appropriate in specific situations.				25%	50%	75%	100%	TBC

No	Objective	Project	Priority	Activity Manager	Annual Target	Q1 Target	Q2 Target	Q3 Target	Q4 Target	Budget
		Increased road maintenance.				25%	50%	75%	100%	TBC
		Technical Services in LMs to compile and implement a stormwater system maintenance plan (if not in existence) that take into account new risks from climate change on an annual basis.	Priority			25%	50%	75%	100%	TBC
		Continued maintenance of hard defensive structures.				25%	50%	75%	100%	TBC
		Ensure trees are trimmed and planted away from overhead line structures.				25%	50%	75%	100%	TBC
		Assess existing dams for vulnerability to flooding.				25%	50%	75%	100%	TBC
		Assess transport infrastructure to identify priority areas for interventions to reduce climate change risk.				25%	50%	75%	100%	TBC
		Develop and implement regional transport management plan.				25%	50%	75%	100%	TBC
30	**Manage increased impacts on traditional and informal dwellings**	Disaster Management Unit to draft a report on increased risk from intense weather events (heat waves, rainfall, fires) in informal shack dwellings within urban area on an annual basis.	Priority			25%	50%	75%	100%	TBC
33	**Manage potential increased risk of wildfires**	LMs to develop Alien Control Plans for Municipal Owned Lands, that include general alien clearing and clearing of fire-prone alien plant species.	Priority			25%	50%	75%	100%	TBC
		Improve awareness raising and mainstreaming of fire and flood awareness through municipal communications platforms.	Priority			25%	50%	75%	100%	TBC
56	**Manage Increased impacts on infrastructure**	Make use of green building technology/ techniques such as passive design, alternative building materials, etc.				25%	50%	75%	100%	TBC
		Upgrade infrastructure to be hazard resistant (e.g. raised electrical boxes at camp sites).				25%	50%	75%	100%	TBC

4.12 Water

4.12.1 Introduction

Programme Name
Water Sector Adaptation to Climate Change
Overview of Key Issues
South Africa's climate is generally arid to semi-arid, with less than 9% of annual rainfall ending up in rivers, and only about 5% recharges groundwater in aquifers. In addition, rainfall and river flow are unpredictable in time and unevenly distributed in space, with only 12% of the land area generating 50% of stream flows. Decadal rainfall variability also results in extended dry and wet periods across the country. The main users of surface water resources are agricultural irrigation, domestic, industrial, mining and power generation, while plantation forestry intercepts and reduces runoff before it reaches the rivers and groundwater. Surface water resources were already over-allocated by the year 2000 in five of nineteen water management areas historically used for water planning and management purposes. The potential demand for water is expected to increase with economic growth, increased urbanisation, higher standards of living, and population growth. Because of the critical importance of water in the South African economy the country has a sophisticated water resources planning capacity, founded on a good understanding of the country's variable rainfall. This planning capacity will be a key capability for adaptation planning under ongoing and future climate change. In the Western Cape the current priority areas have been identified in the WCCCRS for the water sector 1. Invasive alien vegetation clearing; 2. Prioritisation, valuation, mapping, protection, and restoration of ecological infrastructure in catchments; 3. Effective utilisation of irrigation water; 4. Resource nexus decision support; and 5. Develop ecosystem goods and services (EGS) investment opportunities. Furthermore, the following recommendation has been identified in the Western Cape Climate Change Response Strategy Biennial Monitoring & Evaluation Report 2015/16 (Birch et al., n.d.) for the water sector for the province: 1. Review the Specifications of the Regional Bulk Infrastructure Grant (RBIG), Municipal Infrastructure Grant (MIG), Accelerated Community 2. Infrastructure Programmes (ACIP) and other similar funds and allocations to determine their climate responsive state (and link to any other ongoing such initiatives). 3. Protection of Strategic Water Source Areas (SWSAs) should be a strategic climate protection priority for the Western Cape. 4. Ground water monitoring needs to become a growing priority in the Western Cape.

	5. Further cooperation between IAP clearing authorities and rehabilitation programmes for wetlands and rivers will be beneficial in a changing climate. 6. Continued focus on the way in which we manage our water systems, and increased emphasis on Water Sensitive Urban Design
	Objectives
	The following objectives have been identified through the LGCCSP as priority areas for the Water sector in the District Municipality.
35	Manage the decreased quality of drinking water.
37	Manage the quantity of water available for irrigation and drinking.
38	Manage the increased impacts of floods due to litter blocking the sewer system.
51	Manage reducing groundwater reserves

4.12.2 Responses

No	Objective	Project	Priority	Activity Manager	Annual Target	Q1 Target	Q2 Target	Q3 Target	Q4 Target	Budget
35	**Manage the decreased quality of drinking water.**	Collaborative effort in conducting water quality monitoring.				25%	50%	75%	100%	TBC
37	**Manage the quantity of water available for irrigation and drinking.**	Technical Services in each LM to Develop/Update water loss management plan to address water reticulation losses on annual basis	Priority			25%	50%	75%	100%	TBC
		Increase ecological infrastructure to slow, spread and sink water run-off (e.g. on-farm furrows and swales, contour farming, improving the biodiversity status of wetlands and riparian areas, as well as the construction of hard infrastructure where appropriate e.g. gabions).				25%	50%	75%	100%	TBC
		Technical Department in each LM to investigate alternative water sources and water re-use options by 2019/2020 financial year	Priority			25%	50%	75%	100%	TBC

No	Objective	Project	Priority	Activity Manager	Annual Target	Q1 Target	Q2 Target	Q3 Target	Q4 Target	Budget
		Investigate alternative water desalination options – e.g. using wave power to create the pressure needed for desalination, instead of electricity (Cape Verde, Australia); using solar/wind to generate the necessary energy for desalination.				25%	50%	75%	100%	TBC
		Investigate alternative water storage options (e.g. underground) / dam expansion where appropriate.				25%	50%	75%	100%	TBC
		Plan for increased river sediments and its effect on dam infrastructure and storage capacity for municipal owned dams (e.g. river bank stabilisation to prevent erosion leading to sediment build-up in water storage structures).				25%	50%	75%	100%	TBC
		Use flooding events to store water against future drought periods.				25%	50%	75%	100%	TBC
		Diversify water sources to reduce dependence on surface water as the only source available during drought periods (see water-related infrastructure responses).				25%	50%	75%	100%	TBC
		District to Develop drought management plans for areas that don't already have such plans.	Priority			25%	50%	75%	100%	TBC
38	**Manage the increased impacts of floods due to litter blocking the sewer system.**	Manage potential point source pollution (incl. on-site treatment of stormwater runoff from informal settlements).				25%	50%	75%	100%	TBC
51	**Manage reducing groundwater reserves**	Regulate groundwater abstraction.				25%	50%	75%	100%	TBC

4.13 Cross Cutting

4.13.1 Introduction

	Programme Name
	Cross Cutting Adaptations to Climate Change
	Overview of key issues
	Climate change is a new and growing responsibility for local stakeholders in South Africa. Institutional capacity and the availability of skilled personnel and resources, including finances, is a major challenge for South African municipalities. It is therefore crucial that municipalities adopt an integrated approach to climate change that cuts across different sectors and departments. Appropriate institutional structures to guide this approach are required, and it is important that climate change is integrated into city planning documents like integrated developments plans with budget allocations so that climate change related projects come to fruition. Climate change is a relatively new field in South Africa and awareness programmes on climate change and the development of skills in the sector are required for the field to get the attention that is needed. The following cross cutting opportunities, gaps and recommendations have been identified in the Western Cape Climate Change Response Strategy Biennial Monitoring & Evaluation Report 2015/16 (Birch et al., n.d.): 1. Absence of a simple and effective mechanism to raise adequate finance for climate change response projects. 2. Capacity challenges and drafting of project concepts/bankable proposals. 3. Lack of support for feasible provincial and local government climate change projects e.g. from private financiers 4. Challenges relating to upfront costs and long pay back periods of implementing technology changes. 5. Accuracy of projected returns to finance investment in climate change response projects linked to new or alternative technology. 6. Developing indicators for tracking climate finance flows in the Western Cape and mechanisms for collecting data on the finance flows.
	Objectives
	The following objectives have been identified through the LGCCSP as priority areas for the Cross Cutting sector in the District Municipality.
59	Coordinate climate change response in the Municipality
60	Integrate climate change adaptation into municipal strategies and plans

61	Secure financial resources to respond to climate change
62	Build human capacity to respond to climate change
63	Generate knowledge and disseminate information on climate change
64	Integrate the principles of Ecosystem Based Adaptation (EbA) with existing programmes in the municipality

4.13.2 Responses

No	Objective	Project	Priority	Activity Manager	Annual Target	Q1 Target	Q2 Target	Q3 Target	Q4 Target	Budget
59	**Coordinate climate change response in the Municipality**	Apply to EEDSM for municipal retrofits of EE technologies (for municipalities that distribute electricity)	Priority			25%	50%	75%	100%	TBC
		Consider waste-to-energy opportunities (although volumes of waste still quite low)				25%	50%	75%	100%	TBC
		Consider Recycling (municipal & household level) opportunities.				25%	50%	75%	100%	TBC
		Promotion of renewable energy (both grid connected and off-grid).				25%	50%	75%	100%	TBC
		Investigate renewable energy for municipal structures (rooftop PV, small-scale wind, etc.).				25%	50%	75%	100%	TBC
		Switch to cleaner fuels and install energy efficient technologies for municipal owned infrastructure				25%	50%	75%	100%	TBC
		Make use of smart metering and steep block tariff schemes ('more you use the more you pay per unit') for water and electricity to increase water and energy saving measures.				25%	50%	75%	100%	TBC
60	**Integrate climate change adaptation into municipal strategies and plans**	Revise flood lines (likely increase in 1:50 / 1:100 flood line magnitudes) to take climate change into account.				25%	50%	75%	100%	TBC
		Continual water demand-side management to increase preparedness for dry periods (incl. replication of successful water conservation programmes).				25%	50%	75%	100%	TBC

No	Objective	Project	Priority	Activity Manager	Annual Target	Q1 Target	Q2 Target	Q3 Target	Q4 Target	Budget
		Develop/ implement catchment management strategies (cross-reference to environmental rehabilitation responses and management of invasive alien plants).				25%	50%	75%	100%	TBC
		Promote alternative transport options – non-motorised transport & other transport options, e.g. consider developing existing rail network to contribute to tourism.				25%	50%	75%	100%	TBC
61	**Secure financial resources to respond to climate change**	Municipal support structures for Small Scale Embedded Generation (SSEG) / mini-grids – feed-in tariffs in place, applicable bylaws, incentives etc.				25%	50%	75%	100%	TBC
		Retrofit buildings for improved insulation.				25%	50%	75%	100%	TBC
		Insurance market correction – incorporate sea level rise, increased flood risk, projected decreased water resources, etc. into long term economic risk assessments, to appropriately increase premiums to reflect true risk and prevent future liability and losses.				25%	50%	75%	100%	TBC
62	**Build human capacity to respond to climate change**	Build capacity of disaster management centre staff; disaster management planning.				25%	50%	75%	100%	TBC
		Facilitate improved cellular communication networks.				25%	50%	75%	100%	TBC
63	**Generate knowledge and disseminate information on climate change**	Develop a communication protocol for early warning systems with public alerts (risk communication). Must reach all community members.	Priority			25%	50%	75%	100%	TBC
		Increase public awareness on what to do during emergencies / disasters (including if cut off from help / supplies).	Priority			25%	50%	75%	100%	TBC
		Increase drought awareness.				25%	50%	75%	100%	TBC
		Create green information hub for collection of all data and info to avoid duplication, provide co-ordination etc.; identify gaps; raise funds. Find ways to engage private sector in this process, including households, farmers etc.				25%	50%	75%	100%	TBC

No	Objective	Project	Priority	Activity Manager	Annual Target	Q1 Target	Q2 Target	Q3 Target	Q4 Target	Budget
64	**Integrate the principles of Ecosystem Based Adaptation (EbA) with existing programmes in the municipality**	Environmental Management in DM and LMs to coordinate information to communications teams to increase public awareness on the impacts of climate change and benefits of best practice environmental management.	Priority			25%	50%	75%	100%	TBC
		Increase EE awareness in government and general public.				25%	50%	75%	100%	TBC
		Consider urban greening opportunities.				25%	50%	75%	100%	TBC

5 References

Amos, E, U Akpan, and K Ogunjobi. 2015. "'Households' Perception and Livelihood Vulnerability to Climate Change in a Coastal Area of Akwa Ibom State, Nigeria'" 17 (4): 887–908.

Atkinson, Lara, and Barry Clark. 2005. "Marine and Coastal Ecosystems: Background Research Paper Produced for the South Africa Environment Outlook Report on Behalf of the Department of Environmental Affairs and Tourism." http://soer.deat.gov.za/dm_documents/Marine_and_Coastal_-_Background_Paper_wPDBE.pdf.

Birch, Sarah, Lize Jennings-Boom, Frances van der Merwe, and Goosain Isaacs. n.d. "Western Cape Climate Change Response Strategy Biennial Monitoring & Evaluation Report 2015/16." https://www.westerncape.gov.za/eadp/sites/eadp.westerncape.gov.za/files/basic-page/uploads/DEA%26DP_M%26E%20Report_Web.pdf.

Blignaut, J. N., and M. P. De Wit. 2004. "Reflecting on Economic Growth." In *Sustainable Options: Economic Development Lessons from Applied Environmental Economics in South Africa*. UCT Press.

Böckmann, M. 2015. "Exploring the Health Context: A Multimethod Approach to Climate Change Adaptation Evaluation." Bremen: Universität Bremen. https://elib.suub.uni-bremen.de/edocs/00104711-1.pdf.

Climate System Analysis Group. 2017a. "Future Climate Projections." http://cip.csag.uct.ac.za/webclient2/datasets/africa-merged-cmip5/#nodes/cmip5-anomalies?folder_id=33&extent=99843.

———. 2017b. "Historical Climate Monthly Averages." http://cip.csag.uct.ac.za/webclient2/datasets/africa-merged-cmip5/#nodes/seasonality-cmip5?folder_id=33&extent=99843.

Coastal & Environmental Services. 2011. "Eastern Cape Climate Change Response Strategy." Department of Economic Development and Environmental Affairs. http://www.dedea.gov.za/Policies/Draft%20EC%20Climate%20Change%20Response%20Strategy.pdf.

Council for Scientific and Industrial Research. 2011. "National Freshwater Ecosystem Priority Areas (NFEPA): Wetlands 2011 [Vector Geospatial Dataset]." http://bgis.sanbi.org/SpatialDataset/Detail/395.

Davis, C.L. 2011. "Climate Risk and Vulnerability: A Handbook for Southern Africa." http://start.org/download/2011/sadc-handbook-11.pdf.

Department of Agriculture, Forestry and Fisheries. 2010. "Map Showing the Risk of Veld Fires in South Africa."

Department of Environmental Affairs. 2009. "National Protected Area Expansion Strategy Resource Document." https://www.environment.gov.za/sites/default/files/docs/npaes_resource_document.pdf.

———. 2012. "The 2nd South Africa Environment Outlook Report: A Report on the State of the Environment." Pretoria: Department of Environmental Affairs. http://soer.deat.gov.za/newsDetailPage.aspx?m=66&amid=16320.

———. 2013a. "Climate Trends and Scenarios for South Africa; LTAS Phase 1, Technical Report (No. 1 of 6)." https://drive.google.com/open?id=0B88z-WjOEKIlZy0xcG1KTGthSlk.

———. 2013b. "Long Term Adaptation Scenarios: Climate Change and Biodiversity, Climate and Impacts Factsheet Series, Factsheet 7 of 7." http://www.sanbi.org/sites/default/files/documents/documents/ltas-factsheetclimate-change-and-biodiversity-sector2013.pdf.

———. 2013c. "Long Term Adaptation Scenarios: Climate Change and the Agriculture Sector, Climate and Impacts Factsheet Series, Factsheet 4 of 7." http://www.sanbi.org/sites/default/files/documents/documents/ltas-factsheetclimate-change-and-agriculture-sector2013.pdf.

———. 2013d. “Long Term Adaptation Scenarios, Phase 1 - Technical Report - No 1 of 6 - Climate Trends and Scenarios for South Africa.” https://drive.google.com/file/d/0B88z-WjOEKIlZy0xcG1KTGthSlk/.
———. 2013e. “Long Term Adaptation Scenarios, Phase 1 - Technical Report - No 5 of 6 - Marine Fisheries in South Africa.” https://drive.google.com/file/d/0B88z-WjOEKIldmRiNVkxc1FieFE/.
———. 2013f. “Long Term Adaptation Scenarios, Phase 2 - Technical Report 3 of 7 Disaster Risk Reduction and Management in South Africa.” https://drive.google.com/file/d/0B88z-WjOEKIlVF9RN09fU0dIVmc/.
———. 2013g. “Long-Term Adaptation Scenarios Flagship Research Programme for South Africa. Climate Trends and Scenarios.” Department of Environmental Affairs. https://www.sanbi.org/sites/default/files/documents/documents/ltasclimate-trends-and-scenarios-tech-report2013low-res.pdf.
———. 2016. “Minister Edna Molewa Publishes Draft Notices and Regulations to Declare a Network of 22 New Proposed Marine Protected Areas | Department of Environmental Affairs.” February 9, 2016. https://www.environment.gov.za/mediarelease/molewa_22newproposed_mpas.
———. 2017. “South Africa Protected Areas Database (SAPAD_OR_2017_Q2) [Vector Geospatial Dataset].” http://egis.environment.gov.za.
Department of Environmental Affairs and Development Planning, Western Cape. 2008. “A Climate Change Strategy and Action Plan for the Western Cape.” http://www.cityenergy.org.za/uploads/resource_107.pdf.
Department of Water Affairs. 2011. “2011 Blue Drop Report.” https://www.dwa.gov.za/Documents/BD/BDIntro.pdf.
———. 2013. “National Water Resources Strategy: Second Edition.” https://www.dwaf.gov.za/nwrs/LinkClick.aspx?fileticket=u_qFQycClbI%3d&tabid=91&mid=496.
Department of Water and Sanitation. 2013. “2013 Green Drop Report - Volume 1: Municipal and Private Wastewater Systems.” http://www.dwa.gov.za/Dir_WS/GDS/Docs/UserControls/DownloadSiteFiles.aspx?id=74.
———. 2014. “2014 Blue Drop Report.” https://www.dwa.gov.za/dir_ws/DWQR/subscr/ViewComDoc.asp?Docid=703.
———. 2016a. “Green Drop System.” 2016. https://www.dwa.gov.za/dir_ws/GDS/DefaultTopPerformers.aspx?ProvCode=SA.
———. 2016b. “Dam Hydrological Data.” https://www.dwaf.gov.za/iwqs/wms/data/000key.asp.
Driver, A., Sink, K.J., Nel, J.N., Holness, S., Van Niekerk, L., Daniels, F., Jonas, Z., Majiedt, P.A., Harris, L., and Maze, K. 2012. *National Biodiversity Assessment 2011: An Assessment of South Africa’s Biodiversity and Ecosystems: Synthesis Report*. Pretoria: South African National Biodiversity Institute and Department of Environmental Affairs.
Health Systems Trust. 2012. “National-Health-Facilities-Audit.Pdf.” https://www.health-e.org.za/wp-content/uploads/2013/09/National-Health-Facilities-Audit.pdf.
Jiri, O. 2016. “Climate Change and Variability Impacts on Crop Production in the Low Potential Smallholder Farming Regions of Zimbabwe.” PhD thesis, Pietermaritzburg: University of KwaZulu-Natal. https://researchspace.ukzn.ac.za/bitstream/handle/10413/13962/Jiri_Obert_2016.pdf?sequence=1&isAllowed=y.
Koske, J, and M.A Ochieng. 2013. “The Level of Climate Change Awareness and Perception among Primary School Teachers in Kisumu Municipality, Kenya” 3 (21): 174–79.
Kruger, A.C, and S Shongwe. 2004. “Temperature Trends in South Africa: 1960–2003” 15 (24): 1929–45.
Massyn, N, N Peer, R English, A Padarath, P Barron, and C Day, eds. 2016. “District Health Barometer 2015/16.” Health Systems Trust.

Meyiwa, T, T Maseti, S Ngubane, T Letsekha, and C Rozani. 2014. “Women in Selected Rural Municipalities: Resilience and Agency against Vulnerabilities to Climate Change” 3 (28): 102–14.
Millennium Ecosystem Assessment. 2005. *Ecosystems and Human Well-Being: A Framework for Assessment*. Washington DC: Island Press.
Mucina, L., and M.C. Rutherford, eds. 2006. *The Vegetation of South Africa, Lesotho and Swaziland.* Strelitzia 19. Pretoria: South African National Biodiversity Institute. https://www.sanbi.org/documents/vegetation-south-africa-lesotho-and-swaziland-strelitzia-19.
Nelitz, M, S Boardley, and R Smith. 2013. “Tools for Climate Change Vulnerability Assessments for Watersheds.” http://www.mirocan.org/public/documents/outils/uploaded/nxdzgA3x.pdf.
Nelson, Stephen A. 2013. “Coastal Zones.” November 4, 2013. http://www.tulane.edu/~sanelson/Natural_Disasters/coastalzones.htm.
Nicholson-Cole, S.A. 2005. “Representing Climate Change Futures: A Critique on the Use of Images for Visual Communication” 3 (29): 255–273.
Overberg District Municipality. 2013. “Overberg District Municipal Spatial Development Framework.”
———. 2015a. “Overberg Coastal Management Programme Final Situation Analysis Report.”
———. 2015b. “T01/12-2013/13: Draft Overberg Coastal Management Programme.”
———. 2016a. “Overberg Coastal Management Programme.”
———. 2016b. “Overberg District Municipality Integrated Development Plan Review 2016/2017.”
———. 2017. “Overberg District Municipality 4th Generation Integrated Development Plan 2017/18 - 2021/22.”
Palmer, B., R. van der Elst, and O. Parak. 2011. “Understanding Our Coast: A Synopsis of KZN’s Coastal Zone.” KwaZulu-Natal Department of Agriculture, Environmental Affairs and Rural Development. http://www.seaworld.org.za/uploads/files/Understanding-our-Coast.pdf.
Parikh, J. 2007. “Gender and Climate Change Framework for Analysis, Policy & Action.” https://archive.nyu.edu/bitstream/2451/34216/2/gnder_cc.pdf.
Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson. 2007. “Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.” Cambridge University Press. https://www.ipcc.ch/publications_and_data/ar4/wg2/en/contents.html.
Pasquini, L, R.M Cowling, and G Ziervogel. 2013. “Facing the Heat: Barriers to Mainstreaming Climate Change Adaptation in Local Government in the Western Cape Province, South Africa,” no. 40: 225–32.
Provincial Government of the Western Cape. 2005. “Western Cape State of the Environment Report 2005 (Year One).” 2005. http://soer.deat.gov.za/dm_documents/Wcape_full_SoER_aMPpi.pdf.
Republic of South Africa. 2014. “National Environmental Management: Integrated Coastal Management Amendment Act, No 36 of 2014.” Government Gazette. http://www.gov.za/sites/www.gov.za/files/38171_31-10_Act36of2014IntegratedCoastalManagem_a.pdf.
———. 2016a. “Draft Notice Declaring the Agulhas Bank Complex Marine Protected Area. Proclamation No. R. 108 of 2016.” *Government Gazette* 608 (39646). https://www.environment.gov.za/sites/default/files/gazetted_notices/nempaa57of2003_draftregulations_newproposedmarineprotectedarea1_gg39646.pdf.
———. 2016b. “Draft Notice Declaring the Agulhas Muds Marine Protected Area. Proclamation No. R. 112 of 2016.” *Government Gazette* 608 (39646). https://www.environment.gov.za/sites/default/files/gazetted_notices/nempaa57of2003_draftregulations_newproposedmarineprotectedarea1_gg39646.pdf.
———. 2016c. “Draft Notice Declaring the Brown Bank Complex Marine Protected Area. Proclamation No. R. 98 of 2016.” *Government Gazette* 608 (39646).

https://www.environment.gov.za/sites/default/files/gazetted_notices/nempaa57of2003_draftregulations_newproposedmarineprotectedarea1_gg39646.pdf.
———. 2016d. “Draft Notice Declaring the Brown Bank Corals Marine Protected Area. Proclamation No. R. 115 of 2016.” *Government Gazette* 608 (39646). https://www.environment.gov.za/sites/default/files/gazetted_notices/nempaa57of2003_draftregulations_newproposedmarineprotectedarea1_gg39646.pdf.
———. 2016e. “Draft Notice Declaring the Southeast Atlantic Seamount Marine Protected Area. Proclamation No. R. 124 of 2016.” *Government Gazette* 608 (39646). https://www.environment.gov.za/sites/default/files/gazetted_notices/nempaa57of2003_draftregulations_newproposedmarineprotectedarea1_gg39646.pdf.
South African National Biodiversity Institute. 2011a. “Freshwater Ecosystem Priority Areas (FEPAs) for River Ecosystems [Vector Geospatial Dataset].” South African National Biodiversity Institute.
———. 2011b. “National Biodiversity Assessment 2011: Marine Benthic and Coastal Threat Status [Vector Geospatial Dataset].” http://bgis.sanbi.org/SpatialDataset/Detail/407.
———. 2011c. “National List of Threatened Ecosystems 2011 [Vector Geospatial Dataset].” http://bgis.sanbi.org/SpatialDataset/Detail/501.
South African National Biodiversity Institute, and CSIR. 2012. “National Estuaries 2012 [Vector Geospatial Dataset].” http://bgis.sanbi.org/SpatialDataset/Detail/394.
South African National Parks. 2011a. “CCAB - Current Biome Delineations 2011 [Vector Geospatial Dataset].” Available from the Biodiversity GIS website. http://bgis.sanbi.org/SpatialDataset/Detail/484.
———. 2011b. “CCAB - High Risk Scenarios - Biome Delineations 2011 [Vector Geospatial Dataset].” Available from the Biodiversity GIS website. http://bgis.sanbi.org/SpatialDataset/Detail/486.
———. 2011c. “CCAB - Medium Risk - Climate Scenarios - Biome Delineations 2011 [Vector Geospatial Dataset].” Available from the Biodiversity GIS website. http://bgis.sanbi.org/SpatialDataset/Detail/475.
South African National Parks, and South African National Biodiversity Institute. 2011. “National Biodiversity Assessment 2011: Protect Areas [Vector Geospatial Dataset].”
Statistics South Africa. 2011. “Census 2011 Statistical Release.” Pretoria.
———. 2015. “Mortality and Causes of Death in South Africa, 2015: Findings from Death Notification.”
United Nations WomenWatch. 2009. “Women, Gender Equality and Climate Change.” http://www.un.org/womenwatch/feature/climate_change/.
Warburton, M.L. 2012. “Challenges in Modelling Hydrological Responses to Impacts and Interactions of Land Use and Climate Change.” PhD thesis, Pietermaritzburg: University of KwaZulu-Natal. http://researchspace.ukzn.ac.za/xmlui/bitstream/handle/10413/9436/Warburton_Michele_Lynn_2012.pdf?sequence=1.
Warburton, M.L, and R Schulze. 2006. “Climate Change and the South African Commercial Forestry Sector. An Initial Study.” http://www.forestry.co.za/uploads/File/industry_info/environment/Climate%20change%20on%20forestry.pdf.
Western Cape Department of Agriculture. 2017. “Cape Farm Mapper Ver 2.0.6.1.” 2017. https://gis.elsenburg.com/apps/cfm/.
Western Cape Government. 2015. “A Status Quo Review of Climate Change and the Agriculture Sector of the Western Cape Province.” Western Cape Department of Agriculture and the Western Cape Department of Environmental Affairs & Development Planning. http://acdi.uct.ac.za/sites/default/files/filesattached/SmartAgri%20Review%20Executive%20Summary.pdf.
Western Cape Government: Environmental Affairs and Development Planning. 2014. “Western Cape Climate Change Response Strategy.” 2014.

https://www.westerncape.gov.za/text/2015/march/western_cape_climate_change_response_strategy_2014.pdf.
Ziervogel, G, and R Calder. 2003. “Climate Variability and Rural Livelihoods: Assessing the Impact of Seasonal Climate Forecasts in Lesotho” 4 (35): 403–17.

6 Annexure 1: Key District Indicators

The table below provides a summary of the key indicators for the District. The table lists the national indicators for comparison purposes. Many of these indicators are used in the climate change vulnerability assessment process below.

Table 12: Key District Municipal Indicators for the Overberg DM compared to the National Average

General Information	Overberg District Municipality	South Africa
Code	DC03	
Province	Western Cape	
District		
Seat	Bredasdorp	
Area (km²)	11,405	1219740
Census Statistics		
Criteria	**Overberg District Municipality**	**South Africa**
Population	**258,175**	**51770553**
Age Structure		
Population under 15	24.07%	29.17%
Population 15 to 39	41.30%	44.30%
Population 40 to 64	26.29%	21.19%
Population over 65	8.34%	5.34%
Dependency Ratio		
People in age group 0-14 & 65+, supported by age group 15-64	47.9%	52.7%
Employment (between 15 and 64)		
Employed	53.32%	38.87%
Not economically active	32.99%	39.21%
Unemployed	10.89%	16.50%
Discouraged work-seeker	2.79%	5.41%
Education (aged 20 +)		
Post School Qualification	9.57%	9.94%
Grade 12/Matric	22.14%	27.83%
High School	35.60%	32.16%
Less than High School	22.31%	16.43%
Other	10.37%	13.64%
Vulnerability Indicators		

Criteria	Overberg District Municipality	South Africa
Household Dynamics		
Households	77,196	14450151
Average household size	3.34	3.58
Percentage households involved in agricultural activities	8.62%	20.56%
Dwelling Type		
Percentage Households that are Informal Dwelling	14.97%	13.58%
Percentage Households that are Traditional Dwelling	1.28%	7.89%
Combined Percentage Households that are Traditional and Informal Dwelling	16.25%	21.47%
Sources of Water		
Percentage of Population that sources water from Boreholes	5.95%	1.76%
Percentage of Population that do not source water from piped water schemes	16.41%	21.82%
Percentage of Population that source water from Service Providers (e.g. Municipalities)	83.59%	78.18%
Percentage of Population that sources water from Water Tanks	0.93%	2.67%
Electricity Usage		
Percentage of households that use alternatives to electricity for cooking	18.62%	26.12%
Percentage of households that use alternatives to electricity for cooking, heating or lighting	8.19%	17.77%
Sanitation		
Percentage Population with flush toilets	89.42%	56.51%
Percentage Population using pit latrines	1.67%	30.73%
Percentage of Population with no toilet facilities	4.26%	5.34%
Percentage of Population with other toilet facilities	4.65%	7.42%
Refuse		
Percentage of Households with no rubbish disposal	1.03%	5.97%
Percentage of households with refuse removed by local authority/private company	84.06%	59.40%
Health		
Percentage of young (<5yrs) and elderly (>64yrs)	17.17%	16.32%
Percentage workforce employed in the informal Sector	15.77%	12.20%
Vulnerability Tool Indicators		
Criteria	Overberg District Municipality	South Africa

Percentage households involved in agricultural activities	8.62%	20.56%
Percentage Population with flush toilets	89.42%	56.51%
Percentage of young (<5yrs) and elderly (>64yrs)	17.17%	16.32%
Percentage Households that are Traditional and Informal Dwelling	16.25%	21.47%
Percentage of Households with no rubbish disposal	1.03%	5.97%

7 Annexure 2: Sector Summaries

7.1 Overberg DM Agriculture Sector Summary

The Agriculture sector in the Overberg District Municipality is a key sector in terms of employment and food security in the District Municipal Area (Overberg District Municipality 2017). Agricultural activities account for 43% of the land use in the District Municipal Area (Overberg District Municipality 2017). Consequently, the Overberg area is a strong agricultural area that contributes 11% of the total agriculture production in the Western Cape (Overberg District Municipality 2017). Agricultural activities in the District are characterised by vineyards, grain production and apples as well as cattle, sheep and goat farming (Overberg District Municipality 2017). The main crops in the District include: wheat, barley, canola, apples, pears, lucerne, proteas, planted pastures and pears (Overberg District Municipality 2017). The Overberg District Municipality is known for its barley production and accounts for 79.2% of the provincial barley production (Overberg District Municipality 2017).

Even though the agricultural sector is one of the key sectors in the District, droughts in recent years have had a major impact on the overall employment contribution of the agriculture sector. Over a period from 2004 to 2015 the agriculture sector in Overberg District Municipal Area experienced a negative growth trend which resulted in a net loss of approximately 19,624 jobs (Overberg District Municipality 2017). Broken down further, 16,751 jobs were lost from 2004 to 2009, while 2,873 jobs were lost from 2009 to 2015 (Overberg District Municipality 2017). Despite these decreases, the agriculture, hunting, forestry and fishing sectors collectively remain the largest employers (accounting for 21.3% of jobs) in the District Municipality (Overberg District Municipality 2015a).

Furthermore, the South African National Census of 2011 estimated that only 8.62% of households in the Overberg District Municipal Area (Figure 6) are involved in agricultural activities (Statistics South Africa 2011). This is lower than the national average of 20.56 % (Statistics South Africa 2011). In the map (Figure 6) the darker areas indicate higher percentages of households involved in agricultural activities (Statistics South Africa 2011).

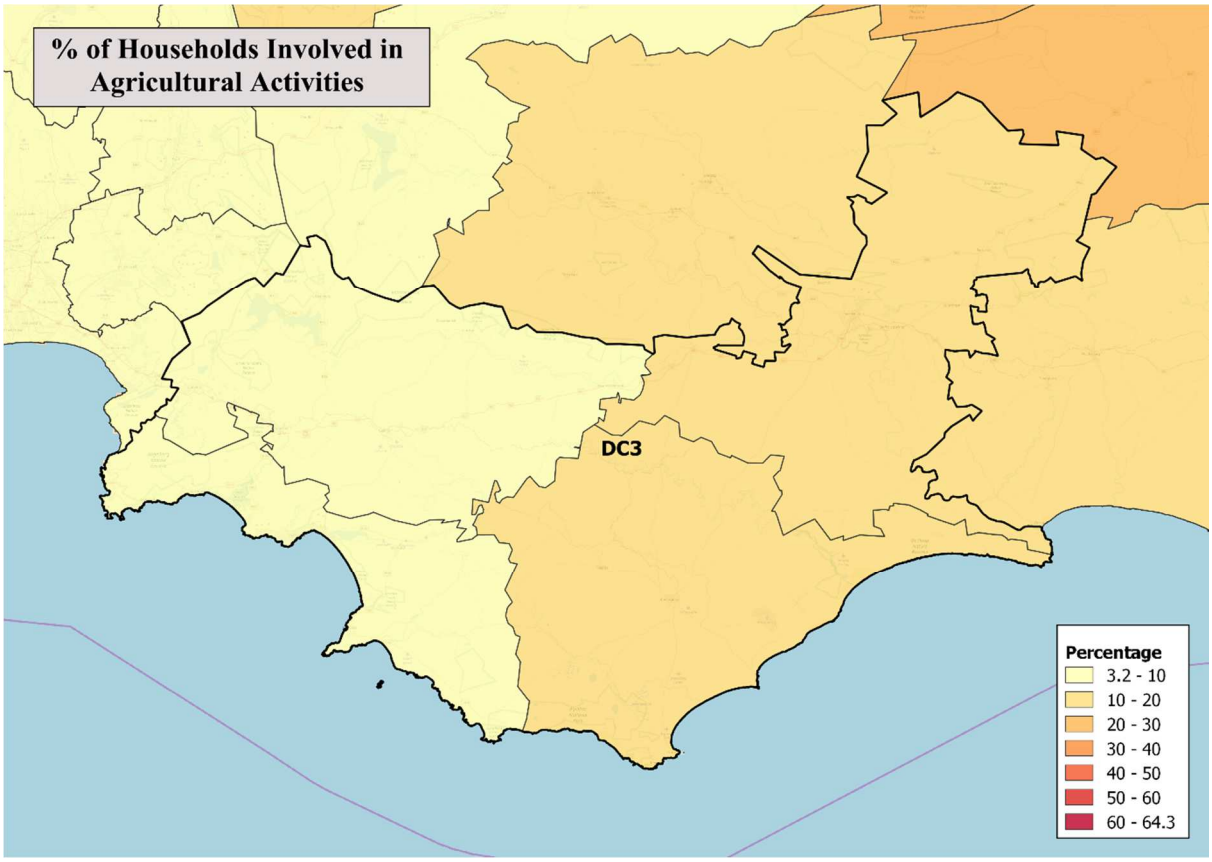

Figure 6: Percentage of households involved in agricultural activities across the District Municipal Area (Statistics South Africa 2011)

Similar to employment in the Agriculture sector, the recent droughts have had dire consequences for the sector's economic contribution in the District Municipal Area (Overberg District Municipality 2017). Over the period from 2005 to 2015 the agriculture, forestry and fishing sector experienced an average economic growth rate of negative7.1% (Overberg District Municipality 2017). This was much lower than the average growth trend for all sectors over the same period which was 3.9%(Overberg District Municipality 2017). In addition to the negative growth trend, in 2015 , the agriculture, forestry and fishing sector contributed 2.9% of the District Municipality's regional gross domestic product (GDPR) (Overberg District Municipality 2017). This was the third smallest economic contribution to GDPR in the District, as only the 'mining and quarrying' and 'electricity, water and gas' sectors contributed less (Overberg District Municipality 2017). The GDPR refers to the total value of all the goods and services produced in the District Municipal Area (Blignaut and De Wit 2004). While the agriculture sector is not a big contributor to the District's economy, it is a key contributor to employment in the District.

Within the Overberg District Municipal Area, agriculture can be split into six SmartAgri Zones, of which only one, the Rûens-west Agri Zone, falls entirely within the District Municipal Area (Figure 7) (Western Cape Department of Agriculture 2017).

The future agricultural potential of the Grabouw-Villiersdorp-Franschhoek and Montagu-Barrydale SmartAgri zones are predicted to maintain high agricultural potential so long as sufficient water is available (Western Cape Government 2015). However, due to higher average temperatures, the farming of apples in the Grabouw-Villiersdorp-Franschhoek SmartAgri Zone is predicted to become unviable (Western Cape Government 2015). While in the Rûens-west SmartAgri zone agricultural

potential is predicted to remain high for small grains (such as wheat and barley), however, the variability of these yields is expected to increase (Western Cape Government 2015). Additionally, the Breede, Tankwa-van Wyksdorp and Rûens-east SmartAgri Zones are all predicted to become less productive due to water availability and heat-related issues (SmartAgri and African Climate and Development Initiative 2015).

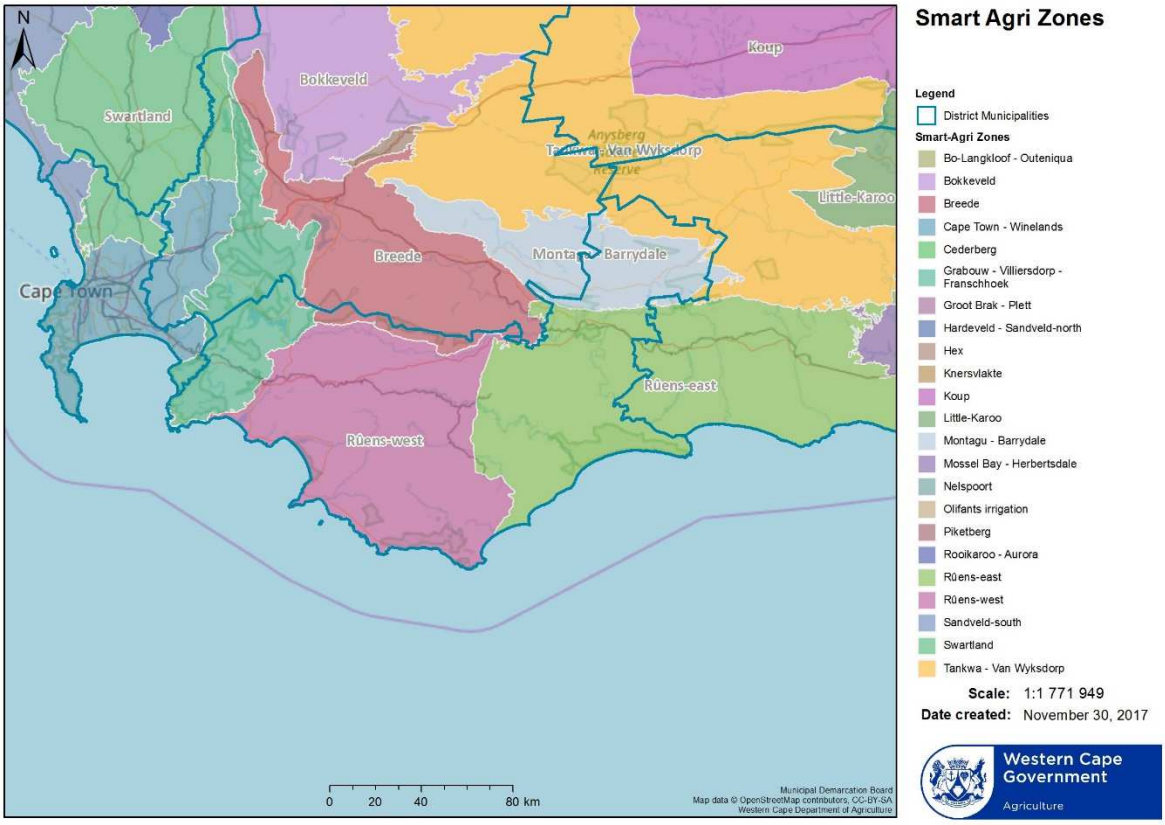

Figure 7: Smart Agri Zones in the District Municipal Area (Western Cape Department of Agriculture 2017)

Regarding grazing capacity, the north eastern part of the Overberg District Municipal Area has the highest grazing capacity (i.e. the highest number of hectares required per large stock unit for viable grazing) in the District Municipal Area, whilst the southern part of has the lowest grazing capacity (Figure 8) (Western Cape Department of Agriculture 2017). Much of the north-western and middle parts of the District Municipal Area have been categorised as “Transformed rangeland” and thus have no grazing capacity (Western Cape Department of Agriculture 2017). It should be noted that the data for this map is from 1993 and so the grazing capacities may have changed somewhat in the intervening years.

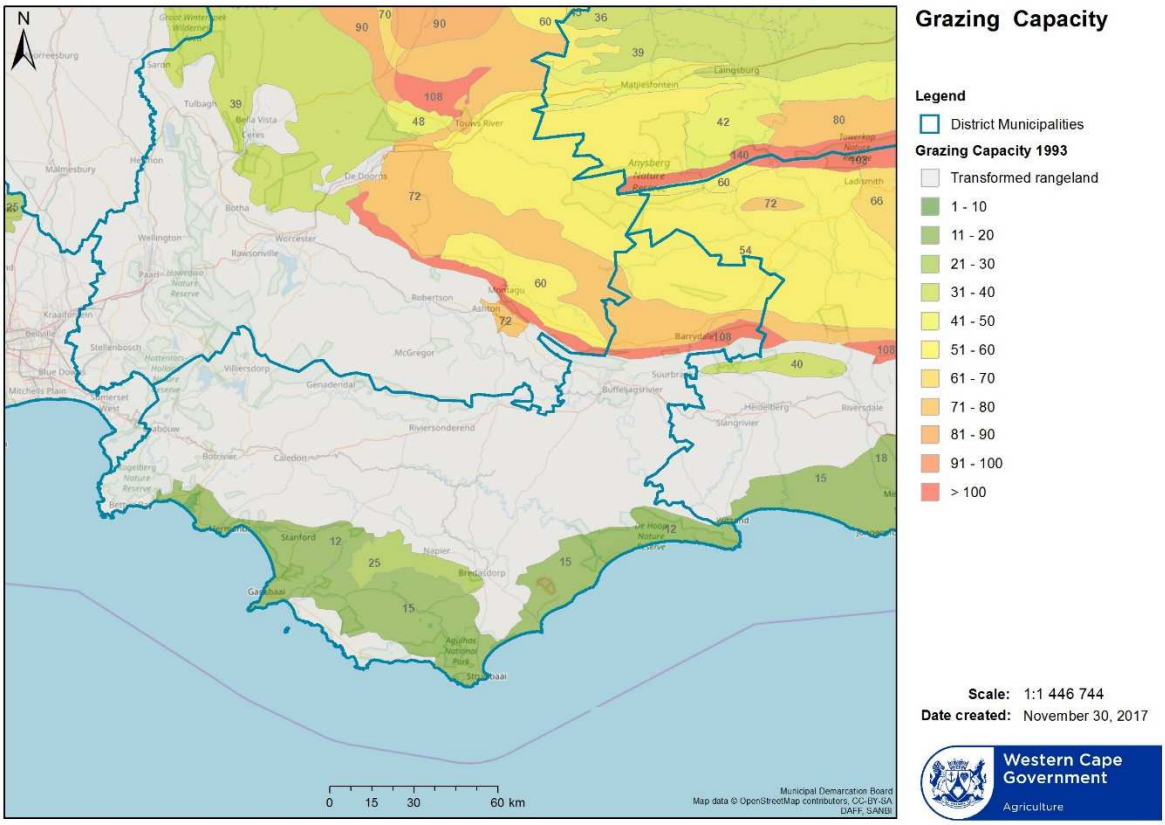

Figure 8: Grazing capacity in the District Municipal Area (Western Cape Department of Agriculture 2017)

Looking at specific livestock density levels (i.e. the number of animals per square kilometre), the availability of small stock is varied within the Overberg District Municipal Area (Figure 9) (Western Cape Department of Agriculture 2017). Specifically, the highest density of small stock occurs in the central and eastern parts of the District Municipal Area. (Western Cape Department of Agriculture 2017).

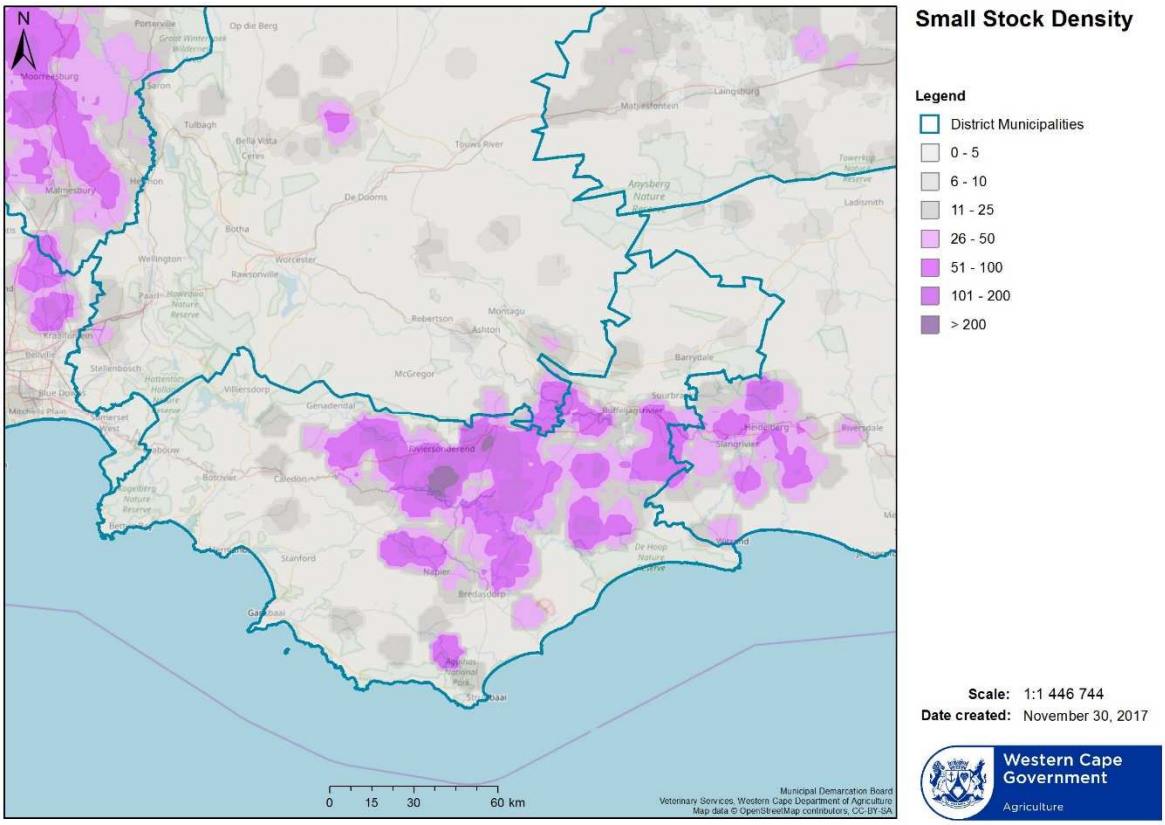

Figure 9: Small stock density levels in the District Municipal Area (Western Cape Department of Agriculture 2017)

Additionally, bovine (cattle) density levels (Figure 10) are mostly low in the Overberg District Municipal Area (Western Cape Department of Agriculture 2017). Specifically, bovine density levels are at their highest in the central areas of the District Municipality (Western Cape Department of Agriculture 2017).

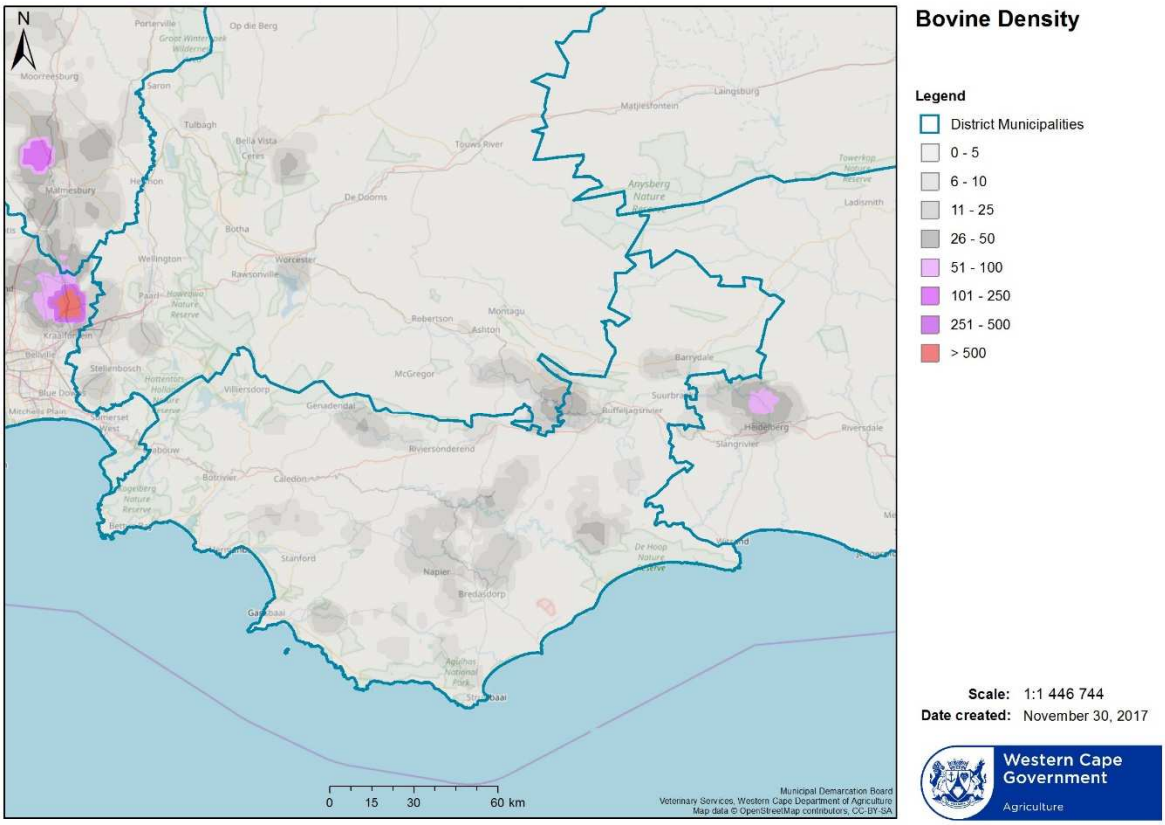

Figure 10: Bovine density levels in the District Municipal Area (Western Cape Department of Agriculture 2017)

Furthermore, ostrich farming (Figure 11) is very limited in the Overberg District Municipal Area, occurring in small areas, with limited density levels, in the eastern half of the District (Western Cape Department of Agriculture 2017).

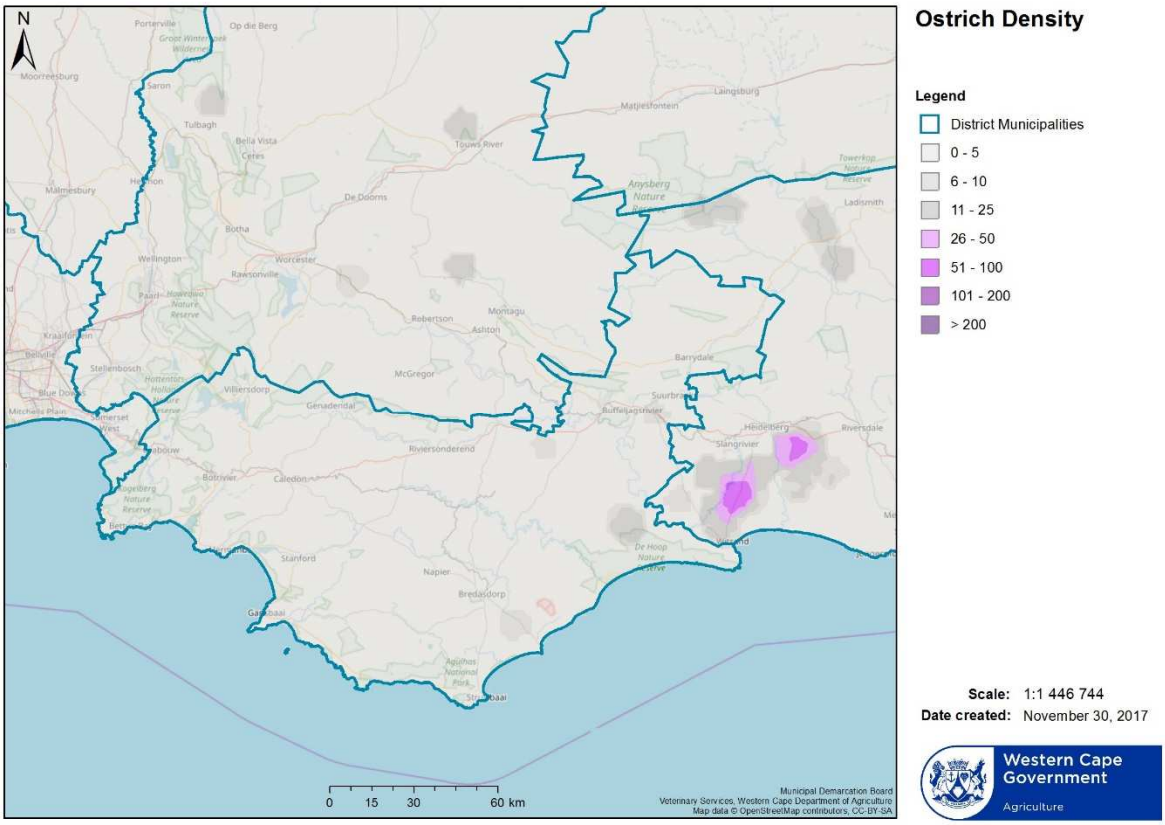

Figure 11: Ostrich density levels in the District Municipal Area (Western Cape Department of Agriculture 2017)

Additionally, grazing capacities in the Overberg District Municipal Area are mostly high, with the crop census (Figure 12) showing that there is a lot of crop production in the central and eastern parts of the District Municipal Area (Western Cape Department of Agriculture 2017). Much of this crop production occurs alongside the District Municipal Area's rivers (Western Cape Department of Agriculture 2017). The main crops grown in the District Municipal Area are 'grains and mixed', 'planted pastures', 'pome fruit' (such as apples) and 'oil seeds' (Western Cape Department of Agriculture 2017).

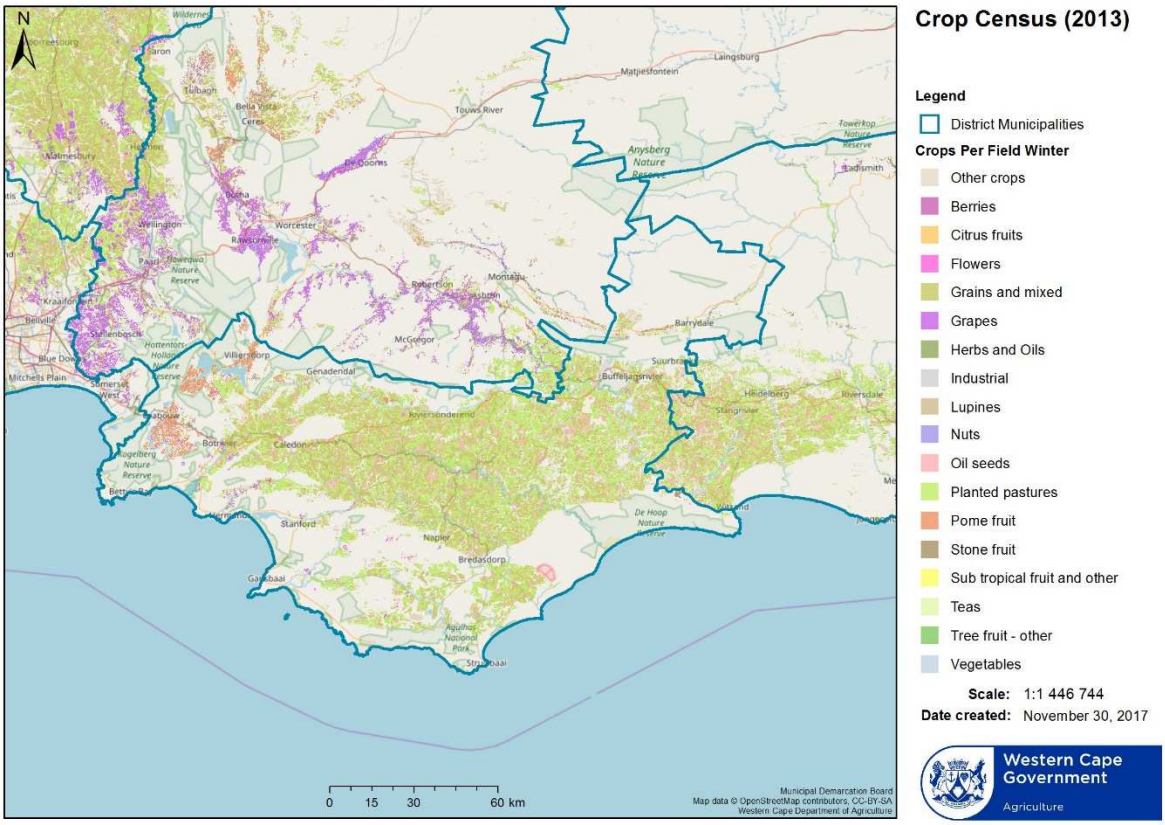

Figure 12: Crop census in the District Municipal Area (Western Cape Department of Agriculture 2017)

There are also five Wine of Origin districts that occur mainly or partially within the Overberg District Municipal Area (Figure 13) (Western Cape Department of Agriculture 2017). Wine of Origin districts are more specific than wine regions and they signify that all the grapes came from the same specific area (Western Cape Department of Agriculture 2017). The Wine of Origin districts that occur in the District Municipal Area are the: Overberg, Elgin, Walker Bay, Swellendam and Cape Agulhas Wine of Origin districts (Western Cape Department of Agriculture 2017).

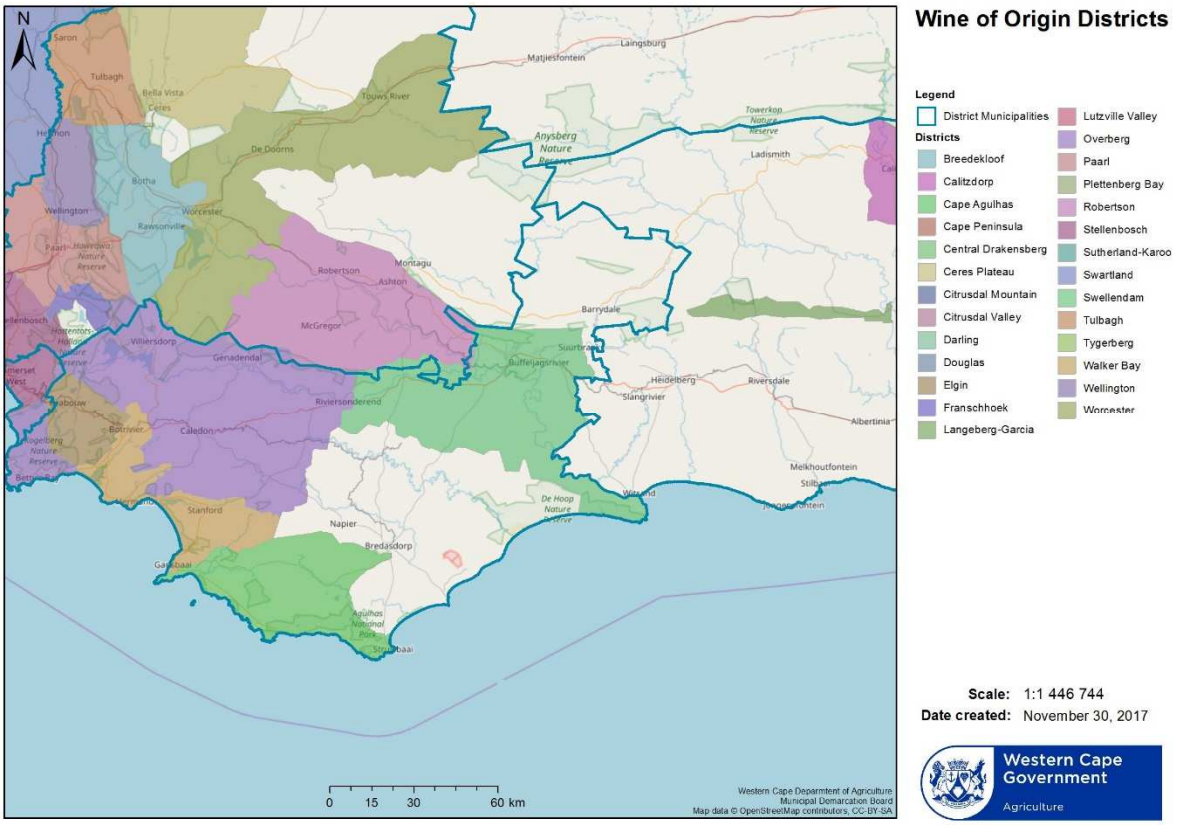

Figure 13: Wine of origin districts in the District Municipal Area (Western Cape Department of Agriculture 2017)

Despite the potential for expanding agricultural production in the Overberg District Municipal Area, it is predicted that climate change will affect the agriculture sector both positively and negatively.

These predicted changes in average rainfall and temperature are forecast to reduce the areas that are suitable for viticulture or shift them to areas that are higher or cooler than current locations (Department of Environmental Affairs 2013c). The reduction in rainfall (and runoff) is forecast to reduce the yields of fruit and vegetables, notably deciduous fruit and rain-fed wheat production in the Western Cape (Department of Environmental Affairs 2013c). Furthermore, the production of fruit (such as apples and pears) and sugar cane will be increasingly vulnerable to damage from a predicted expansion of the areas affected by agricultural pests (Department of Environmental Affairs 2013c).

By decreasing agricultural yields, climate change could also impact the agriculture sector by reducing profitability and job opportunities in the sector as well as increasing food security risks, especially amongst subsistence farmers and their dependents (Department of Environmental Affairs 2013c; Overberg District Municipality 2017).

Indeed, it has been noted in the Overberg District Municipality's 2017/2018 Integrated Development Plan that climate change impacts could have dire consequences for the agriculture sector in the Overberg District Municipal Area (Overberg District Municipality 2017). Specifically, impacts such as droughts, fires, floods and changes in rainfall patterns are predicted to not only result in agricultural losses but also impact other sectors of the local economy as well (Overberg District Municipality 2017).

Moreover, these predicted changes are not only future-related considerations. Impacts to the agricultural sector, which have been attributed to climate variability have already been observed in

the Overberg District Municipal Area, for example, floods(Overberg District Municipality 2017). Therefore, the Overberg District Municipality aims to address the projected impact of climate change on the agriculture sector (and other sectors) by implementing projects that contribute towards sustainable agricultural practices (Overberg District Municipality 2017).

7.2 Overberg DM Biodiversity Sector Summary

The Overberg District Municipal Area is dominated by the Fynbos Biome (Figure 14). The Overberg District Municipal Area also contains a sizable area of Succulent Karoo Biome in the northeast. The Fynbos Biome is part of the Cape Floristic Kingdom (one of six recognised floral kingdoms globally) and is made up of an extremely high number of fynbos and renosterveld species (Mucina and Rutherford 2006). The Fynbos Biome is renowned for its high levels of endemism (Mucina and Rutherford 2006). The Succulent Karoo Biome is extremely dry and is characterised by low winter rainfall. The prevailing vegetation in the Succulent Karoo biome is dwarf, succulent shrubs, with large displays of flowers (annuals) in the spring (Mucina and Rutherford 2006). For the size and dryness of the Succulent Karoo Biome, it has a very high number of plant and flower species (Mucina and Rutherford 2006).

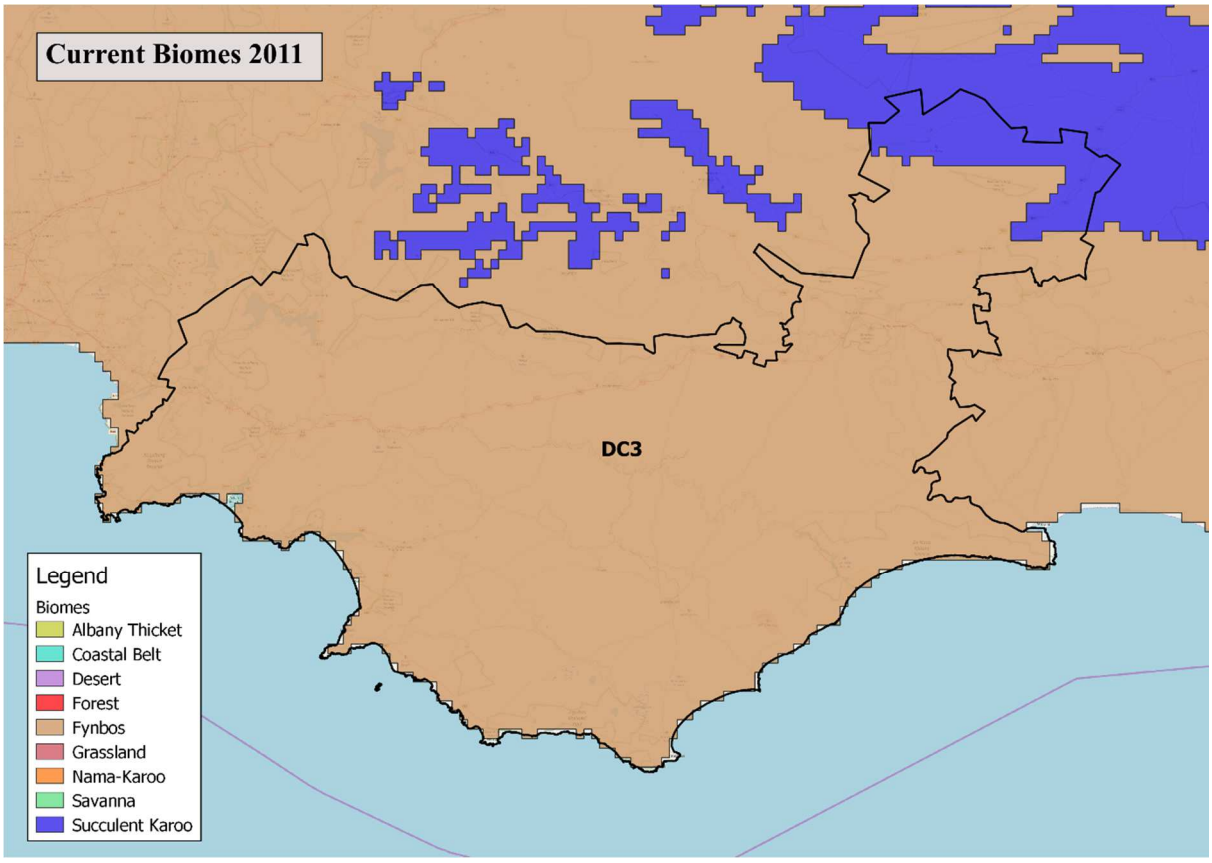

Figure 14: Current biome delineation in the District Municipal Area (South African National Parks 2011a)

Climate change is predicted to shift the biomes in South Africa, resulting in a change to the ecosystems and vegetation found in the Overberg District Municipal Area. The Long Term Adaptation Scenarios Report on biodiversity highlights the following biomes as the most vulnerable and "in need of strong protection, restoration and/or research" (Department of Environmental Affairs 2013b).

- Highest priority for action: Grassland and Indian Ocean Coastal Belt.
- High priority for action: Fynbos and Forest.
- Medium priority for action: Nama Karoo and Succulent Karoo.

The maps below (Figure 15 and Figure 16) show the shift in biomes in the Overberg District Municipal Area given different climate scenarios modelled by the South African National Biodiversity Institute (SANBI) in 2011. It is forecast that under a medium risk climate scenario, the Succulent

Karoo Biome will expand slightly into areas currently covered by the Fynbos Biome. Additionally, the Albany Thicket, Nama-Karoo, and Desert Biomes will appear in the northeast of the Overberg District Municipal Area at the expense of both the Succulent Karoo and Fynbos Biomes. Under a high risk climate scenario, it is forecast that the area currently covered by the Fynbos Biome will be substantially reduced by the Succulent Karoo, Albany Thicket, Nama-Karoo, and Desert Biomes. Furthermore, the Succulent Karoo will move further south and west compared to its current distribution.

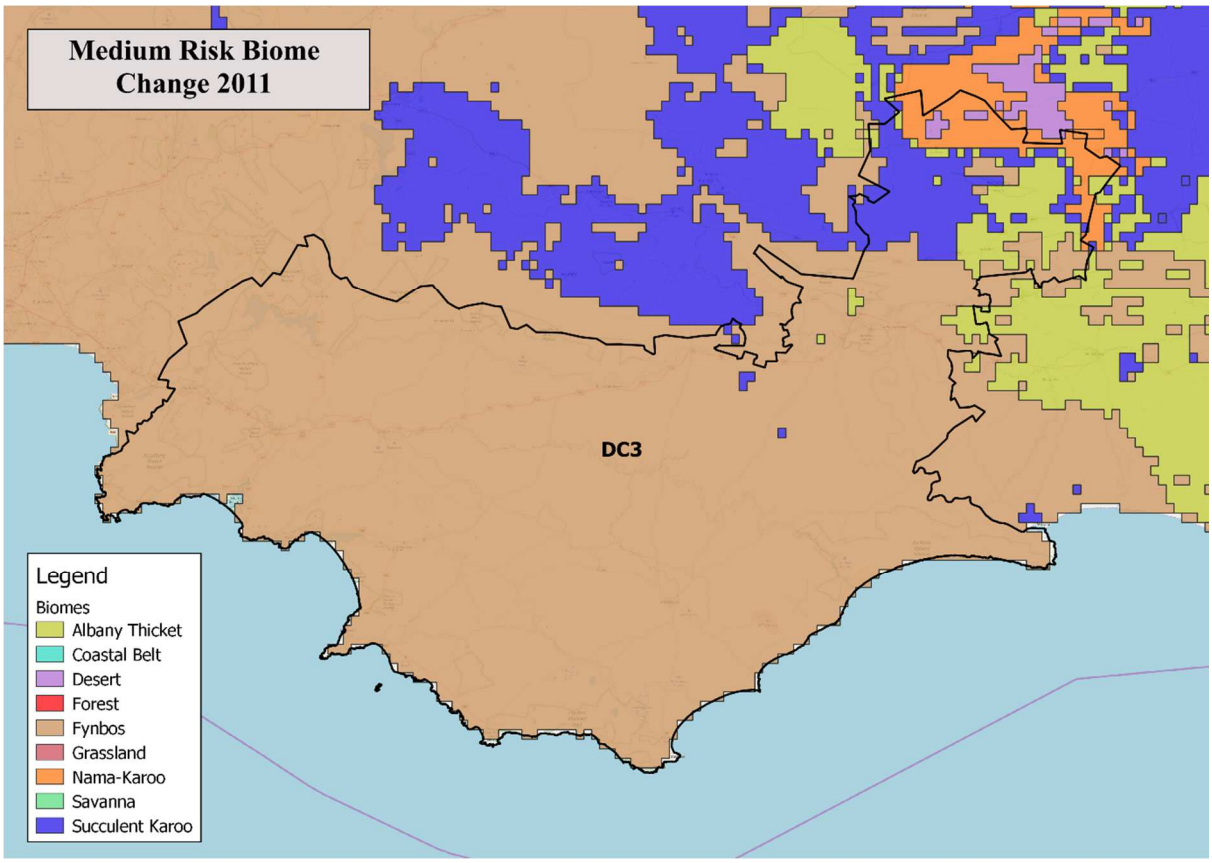

Figure 15: Predicted shift in biomes in the District Municipal Area using a medium risk scenario (South African National Parks 2011c)

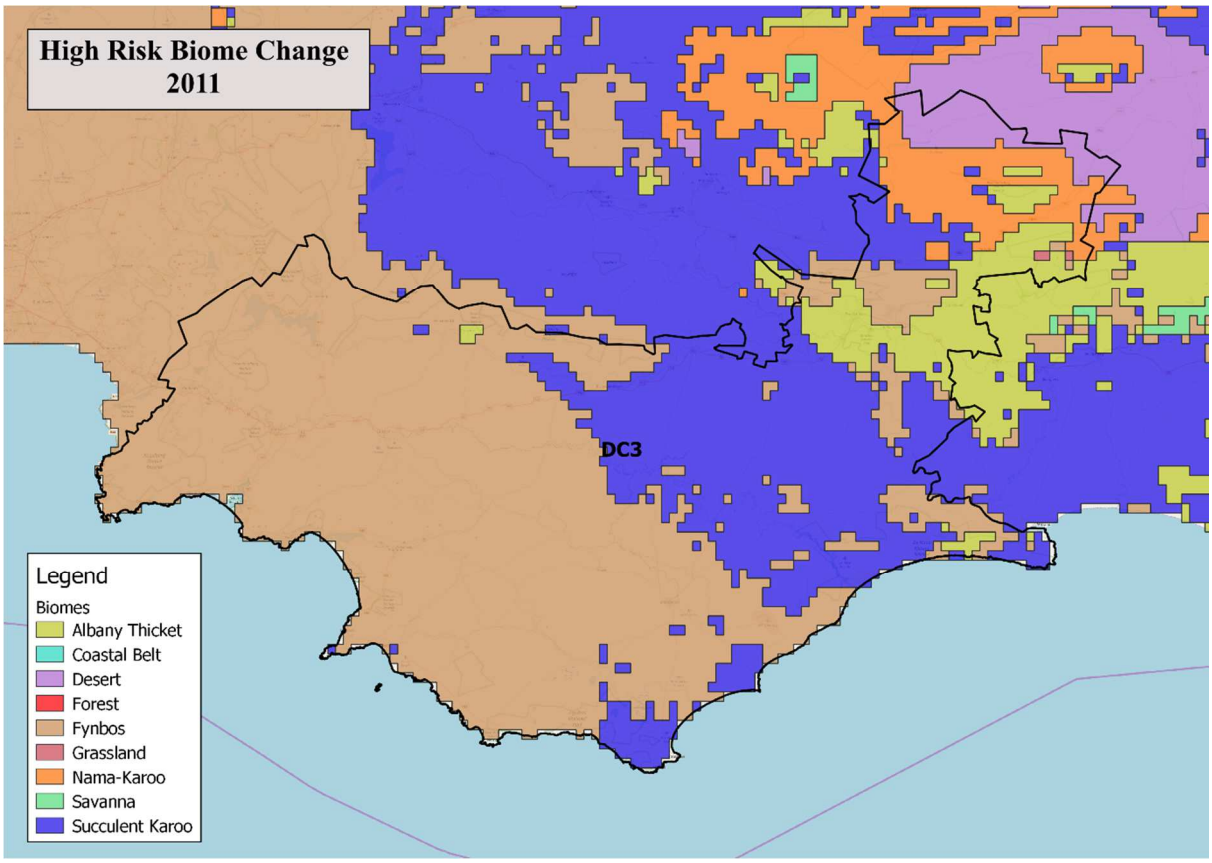

Figure 16: Predicted shift in biomes in the District Municipal Area using a high risk scenario (South African National Parks 2011b)

A substantial portion of the Overberg District Municipal Area is covered by threatened ecosystems types (Figure 17). The 'Kogelberg Sandstone Fynbos', 'Elgin Shale Fynbos', 'Western Ruens Shale Renosterveld', 'Elim Ferricrete Fynbos', 'Overberg Sandstone Fynbos', 'Central Ruens Shale Renosterveld', 'Eastern Ruens Shale Renosterveld', 'Ruens Silcrete Renosterveld' and 'Cape Lowland Alluvial Vegetation' are all categorised as critically endangered ecosystem types. There are also quite a few ecosystem types categorised as endangered or vulnerable in the Overberg District Municipal Area (South African National Biodiversity Institute 2011c).

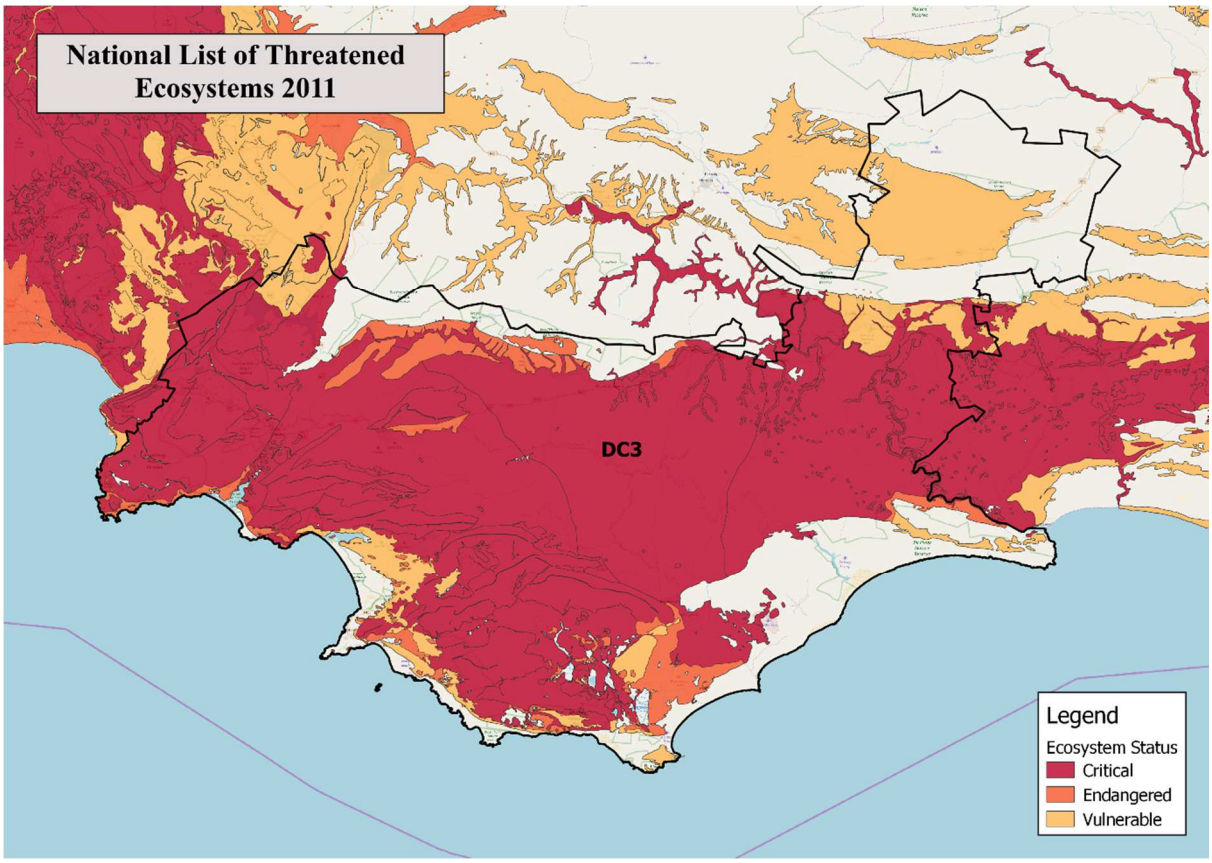

Figure 17: Threatened ecosystem types in the District Municipal Area (South African National Biodiversity Institute 2011c)

In South Africa, a 'protected area' is defined as areas of land (e.g. a national park) or ocean (e.g. a marine protected area) that is legally protected and managed for the conservation of biodiversity, as per the National Environmental Management: Protected Areas Act (No. 57 of 2003) (Department of Environmental Affairs 2009). Internationally, the International Union for Conservation of Nature's (IUCN) definition of protected area includes areas that are not legally protected, which the Department of Environmental Affairs refers to as 'conservation areas' (Department of Environmental Affairs 2009). Within the Overberg District Municipal Area there are 65 protected areas (Figure 18).

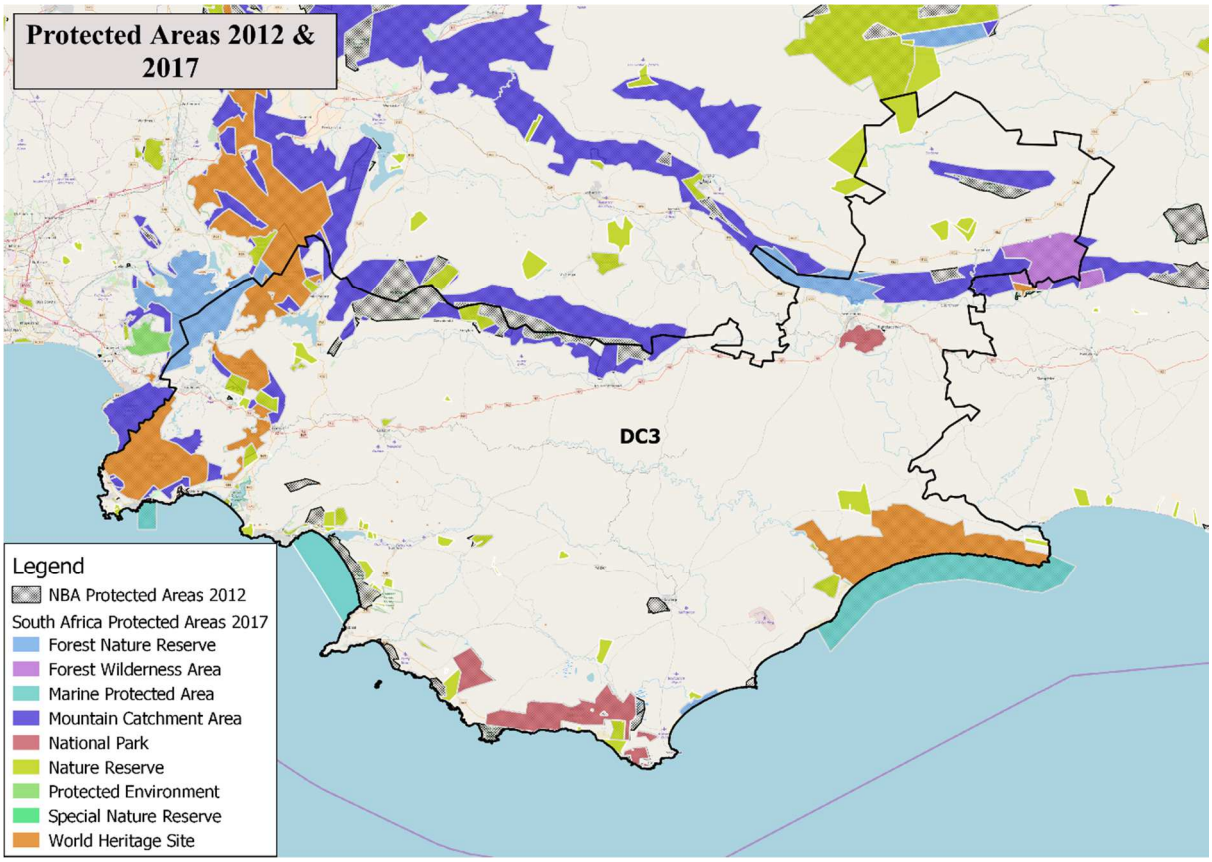

Figure 18: Protected areas in the District Municipal Area (South African National Parks and South African National Biodiversity Institute 2011; Department of Environmental Affairs 2017)

In South Africa, 65% of wetlands are threatened, of which 48% are critically endangered, 12% are endangered and 5% are vulnerable (Driver, A. et al. 2012). Wetland degradation is caused by inter alia: poor land management practises, spatial developments near urban areas, the spread of invasive alien plants; agricultural practises, pollution and the building of dams (Driver, A. et al. 2012).

In the Overberg District Municipal Area (Figure 19), most wetlands are classified as 'heavily to critically modified' (less than 25% of the wetland land cover is natural) (Council for Scientific and Industrial Research 2011). Wetlands classified as 'moderately modified' (between 25% and 75% of the wetland land cover is natural) are less frequent than those classified as 'heavily to critically modified', and those classified as 'mostly natural or good' (more than 75% of the wetland land cover is natural) are much fewer in number (Council for Scientific and Industrial Research 2011).

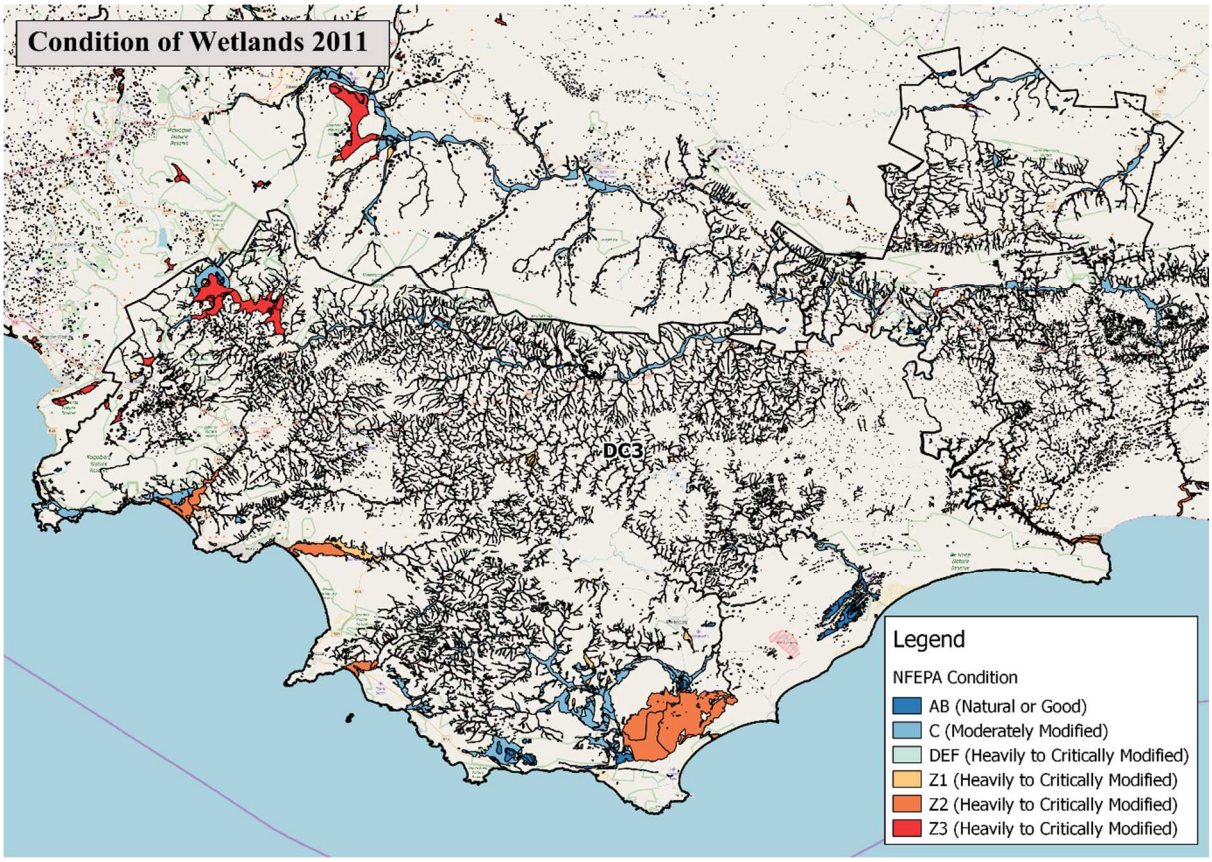

Figure 19: Condition of wetlands in the District Municipal Area (Council for Scientific and Industrial Research 2011)

Land use in the Overberg District Municipal Area is predominantly agriculture based (Overberg District Municipality 2017, 2016b). Other land uses include conservation areas, rural areas, urban areas and some forestry (plantation) and mining areas (Overberg District Municipality 2017, 2016b). These land uses have had varying effects on the biodiversity of the Overberg District Municipal Area.

Biodiversity in the Overberg District Municipal Area has been positively influenced by the conservation areas. It has been negatively influenced by: the spread of invasive alien species, land degradation, soil erosion, coastal erosion, unsustainable harvesting of natural resources, increased pollution, poor waste management, poor stormwater management, population growth, spatial development (such as the expansion of agricultural and urban areas), an ongoing drought and climate change (Overberg District Municipality 2017, 2016b).

According to the Millennium Ecosystem Assessment (2005) ecosystem services are "the benefits that people obtain from ecosystems", which can be divided into four categories: provisioning (e.g. timber), supporting (e.g. nutrient recycling), regulating (e.g. water purification), cultural (e.g. recreational activities) (Millennium Ecosystem Assessment 2005). The existing challenges that negatively affect the biodiversity in the Overberg District Municipal Area (discussed above) have also reduced ecosystem services (particularly provisioning services and regulating services) in the Overberg District Municipal Area and will continue to do so, if these impacts are not reduced (Overberg District Municipality 2017, 2016b).

If the biodiversity and related ecosystem services in the Overberg District Municipal Area are badly reduced, it could have direct negative consequences for the economy and social structures in the Overberg District Municipality. These consequences could have a detrimental effect on efforts to reduce poverty, inequity and unemployment in the Overberg District Municipal Area. Furthermore,

it is predicted that climate change will exacerbate these challenges and their effects on the biodiversity and related ecosystem in South Africa.

7.3 Overberg DM Marine and Coastal Sector Summary

The coastal zone in South Africa includes the inshore, offshore and estuarine ecosystems. It is a continually changing area where land and ocean meet, and includes beaches, rocky shores, estuaries, wetlands and the ocean near the coast (Nelson 2013; Provincial Government of the Western Cape 2005). A coastal zone extends seaward up to the boundary of the exclusive economic zone, which is 200 nautical miles (roughly 370 km) out to sea, and inland up to one kilometre after the high-water mark (Republic of South Africa 2014).

Climate change is predicted to result in several changes to South Africa's coastal zone (Department of Environmental Affairs 2013e, 2012). It is forecasted that climate change will include:

1. increase impacts on marine and benthic ecosystems
2. increase impacts on estuary ecosystems
3. increase impacts on coastal livelihoods, and
4. increase impacts on infrastructure and property due to sea level rise.

These impacts are expected to affect all coastal district municipalities in South Africa (Department of Environmental Affairs 2013e).

In assessing benthic and marine ecosystems, it is worth considering the threat status of the coastal zone. There are several threatened ecosystem types in the coastal zone of the Overberg District Municipal Area (Figure 20). The 'Southern Benguela Hard Shelf Edge', 'Agulhas Muddy Inner Shelf', 'Southern Benguela Gravel Outer Shelf', 'Southern Benguela Gravel Shelf Edge', 'Agulhas Inshore Reef', 'Agulhas Sheltered Rocky Coast' and 'Harbour' are all categorised as critically endangered ecosystem types (South African National Biodiversity Institute 2011b). Furthermore, the 'Agulhas Hard Inner Shelf' is categorised as an endangered ecosystem type (South African National Biodiversity Institute 2011b). There are also numerous ecosystem types in the Overberg District Municipal Area that are categorised as vulnerable (South African National Biodiversity Institute 2011b). Some of these threatened ecosystems are partially being conserved in marine protected areas.

The Overberg District Municipality currently has three marine protected areas entirely within its coastal zone: De Hoop Marine Protected Area, Betty's Bay Marine Protected Area and Walker Bay Whale Sanctuary Marine Protected Area (Department of Environmental Affairs 2017). However, the expanse of marine protected areas off the coast of the Overberg District Municipal Area is set to grow. In 2016, through its participation in the Operation Phakisa Initiative, the Department of Environmental Affairs published draft notices and regulations to declared 22 new marine protected areas in South Africa's coastal zone (Department of Environmental Affairs 2016).

In the coastal zone of the Overberg District Municipal Area it is proposed that four offshore marine protected areas be created, namely the: Brown Bank Corals Marine Protected Area, Brown Bank Complex Marine Protected Area, Agulhas Bank Complex Marine Protected Area and the Agulhas Muds Marine Protected Area (Republic of South Africa 2016d, 2016c, 2016a, 2016b). Additionally, part of the proposed offshore Southeast Atlantic Seamounts Marine Protected Area would fall within the coastal zone of the Overberg District Municipal Area (Republic of South Africa 2016e).

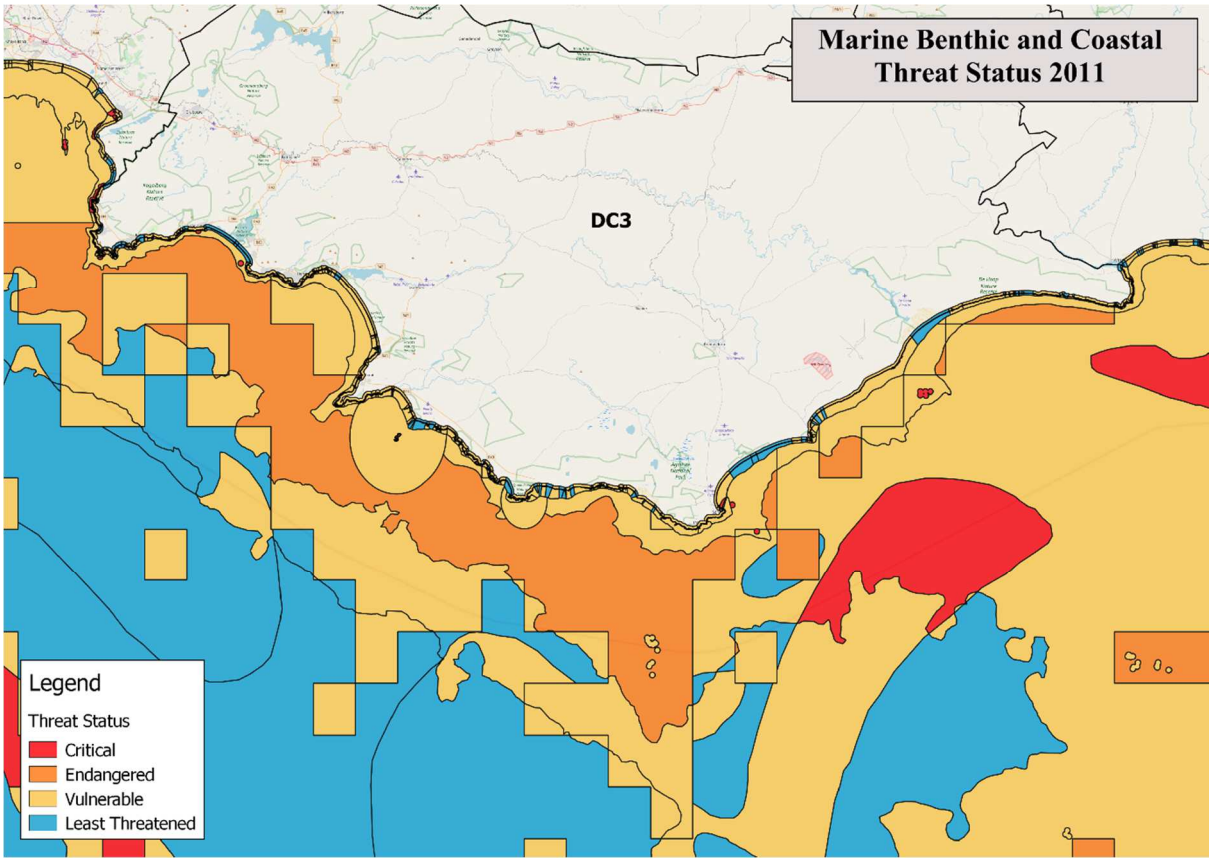

Figure 20: Threatened marine, benthic and coastal ecosystems in the District Municipal Area's coastal zone (South African National Biodiversity Institute 2011)

There are ten estuarian systems wholly in the Overberg District Municipal Area (Figure 21) and one (the Breede estuary) that marks the border between the Overberg and Eden District Municipal Areas (South African National Biodiversity Institute and CSIR 2012). The health condition of these estuaries is varied. The Breede, Klipdrifsfontein, Buffels (Oos) and Rooiels estuaries are all classified as 'largely natural with few modifications' (South African National Biodiversity Institute and CSIR 2012). The Ratel, Klein, Bot/Kleinmond and Palmiet estuaries are classified as 'moderately modified' (South African National Biodiversity Institute and CSIR 2012). The Heuningnes and Uilkraals estuaries are classified as 'largely modified' and the Onrus estuary is classified as 'seriously modified' (South African National Biodiversity Institute and CSIR 2012). There are no estuaries in the Overberg District Municipal Area that are classified as 'unmodified, natural' or 'critically/extremely modified' (South African National Biodiversity Institute and CSIR 2012). In addition, nine of the estuaries have critically endangered ecosystems threat status (Overberg District Municipality 2015b). Furthermore, all of the estuaries in the Overberg District Municipal Area fall under the Western Cape Estuary Programme and all are supposed to have reviewed or new Estuary Management Plans and Mouth Management Plans by 2018 (Overberg District Municipality 2017).

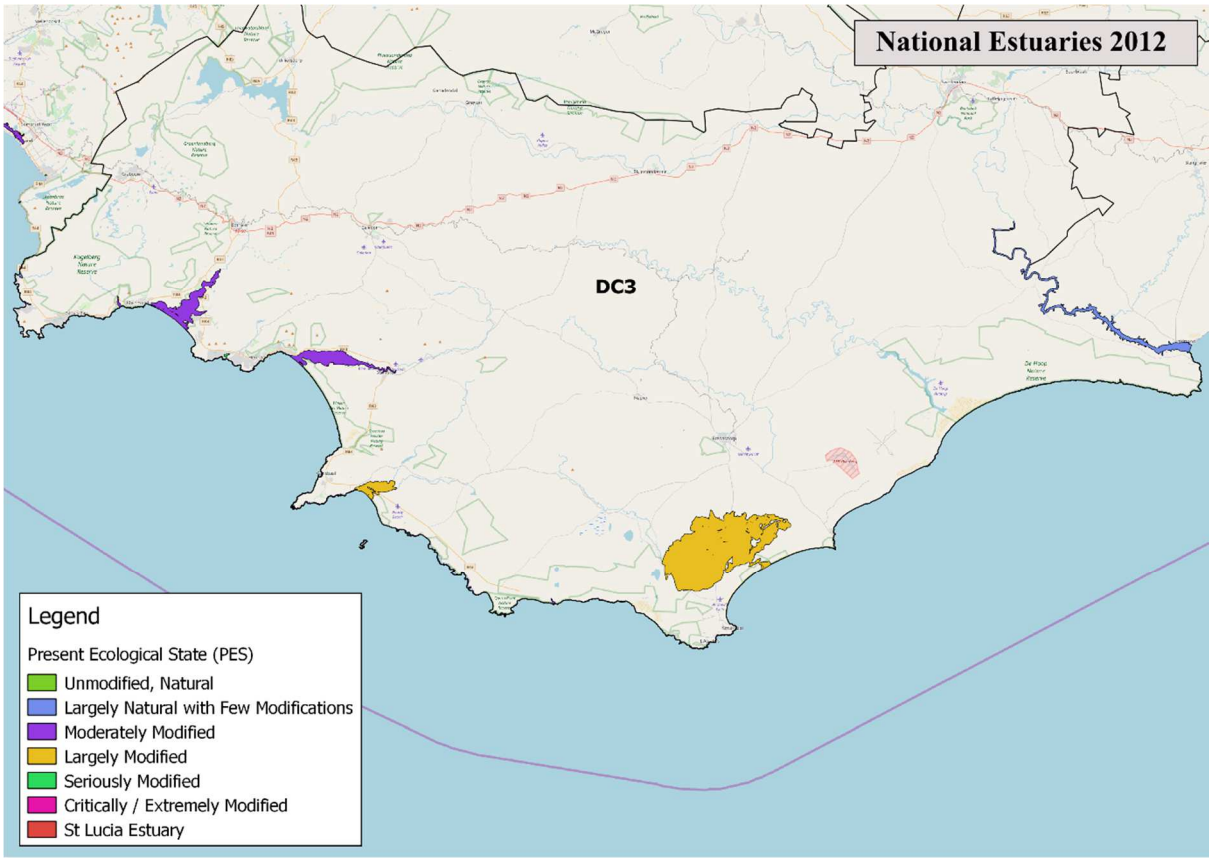

Figure 21: Estuaries in the District Municipal Area (South African National Biodiversity Institute and CSIR 2012)

In South Africa, 43 % estuary ecosystems are threatened (Department of Environmental Affairs 2012). Estuary ecosystems are experiencing increasing pressure from human related activities that are decreasing the quantity and quality of available estuarian ecosystem services (Department of Environmental Affairs 2012). These pressures are caused by: the activities that happen in and around the estuary; changes to the quantity and quality of fresh water entering the estuary; and, poor land use practises and degradation higher up in the catchment (Department of Environmental Affairs 2012). Estuary ecosystems are also impacted by: artificially breaching the mouths of estuaries; pollution; and the expected impacts of climate change, especially escalating sea level rise, coastal erosion, and increased coastal storm frequency and intensity (Palmer, van der Elst, and Parak 2011; Department of Environmental Affairs 2013e).

Climate change is expected to reduce the diversity and quantity of fishes and other biota in estuarine ecosystems (as well as inshore and offshore ecosystems) through changes to: land and sea surface temperatures; frequency and distribution of precipitation; water runoff patterns; increased coastal storm frequency and intensity; oxygen levels; and wind (Department of Environmental Affairs 2013e). Sea level rise may also cause salt water intrusions into estuarine and agricultural lands which could lead to a reduction in their ecosystem services (Atkinson and Clark 2005).

Climate change may also have a negative impact on coastal livelihoods (Department of Environmental Affairs 2013e). Predicted increases in the severity and frequency of storms and sea level rise may reduce the number of feasible fishing days and cause damage to shore-based infrastructure (e.g. harbours and launch sites) and fishing boats (Department of Environmental Affairs 2013e).

With regards to impacts from sea level rise, the *Long-Term Adaptation Scenarios* specifically considers all land under 5.5 metres (m) above the current mean sea level to be part of the coastal zone (Department of Environmental Affairs 2013f). The reason for this is that 5.5m is the maximum estimated height of land that could be affected by the predicted increases in storm surges, sea level rise and tidal fluctuations by the year 2100 (Department of Environmental Affairs 2013f).

Within the Overberg District Municipal Area (Figure 22), 176 square kilometres (km^2) in Cape Agulhas Local Municipality, 72 km^2 in the Overstrand Local Municipality and 12 km^2 in the Swellendam Local Municipality are estimated to be below a 5.5 m elevation (Department of Environmental Affairs 2013b). At 260 km^2 in total, the Overberg District Municipal Area contains the second largest area of coastal land with less than a 5.5 m elevation in South Africa (Department of Environmental Affairs 2013b). These areas under a 5.5 m elevation are at risk of being negatively affected by the predicted increases in storm surges, sea level rise and tidal fluctuations, due to climate change (Department of Environmental Affairs 2013b).

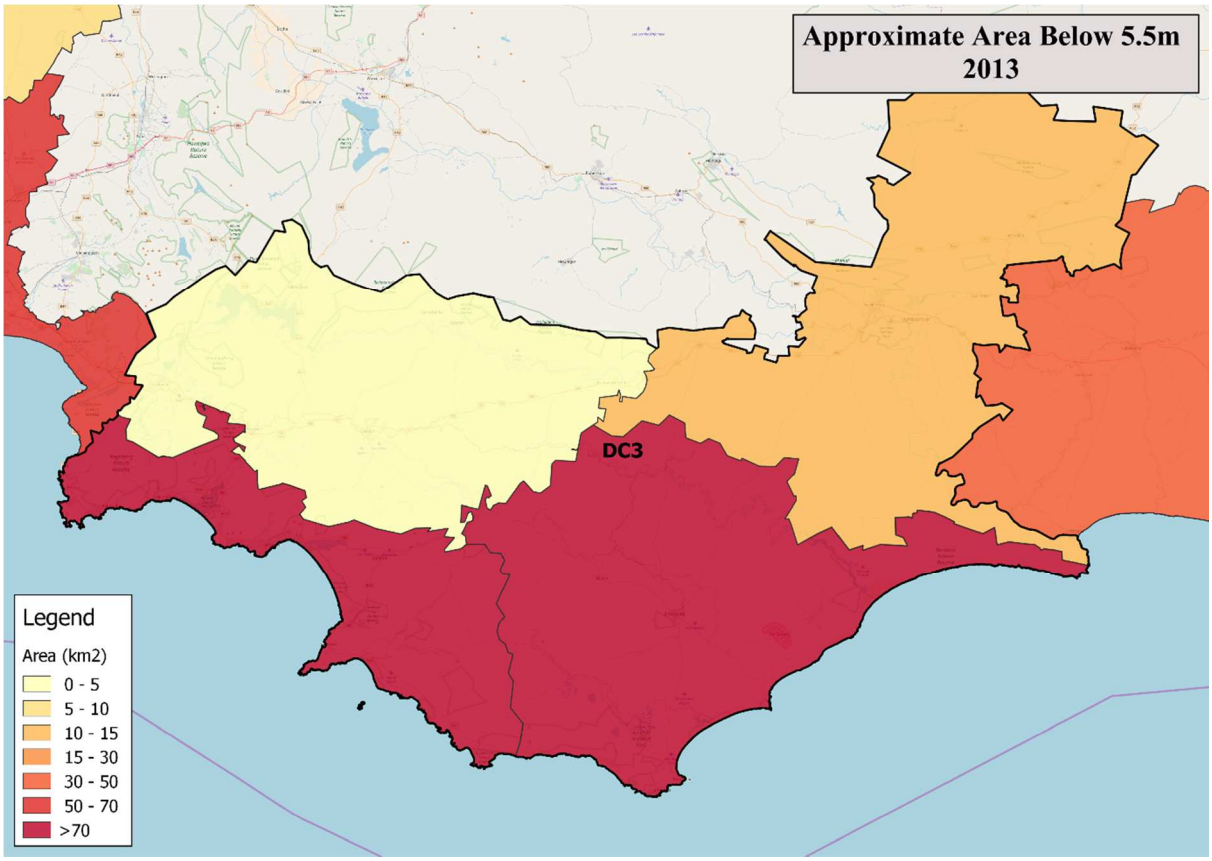

Figure 22: Approximate area below 5.5m in the District Municipal Area (Department of Environmental Affairs 2013f)

In addition to the predicted effects of climate change, the coastal zone in South Africa is susceptible to anthropogenic impacts such as ecosystem overuse (e.g. overfishing) and degradation, increased pollution, and the increased nutrient runoff from coastal developments leading to eutrophication of wetlands, estuaries, etc. (Department of Environmental Affairs 2013e). The anthropogenic and climate change impacts have already negatively affected biodiversity and ecosystems services in the coastal zone (and across South Africa) and are expected to worsen these issues unless climate change adaptation and mitigation responses are developed and implemented (Department of Environmental Affairs 2013e).

The National Environmental Management: Integrated Coastal Management Amendment Act, No 36 of 2014 requires that every coastal district municipality has a Coastal Management Programme (Republic of South Africa 2014). In 2016, the Overberg District Municipal Council approved the Coastal Management Programme for the Overberg District Municipality (Overberg District Municipality 2016a, 2017). The Overberg District Municipality has also implemented a Municipal Coastal Committee that meets quarterly and attends the Provincial Coastal Committee quarterly meetings (Overberg District Municipality 2017). Additionally, a Coastal Management Plan for the Cape Agulhas Local Municipality is being developed, while development of Coastal Management Plan for the Overstrand and Swellendam District Municipalities has yet to start (Overberg District Municipality 2017).

7.4 Overberg DM Health Sector Summary

A great proportion (82.5 %) of South Africa's population are dependent on the public health sector for health related services (Massyn et al. 2016). At the end of the 2015/2016 financial year (ending March 2016), there were 4,061 public health facilities in South Africa (Massyn et al. 2016). These public facilities can be divided into 3,198 clinics; 274 community health centres; 253 district hospitals; 47 regional hospitals; 27 central / tertiary hospitals and 262 hospitals that are classified as 'other' (Health Systems Trust 2012). Presently, within the Overberg District Municipality, there are 17 clinics, four district hospitals, and one other hospital (Massyn et al. 2016).

According to a health care facilities audit by the Health Systems Trust, the Overberg District Municipal Area received a score of 54% on vital measures in six ministerial priority areas for health care facilities and 64% for the infrastructure of health facilities (Health Systems Trust 2012). The score on vital measures in the six ministerial priority areas relates to patient-centred care, specifically focusing on: positive and caring attitudes; waiting times; cleanliness; patient safety; infection prevention and control; and availability of medicines and supplies (Health Systems Trust 2012). The infrastructure score meanwhile is based on the assessment of mainly: building and site infrastructure, facility infrastructure management and standards around the availability of space (Health Systems Trust 2012).

The total population of the Overberg District Municipal Area was approximately 787,491 people in 2011 (Statistics South Africa 2011). In the District Municipal Area, children under the age of 15 make up 24.07% of the total population, while those aged between 15 and 39 account for a further 41.30% (Statistics South Africa 2011). Furthermore, the 40 to 64 years age group makes up 26.29% of the population and the elderly (>64yrs age group) make up the remaining 8.34% of the population (Statistics South Africa 2011). Furthermore, the young (<5yrs age group) and elderly (>64yrs age group) constitute 17.17% of the total population (Figure 23) (Statistics South Africa 2011). These two groups are said to be the most vulnerable to climate change impacts. The darker areas on the map (Figure 23) indicate higher percentages of young and elderly people.

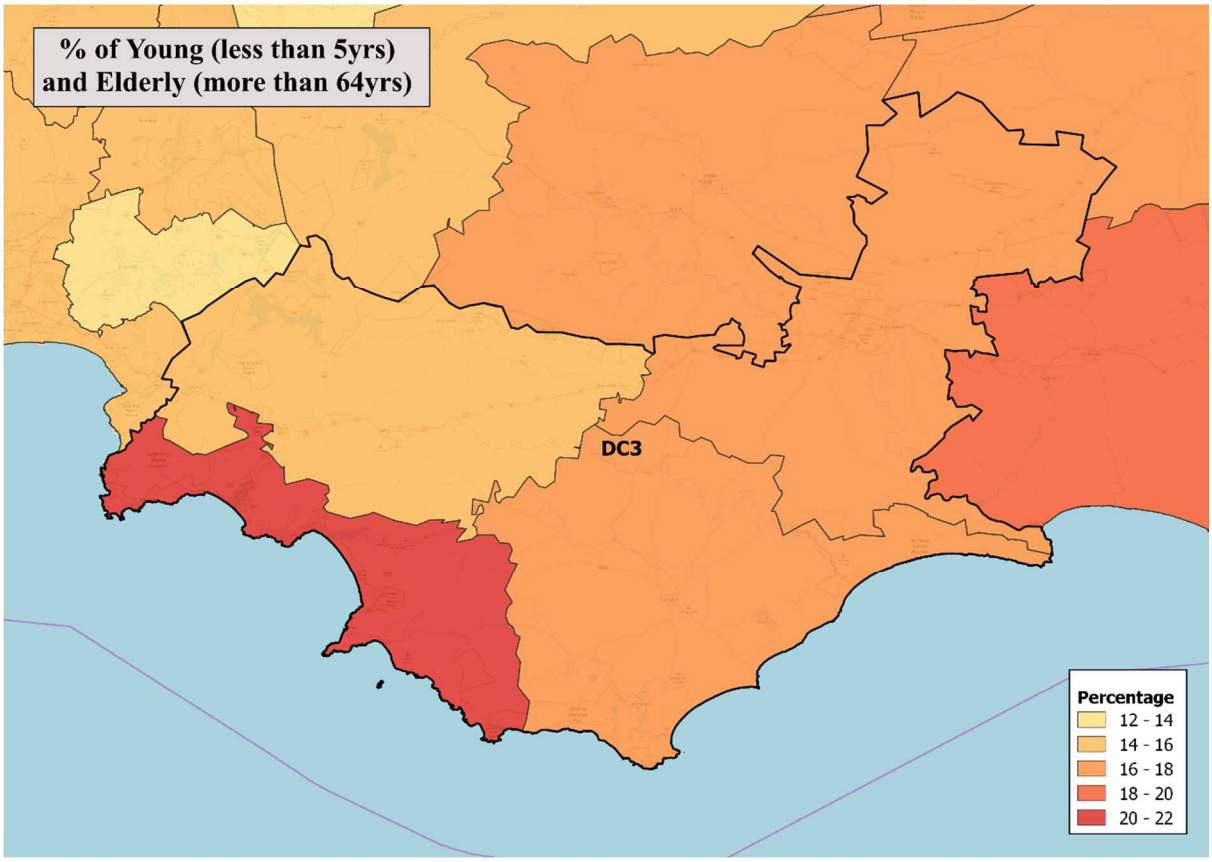

Figure 23: Percentage of young (<5yrs age group) and elderly (>64yrs age group) across the Overberg District Municipal Area (Statistics South Africa 2011)

In 2015, the total number of deaths in South Africa was 460,236, of which 2,243 occurred in the Overberg District Municipal Area (Statistics South Africa 2015). The distribution of deaths by age in South Africa revealed that, in 2015, 7% of deaths occurred in children under the age of 5, while individuals over the age of 64 accounted for 34.4% of the deaths (Statistics South Africa 2015).

In 2015, the top ten underlying natural causes of death within the Overberg District Municipality were: ischaemic heart diseases; cerebrovascular diseases; malignant neoplasms of respiratory and intrathoracic organs; diabetes mellitus; chronic lower respiratory diseases; tuberculosis; malignant neoplasms; hypertensive diseases; other forms of heart disease; and influenza and pneumonia (Statistics South Africa 2015).

Specifically, the leading causes of death for children under five years of age, for the 2009 to 2014 period, in the Overberg District Municipal Area were a group of communicable (infectious) diseases together with perinatal, maternal and nutritional conditions (Massyn et al. 2016). Lower respiratory infections (16.8%) were the leading cause of children's (<5yrs age group) deaths, followed by preterm birth complications, which accounted for 15.7% of deaths (Massyn et al. 2016).

Additionally, the leading causes of death for the elderly (>64yrs age group) in the Overberg District Municipal Area were a group of non-communicable diseases (which cannot be transferred from one person to the next) that accounted for 60.7% of deaths between 2009 and 2014 (Massyn et al. 2016). Of these non-communicable diseases, ischaemic heart disease was the leading cause (16.1%) of deaths, followed by Cerebrovascular disease (13.2%) (Massyn et al. 2016).

Concerning waterborne and communicable diseases, approximately 6.41% of the Overberg District Municipal Area's households do not source water from piped water schemes (Statistics South Africa

2011) and are therefore vulnerable to waterborne diseases. For the “children under five years diarrhoea case fatality” (that is children under five years who died in hospital from diarrhoeal disease) the District Municipal Area ranked 1st (where 1st represents the best performance and 52nd represents the worst performance in South Africa) with a diarrhoea case fatality rate of 0.0% during the 2015/2015 period (Massyn et al. 2016). The national average for “children under five years diarrhoea case fatality” was 2.2% over the same time period (Massyn et al. 2016).

Furthermore, for the “child under 5 years sever acute malnutrition case fatality rate” (that is children under five years who died from acute malnutrition) the Overberg District Municipal Area ranks 1st (where 1st represents the best performance and 52nd represents the worst performance in South Africa) with a rate of 0% during the 2015/16 period (Massyn et al. 2016). This is below the national average of 8.9% over the same time period (Massyn et al. 2016).

In terms of risks posed by working conditions, about 53.32% of the Overberg District Municipal Area’s economically active population are employed, of which roughly 15.8% are employed within the informal sector (Statistics South Africa 2011). Many of the people employed in the informal sector work outdoors in poor conditions, with limited infrastructure and services such as shade, and limited access to amenities such as water and sanitation (Statistics South Africa 2011).

Additionally, 8.62% of the Overberg District Municipal Area’s households are involved in agricultural activities (Statistics South Africa 2011). People who work outdoors, like those involved in agricultural activities, are especially vulnerable to the impacts of extreme weather conditions. Moreover, climate change is forecast to exacerbate the frequency and severity of extreme weather events (Department of Environmental Affairs 2013c). Consequently, predicted impacts for households involved in agriculture include reduced agricultural yields and water security as well as increased food insecurity.

The main disaster risks that are likely to affect human health in the Overberg District Municipal Area are increased wind speeds, increased drought and flood occurrences and sea storm surge events (Overberg District Municipality 2017). It is predicted that these disasters will be exacerbated by climate change (Overberg District Municipality 2017).

From the information above, the predicted impacts of climate change on human health and health services are mostly negative. Hence, there is a need for climate change adaptation (and mitigation) plan to limit the negative impacts and encourage any positive effects of climate change on human health in the Overberg District Municipal Area.

7.5 Overberg DM Human Settlements Sector Summary

The Overberg District Municipality population was approximately 286,786 in 2016 (Overberg District Municipality 2017). Of the local municipalities within the Overberg District Municipality, the most populous local municipality in 2016 was the Theewaterskloof Local Municipality with approximately 117,109 residents, while the least populous was the Cape Agulhas Local Municipality with approximately 36,000 residents (Overberg District Municipality 2017).

Within the District Municipal Area, 41.30% of the population are between 15 and 39 years old, while children under 15 years old make up 24.07% of the total population (Statistics South Africa 2011). People between the ages of 40 and 64 constitute 26.29% of the total population, while people over 64 years old constitute the smallest (8.34%) part of the total population (Statistics South Africa 2011).

Regarding educations levels in the District, 22.14% of the population have completed matric, while 9.57% of the population have earned post-school qualifications, 35.60% have some secondary schooling and 22.31% have some or completed primary schooling (Statistics South Africa 2011). The remaining 9.29% have been classified as "other" in terms of their level of education (Statistics South Africa 2011).

The non-economically active population (Figure 24) constitutes 32.99% of the District's working-age population (those aged 15 to 64) (Statistics South Africa 2011). In addition, approximately 53.32% of the working-age population is employed (Statistics South Africa 2011). The unemployed constitute 10.89% of the working-age population, while 2.79% are discouraged work-seekers (Statistics South Africa 2011).

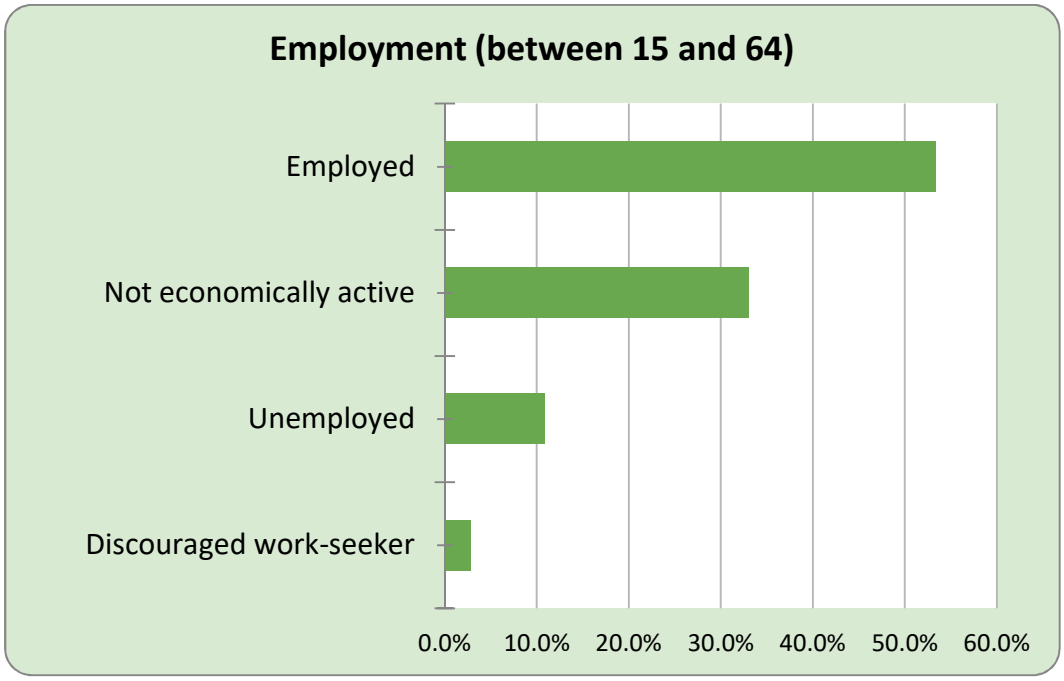

Figure 24: Employment status in the District Municipal Area (Statistics South Africa 2011)

The population in the Overberg District Municipal Area is highly urbanised with about 83% of the population residing in the major towns such as Hermanus, Caledon, Bredasdorp, Grabouw and Swellendam (Overberg District Municipality 2017, 2013). In the District Municipal Area, there are 77,196 households and on average three individuals per household (Statistics South Africa 2011).

The majority (70.8%) of the dwellings in the District Municipal Area are formal1 (houses) while 2.2% are apartments (Statistics South Africa 2011). In addition, 14.2% of the dwellings are informal (Figure 25) and about 12.8% of dwellings have not been specified (Statistics South Africa 2011).

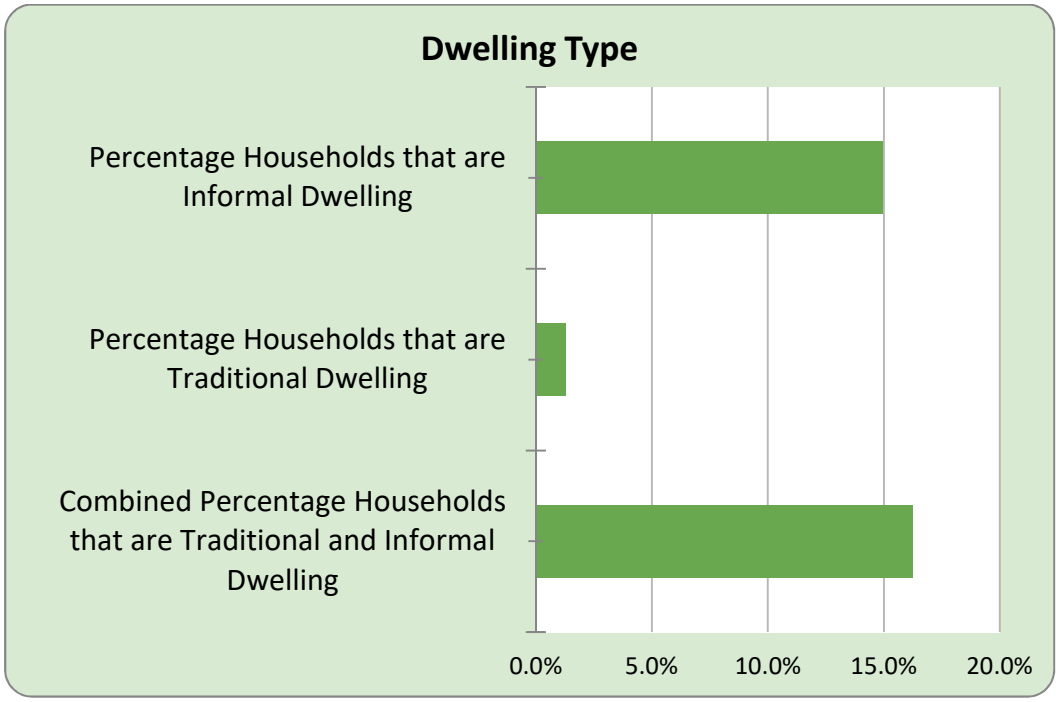

Figure 25: Households by type of dwelling in the District Municipal Area (Statistics South Africa, 2011)

The majority (83.59%) of the population in the District Municipal Area receives water from water service providers (Figure 26) (Statistics South Africa 2011). Water service provider are either the local municipalities or Overberg Water (Overberg District Municipality 2017). Additionally, 5.95% of the population get water from boreholes and 0.93% rely on water tanks for water supply (Statistics South Africa 2011).

Regarding sanitation services, 89.42% of the population have access to flush toilets (Figure 27), while 1.67% use pit latrines, 4.65% have access to other toilet facilities and 4.26% of the population have no toilet facilities (Statistics South Africa 2011).

[1] "Formal House" includes cluster houses, flat or apartment, house/flat/room in backyards, house or brick/concrete block structure on a separate stand or yard or on a farm, room/flatlet on a property or larger dwelling/servants quarters/granny flat and semi-detached houses.

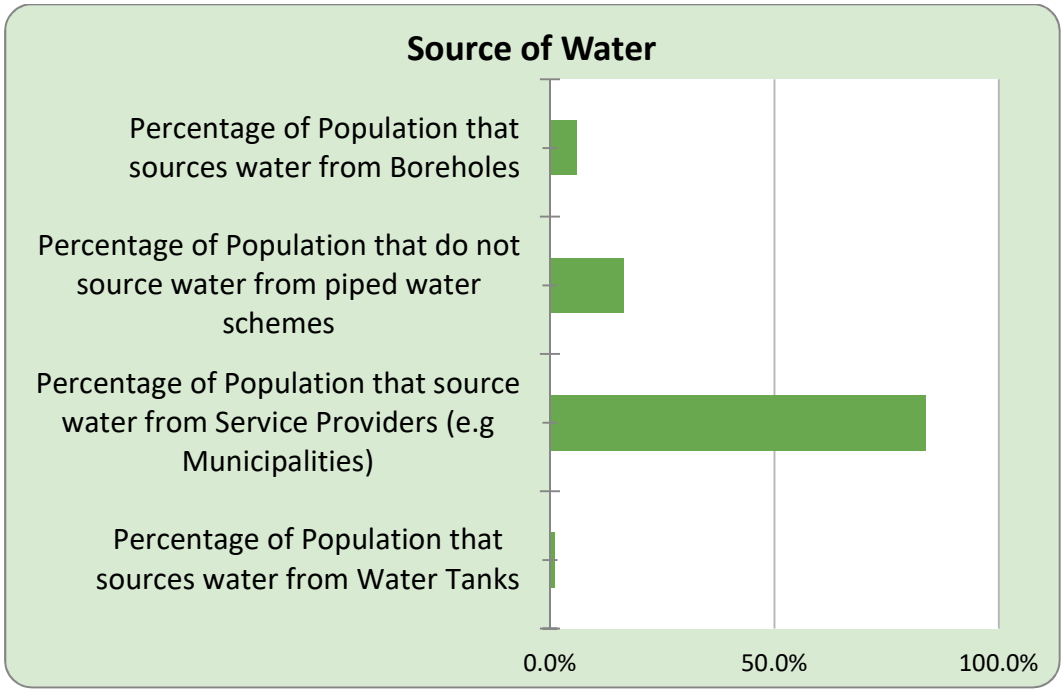

Figure 26: Population by water source (Statistics South Africa 2011)

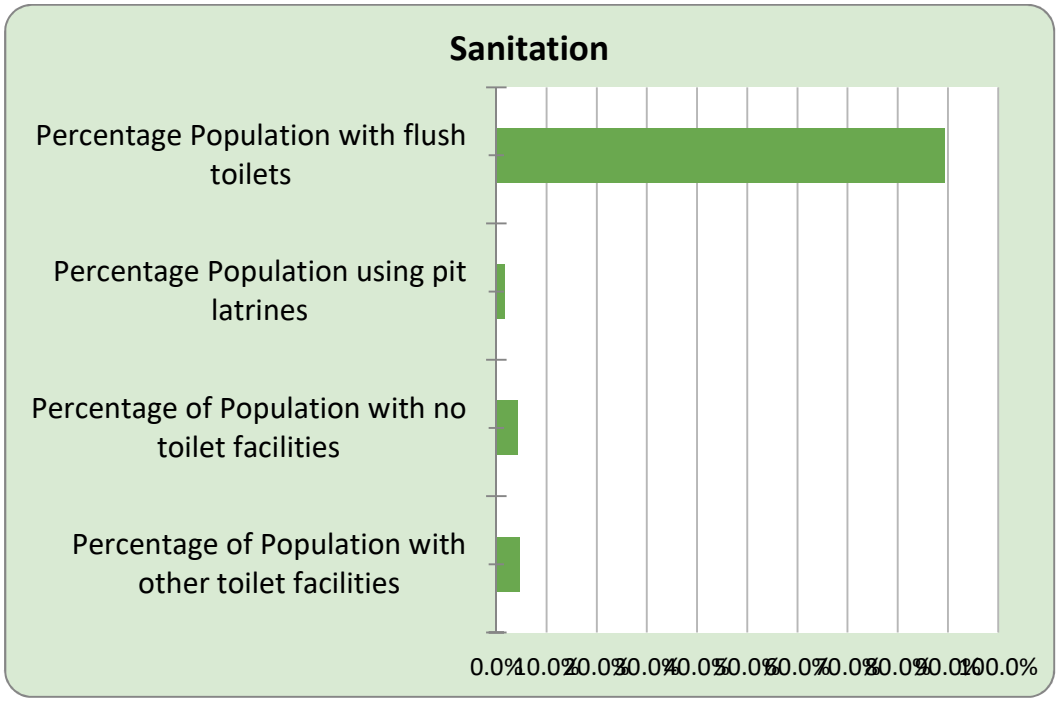

Figure 27: Population by toilet facilities (Statistics South Africa 2011)

Access to the District Municipal Area is facilitated by several main roads including the N2, R43 and R44 (Overberg District Municipality 2015a). There are also several proclaimed harbours in the District Municipal Area (Overberg District Municipality 2016a). There are two harbours in Hermanus, one of which functions as a museum and is also used for research purposes, while the other is proclaimed for fishing (Overberg District Municipality 2016a). Other harbours in the District that are

proclaimed for fishing in include the Arniston, Gansbaai, Hermanus and Struisbaai harbours (Overberg District Municipality 2016a).

Climate-related hazards in the District Municipal Area include increases in extreme weather events, veldfires, wind speeds, droughts and flood occurrences and storm surge events (Overberg District Municipality 2017).It is predicted that climate change will exacerbate the frequency and severity of these hazards (Department of Environmental Affairs 2013b). These hazards are a threat to the numerous tourism attractions in the District (Overberg District Municipality 2013, 2015a).

Regarding veldfires specifically, most of the District Municipal Area has a high veldfire risk, however, there are areas in the centre, east and northeast of the District that have low and medium veldfire risks(Figure 28) (Department of Agriculture, Forestry and Fisheries 2010). Veldfire prevalence in the District Municipal Area is high mainly during the summer months (Overberg District Municipality 2017). Susceptibility to veldfires in the District is inherent because the dominant Fynbos Biome burns easily, and dry and windy conditions prevail in summer (Overberg District Municipality 2017).

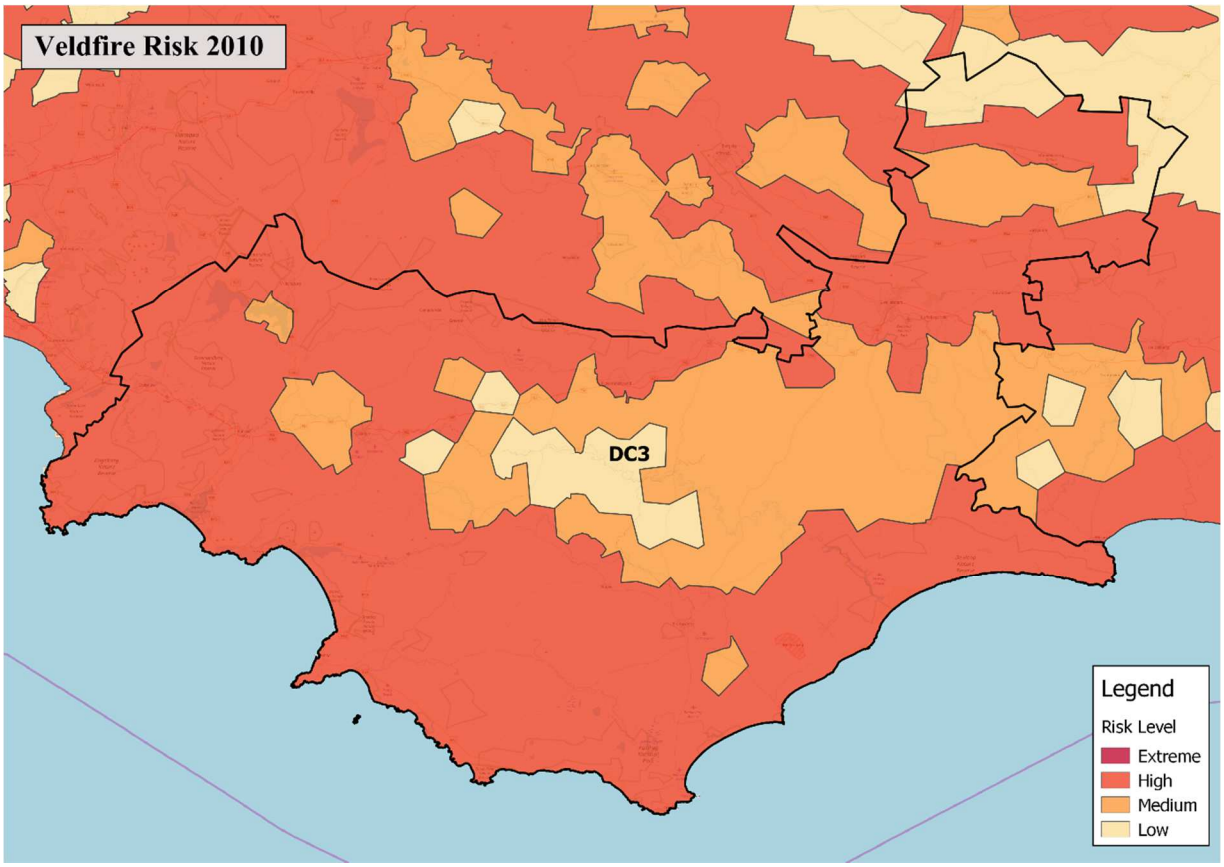

Figure 28: Veld fire risk for Overberg District Municipality (Department of Agriculture, Forestry and Fisheries 2010)

7.6 Overberg DM Water Sector Summary

The Overberg District Municipality falls under the Breede-Gouritz/Berg hydrological zone (Figure 29) (Department of Environmental Affairs 2013d). As outlined above (in Figure 1), in the warmer wetter future scenario, the Breede-Gouritz/Berg hydrological zone is predicted to experience an increase rainfall in an increase in rainfall in winter and spring, and a decrease in autumn(Department of Environmental Affairs 2013d). While in the hotter and drier scenario, the region will experience a decrease in rainfall in all seasons and a strong decrease in rainfall in the west of the Hydrological Zone (Department of Environmental Affairs 2013d).

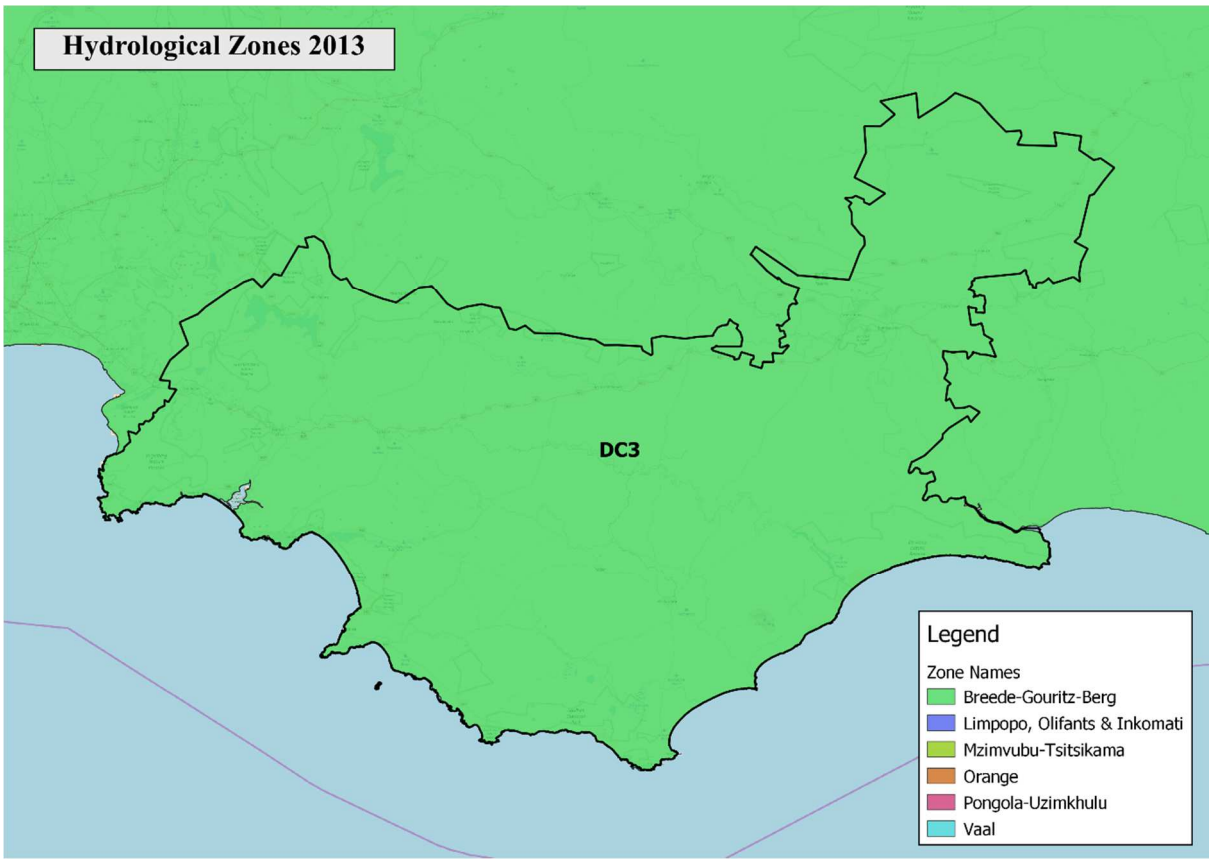

Figure 29: Hydrological Zone for the District Municipal Area (Department of Environmental Affairs 2013d)

Some hydrological zones cover multiple water management areas. The Overberg District Municipality falls almost entirely under the Breede-Gouritz Water Management Area, although some small areas in the west of the District Municipal Area fall under the Berg Olifants Water Management Area (Figure 30) (Department of Environmental Affairs 2013d). Within the Breede-Gouritz Water Management Area, the Overberg District Municipal Area overlaps with two catchments, namely the Gouritz River Catchment and the Breede River Catchment (Overberg District Municipality 2017). Within these catchments, there are 19 main water resources (Figure 31) which include estuaries, dams and lakes, the biggest of which is the Theewaterskloof Dam (Department of Water and Sanitation 2016b). Other water resources include the De Hoop Vlei, Soetendalsvlei, Bot River Estuary, Rockview Reservoir and the Zwiegelaars Reservoir (Department of Water and Sanitation 2016b).

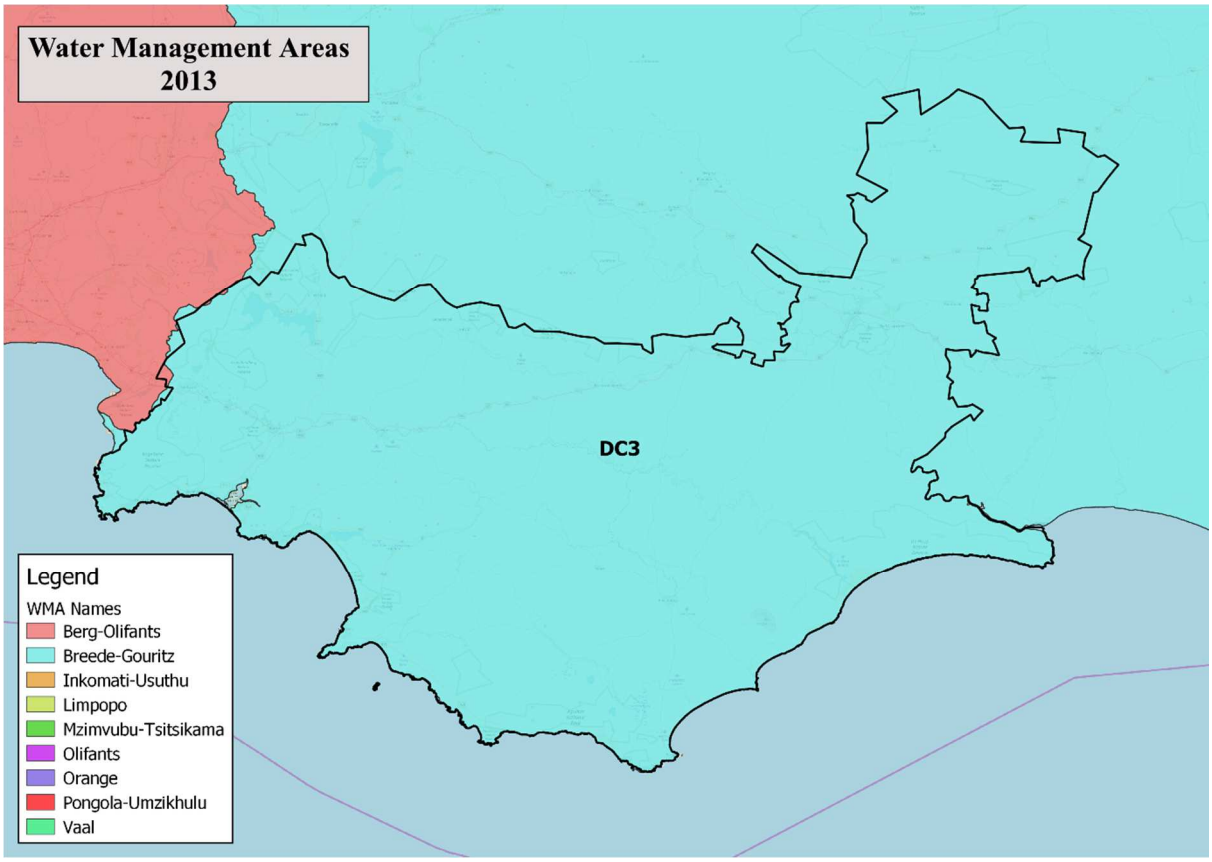

Figure 30: Water Management Area for the District for the District Municipal Area (Department of Water Affairs 2013)

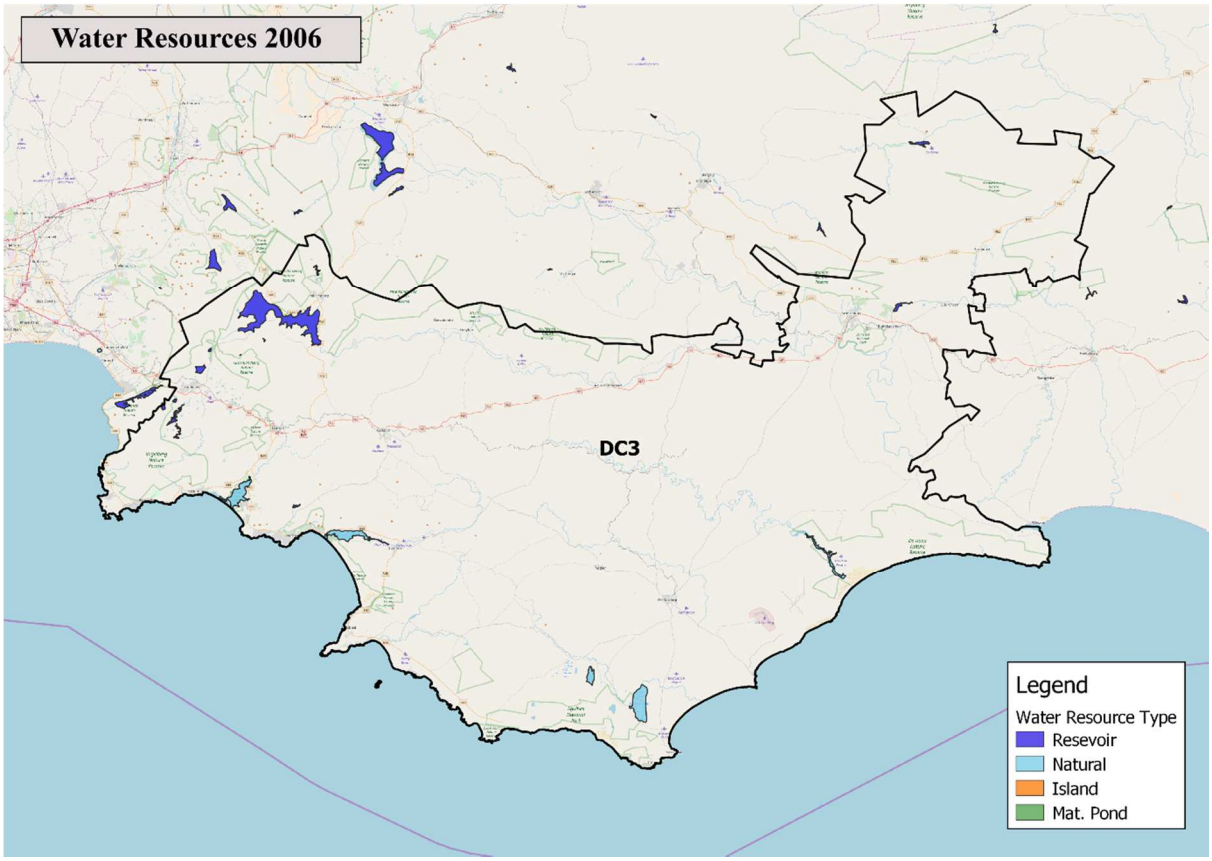

Figure 31. Water Resources Within the Municipal District Area (Department of Water and Sanitation 2016b)

The river quality within the Overberg District Municipality is not in a good state, which means that only some rivers are able to contribute towards river ecosystems biodiversity targets (South African National Biodiversity Institute 2011a). The health of a river system is graded into one of several categories (South African National Biodiversity Institute 2011a). These categories are listed in Text Box 1.

Text Box 1: Freshwater Ecosystem Priority Areas (FEPAs) classification for river ecosystem conditions

River conditions in South Africa have been classified according to the Freshwater Ecosystem Priority Areas (FEPAs) for river ecosystems (SANBI 2011). The different grades are provided below:

A = Unmodified, Natural
B = Largely Natural with Few Modifications
Ab = A or B Above
C = Moderately Modified
D = Largely Modified
E = Seriously Modified
F = Critically/Extremely Modified
Ef = E or F Above
Z = Tributary Condition Modelled as Not Intact, According to Natural Land Cover

Rivers that are unmodified or in their natural state are able to contribute towards river ecosystems biodiversity targets (SANBI 2011). In contrast, rivers that are categorised as 'largely modified' or worse are unable to contribute towards river ecosystems as they are not in a good state.

Many of the rivers in the Overberg District Municipal Area (Figure 32) such as the Breede, Palmiet, Onrus, Klein and Uilkraal Rivers have been classified as 'moderately modified' (South African National Biodiversity Institute 2011a). Additionally, some rivers such as the Rooi Els River are classified as 'largely natural with few modifications', while the Bot and Buffalo Rivers are classified as 'largely modified' (South African National Biodiversity Institute 2011a). Some smaller rivers such as the Poort and Haelkraal Rivers are classified as 'tributary condition modelled as not intact, according to natural land cover' (South African National Biodiversity Institute 2011a).

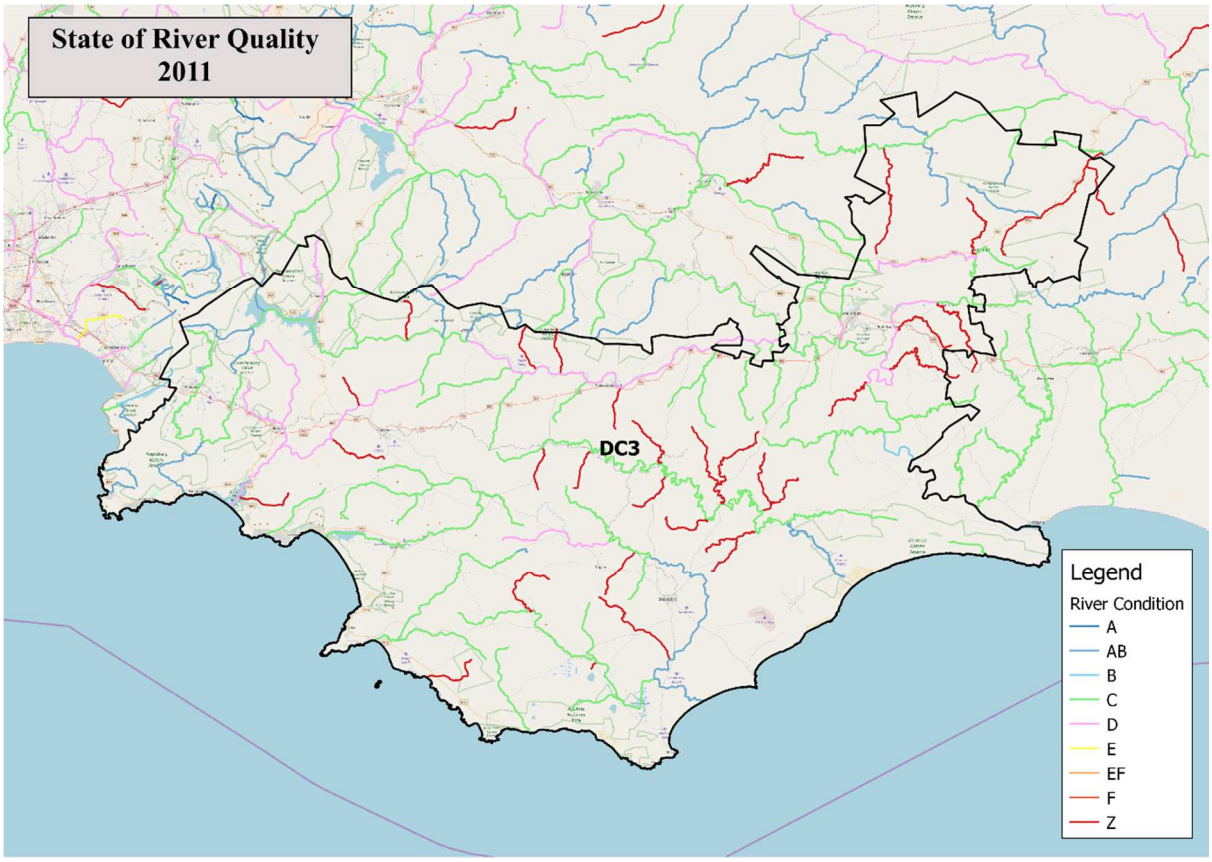

Figure 32: State of Water Quality in Rivers in the District Municipal Area (South African National Biodiversity Institute 2011a)

Water resources in any catchment are largely depended on rainfall. The Historical Climate Monthly Averages include long-term historical monthly average rainfall totals and monthly averaged minimum and maximum temperatures for a particular spot (Climate System Analysis Group 2017b). The Historical Climate Monthly Averages for the Overberg District Municipal Area have been calculated using the nearest weather data station to the Municipality, which is the measuring station at Cape Agulhas (Figure 33). The graph (in Figure 33) shows that average temperatures peak in summer while rainfall peaks in winter (Climate System Analysis Group 2017b). Resultantly, there is less rainfall during summer seasons with the lowest average monthly rainfall historically occurring in February , which averages slightly less than 20 mm (Climate System Analysis Group 2017b).

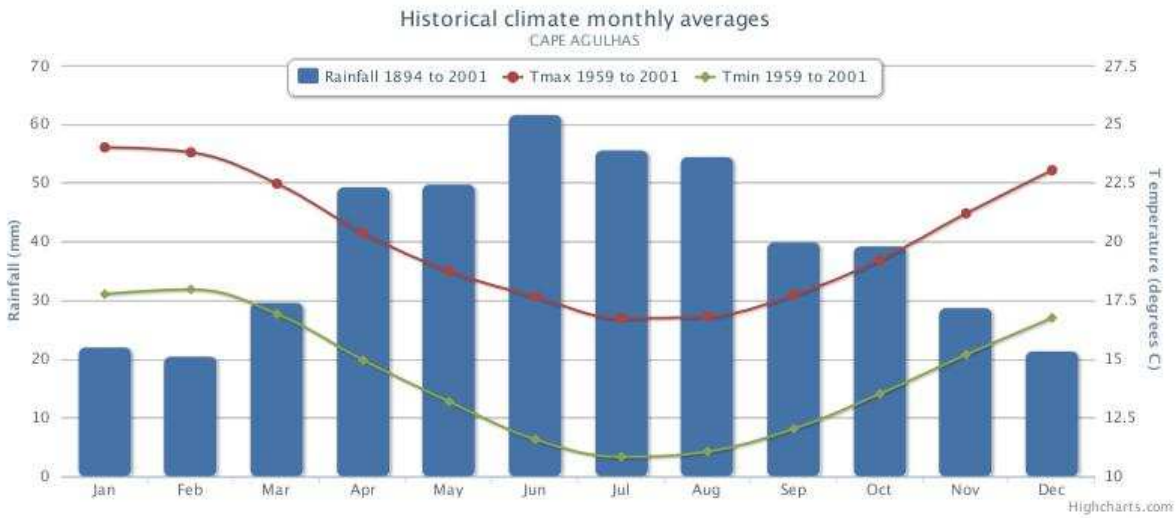

Figure 33: Historical Climate Monthly Averages for Cape Agulhas (Climate System Analysis Group 2017b)

Linked to the rainfall and rivers in the Overberg District Municipal Area are the water and sanitation services. Specifically, a total of 16.41 % of households in the Overberg District Municipal Area do not receive their water from piped water schemes, which is lower than the national average of 21.82 % (Statistics South Africa 2011). Furthermore, the percentage of the population with flush toilets in the Overberg District Municipal Area is 89.42%, while the national average is 56.51 % (Statistics South Africa 2011). This indicates a good spread of sanitation access within the Overberg District Municipality.

Directly linked to water and sanitation services in the Overberg District Municipal Area are the Blue and Green Drop scores. Blue Drop scores rate the quality of drinking water, while Green drop scores rate the quality of wastewater. Blue Drop scores rate the quality of drinking water supplied by water service providers. The Blue Drop score can be understood using the following scale: 90 – 100 % = 'Excellent situation'; 75 - <90 % = 'Good status'; 50 - <75 % = 'Average performance'; 33 - <50 % = 'Very poor performance'; and, 0 - <33 % = 'Critical status' (Department of Water Affairs 2011). There is no 2014 Blue Drop score for the Overberg District Municipality, rather there are Blue Drop scores for each local municipality within the District.

The 2014 Blue Drop scores of each local municipality within the Overberg District Municipality are as follows: The Cape Agulhas Local Municipality scored 69.48%, The Overstrand Local Municipality scored 90.97%, the Swellendam Municipality scored 57.25% and the Theewaterskloof Local Municipality scored 64.18% (Department of Water and Sanitation 2014)

The Green Drop score rates the quality of wastewater management in municipalities. The Green Drop score can be understood using the following scale : 90 – 100 % = 'Excellent situation'; 80 - <90 % = 'Good status'; 50 - <80 % = 'Average performance'; 30 - <50 % = 'Very poor performance'; and, 0 - <30 % = 'Critical state' (Department of Water and Sanitation 2016a). There is no 2013 Green Drop score for the Overberg District Municipality, rather there are Green Drop scores for each local municipalities within the District (Department of Water and Sanitation 2013).

The 2013 Green Drop scores of each local municipality within the Overberg District Municipality are as follows: The Cape Agulhas Local Municipality scored 51.98%, the Overstrand Local Municipality scored 89.14%, the Swellendam Municipality scored 70.82% and the Theewaterskloof Local Municipality scored 55.82% (Department of Water and Sanitation 2013). These Green Drop scores indicate that the wastewater services in the Overberg District Municipality are being managed

according to the expectations of the Department of Water and Sanitation as assessed by the Green Drop score.

In addition to the Green Drop scores, 84.06% of households have their refuse removed by a local authority/private company in the Overberg District Municipal Area (Statistics South Africa 2011). This is much better than the national average for household refuse removal, which is 59.40 % (Statistics South Africa 2011). Nevertheless, uncollected waste often still ends up in water and sanitation infrastructure, blocking stormwater drains and polluting rivers. It is predicted that climate change will affect these water and sanitation challenges.

Climate change is predicted to have an impact on rainfall patterns in South Africa. Future rainfall projections for the Overberg District Municipality (using the measuring station at Cape Agulhas) for the period 2020 to 2040 (Figure 34) are made using the Representative Concentration Pathways (RCP) 4.5 greenhouse gas concentration trajectories (Climate System Analysis Group 2017a).

The bar charts (Figure 34) show the potential change in rainfall, with the blue bars indicating a potential increase in average rainfall and the red bars indicate a potential decrease in average rainfall (Climate System Analysis Group 2017a). The grey lines represent the various models used for this projection. It is therefore projected that the Overberg District Municipality could experience an increase in rainfall in the months of, February, March, April, July , September, October and December and a decrease in rainfall during January, May, June, August and November (Climate System Analysis Group 2017a).

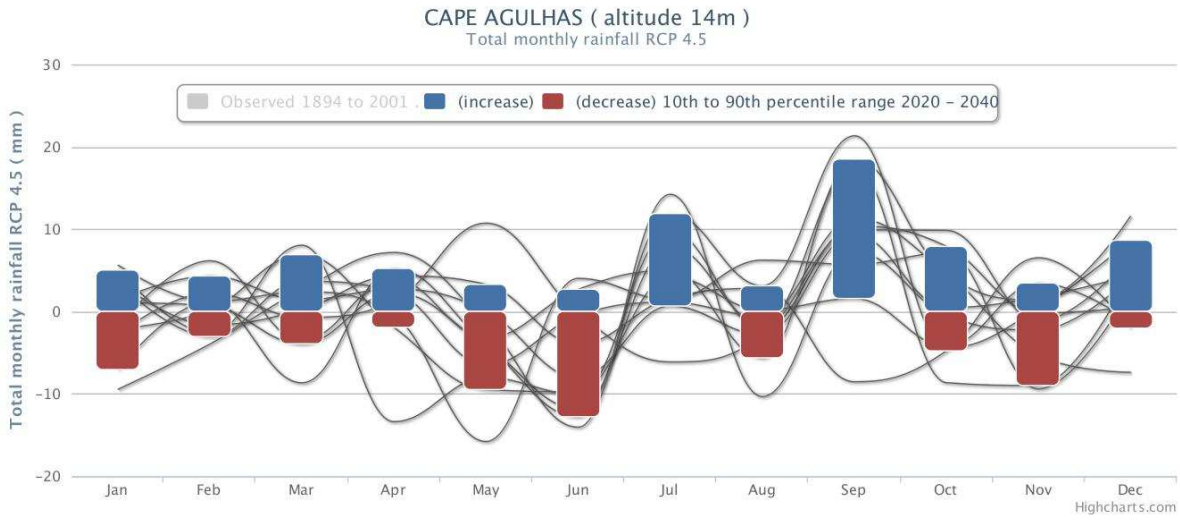

Figure 34: Rainfall Projections for Cape Agulhas (Climate System Analysis Group 2017a)