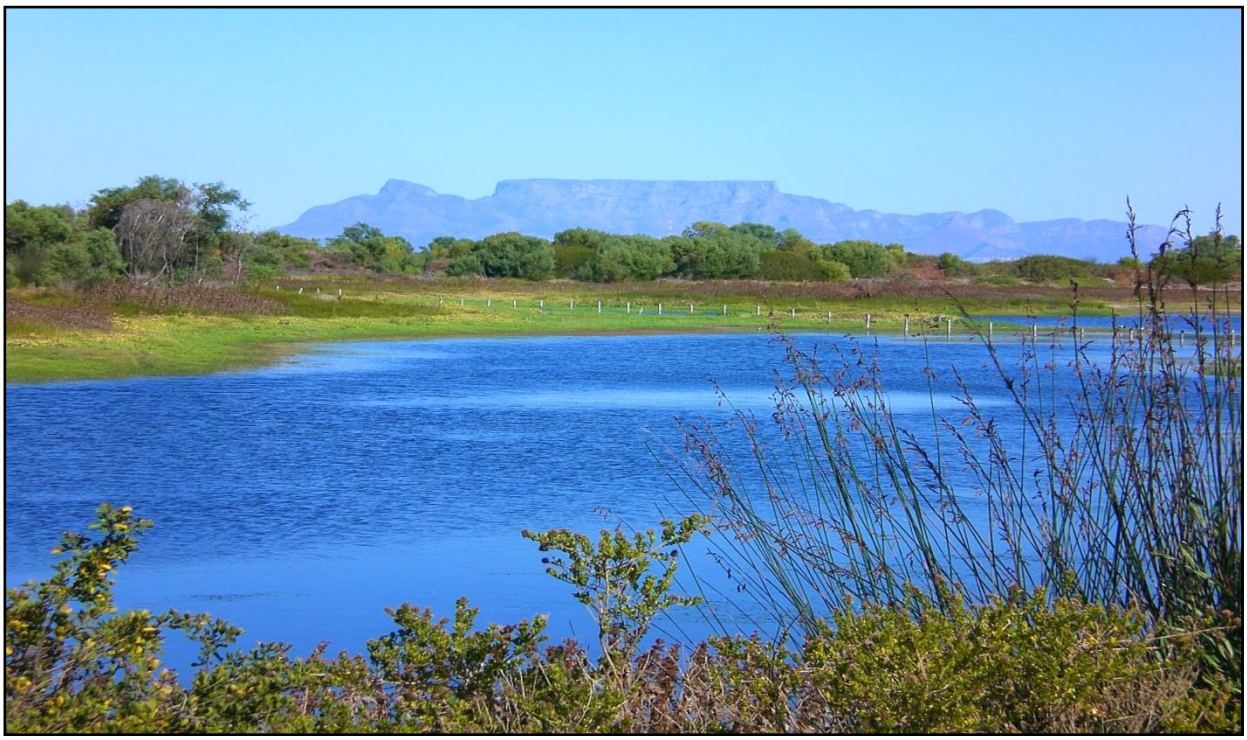
INTEGRATED RESERVE MANAGEMENT PLAN

WITZANDS AQUIFER NATURE RESERVE

City of Cape Town

June 2011, updated September 2014



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INTEGRATED RESERVE MANAGEMENT PLAN

Compiled by

Charline Mc Kie

Biodiversity Management Branch

Environmental Resource Management Department

City of Cape Town

Witzands Aquifer Nature Reserve

June 2011, updated September 2014

ISBN NUMBER

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List of abbreviations used

APO	**annual plan of operations**
ASF	**Atlantis sand fynbos**
C.A.P.E	**Cape Action for People and the Environment**
CARA	**Conservation of Agricultural Resources Act, 1983**
CBD	**central business district**
CBNRM	**community-based natural resource management**
CBO	**community-based organisation**
CDF	**Conservation Development Framework**
CFR	**Cape Floristic Region**
CR	**critically endangered**
CSIR	**Council for Scientific and Industrial Research**
CWAC	**coordinated water-bird counts**
EIA	**environmental impact assessment**
EMS	**environmental management system**
EN	**endangered**
ESRI	**Environmental Systems Research Institute**
FF	**Fynbos Forum**
GIS	**geographic information system**
GPS	**global positioning system**
IDP	**Integrated Development Plan**
IMEP	**Integrated Metropolitan Environmental Policy**
IRMP	**Integrated Reserve Management Plan**
IUCN	**International Union for Conservation of Nature and Natural Resources**
LBSAP	**Local Biodiversity Strategy and Action Plan**
MEC	**Member of Executive Council**
METT-SA	**Management Effectiveness Tracking Tool South Africa**
MOU	**memorandum of understanding**
NEMA	**National Environmental Management Act, Act 107 of 1998**
NGO	**non-governmental organisation**
PAR	**protected-area review**
RPC	**Reserve Planning Committee**
SAAQIS	**South African air quality information system**
SLA	**service-level agreement**
TOR	**terms of reference**
WfW	**Working for Water**
WfWet	**Working for Wetlands**
WWF	**World Wildlife Fund for Nature**
WWTW	**wastewater treatment works**

PART 1
DESCRIPTION

1. INTRODUCTION

The Witzands Aquifer Nature Reserve protects not only the Atlantis aquifer – the main water supply for the towns of Atlantis, Mamre and Pella – but also the rich biodiversity of the area, including an array of plant species, a number of mammals, an abundance of birdlife, and a rich cultural heritage. The none-vegetated mobile dune fields are an outstanding feature of the reserve, which appeals to visitors and locals alike because of its potential for hosting a variety of recreational activities, which includes, but not limited to off road recreational vehicles, sand boarding etc. The reserve's natural beauty and unique features offer a range of environmental education opportunities, making it an ideal venue for both learners and educators for a unique 'outdoor classroom' experience.

The strategic management planning process, which results in the development of an Integrated Reserve Management Plan (IRMP), for the Witzands Aquifer Nature Reserve began with the definition of the vision followed by the purpose for the reserve. This purpose is then supported by desired states for the reserve. The reserve objectives contribute to realising the purpose and desired states. For each desired state, a number of management objectives are identified. These management objectives are then implemented through the identification of outputs. Objectives for each desired state are prioritised for the five-year time horizon of the plan. Time frames, deliverables, performance indicators and targets are then allocated to each objective, or a group of linked outputs contributing to the desired state.

1.1 Aim of the Integrated Reserve Management Plan

The aim of the IRMP is to ensure that the Witzands Aquifer Nature Reserve has clearly defined objectives and activities to direct the protection and sustainable use of its natural, scenic and heritage resources over a five-year period. The IRMP thus provides the medium-term operational framework for the prioritised allocation of resources and capacity in the management, use and development of the reserve. The IRMP intends to add value and continuity by clearly stating management objectives, scheduling action, and providing management guidelines.

The planning process for the Witzands Aquifer Nature Reserve takes place against the backdrop of (i) the City of Cape Town's Integrated Development Plan (IDP) (Anon 2010); (ii) the City of Cape Town's Integrated Metropolitan Environmental Policy (IMEP) (Anon 2003[1]), (iii) biodiversity strategy (Anon 2003[2]) and Local Biodiversity Strategy and Action Plan

(LBSAP) (Anon 2009[1]), as well as (iv) the bioregion (Cape Action for People and the Environment, or C.A.P.E). The major elements of the IRMP are this document (overall strategy, vision and context); the detailed subsidiary plans (as required), and an annual plan of operations (APO). The IRMP for the Witzands Aquifer Nature Reserve is supported by a State of Biodiversity report (City of Cape Town 2008), operational guidelines, and a monitoring and evaluation framework to ensure on-going implementation and review of protected-area management activities (figure 1).

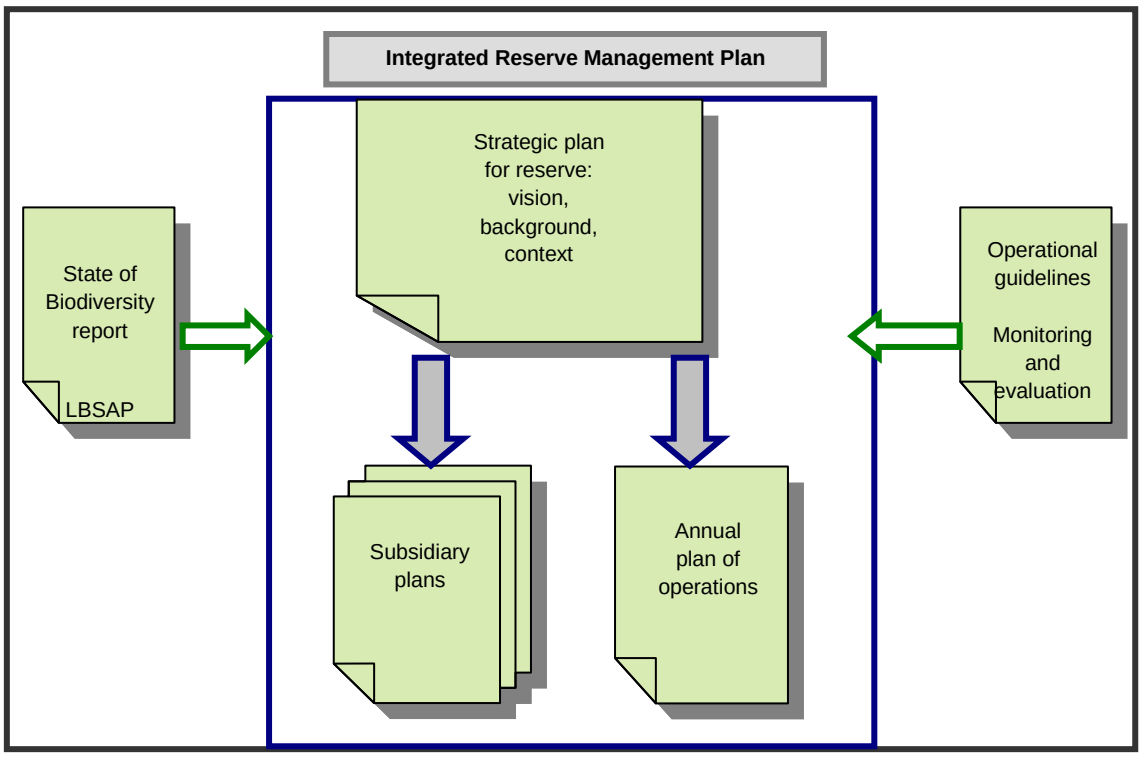


Figure 1: Elements of the IRMP

The IRMP for the Witzands Aquifer Nature Reserve forms part of a tiered series of policies, legislation and related planning documents at the sector, institutional, agency and local level (figure 2).

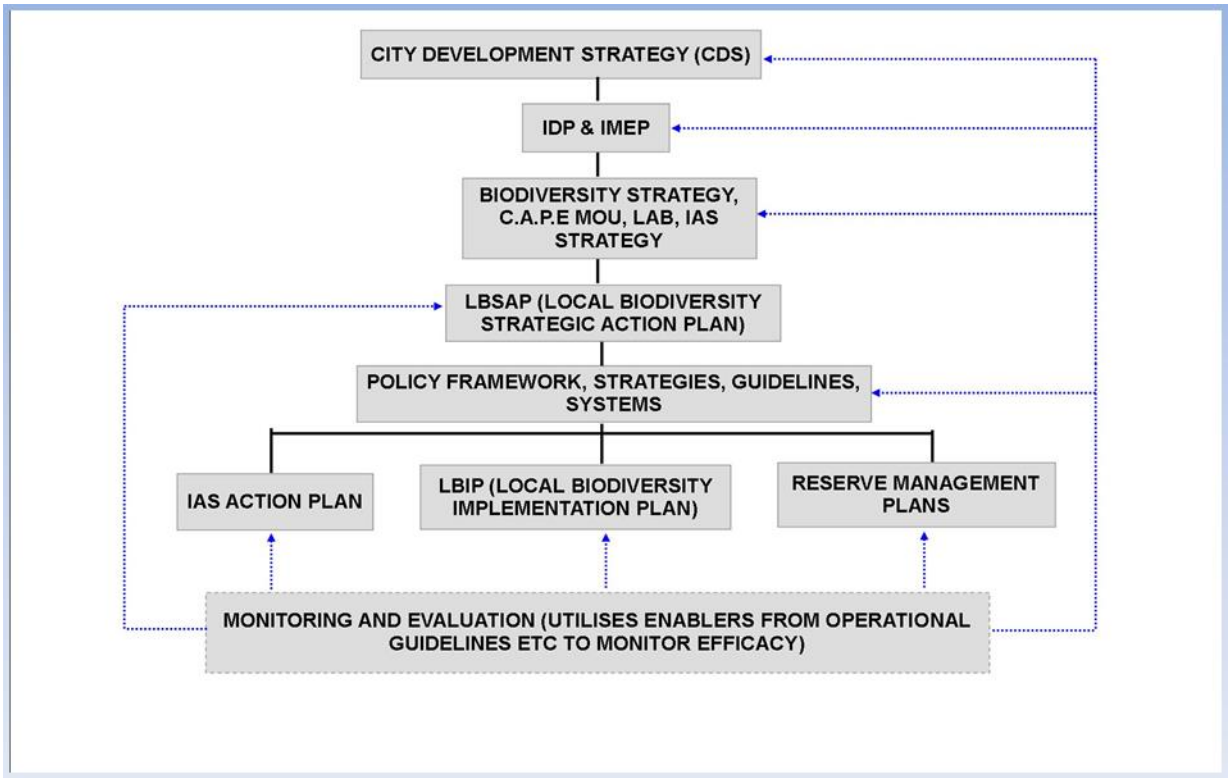


Figure 2: Legal and planning framework for the IRMP

Where possible, emphasis has been placed on the following:

- Assigning responsibility for management interventions
- Scheduling said management interventions
- Quantifying management costs

This approach is specifically intended to create a mechanism whereby management intervention can be monitored and audited on an annual basis.

In context, this IRMP is a dynamic document, and the detailed subsidiary plans should be updated on an annual basis or as soon as new information comes to light that may better inform decisions on responsible land management. The IRMP should be updated every five years.

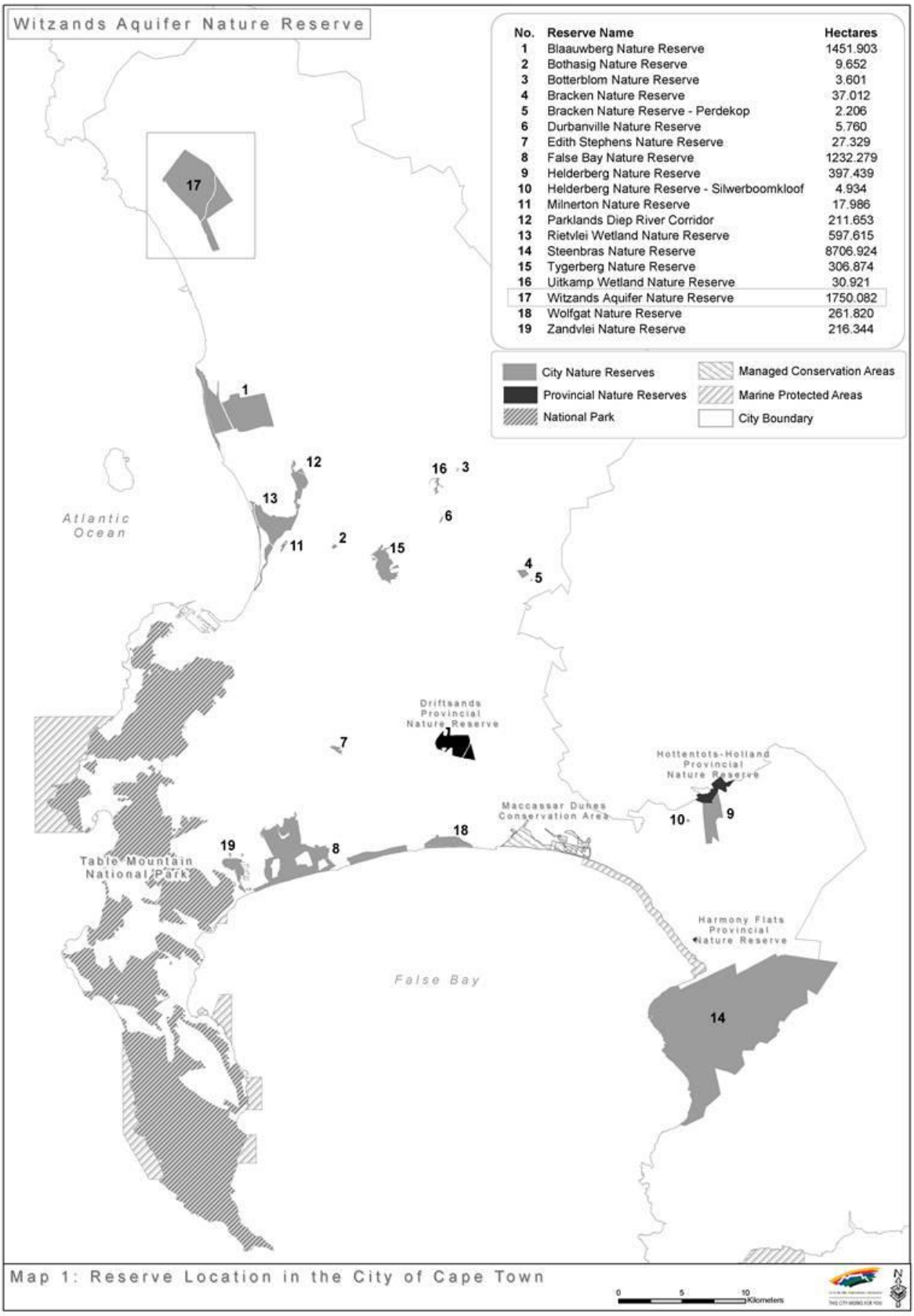
The drafting of this IRMP has been guided by a small interdisciplinary Reserve Planning Committee (RPC) comprising the branch manager, the regional manager, the area manager, various specialists, and other interested and affected persons. Repeated drafts of the IRMP were presented to, and discussed by, the RPC before broader circulation for public participation purposes.

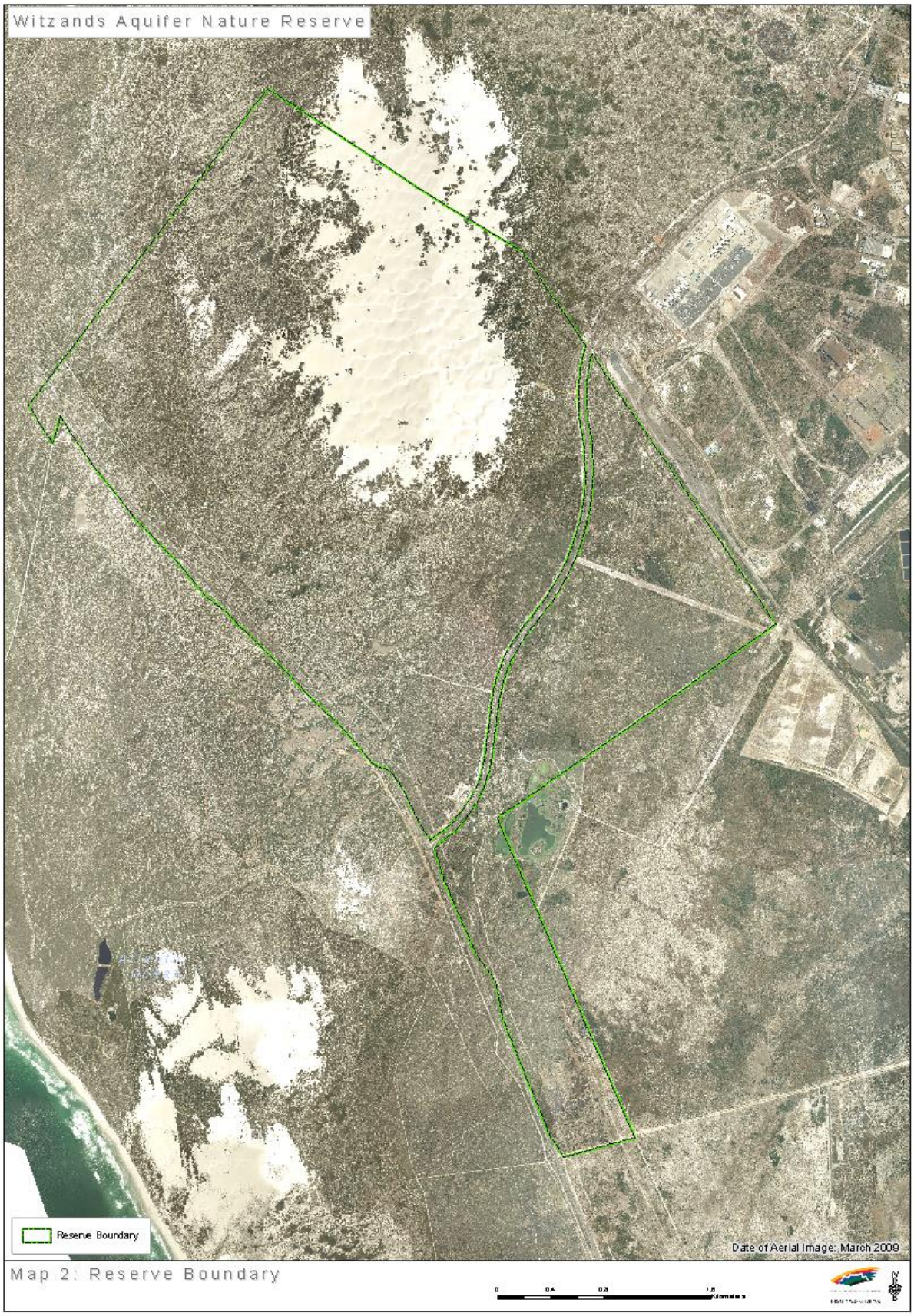
Pre-engagement workshops were held with community partners from March to May 2010. This afforded key community partners an opportunity to give their input at an early stage. Where practical, the ideas and outputs from these workshops have been incorporated into the IRMP.

1.2 Location and extent

The Witzands Aquifer Nature Reserve is situated 45 km from Cape Town's central business district (CBD) in the Western Cape (map 1). The property is currently under the authority of the City of Cape Town's Bulk Water branch of the Water and Sanitation Department. The reserve is 7 km west of the town of Atlantis along the R27 West Coast road, within the northern region of the Cape metropolitan area, and covers an area of approximately 1705.55 ha with a global positioning system coordinate of 33˚35'41.92" S and 18˚26'18.81" E. This GPS coordinate reading was recorded from the centre point of the Atlantis Dune field (Google Earth 2005) (map 2).

The reserve does not have any formal conservation status, but is recognised as a major part of the Atlantis water catchment area, supplying potable water to the towns of Atlantis, Mamre and Pella. The area will be formally proclaimed under the name the Witzands Aquifer Nature Reserve in order to protect the underground aquifer as a water resource, as well as conserve the two vegetation types found here, namely Cape Flats Dune Strandveld and Atlantis Sand Fynbos.


Witzands Aquifer Nature Reserve
No. Reserve Name Hectares
1 Blaauwberg Nature Reserve 1451.903
2 Bothasig Nature Reserve 9.652
3 Botterblom Nature Reserve 3.601
4 Bracken Nature Reserve 37.012
5 Bracken Nature Reserve - Perdekop 2.206
6 Durbanville Nature Reserve 5.760
7 Edith Stephens Nature Reserve 27.329
8 False Bay Nature Reserve 1232.279
9 Helderberg Nature Reserve 397.439
10 Helderberg Nature Reserve - Silwerboomkloof 4.934
11 Milnerton Nature Reserve 17.986
12 Parklands Diep River Corridor 211.653
13 Rietvlei Wetland Nature Reserve 597.615
14 Steenbras Nature Reserve 8706.924
15 Tygerberg Nature Reserve 306.874
16 Uitkamp Wetland Nature Reserve 30.921
17 Witzands Aquifer Nature Reserve 1750.082
18 Wolfgat Nature Reserve 261.820
19 Zandvlei Nature Reserve 216.344
City Nature Reserves
Provincial Nature Reserves
National Park
Managed Conservation Areas
Marine Protected Areas
City Boundary
Atlantic Ocean
Driftsands Provincial Nature Reserve
Hottentots-Holland Provincial Nature Reserve
Maccassar Dunes Conservation Area
Table Mountain National Park
Harmony Flats Provincial Nature Reserve
False Bay
Map 1: Reserve Location in the City of Cape Town
0 5 10 Kilometers



Map 2: Reserve Boundary

2. DESCRIPTION OF LANDHOLDINGS AND OWNERSHIP

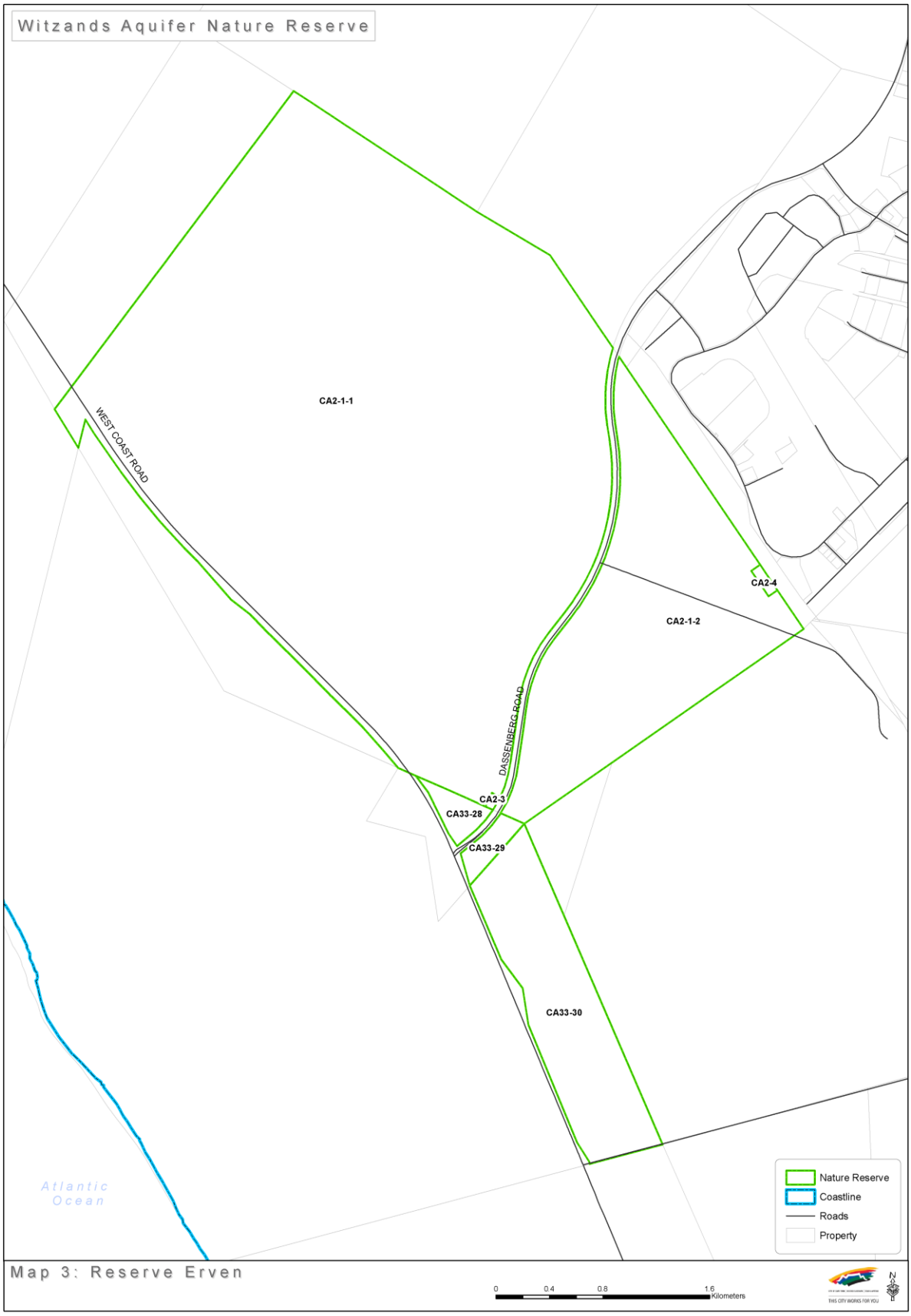
2.1 Property details and title deed information

The Witzands Aquifer Nature Reserve comprises various erven owned by the City of Cape Town (map 3). These erven include the following:

Table 1: Erf numbers of Witzands Aquifer Nature Reserve

NO.	ERVEN	LANDOWNER	EXTENT
1	Erf 33-28	City of Cape Town	11,402 ha
2			
3	Erf 2-1	City of Cape Town	1545 ha
4	Erf 2-4	City of Cape Town	1,836 ha
5	Erf 33-29	City of Cape Town	9,868 ha
6	Erf 2-3	City of Cape Town	0,738 ha
7	Erf 33-30	City of Cape Town	136,71 ha

Refer to the list of appendices under (B) Legal agreements for the Surveyor-General Diagrams for Witzands Aquifer Nature Reserve.


Witzands Aquifer Nature Reserve
CA2-1-1
WEST COAST ROAD
CA2-4
CA2-1-2
DASSENBERG ROAD
CA2-3
CA33-28
CA33-29
CA33-30
Atlantic Ocean
Nature Reserve
Coastline
Roads
Property
Map 3: Reserve Erven
0
0.4
0.8
1.6
Kilometers
N

2.2 Landscape perspective

The reserve falls within the Cape Floristic Region (CFR), the smallest yet richest of the world's six floral regions, and the only one to be found entirely within one country. However, this rich biodiversity is under serious threat for a variety of reasons, including conversion of natural habitat to permanent agricultural land, inappropriate fire management, rapid and insensitive development, overexploitation of water resources, and infestation by invasive species. The region has been identified as one of the worlds 'hottest' biodiversity hot spots (Myers *et al.* 2000).

In response to this challenge, a process of extensive consultation involving various interested parties, including local government and non-governmental organisations (NGOs), resulted in the establishment of a strategic plan (C.A.P.E Project Team 2000) referred to as Cape Action for People and the Environment, which identified the key threats and root causes of biodiversity losses that need to be addressed in order to conserve the floral region. This resulted in a spatial plan, identifying areas that need to be conserved and a series of broad programme activities that need to take place over a 20-year period. Based on the situation assessment and analysis of threats, three overarching, mutually complementing and reinforcing themes were developed:

- To establish an effective reserve network, enhance off-reserve conservation, and support bioregional planning
- To strengthen and enhance institutions, policies, laws, cooperative governance and community participation
- To develop methods to ensure sustainable yields, promote compliance with laws, integrate biodiversity concerns with catchment management, and promote sustainable eco-tourism

The C.A.P.E partnership was formed and works together to implement the C.A.P.E vision and plan by strengthening institutions, supporting conservation efforts, enhancing education, developing tourism benefits, and involving people in conservation. The City of Cape Town was one of the 19 founding signatories of the C.A.P.E memorandum of understanding (MOU).

The Witzands Aquifer Nature Reserve links up with Koeberg Private Nature Reserve, which is managed by Eskom. The City of Cape Town also manages nearby the Blaauwberg Nature Reserve and the Table Bay Nature Reserve, as well as provides assistance to the

communally owned property of Mamre Nature Garden. The Mamre Nature Garden property, although not owned by the City of Cape Town is an important site identified on the biodiversity network in terms of its biodiversity found there. Witzands Aquifer Nature Reserve, Blaauwberg Nature Reserve, Koeberg Nature Reserve and Mamre Nature Garden all form part of the southern core of the greater Cape West Coast Biosphere Reserve (map 4).

The WANR is a key part of the Dassenberg Coastal Catchment Partnership (DCCP). The DCCP is a landscape initiative formed between various conservation partners and the local communities with the goal of linking CapeNature's Riverlands Nature Reserve to the coast (figure 3). The key objectives of the approximately 30000 ha initiatives are:

- Protect critical ecological infrastructure
- Deliver Socio Economic opportunities to the surrounding communities
- Ensure the protection of the identified critical climate change adaptation and mitigation corridor
- Protect and promote the incredible natural and cultural heritage of the area

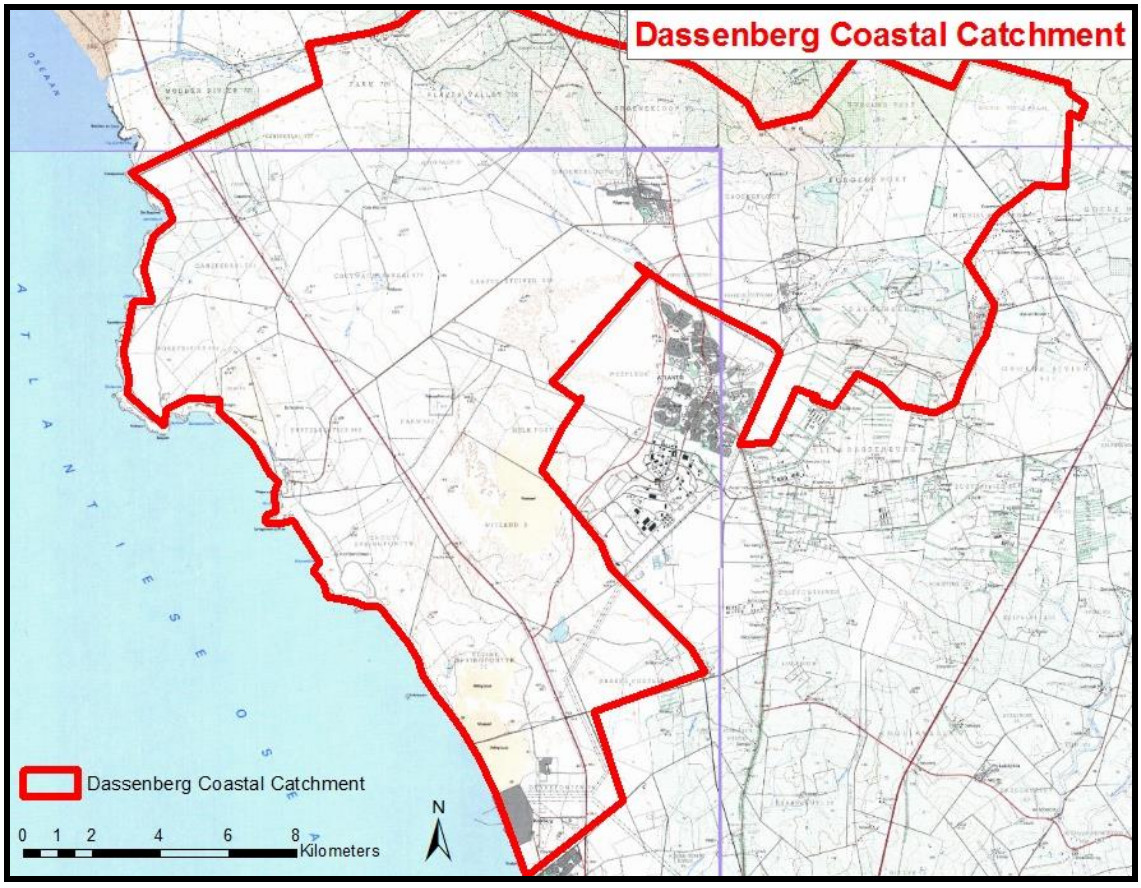
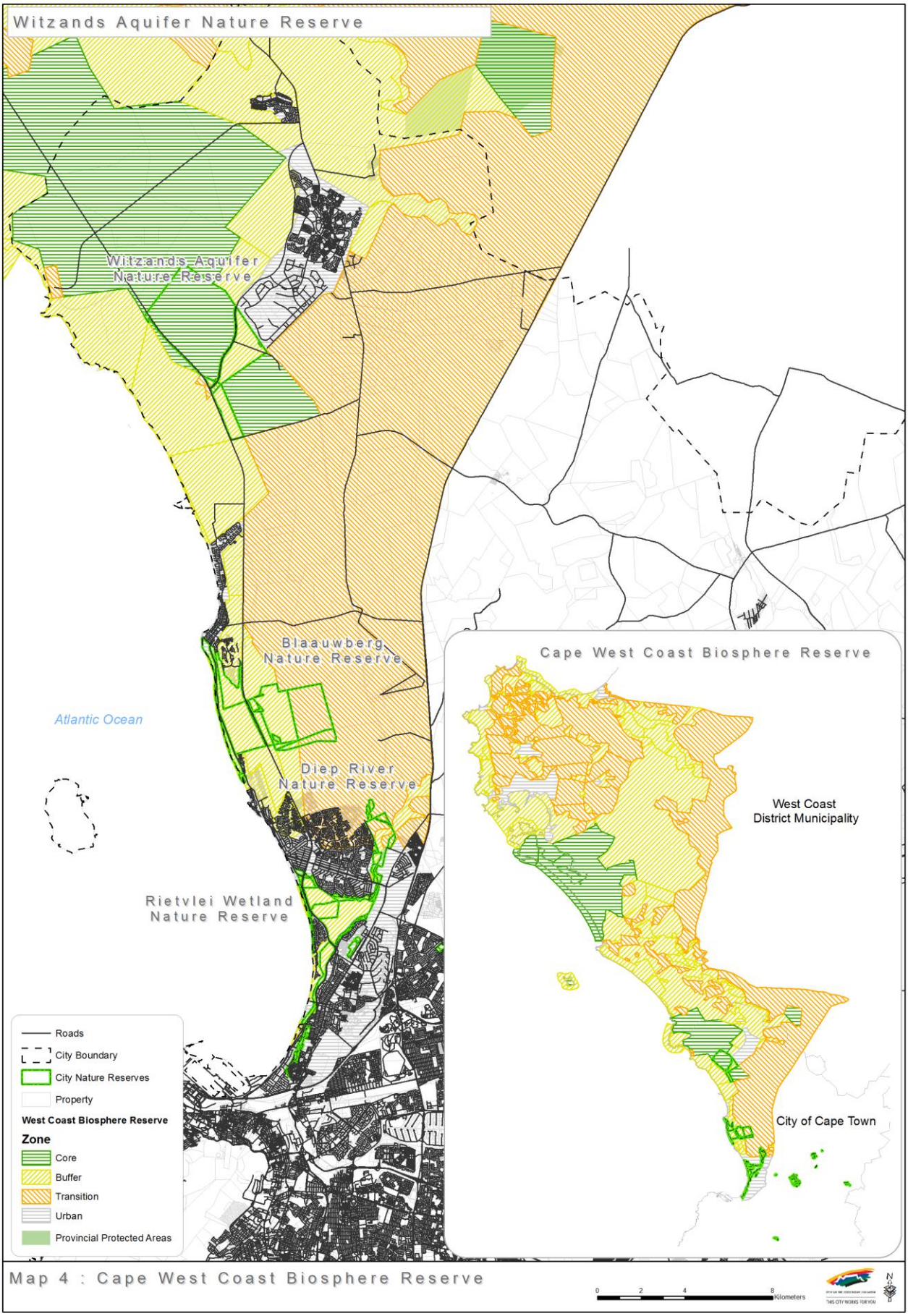


Figure 3: The greater Dassenberg Coastal Catchment Initiative


Witzands Aquifer Nature Reserve
Witzands Aquifer Nature Reserve
Blaauwberg Nature Reserve
Atlantic Ocean
Diep River Nature Reserve
Rietvlei Wetland Nature Reserve
Cape West Coast Biosphere Reserve
West Coast District Municipality
City of Cape Town
Roads
City Boundary
City Nature Reserves
Property
West Coast Biosphere Reserve
Zone
Core
Buffer
Transition
Urban
Provincial Protected Areas
Map 4 : Cape West Coast Biosphere Reserve
0 2 4 8 Kilometers

2.3 Physical environment

2.3.1 Climate

The area is associated with a Mediterranean climate, characterised by winter rainfall, hot, dry summers and cold, wet winters. Rainfall is mainly produced by the passage of westerly-wave frontal systems. Summers are relatively dry due to the effects of the South Atlantic anticyclone system (Eskom 2006). Mean daily maximum and minimum temperatures range between 26,7 °C and 7,5 °C, measured in February and July respectively. The occurrence of mist is frequent in winter thus supplying additional precipitation. The winter rainfall regime includes precipitation peaking from May to August. The mean annual rainfall is 290–660 mm (mean: 424 mm), and the mean annual evaporation rate is 1 445 mm (Mabihi 2009).

This region's entire coastal belt is characterised by strong winds. The dominant summer winds are those from the south and south-east, and the dominant winter wind is from a northerly direction (Mabihi 2009). All weather related data is received monthly from the South African Weather Service's automated weather station. The station is situated within the Atlantis Industrial area, approximately 8 km from the WANR.

2.3.2 Geology, geomorphology, soils and land types

The reserve incorporates a number of environments, two vegetation types as well as an eco-tonal zone between them. One wetland (infiltration pond) and an un-vegetated mobile dune field occur at the Witzands Aquifer Nature Reserve. The dune area comprises a third to half of the overall area. It is a dynamic system consisting of a number of active dune fields that move through an area of naturally vegetated dunes; a small portion of the dune field lies outside the boundaries of the reserve. The source of the sand is the sandy beach at Melkbosstrand and Eskom to the south of the overall dune system (Knight Hall Hendry & Associates 1996). The Centre for Scientific and Industrial Research (CSIR) (2002), report further states that the granite outcrops of Dassenberg, Kanonkop and Mamre-Darling near Mamre constitute the highest points in the area, at altitudes of 210–410 m above sea level.

The geology of the Witzands Aquifer Nature Reserve, as noted in the Eskom report (2006) of the entire Atlantis coastal plain, comprises unconsolidated Cenozoic sediments associated with the sandveld group. Soil types are mainly quartz sand, which was deposited on shale bedrock of the Malmesbury group. The lower Varswater formation is of a shallow marine origin, while the upper Bredasdorp formation is of an Aeolian origin. The shale bedrock outcrops occur sporadically along the coastal parts and inland towards the south and north of Atlantis. Granite intrusions of the Cape granite suite are not found in the reserve, but occur in the Mamre area, 14 km to the north of the reserve.

2.3.3 Hydrology and aquatic systems

2.3.3.1 Catchments

The Witzands Aquifer Nature Reserve falls within the Atlantis water catchment hydro-geological unit (Knight Hall Hendry & Associates 1996) (map 5). Within the inter-dune hollows, natural seasonal wetlands are present, as described in the environmental management system (EMS) (Knight Hall Hendry & Associates 1996), and are scattered throughout the area. An open man-made pan, Pond 12, occurs in the area. The water is collected from stormwater and treated effluent from the wastewater treatment works (WWTW) in Atlantis. The open semi-natural Pond 7 (wetland) is also part of the water abstraction process. However, half of the Pond 7 area falls outside the reserve, on property owned by the National Department of Public Works. The City of Cape Town currently has a servitude right to the Pond 7 area only. Some of the pans are seasonal, such as Pond 12, while others are permanent, such as Pond 7. The pans are an important habitat for birds and other aquatic species of plants and animals, including certain fish species (Knight Hall Hendry & Associates 1996).

The aquifer covers an area of 130 km^2, extending inland from the Atlantic Ocean to below the town of Atlantis (CSIR 2002). The aquifer is defined by the unconsolidated sandy sediments overlying the impervious clay layer, which forms the eroded upper portion of the Malmesbury group shale bedrock. Due to the unconfined nature of the sandy aquifer, it is highly susceptible to pollution, and requires rigorous protection. Clay and other salinity sources in the sediments partially contribute to the wide variations in groundwater quality in the Atlantis area. It squeezes out against the Malmesbury group shale and Cape granite outcrops to the north and east. The thin aquifer slopes steeply in a south-westerly direction from a maximum elevation of approximately 160 m in the north towards the sea. A small portion of the aquifer extends below sea level in the Witzands and adjacent Silwerstroom areas (CSIR 2002).

Groundwater is abstracted from the aquifer at two well fields, which form part of the Atlantis water scheme. Some of the major components of the scheme are situated in the Witzands Aquifer Nature Reserve, such as a portion of the well field; the water-softening plant; the stormwater infiltration ponds, several well points and monitoring boreholes and the dune field. The dune field is responsible for a major part, which is responsible for a major portion of the infiltration.

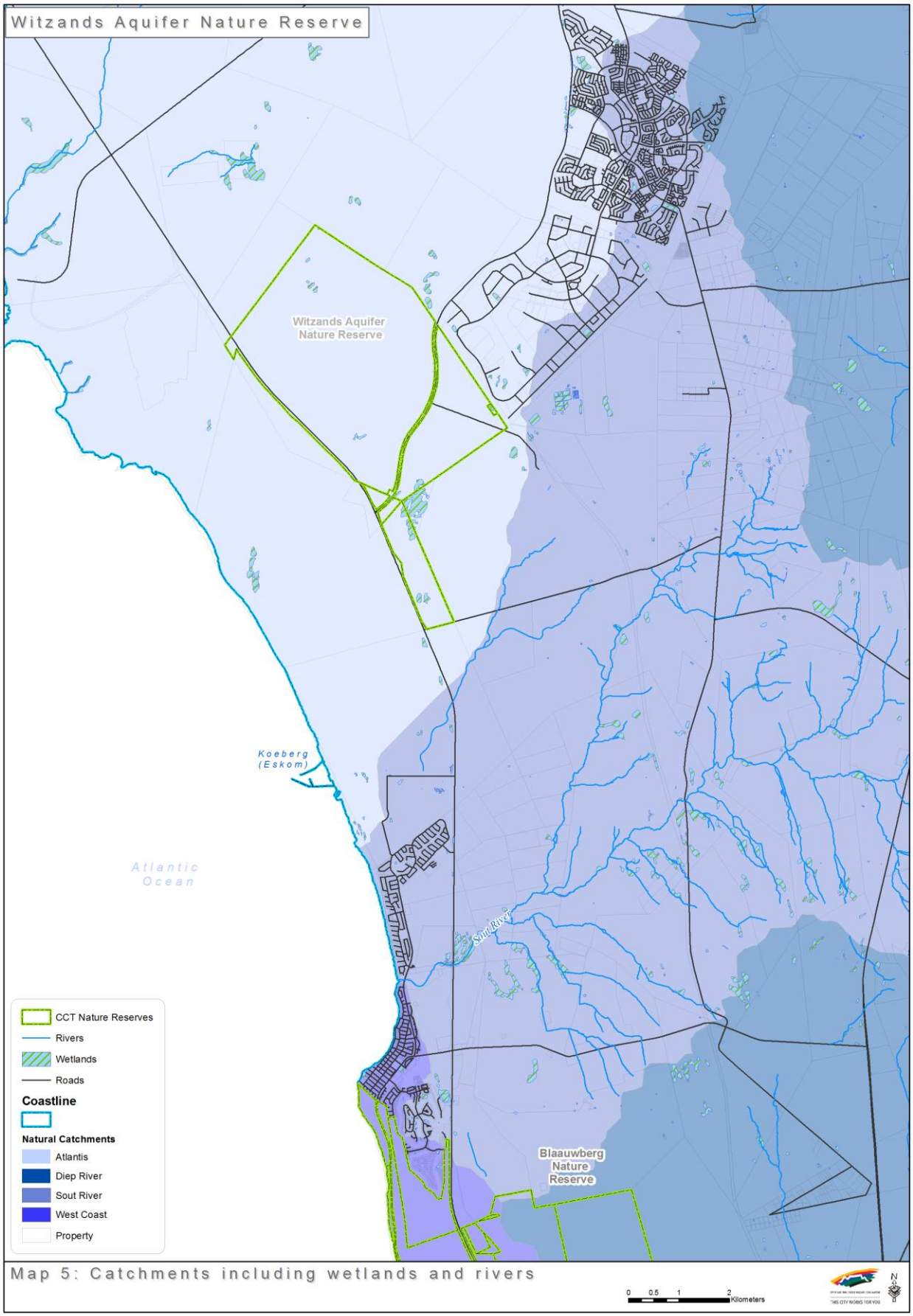
The town of Atlantis requires a reliable supply of potable water in excess of 5,5 million m^3 per annum, while the sustainable yield of the existing (1994) well fields was estimated at 6,1 million m^3 per annum (Knight Hall Hendry & Associates 1996).

The EMS (Knight Hall Hendry & Associates 1996) further explains the process by which the water supply is provided, namely utilising the natural potential of the local coastal aquifer, supplemented with recharged urban stormwater runoff and treated wastewater originating in Atlantis. Groundwater is abstracted from the aquifer at two well fields, treated in an ion-exchange water-softening plant, distributed, utilised, collected in two separate streams (from the industrial and residential areas of Atlantis), and treated in two separate treatment works. It is then artificially recharged together with urban stormwater runoff back into the aquifer. This artificially recharged water augments the natural aquifer potential, which depends on recharge by rainfall (Knight Hall Hendry & Associates 1996).

The monitoring network for the system includes a meteorological station, a flow-gauging station, surface water-level recording stations, more than 100 groundwater-level measuring points and stormwater monitoring sites. In addition, there are wastewater-effluent monitoring sites and groundwater-quality monitoring sites. Sampling is done at regular intervals, and involves both chemical and microbiological analysis. Flow-gauging and water-level measurements are done on a continuous basis – hourly, weekly and monthly – and the data are loaded onto a central database. According to the EMS (Knight Hall Hendry & Associates 1996), the Atlantis water supply system, as managed by the Atlantis water scheme (City of Cape Town's Bulk Water Branch), serves as a prototype for successful, sophisticated water development in Southern Africa.

2.3.3.2 Rivers

The area lacks surface drainage features, except for the Buffels River at Silwerstroom to the west of the reserve, and the Donkergat and Sout rivers in the south, which flow in winter only. All rivers in the area and surrounds are non-perennial, drying up in summer (CSIR 2002). The un-vegetated dune system is an important component of the aquifer as a whole, having a higher recharge potential (Knight Hall Hendry & Associates 1996).



Map 5: Catchments including wetlands and rivers

2.4 Biological environment

Although the detailed species list for the reserve forms part of the appendices to this IRMP, they can nevertheless still be accessed through the South African Biodiversity Database (www.biodiversity.co.za 2010), which contains all listed species and statistics for all City of Cape Town conservation areas as well as other areas that form part of the biodiversity network (map 6).

2.4.1 Vegetation

The natural vegetation in the Witzands Aquifer Nature Reserve predominantly consists of Cape Flats Dune Strandveld. A small area of Atlantis Sand Fynbos, of approximately 2,73 ha, also occurs within the reserve. It is restricted to the southernmost part of the reserve, adjacent to the land owned by the National Department of Public Works (Brakkefontein). A transitional zone consisting of both Cape Flats Dune Strandveld and Atlantis Sand Fynbos is found where the two vegetation types meet (Dorse, 2010 pers. comm.).

Altogether 143 plant species have been recorded in the Witzands Aquifer Nature Reserve (appendix 4). Two permanent vegetation monitoring plots have been established and surveyed. Three more plots must still be established in the next five years. A field herbarium has been established, and is still in its early stages of development. Fixed-point photography will also be conducted for monitoring plots.

According to the latest national ecosystem conservation status, Cape Flats Dune Strandveld is regarded to be Endangered (EN), while Atlantis Sand Fynbos is Critically Endangered (CR). Within the City of Cape Town area, only 45% of Cape Flats Dune Strandveld remains. Some 51% has been transformed, and only 13% is currently conserved against the national conservation target of 24%. The national conservation target for Atlantis Sand Fynbos is 30%. However, only 6% is currently conserved, while 40% has been transformed. Of the West Coast subtype of Cape Flats Dune Strandveld only 83% remains. The reserve is thus an important sanctuary for this vegetation type (Dorse 2010).

The occurrence and distribution of the Witzands vegetation types, namely Cape Flats Dune Strandveld and Atlantis Sand Fynbos, are influenced by the geology of the area. According to Rebelo *et al.* (2006), Atlantis Sand Fynbos grows in deep sands of the coastal plain, with a low pH and a poor nutrient availability, while Cape Flats Dune Strandveld is found on more recent calcareous alkaline sands containing higher nutrients.

2.4.1.1 Cape Flats Dune Strandveld

Cape Flats Dune Strandveld differs from both fynbos and renosterveld in that it does not burn as frequently; the fire cycle is typically 20–100 years. It is therefore far more prone to browsing, and many plant species have thorny defences. Cape Flats Dune Strandveld is endemic to Cape Town, and occurs in two major segments: on the western shoreline from Cape Town to Bokbaai (including the Atlantis dune fields), and on the False Bay shoreline from Muizenberg to Gordon's Bay. It is therefore confined mainly to the coastal margins, only extending inland on dune fields as in the reserve. Historically, this was a series of dunes and dune slack wetlands inhabited by hippopotami and rhinoceroses. For conservation purposes, this vegetation type is considered as two separate units due to its local geographical extent namely, the West Coast subtype and the False Bay subtype. The Witzands Aquifer Nature Reserve consists of the West Coast sub-type of Cape Flats Dune Strandveld, which extends north of the city bowl, at an altitude of 80 m. The dunes in the reserve tend to run southwest to northeast, as does the West Coast Dune Strandveld subtype.

This vegetation type is described as a short to tall, evergreen, hard-leaved and succulent shrubland, with abundant annual herbs and grasses in the gaps and understorey (Rebelo *et al.* (2006). Post-fire, it may have a 'fynbos' phase dominated by fynbos elements, but most thicket species regenerate from underground stems. The West Coast subtype tends to have more succulent elements. Thirty one threatened Red List plant species are associated with this veld type as a whole.

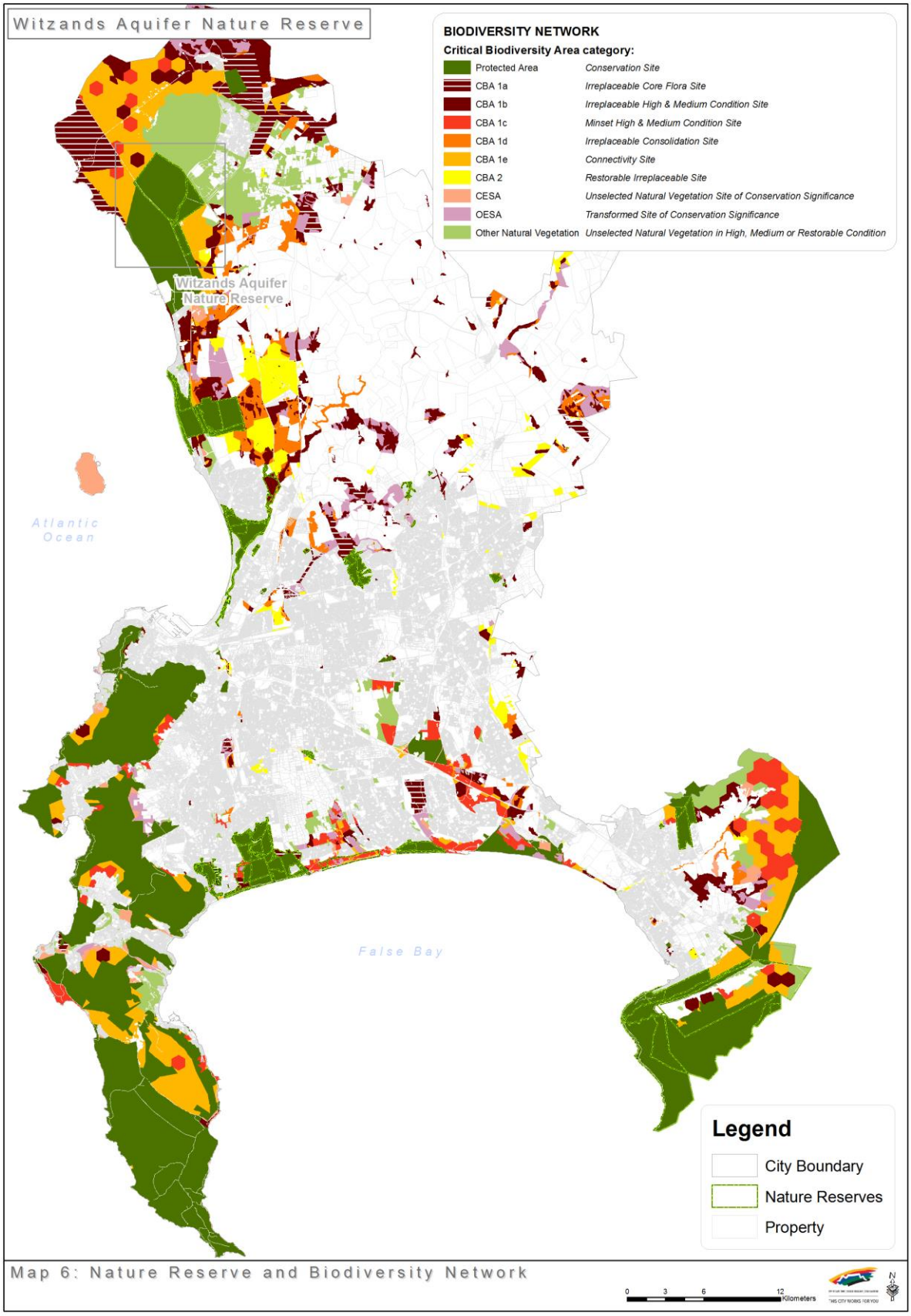
Cape Flats Dune Strandveld plant species found at the reserve include the pioneer species, namely *Metalasia muricata* (Blombos) and *Chrysanthemoides monilifera* (Bitoubos), of which the berries are eaten by both birds and mammals. The succulents include *Euphorbia mauritanica* and *Carpobrotus edulis* (Sour Fig), of which the edible fruit and succulent leaves can be used to treat burns and scalds. Bulbs found in the reserve include *Lachenalia rubida* (Bergnaeltjie) and the commercially harvested *Zantedeschia aethiopica* (Arum Lily), of which the leaves are used to treat burns and insect bites.

Other species occurring in the reserve are *Salvia africana-lutea* (Strand Salie/Sage), an aromatic plant traditionally used as a tea to alleviate coughs and colds, and *Nylandtia spinosa* (Skilpadbessie/Tortoise Berry), which grows abundantly throughout the area and is a food source for tortoises and birds. *Pelargonium capitatum* (Rose-scented Geranium/Kusmalva) and *Leonotis leonurus (*Wild Dagga) are also commonly found in the reserve. The climbers include *Kedostris nana* (Ystervarkpatats), which produces a potato like tuber, and *Cissampelos capensis* (Davidjies) that has medicinal value.

The woody shrub species include *Sercia glauca (*Blue Kuni-bush/BouTaaibos), *Sercia lucida* (Blinktaaibos), *Euclea racemosa* (Sea Guarri) and *Olea exasperata (*Coast Olive/Slanghout), which all produce berries eaten by birds. *Putterlickia pyracantha* (False Spike-thorn), with its prominent thorns, grows predominantly in the eastern sector of the reserve. This indigenous plant can be seen as encroaching in the area. A study is proposed to determine methods to limit this suspected encroachment.

2.4.1.2 Atlantis Sand Fynbos

The vegetation is typical asteraceous and proteoid fynbos, and does not differ structurally from equivalent mountain fynbos types, although very few species are shared. Ericaceae (heaths) are seldom dominant, but ericoid-leaved shrubs tend to dominate with the *Restionaceae* (reeds) and *Proteaceae* (sugarbushes). Sand fynbos is characterised by the presence of the *Erica mammosa* (Ninepin Heath), *Phylica cephalantha* (Starface), *P. stipularis* (Baboon Face), and the restioids including *Thamnochortus obtusus* and *T. punctatus* (Sandveld Thatching Reed*)*. In the south of the reserve, the incidence of grass is much higher than in the north, but most of these are invasive Mediterranean grasses


Witzands Aquifer Nature Reserve
BIODIVERSITY NETWORK
Critical Biodiversity Area category:
Protected Area Conservation Site
CBA 1a Irreplaceable Core Flora Site
CBA 1b Irreplaceable High & Medium Condition Site
CBA 1c Minset High & Medium Condition Site
CBA 1d Irreplaceable Consolidation Site
CBA 1e Connectivity Site
CBA 2 Restorable Irreplaceable Site
CESA Unselected Natural Vegetation Site of Conservation Significance
OESA Transformed Site of Conservation Significance
Other Natural Vegetation Unselected Natural Vegetation in High, Medium or Restorable Condition
Witzands Aquifer Nature Reserve
Atlantic Ocean
False Bay
Legend
City Boundary
Nature Reserves
Property
Map 6: Nature Reserve and Biodiversity Network
0 3 6 12 Kilometers
N

2.4.2 Mammals

Eighteen mammal species have been recorded through a series of baseline fauna surveys that took place from 2008 to 2010 (appendix 5). These include *Genetta genetta* (Small Spotted Genet), *Hystrix africaeaustralis* (Porcupine) and *Galerella pulverulenta* (Small Grey Mongoose). Antelope species in the reserve include *Raphicerus campestris* (Steenbok), *Raphicerus melanotis* (Cape Grysbok) and *Sylvicaptra grimmia* (Common Duiker). A Caracal carcass was also found along the R307 Dassenberg Drive. This sighting could be a much needed confirmation of the presence of this species in the reserve or surrounding areas. Small mammal species found in the reserve include *Rhabdomys pumilio* (Striped Field Mice), *Tatera afra* (Cape Gerbil) and *Otomys irroratus* (Vlei Rat). Sightings of *Mellivorus capensis* (Honey Badger) in the Atlantis area indicate that these animals probably move through the reserve from time to time.

The small-mammal fauna survey protocol for the Witzands Aquifer Nature Reserve is available electronically. The reserve is largely dominated by smaller type mammals, many of which are nocturnal and inconspicuous. Other indications of their presence are middens, scat and spoor. A small antelope count has been conducted in the area south-west of the dunes.

2.4.3 Birds

Altogether 149 bird species have been recorded since 2007 through ongoing coordinated water-bird counts (CWACs), coordinated by the Animal Demography Unit at the University of Cape Town, and ad hoc sightings recorded in the reserve sightings diary (appendix 6). Of special interest is the confirmed presence of raptors, including the vulnerable *Circus ranivorus* (African Marsh Harrier), the Near Threatened *Circus maurus* (Black Harrier) and a resident breeding pair of *Haliaeetus vocifer* (African Fish Eagles). Other raptors recorded are the *Elanus caeruleus* (Black Shouldered Kite) and *Buteo rufofuscus* (Jackal Buzzard). Water birds sighted in the vicinity of Pond 7 (wetland) include the Near Threatened *Pelecanus onocrotalus* (Great White Pelican), *Phalacrocorax africanus* (Reed Cormorant), *Phalacrocorax ludicus* (White Breasted Cormorant), *Platalea alba* (African Spoonbill), *Plegadis falcinellus* (Glossy Ibis), *Threskiornis aethiopicus (*African Sacred Ibis)*, Bostrychia hagedash (*Hadeda Ibis), *Ardea cinerea* (Grey Heron) and *Alcedo cristata* (Malachite Kingfisher).

A special monitoring programme is in place for monitoring the breeding success of the black harrier. Monitoring takes place annually during the breeding season, from July to December. CWACs are done once per quarter.

2.4.4 Reptiles

Twenty-eight reptile species are believed to occur in the Witzands Aquifer Nature Reserve according to a desktop study conducted during the drafting of the EMS (Knight Hall Hendry & Associates) in 1996 (appendix 7).

The reptile species that have been confirmed as present in the reserve are *Naja nivea* (Cape Cobra), *Dispholidus typus* (Boomslang), *Psammophylax rhombeatus* (Rhombic Skaapsteker), *Pseudaspis cana* (Mole Snake) and *Chersina angulata* (Angulate Tortoise).

2.4.5 Amphibians

Six amphibians, including *Strongylopus grayii grayii* (Clicking Stream Frog) and *Xenopus laevis* (Common Platana), have been recorded in the reserve (appendix 8).

2.4.6 Fish

Three fish species have been recorded in Pond 7 (wetland) only, and these are all freshwater fish, including invasive species such as the *Oreochromis mossambicans* (Mozambique Tilapia), the indigenous *Galaxius zabratus* (Cape Galaxias) and the locally invasive *Clarias garipinus* (Sharptooth Catfish).

2.4.7 Invertebrates

Currently, there is no baseline or desktop information on invertebrate fauna for the reserve. The reserve management is required to conduct baseline studies in order to obtain these data. However, *Phymateus morbillosus* (Common Milkweed Grasshopper) and *Opistophthalmus glabrifrons* (Thin-tailed Scorpion) were recently recorded in the reserve.

2.5 **Socio-political context**

2.5.1 History

In 1819, the reserve was part of a large farm, the *"*Gouvernements Plaatsen", along with Melk Post and Hartebeeste Kraal, managed by CM Stoffberg. Jan Nagel, a charcoal burner, was a resident on the farm. In the 18th and 19th centuries, a group of people referred to as the "duinemense" of the Blaauwberg area eked out an existence on the farms, then known as Brakkefontein, Laaste Stuiver, Hartebeeskraal, Wittesand (today the Witzands Aquifer Nature Reserve), Melkpost, Blomboschfontein, Donkergat, Groot Springfontein and Duinefontein (pers. comm. Sjanel Buchel 2010).

Wittesand was later referred to as Witzand, and was then owned by the prominent Duckitts family, and later bought by National Government (Department of Human Settlements/National Housing Board).

In 1976, the land was managed by the City of Cape Town, and the Atlantis water scheme was appointed as the authority to manage the area and its water extraction and supply (Knight Hall Hendry & Associates 1996).

The area has been used as a venue for off road recreational driving since at least 1975 and it forms part of a route along the west coast, from Melkbos to Yzerfontein (Jenkinson 2014). Since the mid 1990's, entry for recreational off-roaders into the dunes has been controlled through a permit system, under the jurisdiction of the City of Cape Town. The venue is one of the most popular off-roading destinations within the Western Cape, being visited by a number of general off road vehicle users and formal off road clubs on a regular basis. The venue has been used in the past for several organised off-road events (Toyota Guinness World Record Attempt, annual 4x4 Family Fun Day, organised by the Four Wheel Drive Club South Africa (4WDCSA)), with the most recent being the annual Mandela Day 4x4 Drive Charity Event, organised by the City of Cape Town's Environmental Resource Management and Water and Sanitation Departments, in partnership with Atlantis Dunes Off-Road Executive (ADORE).

Blaauwberg Municipality and the other municipalities in the Cape Town area were grouped together to form the City of Cape Town in 2000. The reserve is now managed by the City of Cape Town, and exists to provide the people of Cape Town with potable water, a safe environment where biodiversity is maintained, as well as visitor facilities. The water abstraction and supply management continue to be the responsibility of the City of Cape Town's Bulk Water Branch.

The reserve managers of the Witzands Aquifer Nature Reserve have been as follows:

2007–2009	Thumeka Mdlazi
2009–present	Charline Mc Kie

2.5.2 Socio-economic context

Currently, the Atlantis water scheme has approximately 50 on-site staff members as well as four Biodiversity Management Branch staff members. The majority of the staff members employed are from the Atlantis community. The Atlantis, Mamre and Pella communities are the residential communities closest to the site, with Atlantis being only 7 km from the

Witzands Aquifer Nature Reserve. The reserve falls within Subcouncil 1's jurisdiction, which is administered from the suburb of Milnerton, covering six wards, of which ward 29 (Mamre, Pella and Atlantis suburbs) and ward 32 (including Witsands informal settlement, Koeberg and Atlantis Industrial) are relevant to the reserve. The subcouncil forms the link between the City of Cape Town and its communities to promote transparency and accountability. It strives to ensure public participation in City of Cape Town policies, and plans such as the IDP.

The town of Atlantis was established during the apartheid era in the early 1970s, and it was assumed that it would grow with the establishment of an industrial hub. However, with the removal of financial support and the exodus of several of the biggest employer industries, levels of unemployment in the area have soared.

According to the website Cape Gateway (2007), Atlantis has an estimated population of 261 537, with a gender composition of 50% males and 50% females. Some 14% of the population has a Grade 12 certificate as their highest education level. These communities are typically earning a low to medium income, with the low-income bracket being 30% and the medium-income bracket 70%. The average unemployment rate in the Atlantis community is 37%, with some 63% being employed. Atlantis offers 3 400 formal housing units (property owners); houses leased total 1 414 units (leased from the City of Cape Town), and informal living structures total 3 767. During 2011, an estimated 2 000 new formal houses will be built in four phases in the area referred to as Kanonkop (i.e. the Kanonkop housing project). Atlantis has four sectors of neighbourhood watch organisations as well as one ratepayers' association.

These communities are largely geographically isolated in relation to the Cape Town CBD, and are surrounded largely by peripheral undeveloped land. A small component of small-scale farmers is situated between the reserve and the Mamre community to the north.

The Witzands Aquifer Nature Reserve has undertaken to promote community involvement and participation through various activities, including, but not limited to, environmental education at the reserve as well as classroom education at schools. The reserve has established partnerships for implementing projects and activities with two well-known community-based organisations (CBOs) in Atlantis with a focus on the environment. The reserve actively participates in integrated holiday programmes and festivals held in all three towns of Atlantis, Mamre and Pella by means of exhibitions and stalls. Information regarding harvesting of species, particularly in the Mamre Nature Garden, is collated in collaboration

with members of the community. The reserve encourages and promotes community empowerment with a focus on youth development.

According to Knight Hall Hendry and Associates (1996), the activity of recreational off-road driving has been taking place within the Atlantis Dunes area since the 1970s. The area also supports companies, which operate tours to the area as well as being a significant contributor to off road driver training.

2.6 Protected-area expansion

Atlantis state land is located to the north and west of the reserve, approximately 10 000 ha in extent. The Department of Public Works property, referred to as Brakkefontein, is located to the east of the reserve. Parts of this land could be incorporated into the reserve through a stewardship programme, as these properties are largely undeveloped tracts of land. Negotiations have been initiated between the City of Cape Town and the Department of Public Works to incorporate 850 ha of the Brakkefontein property into the reserve.

3. PURPOSE, VISION/MISSION, SIGNIFICANCE/VALUE

3.1 Purpose of the protected area

The Witzands Aquifer Nature Reserve is located in the Cape Floristic Region (CFR), an area of global biodiversity significance. The reserve conserves a unique combination of habitats, ecosystems and species, many of which are either rare or endemic to the area. The primary purpose of the reserve is the conservation of this unique biodiversity and associated ecosystem features and functions.

In conserving this unique biodiversity, secondary objectives will include the following:

- The management of the reserve as a viable water resource by means of the Atlantis water scheme through the aquifer
- The conservation of the habitat for the Black Harriers, Marsh Harriers and breeding pair of Fish Eagles
- The protection of the mobile dunes surrounded by more stable, partially vegetated dune ridges and dune slip faces, many of the latter giving rise to seepage areas at their base
- Developing high-quality visitor infrastructure, facilities and services to grow responsible
- Sustainable tourism activities, including recreational off road driving
- The conservation of Endangered Cape Flats Dune Strandveld and Critically Endangered Atlantis Sand Fynbos

- Promoting sound environmental education principles

3.2 Vision and mission

3.2.1 Vision

Integrated Development Plan vision

The vision of the City of Cape Town remains as follows:

- To be a prosperous city that creates an enabling environment for shared growth and economic development
- To achieve effective and equitable service delivery
- To serve the citizens of Cape Town as a well-governed and effectively run administration

To achieve this vision, the City recognises that it must:

- actively contribute to the development of its environmental, human and social capital;
- offer high-quality services to all who live in, do business in, or visit the city as tourists; and
- be known for its efficient, effective and caring government.

C.A.P.E vision

We, the people of South Africa, are proud to be the custodians of our unique Cape Floral Region, and share its full ecological, social and economic benefits now and in the future.

Environmental Resource Management Department vision

To ensure that sustainable and equitable development is combined with sound environmental practice for a healthy local environment, which sustains people and nature, provides protection for our unique resources and results in an enhanced quality of life for all.

Biodiversity Management Branch vision

To be a City that leads by example in the protection and enhancement of biodiversity; a City within which biodiversity plays an important role, where the right of present and future generations to healthy, complete and vibrant biodiversity is entrenched; a City that actively protects its biological wealth, and prioritises long-term responsibility over short-term gains.

The Witzands Aquifer Nature Reserve vision

To conserve and manage the two central features of the site, namely being a water catchment resource and having unique surface biodiversity, ensuring a positive balance

between utilisation and conservation, and providing long-term sustainable environmental experiences to the surrounding communities.

3.2.2 Mission

Biodiversity Management Branch mission

- To manage biodiversity proactively and effectively
- To ensure an integrated approach to biodiversity between City of Cape Town line functions and departments, actively pursuing external partnerships
- To adopt a long-term approach to biodiversity
- To ensure sustainability of our rich biodiversity
- To adopt a holistic and multifaceted approach to biodiversity
- To continue to measure and monitor the City of Cape Town's performance in the protection and enhancement of biodiversity
- To continue to measure and monitor the state of biodiversity in Cape Town

The Witzands Aquifer Nature Reserve mission

To maintain and, where required, restore the natural environment and its associated ecological processes and services through the implementation of the management objectives of the Witzands Aquifer Nature Reserve, and to support the surrounding communities in fulfilling their environmental and socio-economic responsibilities.

3.3 Significance of property (biodiversity, heritage and social)

The Witzands Aquifer Nature Reserve accommodates two national vegetation types, one of which is critically endangered and the other vulnerable. The reserve forms an integral part of the City of Cape Town's biodiversity network within the area. It has a confirmed bird species list of 149, a plant species list of 143, and a mammal list of 18 species, including threatened and globally endangered species. The site is the closest City of Cape Town nature reserve to the local communities of Atlantis, Mamre and Pella, and endeavours to involve the surrounding communities actively in conservation, awareness and educational activities by promoting youth development through volunteerism and various other means.

Summary of qualifying site assessment criteria

- The reserve hosts a mosaic of two different vegetation types, of which one vegetation type is endemic to the West Coast, as well as approximately eight threatened plant species.

- The reserve houses the Atlantis water scheme, providing potable water to the three surrounding towns.
- A large portion of the Atlantis hydro-geological (aquifer) system falls within the nature reserve.
- The reserve provides a habitat to 149 bird species.
- Natural open spaces connect the reserve to extensive natural areas to the north, west and east, while some of the high-quality state land in the vicinity could also be incorporated into the reserve through stewardship or various other means. This will further maximise conservation for the broader Cape metropolitan area, and promote opportunities for integrating viable linkages (corridors) between the reserve and neighbouring areas.
- A number of stewardship sites, including, but not limited to, Nirvana Private Fynbos Conservation Area, is situated within the greater Atlantis area, and the reserve management plays an important facilitation role with these private landowners.

PART 2

MANAGEMENT POLICY FRAMEWORK

4. ADMINISTRATIVE AND LEGAL FRAMEWORK FOR THE MANAGEMENT AUTHORITY

4.1 Legal framework

Table 2: Legal framework

The following is a list of legislation applicable to the management of the City of Cape Town's Biodiversity Management Branch, and specifically to the Witzands Aquifer Nature Reserve. Repealed legislation has been included in greyed-out text for **information purposes only.**

Legislation: **Acts, ordinances, bylaws**	**Relevance:** **Description**	**Amendment:** **Latest amendment date**	**Comment:** **Other notes**
Constitution of the Republic of South Africa, Act 108 of 1996	Lists South African citizens' environmental rights	N/A	Chapter 2: Bill of Rights assigns citizens with particular rights
ENVIRONMENTAL LEGISLATION			
National legislation			
National Environmental Management Act (NEMA), Act 107 of 1998	One of the most important environmental laws relating to most aspects of the environment, including environmental impact assessments (EIAs), environmental information and legal standing, etc.	• Amendment Act 56 of 2002 • Amended by GN 26018, Vol. 464 of 13 February 2004	Provides for cooperative environmental governance
National Environmental Management: Biodiversity Act, Act 10 of 2004	The objectives of the Act are to provide for: • the management and conservation of South Africa's biodiversity within the framework of the National Environmental Management Act, 1998; • the protection of species and ecosystems that warrant national protection; • the sustainable use of indigenous biological resources; • the fair and equitable sharing of benefits arising from bio-prospecting involving indigenous biological resources; and • the establishment and functions of a South African National Biodiversity Institute.	N/A	The development of the IRMP will assist in ensuring that the objectives of this Act are achieved in the reserve.

	In essence, the Act was put in place to safeguard the important biodiversity attributes in the country, while allowing people to benefit equally from the natural resources. In order to achieve these goals, the Act made provision for the South African National Biodiversity Institute (SANBI), which has been designated certain functions and afforded powers and duties in respect of this Act.		
National Environmental Management: Protected Areas Act, Act 57 of 2003	To provide for: • the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and natural landscapes and seascapes; • the establishment of a national register of all national, provincial and local protected areas; • the management of those areas in accordance with national norms and standards; • intergovernmental cooperation and public consultation on matters concerning protected areas; and • matters in connection therewith.	• Amendment Act 62 of 2008 • Amendment Act 15 of 2009	Regulations Notice 1029 of 2009 lists specific regulations for reserves proclaimed by the Member of the Executive Council (MEC) (draft August 2009).
Conservation of Agricultural Resources Act (CARA), Act 43 of 1983	The CARA regulations contain a list of alien invasive vegetation categorised according to their legal status. The Act regulates the sale, position and use of listed species.	• Amended by GN R 2687 of 6 December 1985 and GN R 280 of 30 March 2001	Alien invasive plant legislation to be included under the Biodiversity Act in future
National Veld and Forest Fire Act, Act 101 of 1998	Relates to veld fire prevention, fire protection associations, fire danger indexing, enforcement of fire legislation, and the fighting of fires	N/A	A detailed fire management plan will be developed.
Marine Living Resources Act, Act 18 of 1998	Regulates conservation of the marine ecosystem and the long term sustainable utilisation of marine living resources		
Environment Conservation Act, Act 73 of 1989	The Environment Conservation Act is the other law that relates specifically to the environment. Although most of this Act has been replaced by NEMA, some important sections still remain in operation. These sections relate to: • protected natural environments; • littering; • special nature reserves; • waste management;	• Environment Conservation Amendment Act 98 of 1991 • Environment Conservation Amendment Act 79 of 1992 • Environment Conservation Second Amendment Act 115 of 1992 • Environment Conservation	

	• limited-development areas; • regulations on noise, vibration and shock; and • EIAs.	Amendment Act 94 of 1993 • Environment Conservation Second Amendment Act 52 of 1994 • Proclamation R27 of 1995 • Proclamation R43 of 1996 • National Environment Management Act 107 of 1998	
National Water Act, Act 36 of 1998	Relates to all use of water and the management of all water resources in South Africa	•	
National Environmental Management: Air Quality Act, Act 39 of 2004	To provide for enhancing the quality of ambient air for the sake of securing an environment that is not harmful to the health and well-being of the people		Promulgated to give effect to section 24(b) of the Constitution. The South African Air Quality Information System is a web-based system that provides information on the quality of ambient air across the country.
Animal Protection Act, Act 71 of 1962	To consolidate and amend the laws relating to the prevention of cruelty to animals	Animal Matters Amendment Act, Act 42 of 1993	
Animal Diseases Act, Act 35 of 1985	Provides for control measures relating to animal diseases		
Animal Health Act, Act 7 of 2002	Regulates animal health		
Game Theft Act, Act 105 of 1991	Regulates the ownership and protection of game		
Mountain Catchment Areas Act, Act 63 of 1970	Provides for catchment conservation		Administered under the Western Cape Nature Conservation Board Act, Act 15 of 1998
National Heritage Resources Act 25 of 1999	Provides for the protection of heritage resources		N/A
World Heritage Conservation Act 49 of 1999	Incorporates the World Heritage Convention into South African law		N/A
Problem Animal Control Ordinance, Ordinance 26 of 1957	Regulates problem animals		Administered under the Western Cape Nature Conservation Board Act, Act 15 of 1998
Mineral and Petroleum Resources Development Act, Act 28 of 2002	Provides for equitable access to, and sustainable development of, mineral and petroleum resources		
Atmospheric Pollution Prevention Act, Act 45		Entire Act repealed on 1 April	

of 1965		2010 in favour of the National Environmental Management: Air Quality Act, Act 39 of 2004	
Provincial legislation			
Land Use Planning Ordinance, Ordinance 15 of 1985	The purpose of the Ordinance is to regulate land use and to provide for incidental matters related to land use.	• Assented to on 22 November 1985 • Western Cape Land Use Planning Ordinance, 1985, Amendment Act, 2004	Although it might not have a direct application in the management of nature reserves, it does affect the surrounding properties, and could possibly be used to control activities/developments around the reserves to minimise negative effects, for example in applying zoning restrictions.
Cape Nature and Environmental Conservation Ordinance, Ordinance 19 of 1974	The purpose of this Ordinance is to regulate wild animals and plants, and the establishment of nature reserves.	Publication date 1 September 1975	Administered under the Western Cape Nature Conservation Board Act, Act 15 of 1998
Western Cape Nature Conservation Board Act, Act 15 of 1998	The purpose of this Act is to promote and ensure nature conservation, render services and provide facilities for research and training and to generate income		Biodiversity agreements are signed under this Act.
Municipal legislation			
Integrated Metropolitan Environmental Policy (IMEP), 2001	Envisages a set of Citywide aligned strategies dealing with all aspects of the environment.		Influenced the Biodiversity Strategy, 2003
Biodiversity Strategy, 2003	To be a city that leads by example in the protection and enhancement of biodiversity	• Draft amendment for 2009–2019	Influenced the development of the IRMP
City of Cape Town Bylaw relating to Stormwater Management, LA 31420	To provide for the regulation of stormwater management in the area of the City of Cape Town, and to regulate activities that may have a detrimental effect on the development, operation or maintenance of the stormwater system	• Publication date 23 September 2005	Communication strategy and action plan will take effect to address the issues with the relevant departments
City of Cape Town Air Pollution Control Bylaw, LA 12649	The purpose of this bylaw is to give effect to the right contained in section 24 of the Constitution of the Republic of South Africa Act (Act 108 of 1996) by controlling air pollution within the area of the Council's	• Publication date 4 February 2003	

	jurisdiction; to ensure that air pollution is avoided, or, where it cannot be altogether avoided, is minimised and remedied.		
Bylaw relating to Community Fire Safety, Province of the Western Cape, LA 11257	The purpose and scope of the bylaw is to promote the achievement of a fire-safe environment for the benefit of all persons within the municipality's area of jurisdiction, and to provide for procedures, methods and practices to regulate fire safety within the municipal area.	• Publication date 28 February 2002	A fire management plan to be designed
City of Cape Town Draft Animal Bylaw, 2009	The purpose of the Bylaw is to formulate a new single bylaw, including ten different municipal dog bylaws and the Animal Protection Act of 1962. The Bylaw includes chapters on dogs, cats, poultry and working equines.	• Draft, 2009	
HUMAN RESOURCES/ADMINISTRATION LEGISLATION			
National legislation			
Occupational Health and Safety Act, 1993	To provide for the health and safety of persons at work, and for the health and safety of persons in connection with the use of plant and machinery; the protection of persons other than persons at work against hazards to health and safety arising out of or in connection with the activities of persons at work; to establish an advisory council for occupational health and safety, and to provide for matters connected therewith.	Occupational Health and Safety Amendment Act, No 181 of 1993	
Basic Conditions of Employment Act, Act 3 of 1997	Provides for control measures pertaining to employment	• Amendment Act 11 of 2002	
Labour Relations Amendment Act, Act 66 of 1995	The Act aims to promote economic development, social justice, labour peace and democracy in the workplace.	• Labour Relations Amendment Act, 42 of 1996 • Afrikaans Labour Relations Amendment Act, 1998 • Labour Relations Amendment Act, 127 of 1998 • Labour Relations Amendment Act, 2000	

		• Amendment Act 12 of 2002	
Local Government Municipal Systems Act, Act 32 of 2000	Establishes core principles, processes and mechanisms relating to local government		
Promotion of Equality/Prevention of Unfair Discrimination Act, Act 4 of 2000	Provides for the prevention of discrimination and other related matters		
Criminal Procedure Act, Act 51 of 1977	Makes provision for procedures and related matters in criminal proceedings	• Criminal Procedure Amendment Act, Act 65 of 2008	
Firearms Control Act, Act 60 of 2000	To establish a comprehensive and an effective system of firearms control and, to provide for matters connected therewith		
Civil Aviation Act, Act 13 of 2009			
Fencing Act, Act 31 of 1963	Regulates all matters relating to fencing		
Hazardous Substances Act, Act 15 of 1973	Controls substances that may cause injury or ill health to, or death of, human beings by reason of their toxic nature		
Land Survey Act, Act 8 of 1997	Regulates land surveying, beacons and other related matters		
Promotion of Access to Information Act, Act 2 of 2000	Promotes access to information		
Promotion of Administrative Justice Act, Act 3 of 2000	Provides for the promotion of administrative justice	• Amendment Act 53 of 2002	
Regional Services Council Act, Act 109 of 1985	Regulates and controls land, land use and other related matters		
Skills Development Act, Act 97 of 1998	Promotes the development of skills		
State Land Disposal Act, Act 48 of 1961	Regulates the disposal of state-owned land		
Subdivision of Agricultural Land Act, Act 70 of 1970	Regulates the subdivision of agricultural land		
Tourism Act, Act 72 of 1993	Provides for the promotion of tourism, and regulates the tourism industry		A tourism strategy is envisaged.
Public Resorts Ordinance, Ordinance 20 of 1971	Regulates nuisance and pollution control		
Municipal Ordinance, Ordinance 20 of 1974	Regulates pollution and waste management		
South African National Road Agency Limited and National Roads Act, Act 7 of 1998			
Aviation Act, Act 74 of 1962	Provides for the control, regulation and encouragement of aviation	• Repealed in favour of the Civil	

	activities in the Republic of South Africa	Aviation Act, Act 13 of 2009	
Provincial legislation			
Western Cape Land Administration Act, Act 6 of 1998	Regulates land and land use		
Western Cape Planning and Development Act, Act 7 of 1999	Regulates planning and development within the province		
Municipal legislation			
City of Cape Town Bylaw relating to Filming, LA30441	The purpose of the Bylaw is to regulate and facilitate filming in Cape Town.	• Provincial Gazette 6277, 24 June 2005	
City of Cape Town Bylaw relating to Streets, Public Places and the Prevention of Noise Nuisances, 2007	The purpose of the Bylaw is to regulate activities in streets and public places, and to prevent excessive noise nuisance	• Promulgated 28 September 2007, PG 6469; LA 44559	
City of Cape Town Bylaw relating to signage		•	

4.2 Administrative framework

Nature conservation and biodiversity-related issues in the Witzands Aquifer Nature Reserve will be managed under the direction of the City of Cape Town's Biodiversity Management Branch in the Environmental Resource Management Department of the Strategy and Planning Directorate. The reserve is located in the northern region (District B, which is one of the City of Cape Town's eight districts) and falls under the oversight of the regional manager. The reserve is the management responsibility of an area manager, assisted by three non-permanent staff members (Table 3 and appendix 1). In the northern region, the area manager's jurisdiction covers the entire greater Atlantis area. The operational management of the Witzands Aquifer Nature Reserve is supported by various other City of Cape Town departments, including, but not limited to, Law Enforcement, Human Resources and Finance. The Bulk Water Branch in the Water and Sanitation Department of the Utility Services Directorate is based on-site, and is responsible for the management of water supply to Atlantis, Pella and Mamre.

The regional manager and regionally based administrative officer operate from the Biodiversity Management Branch's head office in Maitland, 40 km south from the reserve.

Table 3: The current staffing complement for the Witzands Aquifer Nature Reserve:

Designation	Number of Staff	Workweek & Hours	Supervisor	Permanent / Contract
Area Manager	1	40 hours Monday – Friday 07h30 – 16h00	Regional Manager	Permanent
People and Conservation Officer	1	40 hours Monday – Friday 07h30 – 16h00	Area Manager	Contract
Intern	1	40 hours Monday – Friday 07h30 – 16h00	Area Manager	Contract
Experiential Training Student	1	40 hours Monday – Friday 07h30 – 16h00	Area Manager	Contract

5. PROTECTED AREA POLICY FRAMEWORK & GUIDING MANAGEMENT PRINCIPLES

5.1 Management objectives

5.1.1 Biodiversity and heritage objectives

Table 4: Biodiversity and heritage objectives for the reserve

High-level objective	*Objective*	*Sub-objective*	*Initiative*	*Low-level plan*
CONSERVATION OF REPRESENTATIVE, FUNCTIONAL ECOSYSTEMS To conserve a representative sample of the region's ecosystems in a linked landscape, and maintain or restore environmental processes to enable natural spatial and temporal variation in structural, functional and compositional components of biodiversity	**Representative ecosystems** To incorporate a spectrum of viable aquatic and terrestrial ecosystems characteristic of Witzands Aquifer Nature Reserve, and to re-introduce missing elements, where possible	**Consolidation and expansion of land areas** Consolidation of protected areas, focusing on underrepresented ecosystems, functional linkages and processes	(1) Identify underrepresented habitats/ecosystems (2) Consolidate reserve boundaries (3) Incorporate untransformed fynbos (4) Establish corridors linking Witzands Aquifer Nature Reserve with CapeNature and state land through stewardship tool	Reserve expansion plan (to be developed within five years)
		Re-introduction of biota Re-establishment, where possible, of locally extinct or depleted biodiversity components and populations in accordance with International Union for Conservation of Nature (IUCN) principles and guidelines	(1) Re-establish indigenous herbivore complement within constraints of reserve size and urban setting	Faunal management plan (to be developed within five years)
		Fire management Apply appropriate fire regime in fynbos areas (frequency, season, intensity, size)	(1) Implement an ecological fire management plan in accordance with objectives of conserving biodiversity and threatened biota (2) Monitor impact of fire management regime	Fire management plan (being developed)
		Threatened biota Maintain viable populations of threatened species in order to meet obligations in terms of international agreements and conventions	(1) Maintain viable populations of rare/threatened plant and animal species (identify, locate and monitor populations of priority species)	Incorporated into a branch-wide monitoring strategy
		Monitoring plan Implement and maintain an approved monitoring plan for the reserve	(1) Implement and maintain a biological monitoring programme for the reserve	Monitoring plan (monitoring protocols for the reserve have been developed), to be aligned with branch-wide plan

	Rehabilitation Rehabilitate degraded areas, including the re-establishment of natural biodiversity patterns, and the restoration of key processes that support the long-term persistence of biodiversity	**Vegetation** Re-establishment of physical, chemical and biological processes in degraded vegetation areas	(1) Rehabilitate all old, degraded sites	Vegetation rehabilitation plan (in process for ASF)
		Alien plants and other alien biota Control and, where possible, eliminate alien biota to facilitate re-establishment of natural biodiversity pattern and process in invaded areas	(1) Establish the distribution and density of invasive species (2) Prioritise areas for alien removal, focusing on biodiversity restoration (3) Implement removal programmes for priority species and areas	Invasive-plant management plan; invasive-animal management plan (being developed, branch-wide process)
MITIGATE INTERNAL and EXTERNAL PRESSURES To reduce threats and pressures and limit environmental impacts resulting from non-biodiversity management aspects and operations on surrounding land and resource use	**Reconciling biodiversity with other reserve objectives** To ensure that non-biodiversity management aspects of reserve operations (revenue generation, including visitors, resource use, developments, management activities, etc.) are informed and constrained by biodiversity conservation objectives, and that the impacts of these activities on biodiversity are minimised	**Internal developments** Minimise the impacts associated with the development of visitor and reserve management infrastructure, and ensure that such developments do not compromise biodiversity objectives	(1) Reserve zoning (2) Develop and implement Conservation Development Framework (CDF) (3) Develop in accordance with environmental impact assessment (EIA) process (NEMA) and corporate policies (4) Establish visitor carrying capacities (5) Implement green standards and environmental best practice based on corporate policy	CDF (to be developed within five years)
		Internal activities Minimise the impacts associated with visitor and reserve management activities, and ensure that such activities do not comprise biodiversity objectives		
		Extractive resource use Minimise the impacts of extractive resource use, and ensure that such activities are aligned with corporate guidelines, are within management capacity constraints, and do not compromise biodiversity objectives	(1) Quantify current extractive resource activities (2) Define opportunities and constraints in line with corporate guidelines (3) Regulate resource use according to adaptive management process	Sustainable resource use management plan (a feasibility study is required in the next five years)

	Reconciling biodiversity with external threats To reduce external threats and pressures, and limit impacts of surrounding land and resource use on biodiversity conservation within the reserve.	**External developments** Minimise the impacts associated with inappropriate developments outside the reserve	(1) Engage regional land management authorities, including IDPs and spatial development frameworks at local and regional level (2) Align with bioregional planning, including explicitly identified areas for the maintenance of important biodiversity patterns and processes with appropriate land use guidelines (3) Provide input into planning and decision-making processes for external development that may compromise reserve and biodiversity network objectives (4) Negotiate to ensure that external developments are not visually obtrusive or out of character with the park	(Cooperative governance and communication plan) (to be developed, branch-wide)
		External activities Negotiate to ensure that external resource and land use do not detrimentally affect ecological processes within the reserve	(1) Negotiate to mitigate or improve the management of external, potentially detrimental impacts (2) Encourage eco-friendly resource use and land management practices on adjacent properties (3) Mitigate the impacts of oil and other pollution events through appropriate contingency planning	Oil spill contingency plan (cooperative governance and communication plan) (to be developed, the responsibility of Bulk Water Branch, Caltex pipeline and contamination of aquifer)
		Hydrological and water chemistry changes Participate in activities for the maintenance of aquifer flow regimes and water chemistry within limits for the maintenance of ecosystem processes in aquatic ecosystems within the reserve	(1) Lobby for appropriate catchment categorisation (currently general authorisation) (2) Encourage enforcement of legislation applicable to the management and protection of aquatic resources (3) Facilitate regular assessments of river health. (4) Address the issue of sewage and other point-source pollution in aquatic systems	Cooperative governance and communication plan (responsibility of Bulk Water Branch)
		Illegal harvesting of resources Prevent the illegal collection, removal and destruction of physical and biological resources	(1) Public liaison (2) Law enforcement	Reserve protection plan, safety and security programme (a security audit and report have been produced, however not specifically for harvesting of resources; feasibility study required within the next

				five years)
WILDNESS/ REMOTENESS To maintain and restore wildness/remoteness in Witzands Aquifer Nature Reserve so that the spiritual and experiential qualities of wildness are maintained, enhanced or, where necessary, restored	**Range of experiences** Provide a range of visitor experiences		(1) Reserve zoning (2) Develop CDF and sensitivity-value analysis	(1) CDF (to be developed within the next five years; sensitivity and zoning report have been completed) (2) Reserve expansion plan (to be developed within the next five years) (3) Invasive-alien plant management plan, (in process, branch-wide)
	Sense of place Maintain or restore appropriate sense of place		(1) Implement and update CDF (2) Establish and apply appropriate visitor carrying capacity (3) Negotiate to ensure that external developments are not visually obtrusive or out of character with the reserve	
CULTURAL HERITAGE MANAGEMENT To investigate and manage all cultural assets	**Conserve and manage cultural heritage assets**		(1) Develop a database of all tangible and intangible cultural assets, including inventory, maps and relevant documentation (2) Develop site management plans for each cultural heritage site, with monitoring systems in place for management priorities and prescriptions (3) Facilitate appropriate interpretation of cultural heritage associated with the reserve	Cultural heritage management plan (to be developed within the next five years)

5.1.2 Socio-economic objectives

Table 5: Socio-economic objectives for the reserve

High-level objective	*Objective*	*Sub-objective (where required)*	*Initiative*	*Low-level plan*
Nurture productive and mutually beneficial partnerships that result in gains in economic and/or biodiversity equity	Enhance socio-economic benefits to local communities		(1) Contribute to local community development by supporting the Expanded Public Works Programme/poverty relief initiatives (2) Contribute to local skills development by supporting the skills and learnership programmes (3) Identify and facilitate the creation of business opportunities in association with the reserve (4) Support community-based social development initiatives	Local socio-economic development plan (to be developed, as part of the community conservation management plan for the northern region within the next three years)
	Increase environmental awareness, and encourage participation in conservation initiatives	Inspire visitors and communities to consider the environment as an interrelated and interdependent system, of which they are an integral part	(1) Develop and implement an interpretation plan that feeds into both the education and zoning plans (2) Implement environmental education and youth development programmes suited to the needs of each focus group (i.e. tailor-made programmes for each focus group)	Education development plan (as part of the environmental education strategy plan for the northern region, and in process of being developed)
		Educate learners, educators and other community focus groups to be able to take environmental action		
		Support educators and community leaders with resource and information materials	(1) Establish and market an environmental resource centre and outdoor classrooms with a range of interpretive and information resources	
Support cooperative governance that will build custodianship	Maintain good reserve/community/ stakeholder relations		(1) Identify and involve all relevant stakeholders for participation in the reserve advisory forum (2) Develop effective communication	Stakeholder relationship plan (as part of the community conservation plan for the northern region)

			mechanisms and responsibilities for representatives	
	Effective cooperative governance	Minimise degrading impact and consequences of inappropriate development in and around the reserve	(1) Establish and maintain good working relationship with relevant government departments as well as internal City of Cape Town departments	
		Ensure support/buy-in for management decisions through participatory decision-making processes	(1) Define roles and responsibilities with stakeholder groups, partnerships, City of Cape Town departments and government through written agreements/terms of reference (TORs), MOUs and service-level agreements (SLAs)	
Become the nature-based visitor destination of choice in the region	To develop, manage and enhance a range of sustainable visitor products		(1) Design customer satisfaction survey (2) Analyse current product usage and identify opportunities	Visitor plan (dune management plan to be developed with reference to the existing zoning and sensitivity report)
			(1) Plan for visitor infrastructure and facilities, as identified by the CDF (2) Develop and implement the infrastructure management plan (in compliance with State of Infrastructure report) (3) Compile a State of Infrastructure report	Infrastructure programme (to be developed with reference to the zoning and sensitivity report)
	Conserve and manage cultural heritage assets		(1) Develop a database of all tangible and intangible cultural assets, including inventory, maps and relevant documentation (2) Develop management plans for each cultural heritage site, with monitoring systems in place for management priorities and prescriptions (3) Facilitate appropriate interpretation of cultural heritage associated with the reserve	Cultural heritage management plan (to be identified and developed within the next five years)

Grow the domestic visitor profile to be representative of South African society	Grow the domestic visitor profile of the reserve to be representative of regional demographics		(1) Promote and manage access to the reserve (2) Develop and support dedicated access programmes, or incorporate a 'dedicated access' element into existing programmes (3) Actively market reserve resources and services	Marketing plan (to be developed, branch-wide process within the next five years)
Enhance the City of Cape Town's reputation	Enhance the reserve's reputation		(1) Develop and implement a communication plan to promote reserve activities	Communication programme (to be developed within the parameters of the City of Cape Town policies for the Branch)
Advance strategic human resource management	Ensure good human resource management		(1) Implement and support learnership and volunteer programmes (2) Ensure that all staff have access to training initiatives as per the Workplace Skills Plan (3) Ensure adherence to all corporate human resource policies	Staff capacity-building programme/institutional development and staff capacity-building programme (to be developed, City of Cape Town-wide process)
Financial management	Ensure sound financial management practices are applied to and underpin the reserve		Manage cost spending appropriately	To be developed; branch-wide process
Achieve good corporate governance management	Effective management of risk profile	N/A	Conduct legal review	Risk management programme (to be developed)

5.2 SWOT analysis

The following analysis identifies the strengths, weaknesses, opportunities and threats for the Witzands Aquifer Nature Reserve:

Strengths

- Local knowledge and expertise of areas under its jurisdiction
- Two City of Cape Town branches' willingness to co-manage the area
- Community involvement and participation
- Management commitment to compile and implement management plans and biodiversity action plans
- Legislative support: municipal bylaws, Nature Conservation Ordinance, National Environmental Management Act (NEMA) and various other relevant or related legislation
- Constitutional support
- Management has experience and knowledge in managing protected areas
- Existing corporate support services
- Three reserve entry and exit points are controlled by gates, and some by a security company
- Staff determination and will to succeed
- Existing, fully functional ecosystems
- Biological monitoring systems are implemented and monitored regularly
- Security hired by Atlantis water scheme to patrol access routes 24 hours a day, 7 days a week
- Access to specialist services and databases
- Koeberg Nature Reserve in close proximity, part of the southern core of the Cape West Coast Biosphere Reserve
- Stewardship sites within the greater Atlantis area

Weaknesses

- Lack of permanent, appropriately trained staff, such as basic field rangers, senior field ranger, and people and conservation officer, to ensure that all biodiversity objectives are met
- Operating budget needs review
- Law enforcement tends to be reactive instead of proactive
- Hired security patrols only access routes and not the entire reserve
- Lack of operationally mandated staff to utilise environmental legislation adequately

- Public's ignorance of applicable environmental legislation
- Lack of adequate operational and administrative office space and equipment
- Geographically far from City of Cape Town administrative hubs
- Roles and responsibilities of the two branches managing the area not yet clearly defined
- Haphazard network of paths and vehicles
- Lack of coordination and cooperation between the reserve and national/provincial government departments

Opportunities

- Aesthetic beauty of the reserve attracts birdwatchers, environmental education groups and recreational users
- Creating buy-in among key stakeholders and role players, by having them represented on the Protected Area Advisory Committee.
- Community constituency building
- Increased community ownership
- Creation of job opportunities, and career succession and planning
- Accessing funds for Expanded Public Works/Sustainable Livelihoods programmes to assist in the creation of job opportunities and reserve infrastructure maintenance and development
- Proactively engaging communities closest to the reserve, and recognising their needs
- Continuous liaison with CBOs and other NGOs
- Linking up with surrounding landowners, sharing knowledge and resources in order to manage the biodiversity network effectively
- Promoting the reserve as a destination of choice for environmentally sound outdoor activities
- Building and establishing a viable volunteer group to actively participate in reserve management activities
- Involving the Atlantis water scheme staff in reserve management activities
- Entrenching and maintaining strong political support from local ward councillors

Threats

- Unemployment leads to rising crime levels
- Threats and intimidation to conservation staff when enforcing legislation
- Lack of commitment from stakeholders
- Lack of appropriate training

- Personal safety of staff
- Growing external communities, with increasing needs
- Increased incidents of crime and other illegal activities in and around the reserve
- Lack of sustained funding for students and interns
- Lack of adequate funding to hire appropriate numbers of full-time staff
- Lack of adequate operational funding
- Loss of biodiversity due to inappropriate fire, invasive species, illegal activities and inappropriate land use practices
- Change in local government political structures
- Illegal entry points not controlled, i.e. off-road vehicles and the network of footpaths and tracks
- Inappropriate development edge could reduce the viability of the reserve through habitat fragmentation
- Future expansion of Eskom facilities
- Proposed aquaculture development at Silwerstroom
- Informal settlement spreading from the urban edge of Atlantis
- Contamination of the aquifer and surface biodiversity by the Caltex pipeline running underground through a section of the reserve
- Climate change

5.3 Protected-area management policy framework and guiding principles

5.3.1 Community participation

The Witzands Aquifer Nature Reserve will strive to nurture productive and mutually beneficial partnerships that result in economic and/or biodiversity equity, such as alien-clearing initiatives as per City of Cape Town procurement processes and the commercial harvesting of invasive plant species by woodcutters. Participation in skills development and learnership programmes in working partnerships with CBOs and NGOs can contribute to the development of local skills. Through the support of community-based social development initiatives, the reserve can also enhance socio-economic benefits to local communities.

Through the development of a regional education plan, the reserve will contribute to raising environmental awareness and encouraging participation in conservation initiatives.

The main aims of the reserve education plan will be:

- to inspire visitors and communities to considering the environment as an interrelated and interdependent system, of which they are an integral part;
- to educate learners, educators and community focus groups to take environmental action, assisted by resource and information materials;
- to develop and implement environmental education programmes suited to the needs of various focus groups; and
- to develop and implement an interpretation plan that complements the education plan.

Through the development of a regional community conservation management plan, the reserve will strive to:

- identify, develop and maintain good nature reserve/community/stakeholder relations involving all relevant stakeholders;
- develop an effective communication system in order to address interested and affected parties and the dissemination of information;
- where necessary, establish task teams and working groups in order to assist the reserve with key issues;
- establish a steering committee in an advisory capacity, and to promote transparency; and
- develop sustainable volunteer programmes with the emphasis on capacity building and development.

5.3.2 Safety and security

A safety and security audit aimed at completing a rapid and verifiable analysis of the current security situation, security services, infrastructure, staffing and social context has been carried out in the Witzands Aquifer Nature Reserve (see appendix 10 for the executive summary of the audit report).

In summary, the results of this audit confirmed the threat level for the reserve as medium, the main threats being illegal access and trespassing, which are primarily caused by a lack of adequate fencing, in particular on the eastern boundary of the reserve. Woodcutter activity in the reserve should also be closely monitored while these persons are in the area harvesting, and after they leave the premises.

Furthermore, woodcutters should be restricted to a certain area and certain days in order to manage the risk of setting snares or illegal flower harvesting. The number of woodcutters or

groups should be limited, and operations can take place during working hours only, which should be clearly specified on a permit. The validity and identity numbers should also be displayed on the permit.

Illegal access must be addressed through specific actions, particularly on weekends and public holidays. It is recommended that the reserve set up a multi-enforcement agency stake-out to combat the illegal access challenge. Not mentioned in the security audit report is the issue relating to the activities in, and access to, the dune area, including off-road vehicles (quad bikes, motor cycles, etc.). Other activities in the dune area include sand boarding and commercial filming. Currently, there are two legal-tariff access gates to the dune area. However, due to a lack of fencing, there are several places where access can be gained illegally. The fencing, access and management of the recreational activities in this area must be adequately controlled in accordance with the zoning of the dunes system.

5.3.3 Culture-historical, archaeological and paleontological management

In 2009, bones were discovered in the dune fields of the reserve, and, according to Stynder (2010), a lecturer at the University of Cape Town, they are from small game, including *Raphicerus melanotis* (Cape grysbok) and tortoise species, as well as domestic farm animals such as sheep. These bones have not been formally identified and published as yet. They have also not been dated, but, from associated artefacts, it appears that they are from the last 2 000 years. Stynder (2010) further states that the bones are definitely from the colonial time period, since a clay pipe was also found with them. Dr Graham Avery Curator at the Iziko Museum, Cape Town has stated that he has also found a single black rhino tooth, when a learner discovered the remains of a skull in the dunes.

5.3.4 Tourism development and management

The reserve has tourism potential as part of the greater Atlantis/Mamre tourism route concept. A marked, established hiking trail has been discussed as part of the above concept, and there are already trained tour guides in Mamre. The tourism route project developers have proposed that the reserve be part of the route. The area is a popular destination for off-road tourism, with a number of local, national and

International visitors (ADORE, pers comm, 2014). There is great scope to further develop this user group and to potentially unlock real benefits to the surrounding communities.

5.3.5 Infrastructure management

Minimum infrastructure exists within the Witzands Aquifer Nature Reserve. Existing infrastructure, such as the office complex, is maintained by the Bulk Water Branch. However,

in order for the reserve to reach its full operational potential, these facilities will have to be extended to accommodate three administrative offices. The road network infrastructure also needs to be prioritised in order to avoid vehicles driving across the reserve, causing continuous damage to the already sensitive vegetation types. Fencing, where appropriate, should also be prioritised in order to ease the management and control of illegal access to the reserve. Future infrastructure should be included in a five-year maintenance plan. Infrastructure with no use should be demolished and the sites rehabilitated.

5.3.6 Biodiversity conservation management

5.3.6.1 Community-based natural resource management (CBNRM)

Harvesting of certain natural resources within the Witzands Aquifer Nature Reserve is currently permitted. Research on the amount of harvesting and the species harvested across the city is currently under way. Some investigations as to the types and the extent of harvesting in the reserve have been started, but, to date, there has been no detailed or conclusive information to determine where current harvesting is sustainable and/or what potential threats are foreseen should these activities persist. Where necessary, a species harvesting plan should be developed in order to ensure the sustainability of such species and the community's livelihoods.

5.3.6.2 Fire management

Too frequent fires, or fires that burn out of phase with the natural burning regime, present a threat to slower-growing species, which may be entirely eliminated. On the other hand, if fire is excluded from the area, other indigenous species could encroach, resulting in a loss of species diversity. Conversely, if vegetation is allowed to burn too frequently, the area could become degraded, and alien species, especially grasses, could start to invade. Grasses maintain a shorter fire cycle, and permanently change the vegetation structure and biodiversity value of the area.

Cape Flats Dune Strandveld, the predominant vegetation type in the reserve, does not burn as frequently, with a fire cycle of typically 20–100 years. It is far more prone to browsing, and many plant species have thorny defences. Therefore, the fire management programme for the Witzands Aquifer Nature Reserve involves the prevention and control of large wildfires, as well as smaller fires, whether natural or unnatural. Historical records of fire events in the reserve area as well as post-fire monitoring records assist in the documentation of veld ages, which in turn influence fire management. Natural fires are limited in spread within the constraints of ecological, project and public safety requirements. All possible actions are taken to prevent the spread of fire onto the adjacent properties. All unnatural fires that

threaten the reserve ecologically, or pose a threat to infrastructure and/or public safety, are controlled.

Fire may be used to keep fuel loads low so as to reduce the risk of uncontrolled fires, particularly on the urban edge and in areas that become a potential risk to infrastructure and public safety. Firebreaks and other fire control measures required by law will be implemented where necessary and feasible.

The nature of the area's terrain, property boundaries and extensive areas of natural veld increase the chances of fire spreading both into and out of the reserve. Reasonable pre-fire protection measures are necessary, as well as a plan of action in the event of wildfire. Interaction by various City of Cape Town departments and independent stakeholders as well as continuous public and private landowner involvement are essential. The development of a fire management plan (covering the issues of fire protection and response plans) is an important component of the reserve's fire management approach.

Fire management implementation in the Witzands Aquifer Nature Reserve involves the following:

- Application of guidelines on seasonal burning intervals and species requirements acquired from relevant documentation and biophysical specialists
- Accurate record keeping of all fires, including details and maps
- Use of fire data and the geographic information system (GIS) for recording and mapping
- Application of post-fire monitoring programmes
- Application of fire data to determine prescribed burning needs
- Development and implementation of a fire protection and response plan, including affected stakeholders such as additional City of Cape Town departments and private landowners neighbouring the reserve

5.3.6.3 Catchment management

This is managed by the Atlantis water scheme (see Knight Hall Hendry 1996). Detailed information on the management of the water extraction and supply is available from the reserve and Atlantis water scheme management. Also see point 2.3.3 for further information regarding catchment management.

5.3.6.4 Soil erosion and control

Within the Witzands Aquifer Nature Reserve, a soil erosion assessment is required. If human-induced erosion takes place within natural areas, appropriate management action must be taken.

Potential human impacts should be avoided through correct planning and maintenance of infrastructure. Areas that had been previously degraded by human activities and are no longer in use will be restored as close as possible to their natural state. Disturbed areas and areas affected by unnatural accelerated erosion will be controlled by means of appropriate methods. The cause and management of problem erosion sites will also be considered.

Soil management implementation in the reserve includes the following:

- Identification and recording of all soil erosion sighted, including the assessment and development of restoration plans where required
- Use of soil erosion data and GIS for recording and mapping
- Application of fixed-point monitoring programmes at identified soil erosion sites
- Accurate documentation of management actions applied to restoration sites, including results from areas responding to these actions

5.3.6.5 Invasive-species management

The management of invasive species is a priority in the Witzands Aquifer Nature Reserve. Alien biota need to be controlled and, where possible, eliminated in order to facilitate the re-establishment of natural biodiversity and processes in invaded areas.

Invasive-species management within the reserve is applied in accordance with the City of Cape Town invasive alien species strategy and in coordination with various government-funded initiatives, including Working for Water (WfW) and Working for Wetlands (WfWet). Invasive plant species could spread rapidly should management fail to continue implementing a properly planned and coordinated programme.

Until recently, invasive species management focused on woody alien plant species only, such as Port Jackson willow (*Acacia saligna*) and rooikrans (*Acacia cyclops*). Herbaceous weeds were largely ignored. Recently, recorded herbaceous weed and grass species in the reserve have however shown that some herbaceous species already pose a risk to biodiversity in the area, while others have the potential to become one.

A number of alien herbaceous weed species have been identified in the reserve. The occurrence of such species is generally as a result of planting and/or unintentional seed dispersal from the surrounding areas when maintenance is undertaken. Horticultural strains of indigenous species also present a risk to naturally occurring specimens. Some species are known to hybridise with endemic species in the area, and pose a potential threat to the genetic diversity of such populations.

In order to protect indigenous species from alien invasive species, the following is required:

- Prioritisation of areas for alien removal, focusing on biodiversity restoration
- The implementation of removal programmes for priority species and areas
- The development and implementation of an invasive and alien-plant management plan as well as a management plan for alien biota

The eradication of invasive alien faunal species is also carried out in the reserve. Formal plans outlining the monitoring of the removal of identified species is however required.

5.3.6.6 Species introductions

There is potential to re-introduce species that were historically indigenous to the reserve, and for which suitable habitat and eco-niches are available. Several fauna species that previously occurred in the reserve are no longer present or down to small numbers.

Prior to the re-introduction of any species, a full proposal is required, which must be submitted to the Fauna Management Committee for consideration and endorsement before implementation. The committee will therefore ensure that investigations are conducted into the availability of suitable habitat for the species with reference to public utilisation of areas, as well as a full investigation into the historical occurrence and status of the species. The effect of re-introducing species to the area must also be researched. Re-introduction of potentially dangerous and problematic species may also require a public participation process. Another requirement is an investigation into suitable sources.

All proposed re-introductions need to be recommended and approved by the Flora and Fauna Management Committee as well as provincial authorities before implementation. The implementation of any re-introduction programmes must be specified in a plan of action, and documented accurately.

5.3.6.7 Strategic research

The reserve needs to identify research subjects that are beneficial to its management. These subjects can then be prioritised and further pursued.

Although research does currently take place in, and is supported by, the reserve, many of the projects are conducted by outside student researchers and organisations, and are not informed by the reserve's needs. Only recently have a list of research topics been formulated by the Biodiversity Management Branch in line with the Fynbos Forum (FF) research priorities, and these will be used by both internal researchers and reputable external institutions.

An effort needs to be made to obtain copies of data resulting from research projects conducted within the reserve's boundaries.

5.4 Sensitivity-value analysis of the Witzands Aquifer Nature Reserve

The reserve is a significant asset to the City of Cape Town, and significantly contributes to the national vegetation targets of threatened vegetation types, as listed in the National Spatial Biodiversity Assessment (Driver *et al.* 2005), as well as provides a service and facilities to local residents and schools.

The development of the sensitivity and zoning plan is one of the steps required in compiling a CDF for the reserve. A CDF is a tool to reconcile the various land use needs, and to delineate visitor user zones and the positioning and nature of new infrastructure, access points, roads and facilities (see appendix 9 for the sensitivity-value analysis and zoning report).

The CDF process has grown in response to the requirements of the National Environmental Management: Biodiversity Act, Act 10 of 2004, and seeks to comply with the spatial planning requirements of the Act. The CDF will ensure that best practice and sustainable development principles are integrated with spatial planning in protected areas.

The sensitivity-value analysis is the landscape analysis portion of the broader CDF. It is a multi-criteria decision-support tool for spatial planning, designed to present the best available information in a format that allows defensible and transparent decision making. The sensitivity-value process is based on the principle that the acceptability of a development (or placement of a structure) at a site is based on the site's value (arising from that site's

biodiversity, heritage, aesthetic or other values) and its sensitivity or vulnerability to a variety of disturbances (Holness 2005).

The sensitivity-value analysis, the CDF and the associated zoning plan should form part of an adaptive management system. They will grow and change over time as the understanding of the landscapes and ecosystems improves. These documents, however, do not replace the need for detailed site and precinct planning and EIA compliance at site level.

The size of the reserve may require an extensive analysis, with the subsequent zoning process being fairly straightforward. The methodology used for both the sensitivity-value analysis and the zoning process was adapted from Holness and Skowno (2008) and SRK Consulting (2008[1]; 2008[2]).

All geographic information work was carried out in Environmental Systems Research Institute ESRI's ArcMap Version 9.3.1 GIS, using the ArcInfo licence level, with Spatial Analyst and 3D Analyst extensions. Map 7 depicts the balanced summary of the sensitivity analysis for the Witzands Aquifer Nature Reserve.

5.5 Zoning plan of the Witzands Aquifer Nature Reserve

5.5.1 Zoning informants

This section briefly outlines the values underlying the identification of broad tourism use zones. It is important to remember that the landscape/biodiversity analysis is just one of the informants in the zoning process. Although the biodiversity analysis is intrinsically a relatively objective scientific process, other informants to the zoning process are not.

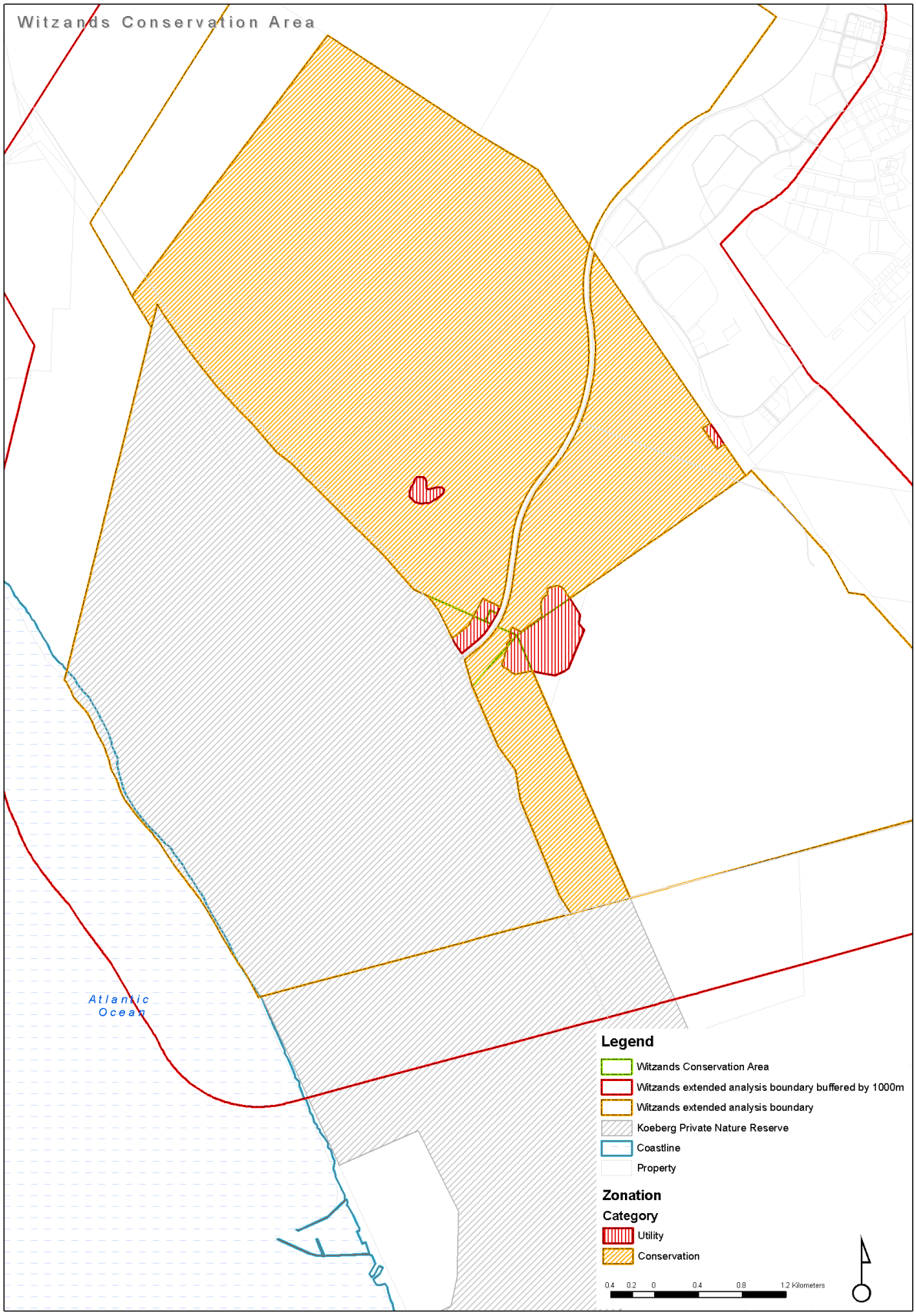
Although every attempt is made to place high sensitivity-value sites into more protected zones where possible, the zoning process is essentially a compromise between environment and development. In particular, the identified high-value sites are often the key biodiversity assets that need to be made available in an appropriate manner to the eco-tourism market. Direct links between the biodiversity layers and the spatial management of the reserve are made during the identification of special management areas (where applicable). Even within broad high tourist-use zones, some areas will likely be subject to very tight conservation controls (potentially including complete exclusion of human impacts from an area).

Underlying decision-making rules used in the zoning process

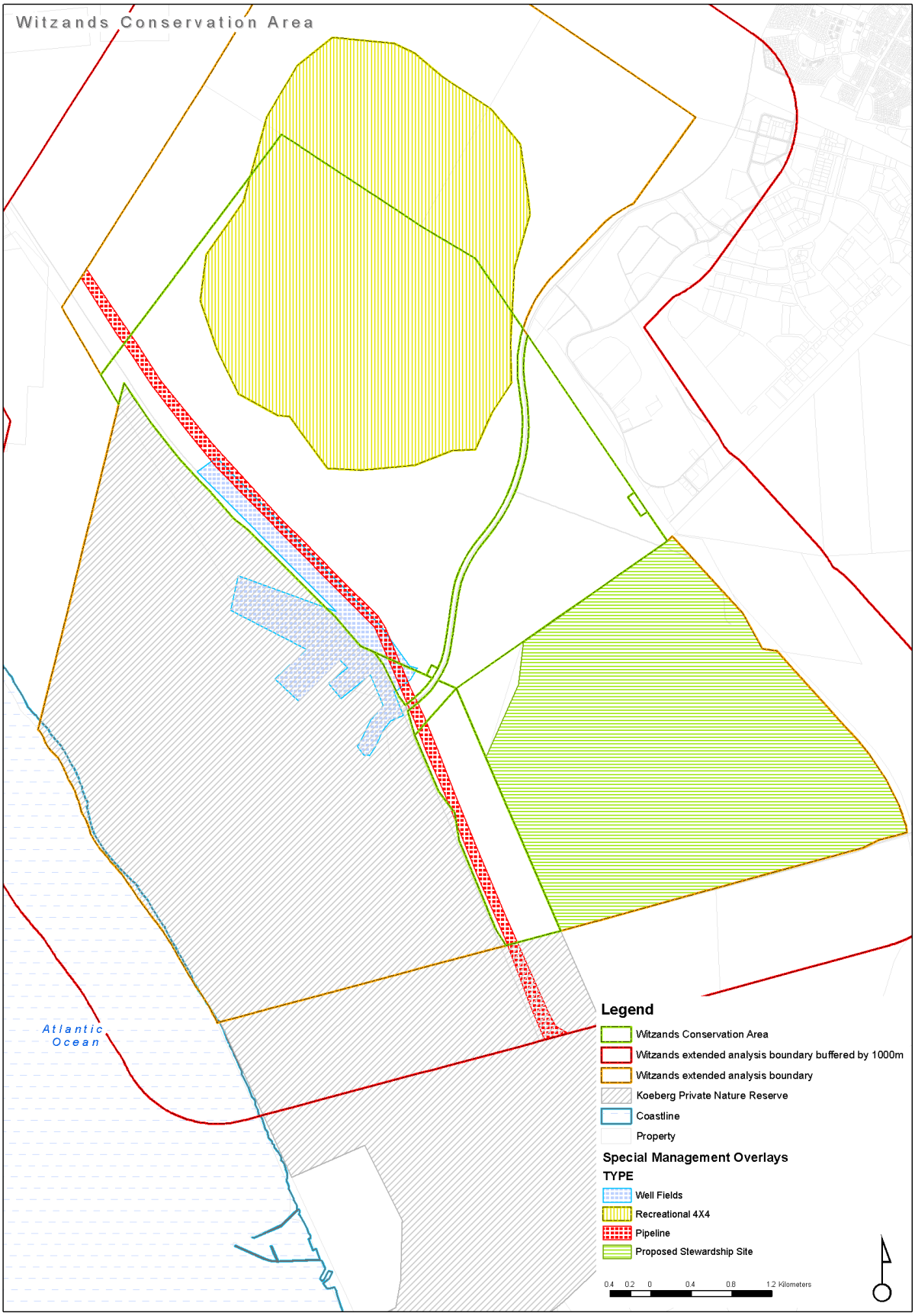
- The zoning process is aimed at striking a *balance* between environmental protection and the development required to meet the broader economic and social objectives of the reserve.
- The zoning process takes into account existing development footprints and tourism access routes.
- This is based on the underlying principle that, all else being equal, an existing transformed site is preferable to a greenfields site from a biodiversity perspective.
- Infrastructure costs are dramatically increased when developments take place away from existing infrastructure.
- Existing tourism nodes and access routes are a reality of the economic landscape, and it would not be possible to shut down existing tourism sites compromising the development objectives of the reserve.
- Where existing development nodes, tourist sites and access routes occur in areas with high sensitivity-value, the broad use zoning aims to keep the development footprint as small as is realistically possible, preferably within the existing transformed site.
- Where possible, sites with high biodiversity sensitivity-value are put into stronger protection zones.
- Peripheral development is favoured and, where possible, should be located outside the conservation area.
- Two key points need to be emphasised:
  - The designation of a broad use zone does not imply that all sites within that zone would be suitable for all the development types anticipated. Detailed site-level planning is still required, and many sites may prove to be unsuitable at a site/precinct/EIA level.
  - Special management areas/overlays need to be formalised and linked to the management plans. (Holness 2008[1]; 2008[2])

5.5.2 Zoning definitions and descriptions

The zoning definitions and descriptions were worked through with regional and area managers in the form of a workshop. Four categories were decided on, namely primary conservation zone, conservation zone, low-intensity leisure zone and high-intensity leisure zone. Appendix 2 outlines the proposed zoning and zone descriptions. However, the process is still linked to the zoning used for the CapeNature reserves (Holness 2008[1]; 2008[2]), as there should be general alignment of the broader use zones to enable comparison and integration if provincial documents so require.



Map 7: Witzands Aquifer Nature Reserve zoning summary (Purves 2010)



Map 8: Witzands Aquifer Nature Reserve special management overlays (Purves 2010)

6. DEVELOPMENT PLAN

The future expansion development plan will inform the following envisaged plans:

- Office complex extension plan
- Visitor facilities plan
- Roads and access plan
- Witzands aquifer and Brakkefontein expansion plan

A detailed development plan for the Witzands Aquifer Nature Reserve is required.

7. COSTING PLAN

Table 6: Broad costing management breakdown for the reserve:

Item	Funding source	2011–2012	2012–2013	2013–2014	2014–2015	2015–2016
Invasive alien plants	Grant	R956 975,66	R1 014 394	R1 075 257	R1 139 773	R1 208 159
Fire management	Operating	R70 000	R77 000	R84 700	R93 170	R102 487
Road and trail maintenance	Operating	R1 700 000	R1 870 000	R2 057 000	R2 262 700	R2 488 970
Human resources	Operating	R1 100 000	R1 188 000	R1 283 040	R1 385 683	R1 496 537
Infrastructure development	Capital expenditure/grant	R1 200 000	R1 320 000	R2 772 000	R2 993 760	R3 293 136
Fencing	Operating/capital expenditure	R3 515 000	R3 866 500	R4 560 000	R5 016 000	R5 517 600
General expenses	Operating	R15 000	R15 750	R17 325	R18 191	R19 100
Special projects	Grant/capital expenditure					
Human resources are escalated at 8%.						
Operating expenditure is escalated at 5%.						
Invasive alien as per management unit clearing plan (6%)						

PART 3

MONITORING & AUDITING

8. MONITORING & AUDITING

8.1 Annual audit procedure

8.1.1 Management Effectiveness Tracking Tool South Africa (METT-SA)

The METT-SA is a rapid, site-level assessment tool adapted from the World Bank and Worldwide Fund for Nature (WWF) system (second edition, 2007). The system is based on the idea that good protected-area management follows a process comprising six distinct stages or elements:

It begins with understanding the **context** of existing values and threats (where are we now?), then progress through **planning** (where do we want to be?), followed by allocation of resources (**inputs**) (what do we need?). As a result of management actions (**processes**) (how do we go about it?), it eventually produces products and services (**outputs**) (what were the results?), which result in impacts or **outcomes** (what did we achieve?).

This version has been compiled so that it can be applied to the full range of protected areas managed by all C.A.P.E partners. It also applies to protected areas in other regions, and, with minor adaptations, could be applied outside of South Africa as well. It may also be used for marine protected areas (MPAs) and islands, but, in the long run, it may become necessary to amend the system to be more specific to these areas. In addition, a system for off-reserve conservation areas, such as conservancies or stewardships, may need to be developed.

When applying METT-SA, it is important for the following to be kept in mind:

- The METT-SA is intended to report on the reserve's progress. Thus, the score is the baseline against which future assessments are made to see if there has been an improvement.
- It is site-specific and must therefore not be used to compare scores between different protected areas.
- It is a useful tool to give indications of management trends. In this version, the six elements of the management process, as defined in the original version, are scored as subsets of the total. This gives an indication of where management should strive for improvement.
- It is not intended to replace more detailed assessments as part of adaptive management systems.
- The METT-SA has limitations in the quantitative measurement of outcomes, and these should be measured by more objective and quantitative systems.
- This version adjusts the total score where questions are irrelevant.

- Often, low scores on some questions could be a reflection on the organisation as a whole, and do not necessarily point to issues over which the protected-area manager has control. **The performance of managers should therefore under no circumstances be measured against the METT-SA results.**

Tracking the trends of management effectiveness is a long-term process, and instant improvements are unlikely. Generally, the METT-SA is applied at three-year intervals, but an annual application is acceptable if it is understood that changes may only be slight.

Most of the City of Cape Town's reserves have undergone a METT-SA audit in 2007, and the next one is planned for September 2011. However, the Witzands Aquifer Nature Reserve, although identified on the biodiversity network, had no biodiversity staff assigned to the area in 2007. This will therefore be the first METT-SA conducted for the reserve.

8.1.2 Protected-area review

The protected-area review (PAR) is an internal review conducted annually to assist managers in reviewing their sites, and to allow for adaptive management actions to be taken where required (and within managers' control).

8.2 Management plan review

Every five years, this management plan should be reviewed, and adjusted where necessary. To achieve this, the following questions (and others as needed) should be addressed:

- Did this IRMP make a meaningful contribution to the management of the Witzands Aquifer Nature Reserve?
- Were individual management 'prescriptions' realistic and achievable? Were they written unambiguously, or was there room for misunderstanding?
- Were budgets for each management activity realistic? Were the allocated budgets too much or too little?
- Were sufficient staff members with the right qualifications allocated to each management activity?

There will be some overlap between the review and the audit, and they should therefore be done on the same day, by the same team.

8.3 Biodiversity monitoring

Table 7: Reserve's monitoring requirements:

Action	Responsible party	Means of verification	Frequency
Vegetation monitoring Invasive alien plants Aspects to be monitored include the effectiveness of the operations, the effectiveness of the follow-up, methods used, compliance with the alien clearing schedule, and environmental damage such as herbicide spillage	Reserve staff Area manager, students and interns	Weekly inspections, final inspections, field verification sheet	Weekly Once-off – completion of contract Annually – to determine management unit clearing plan
Fire mapping All veld fires must be accurately mapped and recorded to build up a useful record that will assist with veld interpretation. These records will take the guesswork out of the effects of fire when it occurs on the property. A simple map indicating the extent and date of the burn is the minimum requirement.	Reserve staff Area manager, students and interns	Veld age map, fire map	Post-fire
Post-fire recruitment	Reserve staff, area manager, students and interns	Stratified sampling plots	Post-fire Six months 12 months Annually for three years
Abundance, density and structure	Reserve staff, area manager, students and interns	Fixed-point photography, presence, abundance, density	Annually Every three years – permanent vegetation plots
Fine-scale vegetation community mapping	Reserve staff, area manager, biophysical specialist, interns and students	Land use survey of area and neighbouring properties in field density assessments of plant communities	Once-off
Atlantis Sand Fynbos	Interns and students	Species identification, abundance	Once-off

Aquatic weeds survey	Interns and students	Water bodies, species identification	Once every three years
<u>Faunal monitoring</u> Small-antelope sample survey	Reserve staff, area manager, students and interns, people and conservation officer	Game drive count	As required
Small mammal	Students and interns	Trap cages, Sherman traps	2009–2010
Black harrier	Area manager, students, interns	Visit to nesting/activity site	Once per annum, September to November
Bird distribution	Reserve staff, area manager, students, interns	Field observations	Monthly
Coordinated water-bird count	Reserve staff, students, interns	Bird count at water body (Pond 7)	Quarterly
Reptile survey	Students, interns, reserve staff, area manager	Traps used to capture, identify and release	Once every five years
Amphibian survey	Students, interns, reserve staff, area manager	Audio and visual observation	Once every five years
Geological features	Mobile dune fields	Vehicular and foot visual observations	Before and after winter
<u>Water monitoring</u> Water quality	Students, interns, reserve staff	Field collection equipment – samples	Bi-monthly

PART 4

REFERENCES

9. REFERENCES

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PART 5

10. APPENDICES

Appendix : Zonation and Zone descriptions

City of Cape Town Nature Reserves and Conservation Areas: Visitor Use Zoning - Desired State* & Experiential Qualities

Experience	Zone	Desired State*	Conservation objectives	Secondary objective	Experiential Qualities	Activities	Interaction between users	Frequency of use	Group size	Sophistication and type of facilities	Primary user movement within the zone	Roads & footpaths	Equivalent Provincial zone
Close ToNature **Activities tend to be at landscape level**	**Primary conservation**	Natural or near-natural areas (or areas that can be rehabilitated to this state) that are managed primarily for biodiversity conservation. The experience is one of relative solitude and wildness. The nature of the experience is dependant on the quality of the natural environment. The main accent of management is biodiversity conservation and "Pack it in Pack it out" principles are applied to all activities including management. There may be some signs of infrastructure mainly of a heritage nature. In the longer term, unused utility infrastructure (e.g. reservoirs) should be phased out and the site rehabilitated.	Natural areas should be kept intact in order to protect habitat required to meet biodiversity targets for various vegetation types and to provide undisturbed habitat for a range of species. Where possible degraded areas should be rehabilitated.	Managed to provide visitor experiences in a way that does not impact on the biodiversity objective. Where appropriate heritage values are managed as required	Relative sense of isolation	Controlled access** Research and monitoring. Accompanied small groups. The size and frequency of groups to be specified for each reserve.	None or very low	None -Very low	Small	No new facilities. Existing structures should be phased out where appropriate. Heritage assets are managed where appropriate	Pedestrian access in accompanied small groups Motorised for essential management only.	Absolutely essential management tracks and footpaths in accordance with the foot path and road management plan Ongoing restoration of old paths/roads to be prioritized and monitored.	Quiet
	Conservation	Natural or near-natural areas (or areas that can be rehabilitated to this state) that are managed for biodiversity conservation. This zone provides experiences of a relative sense of relaxation in an environment that is openly exposed to the sights and sounds of the city. Although it is a place of quietness and naturalness, there will be more interaction between users than in the Primary Conservation Zone. The quality of the experience is less dependant on the quality of the natural	Natural areas should be kept intact in order to protect habitat required to meet biodiversity targets for various vegetation types and to provide undisturbed habitat for a range of species. Where possible degraded areas should be rehabilitated.	Managed to provide visitor experiences in a way that does not impact on the biodiversity objective.	Relaxation	Self guided hiking, non-motorised access***. bird watching, etc. In reserves where access to water bodies is allowed, this area is limited to non-motorized vessels onlyin accordance with the Vlei By-Laws.	Moderate	Moderate	Small	Low impact, eco-friendly facilities that facilitate ecologically sustainable activities and visitor experiences may be permitted under certain circumstances. These are strictly for achieving the social and development objectives of the reserve where appropriate and are subject to a stringent internal approval process and must be inline with an approved reserve management plan.	Pedestrian Non motorised Motorised access for management only.	Management tracks/roads and footpaths. Minimal footpath construction to prevent ecological damage. Boardwalks may be permitted where appropriate to protect sensitive areas. The footpath system should be designed so as to control access into the Primary Conservation zone. Off road wheelchair access may be provided where appropriate.	

		environment.											
Outdoor Natural Experience **Activities tend to be at precinct level**	**Low** **Intensity leisure**	Natural, near-natural or managed landscapes which are primarily managed to promote recreational and educational objectives. The main accent is on recreational activities which are more reliant on the quality of the facilities provided than in a Conservation Zone. By their nature these zones are placed in more transformed landscapes. Interaction and socialisation are an integral part of the experience.	Although some areas will be impacted by a range of activities and limited infrastructure, most areas should be kept largely intact and ecological processes should remain functioning. Where possible degraded areas should be rehabilitated.	Recreation and education Managed to provide a largely natural outdoor area to support the recreational and education objectives of the reserve.	Socialisation	Walking, non-motorised access, bird watching. In reserves where access to water bodies is allowed, motorized vessels are only allowed under strict control (e.g. no waterskiing, low speed limits and wake-free zones) in accordance with the Vlei By-Laws.	Frequent	Moderate -high	Small-moderate	Low-Medium impact, eco-friendly facilities that facilitate ecologically sustainable activities and visitor experiences. E.g. Benches, bird hides, informative signage, lookouts. Parking for access to this and other zones.	Pedestrian Non motorised Motorised access for management only	Appropriate foot paths with directional signage Boardwalks should facilitate access and protect sensitive areas. Normal wheelchair access where appropriate Parking with no facilities for access to this and other zones	Low intensity leisure
	High **Intensity Use**	High use landscapes, which are often largely transformed, which are managed largely to support visitor activities more dependent on facilities, education and administrative functions of reserves. High intensity visitor facilities with modern commercialised amenities with very concentrated, activities. The quality of the visitor experience is heavily dependant of the quality of the facilities which enable the visitor to experience the environment with a minimum of effort. Due to the high impacts these are concentrated at specific nodes. These nodes are generally situated at existing facilities including historic buildings and precincts. The main focus of management is to ensure a high quality visitor experience whilst ensuring that the activities have a minimal impact on the surrounding environment and that heritage resources are respected and celebrated.	The activities and infrastructure in these areas should be managed to minimize impacts on biodiversity and visitor experience in other zones. Where feasible, non-crucial infrastructure should over time be removed from the reserve and the sites rehabilitated.	Facilities are managed to facilitate and promote appropriate visitor activities and educational use of the reserve. Administration; provides appropriate management infrastructure to facilitate other objectives of the reserve.	Entertainment	Events, self guided walks, wheelchair accessible trails, parking, picnicking. In reserves where access to water bodies is allowed, this area is appropriate for high intensity uses such as power boating and waterskiing in accordance with the Vlei By-Laws.	Very frequent	Very high	Small - Large	Picnic areas, parking areas, restaurants, information centers, ablutions, environmental education facilities, nurseries etc. Provides parking from which pedestrian access is gained to other zones.	Motorised Access People movers & Pedestrian access	Access roads and associated parking. Footpaths constructed to a higher standard for the comfort of the user. Design standards to be set in the footpath and road management plan Wheelchair access encouraged in this zone.	High Intensity Leisure
Site Specific	**Utility zone**	Area used for utility functions such as bulk water provision, landfill sites within the protected	The activities and infrastructure in these areas should be managed to minimize	Administration Conservation where appropriate	Utility	Determined at site	Determined at site	Determined at site	Determined at site	Determined at site	Determined at site level	Access roads and associated parking as required by the Utility	

Level		/conservation areas etc.	impacts on biodiversity and visitor experience in other zones. Where feasible, non-crucial infrastructure should over time be removed from the reserve and the sites rehabilitated.									Function	

*Note. The "Desired State" is the long term objective of the zone and these desired conditions may not actually exist at the time of zoning. Achieving the" Desired State" will be informed by many factors and may only be reached after many years.

** Accompanied access refers to controlled access. The level and type of control is determined at reserve level.

*** Non-motorised access refers to mountain bikes, horses, paragliding etc. These activities are reserve specific and reference must be made to the reserve management plan for a list of acceptable activities per reserve.

B. Legal Agreement

Appendix 2: Surveyor General (SG) diagrams

De Haan & Ward
Land Surveyors

OFFICE COPY

SIDES Metres		ANGLES OF DIRECTION		CO-ORDINATES Y system Lo 19° X		
		Constants	+	0,00	+	3700000,00
AB	631,44	293 50 30	A	+ 52204,46	+	21840,69
BC	0,67	29 58 40	B	+ 51626,91	+	22095,93
CD	96,41	36 43 00	C	+ 51627,24	+	22096,51
DE	96,41	43 27 40	D	+ 51684,88	+	22173,79
EF	78,12	48 53 00	E	+ 51751,20	+	22243,77
FG	111,31	50 25 00	F	+ 51810,05	+	22295,14
GH	113,92	145 05 00	G	+ 51895,84	+	22366,07
HJ	124,19	153 45 20	H	+ 51961,04	+	22272,65
JK	218,53	153 56 20	J	+ 52015,96	+	22161,27
KA	154,91	143 20 20	K	+ 52111,97	+	21964,96
		1 CB 14	⊕	+ 51627,74	+	22174,97
		7 CB 14	⊕	+ 54695,26	+	19328,18
		3 CB 9	⊕	+ 54611,55	+	18812,52

S.G. No. 6145-94

Approved
R.A.F—C.
for Surveyor-General
1994 · 11 · 17

SHEET 1 OF 2 SHEETS

Beacons:

A	:	20mm Round iron peg.
B	:	South Eastern corner of Rail Corner Fence Post.
C,D,F	:	12mm Round iron peg.
E,H,J,K	:	Wood Fence Post.
G	:	Section of Iron Standard.

Servitude Note

1.) The figure abcd represents a Pipeline Servitude 7m wide
Diagram No. 2165/1984 D/S K. 1214/1984

The figure A B C D E F G H J K

represents 11,4000 Hectares of land, being

Portion 28 (a Portion of Portion 6) of the Farm Kleine Springfontyn No. 33

situate in the Administrative District of Cape Province of Cape of Good Hope

Surveyed in March - June 1994

by me, J WARD (PLS.0700) Land Surveyor

This diagram is annexed to	The original diagram is	File No Cape 33
No.	No. 2637/1970 annexed to	S.R. No. E 2035/94
Dated	Transfer/~~Grant~~	Comp. No. BH-5DB (5854) BH-5B (3707)
I.f.o.	No. 1978- -21287	
Registrar of Deeds		

COLOURTONE

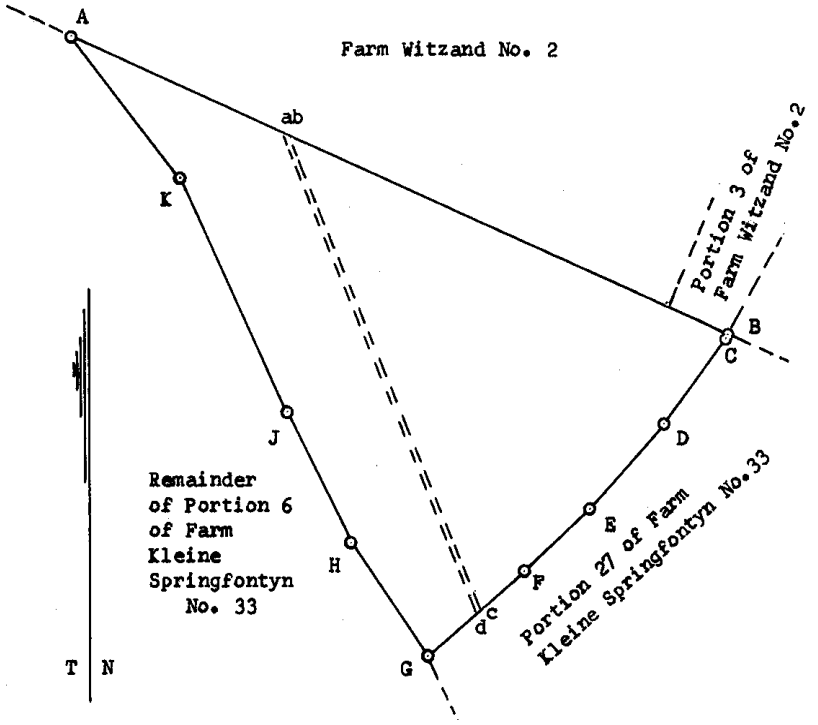
33/28

De Haan & Ward
Land Surveyors

OFFICE COPY

S.G. No.
6145-94
Approved
Surveyor-General
1994 . 11 . 17
SHEET 2 OF 2 SHEETS

Portion 1 of
Farm Witzand No. 2



Scale t 5000

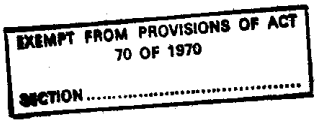
The Property Portion 28 (a Ptn. of Ptn. 6) of the Farm Kleine Springfontyn No. 33

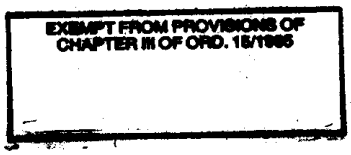
Surveyed in March - June 1994 Administrative District Cape

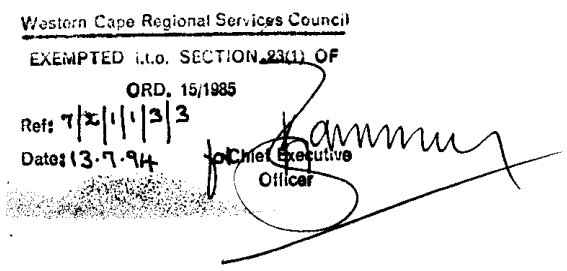
by me, J. WARD (PLS. 0700) Land Surveyor

COLOURTONE

33/28


EXEMPT FROM PROVISIONS OF ACT
70 OF 1970
SECTION


EXEMPT FROM PROVISIONS OF
CHAPTER III OF ORD. 15/1985


Western Cape Regional Services Council
EXEMPTED i.t.o. SECTION 23(1) OF
ORD. 15/1985
Ref: 7/2/1/1/3/3
Date: 13-7-94
for Chief Executive
Officer

MILLS & BOLLE
Land Surveyors
Cape Town.

SERVITUDE DGM. 3645-84

SIDES Metres		ANGLES OF DIRECTIONS		CO-ORDINATES y System	x
		CONSTANT		± 0,00	+3 700 000,00
AB	74,53	326 37 30	A	+ 54 649,99	+ 18 758,60
BC	457,59	326 34 40	B	+ 54 608,99	+ 18 820,84
CD	1129,58	320 48 05	C	+ 54 356,94	+ 19 202,76
DE	1757,18	315 02 59	D	+ 53 643,03	+ 20 078,14
EF	356,92	317 57 10	E	+ 52 401,60	+ 21 421,73
FG	361,87	337 21 00	F	+ 52 162,56	+ 21 586,78
			G	+ 52 023,19	+ 21 920,74
		Δ Klein Springfontein		+ 51 598,36	+ 23 844,20
		Δ Melkpost		+ 54 297,35	+ 18 008,51

Beacons.

A,B,C,D,E,F,G : 20mm round iron pegs.

The ~~figure~~ line A B C D E F G ~~represents~~ the south western boundary of a pipeline servitude area, 7,00m wide, over the remainder of Portion 1 of the ~~of land, being~~ Farm Witzand No.2

situate of the Cape — Administrative District: Province of Cape of Good Hope

Surveyed in August 1983 - February 1984 by ~~me~~ us

Land Surveyors

This diagram is annexed to Deed of Servitude No. 1207/1984 S dated — t.f.o. — Registrar of Deeds.

The original diagram is No. 397/1879 annexed to Transfer/~~Grant~~ No. 1879. 27. 798.

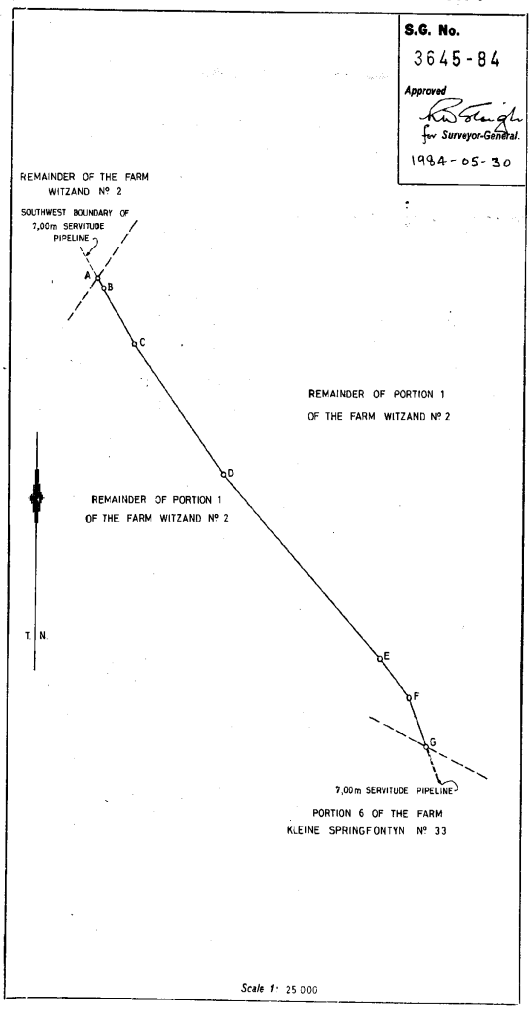
OUR REF.

File No. Cape 2
S.R. No. E 902/84
Comp. BH - 5DB (5854)
BH - 5B (3707)

SERVITUDE DGM.

OFFICE COPY

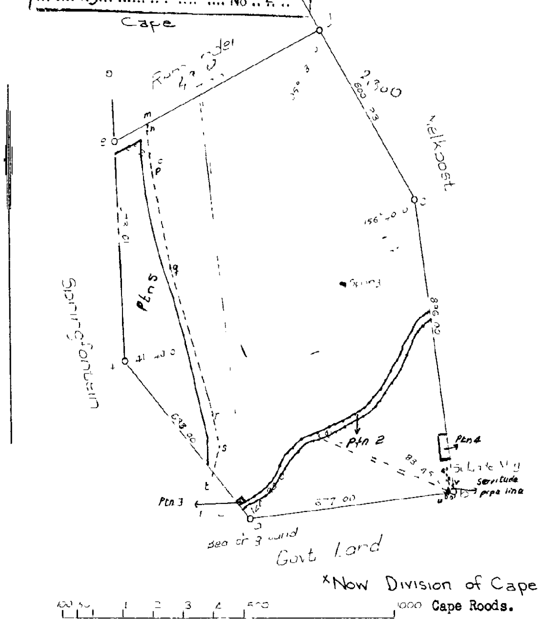
S.G. No. 3645-84
Approved
for Surveyor-General.
1984-05-30



NO. 397/1879.

The numerical Data of this Diagram are sufficiently consistent.
(Sgd.) Max Jurisch.
Acting Examiner.

Portion .. 1 ... (Zandfontein ....)
(a portion of Portion ......) of the farm
... Witsand ... . No .. 2 ..
Cape



The above Diagram a to f, represents 2000 Morgen of Land, called "Zandfontein", situate in the xDivision of Malmesbury Field-Cornetcy of Darling being part of "Witzand" granted in Freehold to Catharina van Reenen on the 25th day of May 1837.

Bounded N. & N.E. by Melkpost.
S. " Govt. Land.
E. " Melkpost.
W. & N.W. " Springfontein & Remainder.

Surveyed and divided by me,

(Sgd.) A. Freislich.
Government Land Surveyor.
Nov. 1878.

Copied from diagram relating to Transfer 798 dated 31.5.1879 (Vol. 27)
for
1.10.1962

Sheet ~~BH 5~~B BHSH-12(M3278)

FOR ENDORSEMENTS SEE BACK OF DGM

C

CE/PS

SURVEY RECORD	DIAGRAM NO	[illegible]	[illegible]	[illegible]	INITIALED	[illegible]
E1497/77	6874/77	Ptn 2	22,1193	4661/78	[illegible]	
E 814/81	2474/81	Ptn 3	7381sm	5294/83	[illegible]	
E1081/87	3657/87	Ptn A	1,8399	62718/87		
E2035/94	6144/94	Ptn 5	10,5741 ha	28036/95	[illegible]	

SERVITUDES LEASEHOLD AREAS

SURVEY RECORD	DIAGRAM NO	DESCRIPTION	DEED	INITIALED
E 902/84	3645/84	The line [illegible] represents the south western boundary of a pipeline servitude area 7,00m wide	D/S K120/1984	[illegible]
E1081/87	3657/87	For pipeline servitude near b see original diagram	D/T 62718/87	[illegible]
E 2908/93	8592/93	[illegible]		

david hellig & abrahamse (ref L4481)

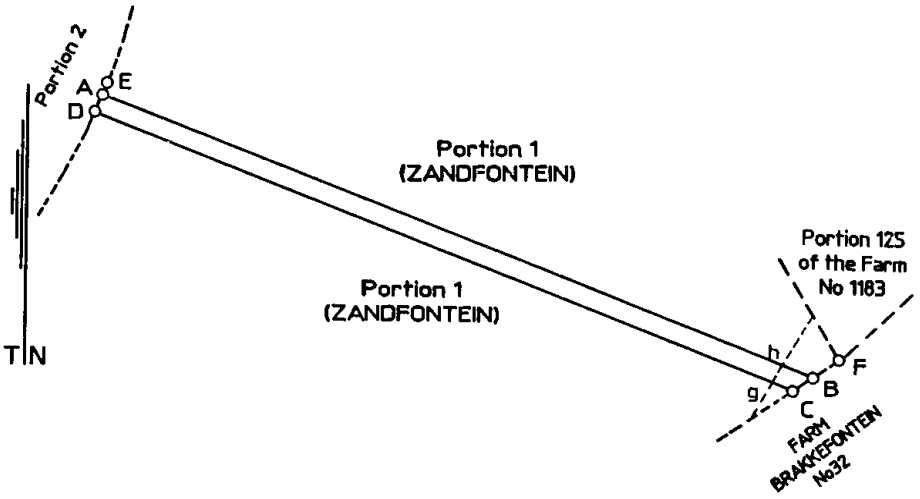
SERVITUDE DGM.

OFFICE COPY

SIDES Metres		ANGLES OF DIRECTION		CO-ORDINATES Y System Lo19° X		S.G. No.
		Constants		0,00	+ 3700 000,00	8592-93
AB	1546,35	290 33 20	A	+ 50 800,29	+ 20 235,78	Approved
BC	48,58	55 08 13	B	+ 49 352,40	+ 20 778,75	R.A.F.
CD	1520,37	110 33 20	C	+ 49 392,26	+ 20 806,52	Surveyor-General
DA	40,03	202 49 40	D	+ 50 815,82	+ 20 272,67	1993 · 10 · 26
Connecting Data						
AE	23,05	202 49 40	E	+ 50 791,35	+ 20 214,53	
BF	61,40	235 08 13	F	+ 49 302,02	+ 20 743,65	
		275 Witsand	△	+ 49 722,26	+ 20 802,79	
		521 Avondale	△	+ 48 888,80	+ 16 366,75	

Beacon Description

A,B,C,D - 20mm iron peg
E - 12mm iron peg in concrete next to wooden fence post
F - Base heavy rail fence section in concrete



Servitude Note:
The figure BCgh is an Electric Powerline servitude area vide Dgm No. 9226/77

Scale 1:12500

The figure A B C D represents a servitude right of way 40,00 metres wide as shown over

PORTION 1 (ZANDFONTEIN) of the farm WITZAND NO. 2

situate in the Administrative District of the Cape Province of Cape of Good Hope

Surveyed in September 1993

by me,

S G Le Brun
Professional Land Surveyor

This diagram is annexed to	The original diagram is	File No. Cape 2
No. dated i.f.o. Registrar of Deeds	No. 397/1879 annexed to Transfer No. 1879.27.798	S.R. No. S 2908/93 Comp. BHSH 12 (M3278)

SERVITUDE DGM.

MILLS & BOLLE
Land Surveyors
Cape Town

SERVITUDE DGM. 3645-84

SIDES Metres		ANGLES OF DIRECTIONS		CO-ORDINATES y System	x
		CONSTANT		± 0,00	+3 700 000,00
AB	74,53	326 37 30	A	+ 54 649,99	+ 18 758,60
BC	457,59	326 34 40	B	+ 54 608,99	+ 18 820,84
CD	1129,58	320 48 05	C	+ 54 356,94	+ 19 202,76
DE	1757,18	315 02 59	D	+ 53 643,03	+ 20 078,14
EF	356,92	317 57 10	E	+ 52 401,60	+ 21 321,73
FG	361,87	337 21 00	F	+ 52 162,56	+ 21 586,78
			G	+ 52 023,19	+ 21 920,74
		△ Klein Springfontein		+ 51 598,36	+ 23 844,20
		△ Melkpost		+ 54 297,35	+ 18 008,51

Beacons.

A,B,C,D,E,F,G : 20mm round iron pegs.

The ~~figure~~ line A B C D E F G represents the south western boundary of a pipeline servitude area, 7,00m wide, over the remainder of Portion 1 of the Farm Witzand No.2 ~~of land, being~~

situate

of the Cape

Administrative District

Surveyed in August 1983 - February 1984 by ~~me~~ us

Province of Cape of Good Hope

C.K. Rumboll & Bolle
Land Surveyors

This diagram is annexed to Deed of Servitude No. 1207/1984 S dated

f.f.o.

Registrar of Deeds.

The original diagram is No. 397/1879 annexed to

Transfer/~~Grant~~ No. 1879. 27. 798.

OUR REF.

File No. Cape 2

S.R. No. E 902/84

Comp. BH - 5DB (5854)
BH - 5B (3707)

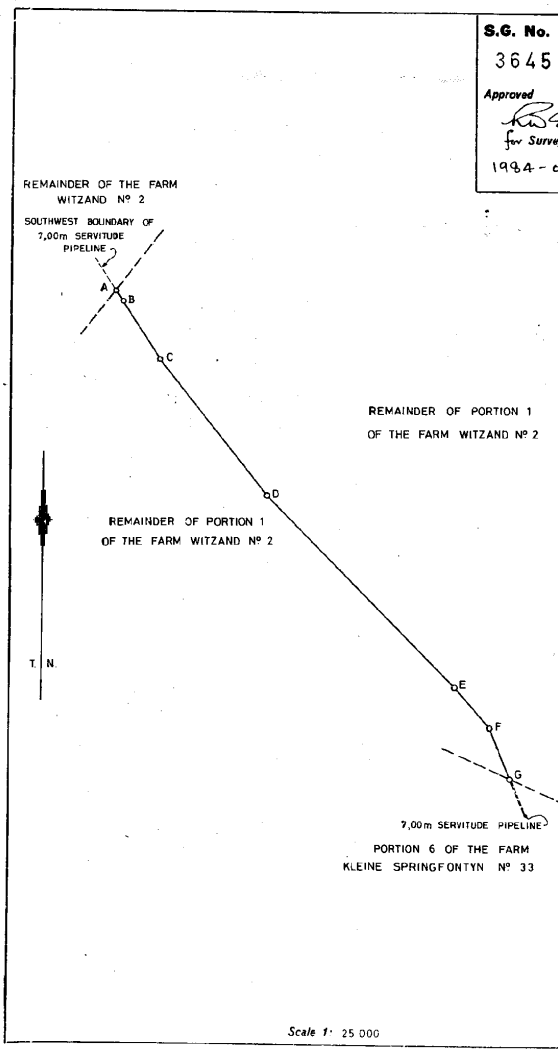
ARTCHART

SERVITUDE DGM.

OFFICE COPY

S.G. No. 3645

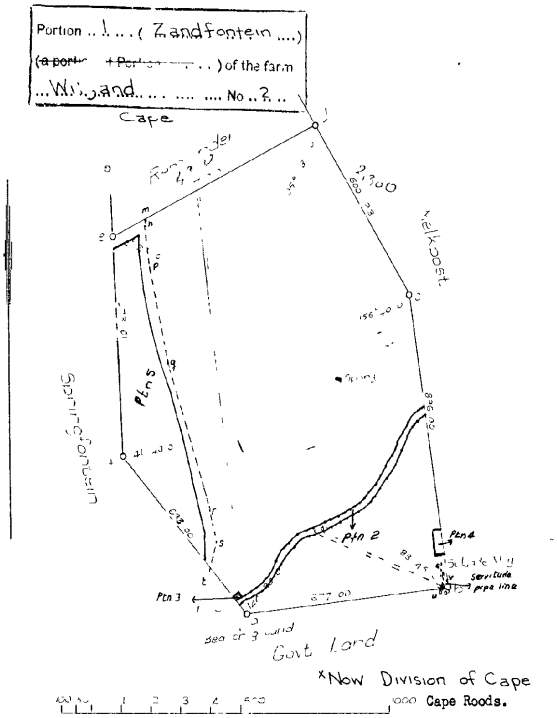
Approved
for Surveyor-General
1984-



Scale 1: 25 000

NO. 397/1879.

The numerical Data of this Diagram are sufficiently consistent.
(Sgd.) Max Jurisch.
Acting Examiner.



The above Diagram a to f, represents 2000 Morgen of Land, called "Zandfontein", situate in the xDivision of Malmesbury Field-Cornetcy of Darling being part of "Witzand" granted in Freehold to Catharina van Reenen on the 25th day of May 1837.

Bounded N. & N.E. by Melkpost.
S. " Govt. Land.
E. " Melkpost.
W. & N.W. " Springfontein & Remainder.

Surveyed and divided by me,

(Sgd.) A. Freislich.
Government Land Surveyor.
Nov. 1878.

Copied from diagram relating to Transfer 798 dated 31.5.1879 (Vol. 27)
for
1.10.1962

Sheet BH 5B BHSH-12(M3278)

FOR ENDORSEMENTS SEE BACK OF DGM

C

CE/PS

SURVEY RECORD	DIAGRAM NO	S/DIV	[illegible]	[illegible]	INITIALED	REMARKS
E1497/77	6874/77	Ptn 2	22,1193	4661/78		
E 814/81	2471/81	Ptn 3	738 I sm	5294/83		
E1081/87	3657/87	Ptn 4	1,8399	62718/87		
E2035/94	6144/94	Ptn 5	10,5741 ha	28036/95		

SERVITUDES LEASEHOLD AREAS

SURVEY RECORD	DIAGRAM NO	DESCRIPTION	DEED	INITIALED
E 902/84	3645/84	The line [illegible] represents the south western boundary of a a pipeline servitude area 7,00m wide	D/S K 1207/1984	
E1081/87	3657/87	For pipeline servitude near b see original diagram	D/T 62718/87	
E 2908/93	8592/93	[illegible]		

david hellig & abrahamse (ref L4481)

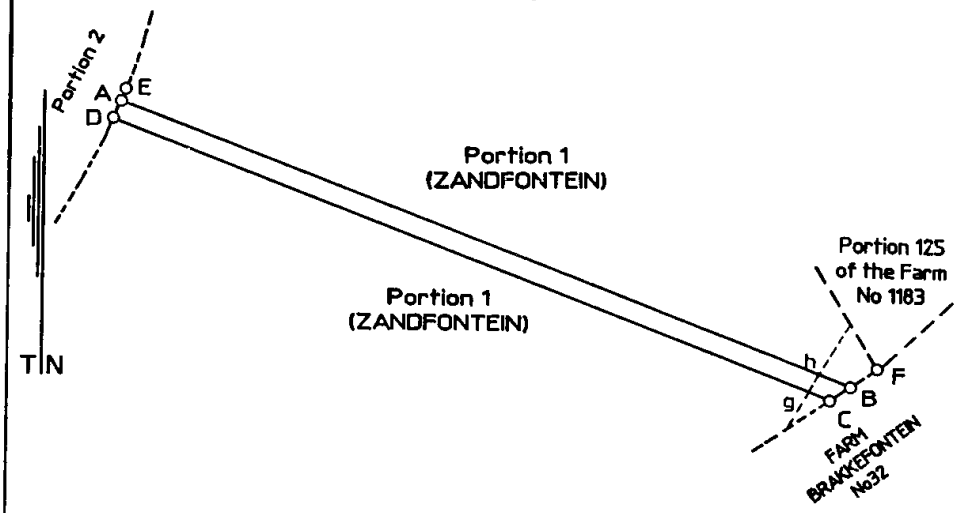
SERVITUDE DGM.

OFFICE COPY

SIDES Metres		ANGLES OF DIRECTION		CO-ORDINATES Y System Lo19° X		S.G. No.
		Constants		0,00	+ 3700 000,00	8592-93
AB	1546,35	290 33 20	A	+ 50 800,29	+ 20 235,78	Approved
BC	48,58	55 08 13	B	+ 49 352,40	+ 20 778,75	R.A.F.
CD	1520,37	110 33 20	C	+ 49 392,26	+ 20 806,52	Surveyor-General
DA	40,03	202 49 40	D	+ 50 815,82	+ 20 272,67	1993 · 10 · 26
Connecting Data						
AE	23,05	202 49 40	E	+ 50 791,35	+ 20 214,53	
BF	61,40	235 08 13	F	+ 49 302,02	+ 20 743,65	
		275 Witsand	△	+ 49 722,26	+ 20 802,79	
		521 Avondale	△	+ 48 888,80	+ 16 366,75	

Beacon Description

A,B,C,D - 20mm iron peg
E - 12mm iron peg in concrete next to wooden fence post
F - Base heavy rail fence section in concrete



Servitude Note:
The figure BCgh is an Electric Powerline servitude area vide Dgm No. 9226/77

Scale 1:12500

The figure A B C D represents a servitude right of way 40,00 metres wide as shown over

PORTION 1 (ZANDFONTEIN) of the farm WITZAND NO. 2

situate in the Administrative District of the Cape Province of Cape of Good Hope

Surveyed in September 1993

by me,

S G Le Brun
Professional Land Surveyor

This diagram is annexed to	The original diagram is	File No. Cape 2
No. dated i.f.o. Registrar of Deeds	No. 397/1879 annexed to Transfer No. 1879.27.798	S.R. No. S 2908/93 Comp. BHSH 12 (M3278)

SERVITUDE DGM.

De Haan & Ward
Land Surveyors

OFFICE COPY

SIDES Metres		ANGLES OF DIRECTION		CO-ORDINATES Y system Lo 19° X	
		Constants	+	0,00	+ 3700000,00
AB	194,84	293 51 10	A	+ 51570,41	+ 22120,91
BC	617,90	41 25 00	B	+ 51392,21	+ 22199,70
CD	250,33	164 01 50	C	+ 51800,96	+ 22663,09
DE	127,18	230 24 50	D	+ 51869,84	+ 22422,42
EF	81,93	229 56 30	E	+ 51771,82	+ 22341,38
FG	103,65	223 27 20	F	+ 51709,11	+ 22288,65
GH	103,65	216 43 30	G	+ 51637,82	+ 22213,41
HA	10,87	209 58 40	H	+ 51575,84	+ 22130,33
		1 CB 14	⊕	+ 51627,74	+ 22174,97
		7 CB 14	⊕	+ 54695,26	+ 19328,18
		3 CB 9	⊕	+ 54611,55	+ 18812,52

S.G. No.
6146-94

Approved
R.a.f.
Surveyor-General
1994.11.17

SHEET 1 OF 2 SHEETS

Beacons:

A,C,E,F,G,H	: 12mm Round iron peg.
B	: 20mm Round iron peg next to Wood Fence Post.
C	: 16mm Round iron peg.
D	: Section Iron Standard next to Wood Fence Post.

Servitude Note

1) The figure abcd represents a Pipeline Servitude 7 m wide
Diagram No. 2166/1984 D/S K. 1214/1985

The figure A B C D E F G H

represents 9,8732 Hectares of land, being

Portion 29 (a Portion of Portion 6) of the Farm Kleine Springfontyn No. 33

situate in the

Administrative District of Cape Province of Cape of Good Hope

Surveyed in March - June 1994

by me, J.WARD (PLS.0700) Land Surveyor

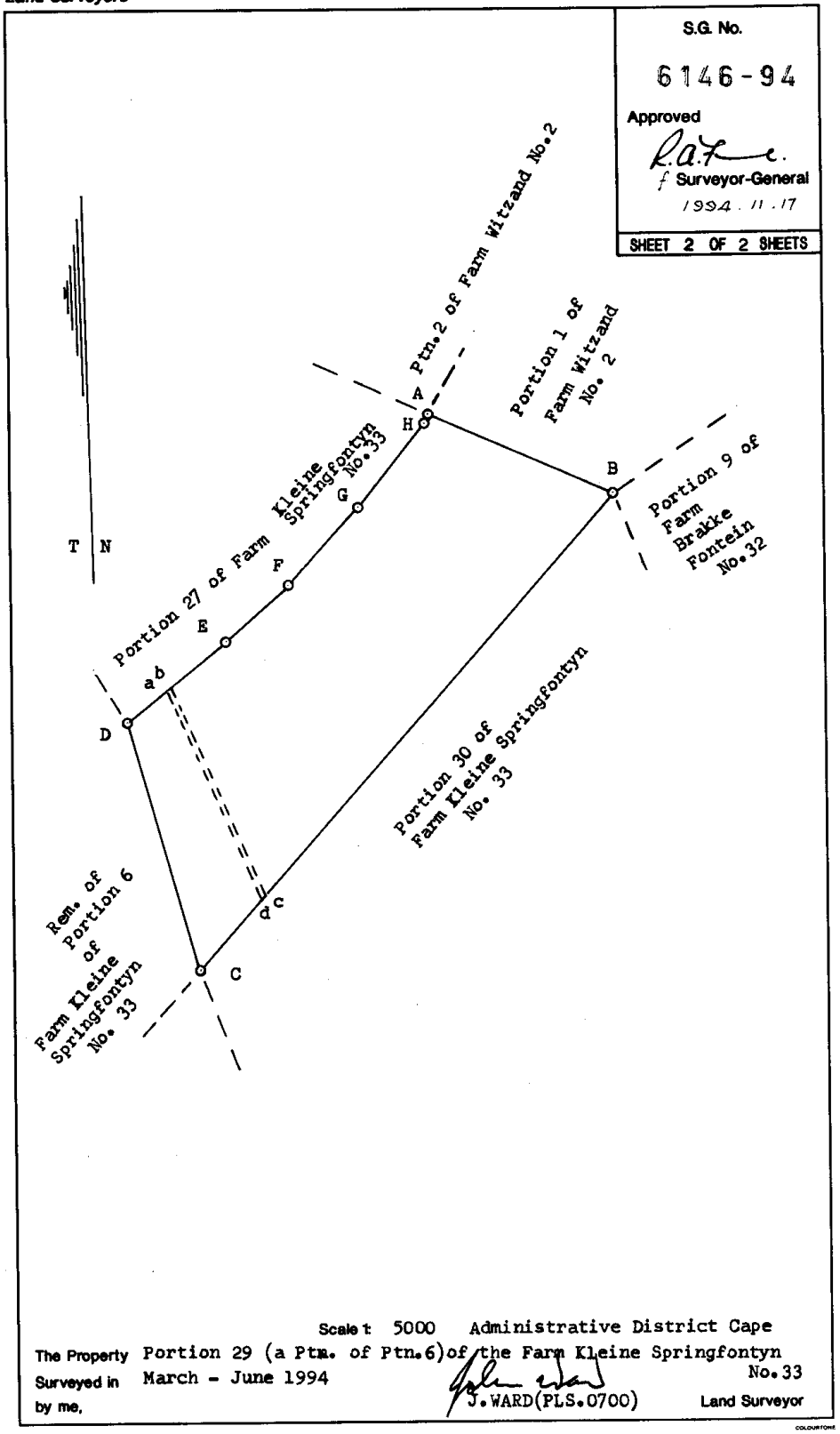
This diagram is annexed to	The original diagram is	
No.	No. 2637/1970 annexed to	File No Cape 33 S.R. No. E 2035/94 Comp. No. BH-5DB (5854)
Dated	Transfer/Grant	
i.f.o.	No. 1978- -21287	
Registrar of Deeds		

33/29

De Haan & Ward
Land Surveyors

OFFICE COPY

S.G. No.
6146-94
Approved
f Surveyor-General
1994 . 11 . 17
SHEET 2 OF 2 SHEETS



Scale 1: 5000 Administrative District Cape

The Property Portion 29 (a Ptn. of Ptn. 6) of the Farm Kleine Springfontyn No. 33

Surveyed in March - June 1994

by me, J. WARD (PLS. 0700) Land Surveyor

33/29

EXEMPT FROM PROVISIONS OF ACT
70 OF 1970
SECTION 26(a)

EXEMPT FROM PROVISIONS OF
CHAPTER III OF ORD. 15/1985

Western Cape Regional Services Council
EXEMPTED i.t.o. SECTION 23(1) OF
ORD. 15/1985
Ref: 7/2/1/1/3/3
Date: 13.7.94
for Chief Executive
Officer

SERVITUDE DGM.

OFFICE COPY

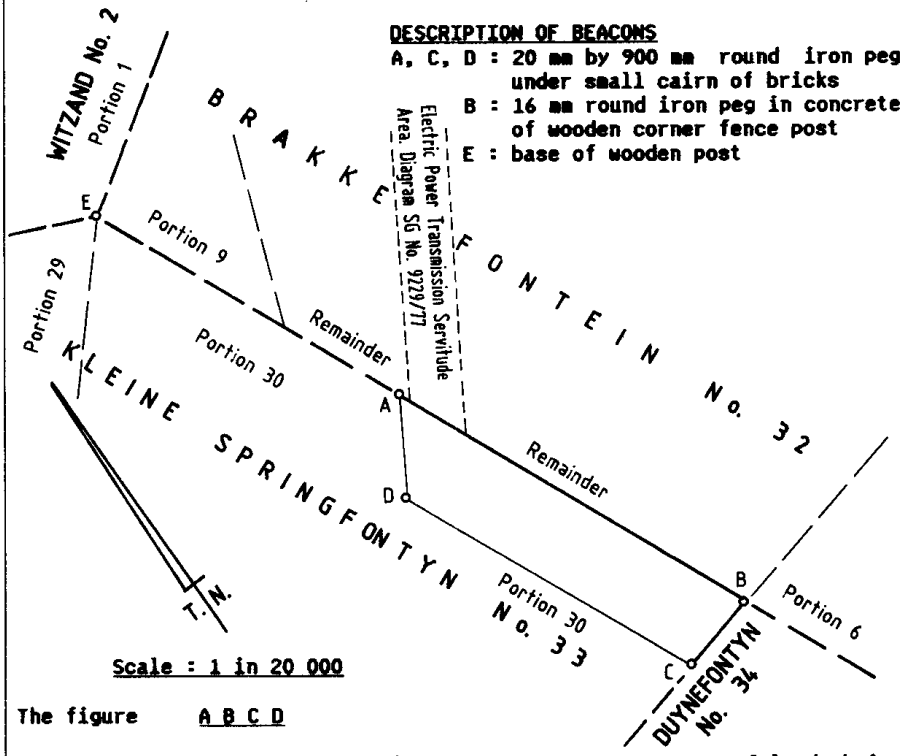
	SIDES Meters	ANGLES OF DIRECTION		CO-ORDINATES Y System Lo.19° X
		Constants		± 0,00 +3700000,00
AB	1 406,00	336 39 55	A	+ 50914,44 + 23306,86
BC	275,90	75 03 01	B	+ 50357,53 + 24597,86
CD	1 153,90	156 08 31	C	+ 50624,09 + 24669,03
DA	353,94	209 53 10	D	+ 51090,81 + 23613,73
CONNECTION				
AE	1 205,84	156 39 55	E	+ 51392,08 + 22199,66
KLEIN SPRINGFONTEIN (467)				+ 51598,39 + 23844,14
BRAKFONTEIN (462)				+ 47942,31 + 25145,77

S.G. No. 333/95

Approved

for Surveyor-General

1995-02-06



DESCRIPTION OF BEACONS

A, C, D : 20 mm by 900 mm round iron peg under small cairn of bricks

B : 16 mm round iron peg in concrete of wooden corner fence post

E : base of wooden post

Scale : 1 in 20 000

The figure A B C D

represents 35,6555 hectares of land, being

an ELECTRIC POWER TRANSMISSION SERVITUDE AREA on Portion 30 of the farm KLEINE SPRINGFONTYN No. 33

situate in the Administrative District of CAPE
Province of the CAPE OF GOOD HOPE

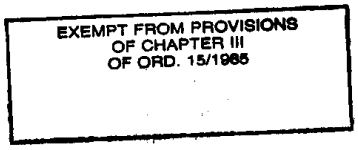
Surveyed in November 1994 by me

P. du Toit.

P.DU TOIT
Professional Land Surveyor
Registration Number PLS 0181

This diagram is annexed to	The original diagram is No. 6147-1994 annexed to Deed of Transfer No.	File No. Cape 33
No. dated i.f.o. Registrar of Deeds		S.R. No. E3520/94 Comp. BH-5DB (5854)

SERVITUDE DGM. 333/95



Western Cape Regional Services Council
EXEMPTED i.t.o. SECTION 23(1) OF
ORD. 15/1985
Ref: 7/2/1/1/3/3
Date: 04 01 95
Chief Executive Officer

De Haan & Ward
Land Surveyors

SIDES Metres		ANGLES OF DIRECTION		CO-ORDINATES Y system Lo 19° X		
		Constants		+	0,00	3700000,00
AB	2611,83	336 39 42		A	+ 51392,21	+ 22199,70
BC	565,47	75 02 40		B	+ 50357,51	+ 24597,83
CD	17,61	165 06 10		C	+ 50903,82	+ 24743,77
DE	170,24	147 31 10		D	+ 50908,35	+ 24726,75
EF	951,82	157 39 20		E	+ 50999,77	+ 24583,14
FG	275,87	170 53 40		F	+ 51361,64	+ 23702,79
GH	267,18	143 29 00		G	+ 51405,30	+ 23430,40
HJ	601,13	156 48 50		H	+ 51564,29	+ 23215,67
JA	617,90	221 25 00		J	+ 51800,96	+ 22663,09
		1 CB 14		⊕	+ 51627,74	+ 22174,97
		7 CB 14		⊕	+ 54695,26	+ 19328,18
		3 CB 9		⊕	+ 54611,55	+ 18812,52

S.G. No.
6147-94

Approved
R.A.F.
for Surveyor-General
1994 11 17

SHEET 1 OF 2 SHEETS

Beacons:

A	:	20mm Round iron peg next to Wood Fence Post.
B	:	16mm Round iron peg in concrete of Wood Fence Post
C	:	20mm Round iron peg.
D,E,F,G,H	:	Wood Fence Post.
J	:	16mm Round iron peg.

Servitude Note

1)The figure abcd represents a Pipeline Servitude 7m wide
Diagram No. 7166/1984 D/S K. 1214/1984

The figure A B C D E F G H J

represents 136,7100 Hectares of land, being

Portion 30 of the Farm Kleine Springfontyn No. 33

situate in the Administrative District of Cape Province of Cape of Good Hope

Surveyed in March - June 1994
by me, J. WARD (PLS.0700) Land Surveyor

This diagram is annexed to	The original diagram is	File No Cape 33
No.	~~2631/70~~ No. ~~240/1819~~ 240/1819 annexed to	S.R. No. E 2035/94
Dated	Transfer/Grant	Comp. No. BH-5DB(5854)
i.f.o.	No. CAPE Q.8.24	
Registrar of Deeds		

FOR ENDORSEMENTS SEE BACK OF DIAGRAM

33/30

De Haan & Ward
Land Surveyors

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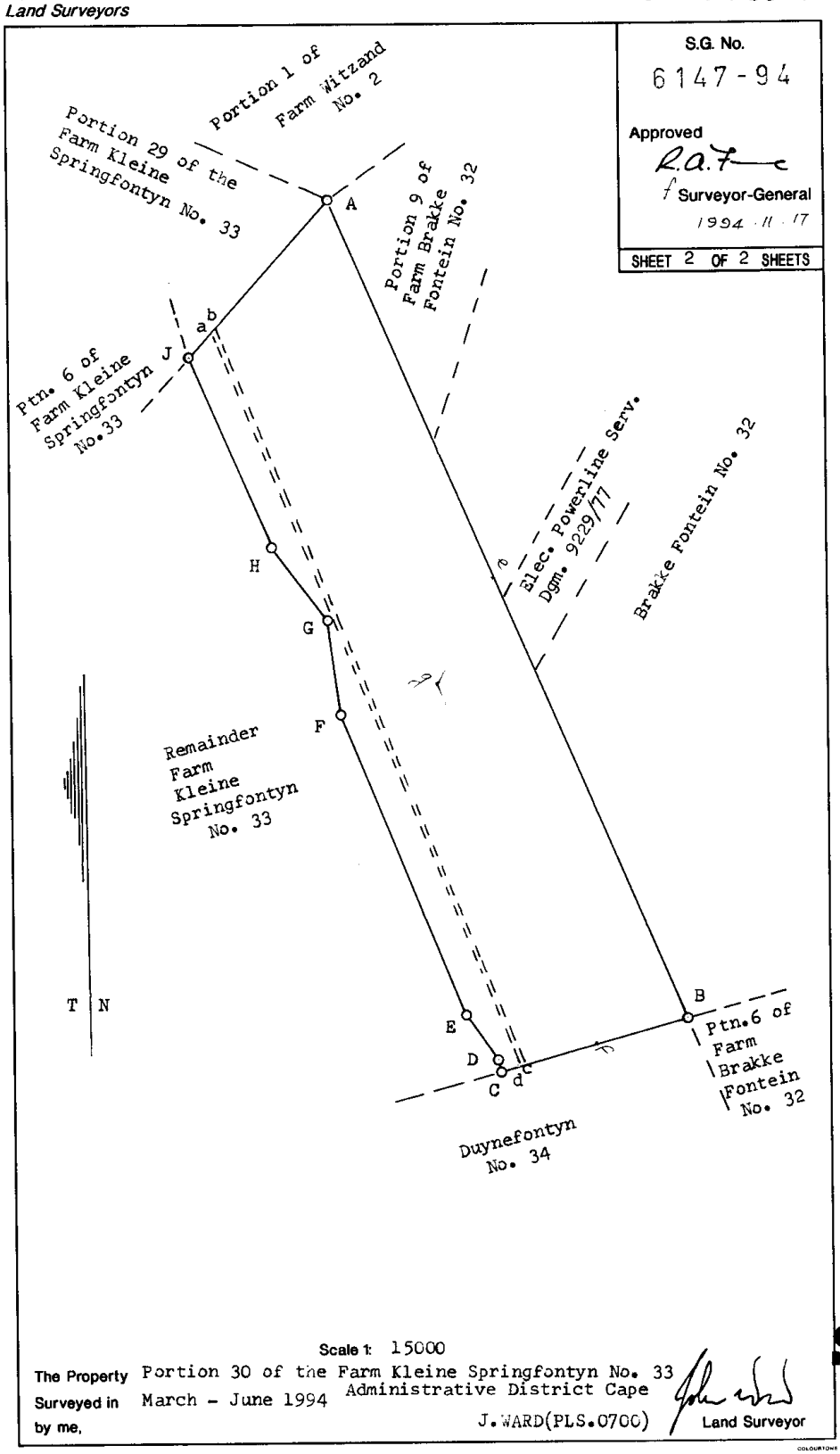


33/30

33/30

SERVITUDE/LEASE/EXEMPTIONS				
[illegible]	DIAGRAM No.	DESCRIPTION	DEED	INITIALED
E3520/94	533/95	The figure eBfg represents an electric power transmission servitude area		

EXEMPT FROM PROVISIONS OF ACT 70 OF 1970
SECTION 2(a)

Western Cape Regional Services Council
EXEMPTED i.t.o. SECTION 23(1) OF ORD. 15/1985
Ref: 7(2)(1)(1)(3)(3)
Date: 13.7.94
for Chief Executive Officer

EXEMPT FROM PROVISIONS OF CHAPTER III OF ORD. 15/1985

C. Species Checklist

Appendix 3: Plants

Species Name	Common Name	Alien
Acacia cyclops	Rooikrans	Yes
Acacia saligna	Port Jackson	Yes
Agathosma capensis		No
Agathosma serpyllacea		No
Albuca cooperi		No
Albuca maxima		No
Androcymbium capense		No
Anthospermum aethiopicum		No
Anthospermum prostratum		No
Anthospermum spathulatum~		No
Arctotheca calendula		No
Arctotis stoechadifolia		No
Aspalathus hispida~		No
Aspalathus ternata		No
Asparagus aethiopicus		No
Asparagus capensis		No
Avena barbata		Yes

Babiana nana~		No
Babiana tubiflora		No
Brunsvigia orientalis	Candelabera Flower	No
Carpobrotus acinaciformis		No
Carpobrotus edulis		No
Chironia baccifera		No
Chrysanthemoides incana		No
Chrysanthemoides monilifera	Bitoubos	No
Cineraria geifolia		No
Cissampelos capensis		No
Cliffortia strobilifera		No
Clutia alaternoides~		No
Coleonema album		No
Conicosia pugioniformis~		No
Conyza scabrida		No
Corycium crispum		No
Cotula turbinata		No
Cotyledon orbiculata~		No
Crassula tetragona tetragona		No
Crassula vaillantii		No
Cullumia squarrosa		No

Cynanchum africanum		No
Cynodon dactylon	couch grass; kweekgras; kweek	No
Cyphia digitata~		No
Cysticapnos vesicaria		No
Dasispermum suffruticosum		No
Dimorphotheca pluvialis		No
Dimorphotheca sinuata		No
Dischisma arenarium		No
Dorotheanthus bellidiformis bellidiformis		No
Ehrharta calycina		No
Ehrharta villosa var. villosa		No
Eucalyptus sp.1		Yes
Euclea racemosa		No
Euphorbia mauritanica~		No
Exomis microphylla~		No
Ferraria crispa		No
Ferraria crispa~		No
Ficinia dunensis		No
Galium tomentosum		No
Gazania pectinata		No
Geranium incanum~		No

Gethyllis ciliaris~		No
Gladiolus carinatus	Blou Afrikaner	No
Gladiolus sp.1		No
Gladiolus sp.2		No
Grielum grandiflorum		No
Gymnodiscus capillaris		No
Haemanthus coccineus		No
Haemanthus pubescens~		No
Helichrysum cochleariforme		No
Helichrysum revolutum		No
Heliophila africana		No
Heliophila sp.1		No
Hellmuthia membranacea		No
Hemimeris sabulosa		No
Hermannia pinnata		No
Holothrix villosa~		No
Hyobanche sanguinea		No
Indigofera psoraloides		No
Ischyrolepis eleocharis		No
Jordaaniella dubia		No
Kedrostis nana~		No

Lachenalia rubida		No
Lampranthus explanatus		No
Lapeirousia anceps		No
Leonotis leonurus		No
Lessertia argentea		No
Leucospermum hypophyllocarpodendron canaliculatum		No
Leucospermum tomentosum		No
Lycium afrum		No
Malva parviflora~		No
Massonia sp.1		No
Melasphaerula ramosa		No
Metalasia muricata		No
Microloma sagittatum		No
Monoculus monstrosus		No
Moraea miniata		No
Morella cordifolia		No
Morella quercifolia		No
Nemesia affinis		No
Nylandtia spinosa	Skilpadbessie Bos, Tortoise Berry Bush	No
Olea exasperata		No

Ornithoglossum viride		No
Orphium frutescens		No
Osyris compressa		No
Otholobium fruticans		No
Othonna filicaulis		No
Oxalis hirta~		No
Oxalis luteola		No
Oxalis obtusa		No
Oxalis pes-caprae~		No
Oxalis versicolor~		No
Passerina corymbosa		No
Passerina paleacea		No
Pelargonium betulinum		No
Pelargonium capitatum		No
Pelargonium gibbosum		No
Pelargonium myrrhifolium var. myrrhifolium		No
Pelargonium senecioides		No
Pelargonium triste		No
Pennisetum clandestinum	Kikuyu grass	Yes
Pentaschistis pallida		No
Pharnaceum lanatum		No

Phylica cephalantha		No
Phylica ericoides~		No
Putterlickia pyracantha		No
Rhus glauca	Blou Taaibos	No
Rhus lucida~		No
Ruschia macowanii		No
Salvia africana-lutea		No
Thamnochortus erectus		No
Thamnochortus punctatus		No
Thamnochortus spicigerus		No
Trachyandra ciliata		No
Typha capensis	Bulrush, Papkuil	No
Viscum capense		No
Zantedeschia aethiopica		No

Appendix 4: Mammals

Species Name	Common Name	Red Book Status	Alien
Bathyergus suillus	Cape Dune Molerat	Least Concern (LC)	No
Felis caracal	Caracal	Least Concern (LC)	No

Galerella pulverulenta	Small Grey Mongoose	Least Concern (LC)	No
Genetta genetta	Smallspotted Genet	Least Concern (LC)	No
Gerbillurus paeba	Hairyfooted Gerbil	Least Concern (LC)	No
Hystrix africaeaustralis	Porcupine	Least Concern (LC)	No
Myosorex varius	Forest Shrew	Data Deficient (DDD)	No
Otocyon megalotis	Bateared Fox	Least Concern (LC)	No
Otomys irroratus	Vlei Rat	Least Concern (LC)	No
Raphicerus campestris	Steenbok	Least Concern (LC)	No
Raphicerus melanotis	Cape Grysbok	Least Concern (LC)	No
Rhabdomys pumilio	Striped Mouse, Striped Field Mouse	Least Concern (LC)	No
Steatomys krebsii	Kreb's Fat Mouse	Least Concern (LC)	No
Suncus varilla	Lesser Dwarf Shrew	Data Deficient (DDD)	No
Sylvicapra grimmia	Common Duiker	Least Concern (LC)	No
Tatera afra	Cape Gerbil	Least Concern (LC)	No
Vulpes chama	Cape Fox	Least Concern (LC)	No

Appendix : Birds

Species Name	Common Name	Red Book Status	Alien

Acrocephalus gracilirostris	Lesser Swamp-Warbler		No
Alcedo cristata	Malachite Kingfisher		No
Alopochen aegyptiacus	Egyptian Goose, Kolgans		No
Anas capensis	Cape Teal		No
Anas erythrorhyncha	Red-billed Teal		No
Anas smithii	Cape Shoveler		No
Anas sparsa	African Black Duck		No
Anas undulata	Yellow-billed Duck		No
Anhinga rufa	African Darter		No
Anthoscopus minutus	Cape Penduline-Tit		No
Anthus cinnamomeus	African Pipit		No
Apalis thoracica	Bar-throated Apalis		No
Apus affinis	Little Swift		No
Apus apus	Common Swift		No
Apus barbatus	African Black Swift		No
Apus caffer	White-rumped Swift		No
Ardea cinerea	Grey Heron		No
Ardea melanocephala	Black-headed Heron		No
Ardea purpurea	Purple Heron		No
Batis capensis	Cape Batis		No
Bostrychia hagedash	Hadeda Ibis		No

Bradypterus baboecala	Little Rush-Warbler		No
Bubo africanus	Spotted Eagle-Owl		No
Bubulcus ibis	Cattle Egret		No
Burhinus capensis	Spotted Thick-knee, Spotted Dikkop		No
Burhinus vermiculatus	Water Thick-knee, Water Dikkop		No
Buteo rufofuscus	Jackal Buzzard		No
Calandrella cinerea	Red-capped Lark		No
Calidris alba	Sanderling		No
Calidris bairdii	Baird's Sandpiper		No
Calidris canutus	Red Knot		No
Calidris ferruginea	Curlew Sandpiper		No
Calidris minuta	Little Stint		No
Caprimulgus pectoralis	Fiery-necked Nightjar		No
Centropus burchellii	Burchell's Coucal		No
Cercomela familiaris	Familiar Chat		No
Cercomela sinuata	Sickle-winged Chat		No
Charadrius hiaticula	Common Ringed Plover		No
Charadrius marginatus	White-fronted Plover		No
Charadrius pecuarius	Kittlitz's Plover		No
Charadrius tricollaris	Three-banded Plover		No
Chrysococcyx klaas	Klaas's Cuckoo		No

Circus maurus	Black Harrier	Near Threatened (NT)	No
Circus ranivorus	African Marsh-Harrier	Vulnerable (VU)	No
Cisticola tinniens	Levaillant's Cisticola		No
Colius colius	White-backed Mousebird		No
Colius striatus	Speckled Mousebird		No
Columba guinea	Speckled Pigeon		No
Corvus albus	Pied Crow		No
Corvus splendens	Indian House Crow		No
Cossypha caffra	Cape Robin-Chat		No
Creatophora cinerea	Wattled Starling		No
Dendropicos fuscescens	Cardinal Woodpecker		No
Egretta alba	Great Egret		No
Egretta garzetta	Little Egret		No
Egretta intermedia	Yellow-billed Egret		No
Elanus caeruleus	Black-shouldered Kite		No
Emberiza capensis	Cape Bunting		No
Emberiza impetuani	Lark-like Bunting		No
Eremopterix verticalis	Grey-backed Sparrowlark		No
Estrilda astrild	Common Waxbill		No
Euplectes capensis	Yellow Bishop		No
Euplectes orix	Southern Red Bishop		No

Falco biarmicus	Lanner Falcon	Near Threatened (NT)	No
Falco naumanni	Lesser Kestrel	Vulnerable (VU)	No
Falco peregrinus	Peregrine Falcon	Near Threatened (NT)	No
Fulica cristata	Red-knobbed Coot		No
Galerida magnirostris	Large-billed Lark		No
Gallinago nigripennis	African Snipe, Ethiopian Snipe		No
Gallinula chloropus	Common Moorhen		No
Haliaeetus vocifer	African Fish-Eagle		No
Himantopus himantopus	Black-winged Stilt		No
Hirundo albigularis	White-throated Swallow		No
Hirundo cucullata	Greater Striped Swallow		No
Hirundo dimidiata	Pearl-breasted Swallow		No
Hirundo rustica	Barn Swallow		No
Laniarius ferrugineus	Southern Boubou		No
Lanius collaris	Common Fiscal, Fiscal Shrike		No
Larus cirrocephalus	Grey-headed Gull		No
Larus dominicanus	Kelp Gull		No
Larus hartlaubii	Hartlaub's Gull		No
Macronyx capensis	Cape Longclaw		No
Merops apiaster	European Bee-eater		No

Mirafra apiata	Cape Clapper Lark		No
Motacilla capensis	Cape Wagtail		No
Muscicapa adusta	African Dusky Flycatcher		No
Nectarinia famosa	Malachite Sunbird		No
Netta erythrophthalma	Southern Pochard		No
Numenius phaeopus	Common Whimbrel		No
Numida meleagris	Helmeted Guineafowl		Yes
Nycticorax nycticorax	Black-crowned Night-Heron		No
Oena capensis	Namaqua Dove		No
Oenanthe pileata	Capped Wheatear		No
Ortygospiza atricollis	African Quailfinch		No
Pandion haliaetus	Osprey		No
Parisoma subcaeruleum	Chestnut-vented Tit-Babbler		No
Parus afer	Grey Tit		No
Passer domesticus	House Sparrow		Yes
Passer melanurus	Cape Sparrow		No
Pelecanus onocrotalus	Great White Pelican, Wit Pelikan	Near Threatened (NT)	No
Phalacrocorax africanus	Reed Cormorant		No
Phalacrocorax lucidus	White-breasted Cormorant		No
Philomachus pugnax	Ruff		No
Platalea alba	African Spoonbill		No

Plectropterus gambensis	Spur-winged Goose		No
Plegadis falcinellus	Glossy Ibis		No
Ploceus capensis	Cape Weaver		No
Ploceus velatus	Southern Masked-Weaver		No
Pluvialis squatarola	Grey Plover		No
Podiceps cristatus	Great Crested Grebe		No
Prinia maculosa	Karoo Prinia		No
Promerops cafer	Cape Sugarbird		No
Pycnonotus capensis	Cape Bulbul		No
Riparia paludicola	Brown-throated Martin		No
Serinus canicollis	Cape Canary		No
Sigelus silens	Fiscal Flycatcher		No
Sphenoeacus afer	Cape Grassbird		No
Spreo bicolor	Pied Starling		No
Sterna bergii	Swift Tern		No
Sterna caspia	Caspian Tern	Near Threatened (NT)	No
Sterna hirundo	Common Tern		No
Sterna paradisaea	Arctic Tern		No
Sterna sandvicensis	Sandwich Tern		No
Streptopelia capicola	Cape Turtle-Dove		No
Streptopelia semitorquata	Red-eyed Dove		No

Streptopelia senegalensis	Lag Duifie, Laughing Dove		No
Sturnus vulgaris	Common Starling, European Starling		Yes
Sylvietta rufescens	Long-billed Crombec		No
Tachybaptus ruficollis	Little Grebe		No
Tachymarptis melba	Alpine Swift		No
Tadorna cana	South African Shelduck		No
Telophorus zeylonus	Bokmakierie		No
Thalassornis leuconotus	White-backed Duck		No
Threskiornis aethiopicus	African Sacred Ibis		No
Tricholaema leucomelas	Acacia Pied Barbet		No
Tringa nebularia	Common Greenshank		No
Turdus olivaceus	Olive Thrush		No
Tyto alba	Barn Owl		No
Upupa africana	African Hoopoe		No
Urocolius indicus	Red-faced Mousebird		No
Vanellus armatus	Blacksmith Lapwing, Blacksmith Plover		No
Vanellus coronatus	Crowned Lapwing		No
Vidua macroura	Pin-tailed Whydah		No
Zosterops pallidus	Orange River White-eye		No
Zosterops virens	Cape White-eye		No

Appendix 6: Reptiles

Species Name	Common Name	Alien
Acontias meleagris	Cape Legless Skink	No
Afrogecko porphyreus	Marbled Leaf-toed Gecko, Marbled Leaftoed Gecko	No
Aspidelaps lubricus lubricus	Coral Snake	No
Bradypodion pumilum	Cape Dwarf Chameleon	No
Chersina angulata	Angulate Tortoise	No
Crotaphopeltis hotamboeia	Herald Snake	No
Dasypeltis scabra	Common Eggeater	No
Dispholidus typus	Boomslang	No
Duberria lutrix	Common Slug Eater	No
Goggia lineata	Striped Dwarf Leaf-toed Gecko, Striped Dwarf Leaftoed Gecko	No
Homoroselaps lacteus	Spotted Harlequin Snake	No
Lamprophis aurora	Aurora House Snake	No
Lamprophis capensis	Brown House Snake	No
Lamprophis inornatus	Olive House Snake	No
Leptotyphlops nigricans	Black Thread Snake	No
Meroles knoxii	Knox's Desert Lizard	No
Naja nivea	Cape Cobra	No
Pachydactylus austeni	Austen's Thick-toed Gecko, Austen's Thicktoed Gecko	No

Pachydactylus geitje	Ocellated Thick-toed Gecko, Ocellated Thicktoed Gecko	No
Psammophis crucifer	Cross-marked Grass Snake, Crossmarked Grass Snake	No
Psammophis leightoni	Cape Sand Snake	No
Psammophis notostictus	Karoo Sand Snake	No
Psammophylax rhombeatus	Rhombic Skaapsteker	No
Pseudaspis cana	Mole Snake	No
Scelotes bipes	Silvery Dwarf Burrowing Skink	No
Tetradactylus tetradactylus	Common Long-tailed Seps, Common Longtailed Seps	No
Typhlosaurus caecus	Cuvier's Blind Legless Skink	No

Appendix 7: Amphibians

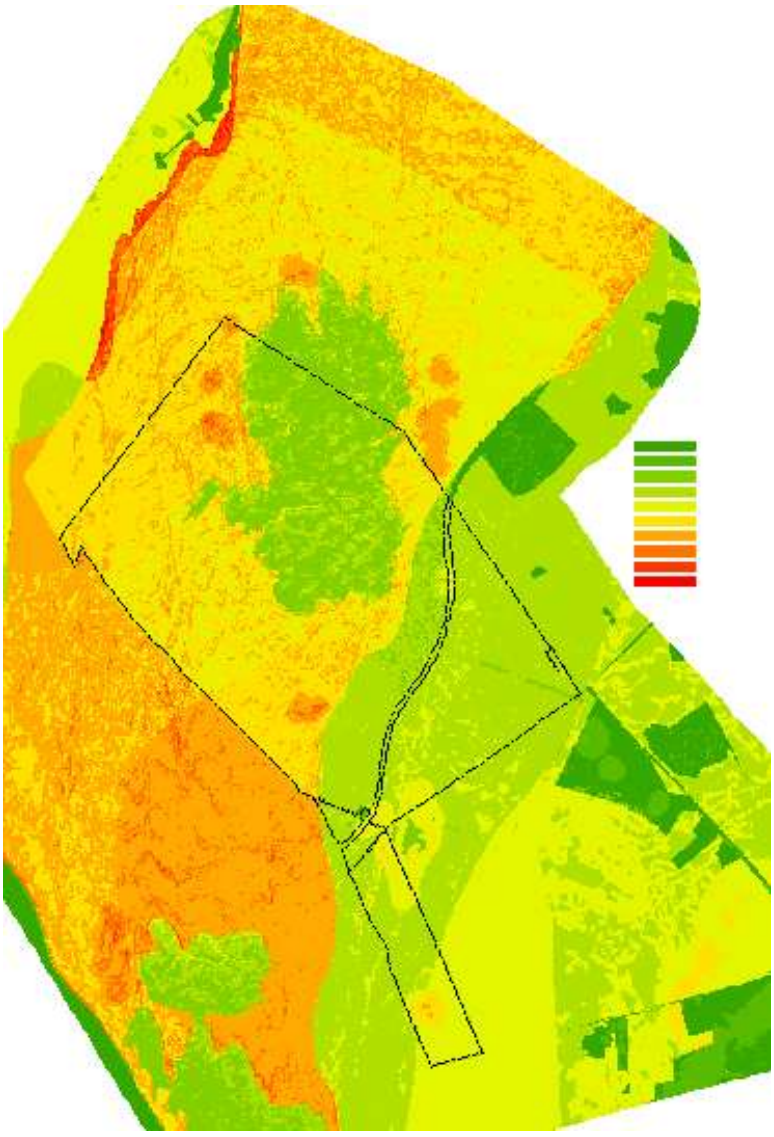
Species Name	Common Name	Alien
Breviceps namaquensis	Namaqua Rain Frog	No
Breviceps rosei	Sand Rain Frog	No
Cacosternum platys	Caco sp., Flat Caco	No
Strongylopus grayii grayii	Clicking Stream Frog	No
Tomopterna delalandii	Cape Sand Frog	No
Xenopus laevis	Common Platanna	No

D.

Appendix 8: Sensitivity Analyses report

SENSITIVITY- VALUE ANALYSIS AND ZONATION PROCESS:

Witzands Aquifer Nature Reserve



Prepared for the Biodiversity Branch and Environmental Management Systems Branch

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Arne Purves

Natural Resource Specialist

Arne.purves@capetown.gov.za

Contents

1 1. INTRODUCTION

The Witzands Aquifer Nature Reserve (WANR) is situated to the West of Atlantis, within the northern region of the Cape Metropolitan Area. The reserve forms part of the City's Biodiversity Network and is listed as a protected area, although it is currently City owned land without any formal conservation status.

The predominant vegetation type is Cape Flats Dune Strandveld (Rebelo et al, 2006). This vegetation type is listed as least threatened, but is poorly represented in formally protected areas. Only 28% of the vegetation target of 24% (of the original extent) is formally conserved. The two other vegetation types that occur in the study area are Atlantis Sand Fynbos (listed as vulnerable) and Swartland Shale Renosterveld (listed as critically endangered). The ecotone that occurs between the Strandveld and Sand Fynbos vegetation is also an important area.

The Atlantis dune field forms a large mobile sand dune system within the conservation area.

The Atlantis Aquifer

The WCA overlies a large portion of the Atlantis aquifer, which is located in a narrow, low-lying coastal plain to the west and south of Atlantis. It is an unconfined, sandy aquifer which results in the aquifer being highly vulnerable to pollution. The groundwater from the Atlantis aquifer provides high quality water to the town of Atlantis and surrounds, and is extracted from well fields in Witzand and Silwerstroom. Since 2000, the groundwater supply has been augmented by surface water and has become known as the Atlantis Water Scheme. Much research has been carried out by the CSIR on groundwater management etc in this area (CSIR, 2002)

The reserve is a significant asset to the City and makes significant contributions to national vegetation targets of threatened vegetation types as listed in the National Spatial Biodiversity Assessment (Driver *et al*, 2005), as well as providing a service and facilities to local residents and schools.

1.1 1.1 SCOPE OF REPORT

The development of the Sensitivity and Zonation plan is one of the steps required in compiling a Conservation Development Framework (CDF) for the reserve. CDFs are tools to reconcile the various land-use needs and to delineate visitor user zones and the positioning and nature of new infrastructure, access points, roads and facilities.

The CDF process has grown in response to the requirements of the NEMBA (2004) and is a strategy to comply with the spatial planning requirements of these acts. The CDFs will ensure that best practice and sustainable development principles are integrated into spatial planning within protected areas.

The Sensitivity-Value analysis is the landscape analysis portion of the broader Conservation Development Framework. It is a multi-criteria decision-support tool for spatial planning that is designed to integrate the best available information into a format that allows for defensible and transparent decisions to be made. The Sensitivity-Value process is based on the principle that the acceptability of a development (or placement of a structure) at a site is based on the site's value (either from biodiversity, heritage, aesthetic or a

combination of values) and its sensitivity or vulnerability to a variety of types of disturbance (Holness *et al*, 2005).

- The Sensitivity-Value analysis, the CDF and the associated zonation plan should form part of an adaptive management system. They will grow and change over time as the understanding of the landscapes and ecosystems improve; and
- It does not replace the need for detailed site and precinct planning and EIA compliance at site level.

2 2. BACKGROUND AND BRIEF

The Sensitivity-Value analysis was undertaken by the EMS Branch's natural resource specialist. The small size of the City's nature reserve also did not require an extensive analysis, with the subsequent zonation process being fairly straight forward. The methodology used for both the Sensitivity-Value analysis and the zonation process was adapted from Holness (2008) and SRK Consulting (2008).

All geographical information work was carried out in ESRI's ArcMap version 9.3.1 GIS (Geographical Information System) using the ArcInfo license level with Spatial Analyst and 3D Analyst extensions.

The brief for the project was to compile a Sensitivity-Value analysis and zonation plan for the Witzands Aquifer Nature Reserve.

3 3. SENSITIVITY-VALUE ANALYSIS

Sensitivity-Value Analysis and Zoning Process methodology

Stage 1: Data synthesis and compilation

Compilation of required data for the analysis

- Spatially define the planning domain or study area.
- Evaluate available and required datasets for the Sensitivity-Value model.
- Spatial data is collected or created for each element of the Sensitivity-Value model.

Stage 2: Layer interpretation

Layer interpretation is an important component of the Sensitivity-Value process that requires a combination of spatial data interpretation and expert knowledge.

- Using the assembled data, areas are assigned a score on a common scale for each element of the model; and
- The scores achieved for each element of the model are represented as separate input layers on a GIS.

Stage 3: Sensitivity-Value Analysis

The Sensitivity-Value analysis stage involves an iterative exploration of the input layers.

- The scores achieved for each element of the model are weighted and aggregated to obtain an overall Sensitivity-Value ranking.
- Different weightings and aggregation procedures and combinations of input layers can be explored; and
- The robustness of the Sensitivity-Value analysis is examined.

The resultant Sensitivity-Value output maps should provide an initial understanding of the spatial distribution of the important and sensitive biodiversity, landscape and heritage features.

Stage 4: Development of a draft zonation plan

The outputs of the Sensitivity-Value process are used as the foundation for the development of a draft zonation plan. The Sensitivity-Value outputs and draft zonation plan are workshopped with relevant stakeholders.

Stage 5: Refinement of the draft zonation and the identification of special management overlays

Special management areas/overlays are identified using the information derived from the Sensitivity-Value analysis. Recommendations are made regarding the management of the land-use zones and special management areas.

The draft is then presented for comment to the City and stakeholder groups to obtain broad public input into the plan prior to finalisation,

Stage 6: Final Zonation and Conservation Development Framework.

The comments and input from the public participation process are integrated into the final zonation plan. The plan is passed through Council for approval and adoption.

4 3.1 INPUT LAYERS

The study area for the CDF was defined as the current management boundary of the Witsands Conservation Area, but also included additional portions of land that cover the shifting dune fields to the North as well as portions of Eskom's property to the west and the military shooting range to the south east. This boundary was then buffered by 1000m and this was used as the outer analysis boundary (see Figure 1).

4.1 3.1.1 BIODIVERSITY

4.1.1 3.1.1a Habitat Value

The habitat unit as defined by a particular vegetation community is used as the broad proxy for biodiversity. The vegetation communities are good surrogates for habitat value as it uses readily available information that clearly delineates the distribution of distinct subsets of biodiversity across the landscape.

The South African National Vegetation Map (Rebelo et al, 2006) was used to broadly define the habitat units. The NSBA (Driver *et al*, 2005) values were used to inform current ecosystem status and level of protection of vegetation types within the study area.

The following factors were also incorporated in the habitat value calculation

- The value assigned to a habitat unit should reflect the contribution that vegetation type makes to the local, provincial and national conservation estate.
- This value should reflect the rarity of the habitat, the level of transformation that occurred within the habitat type, species richness and diversity, habitat heterogeneity, and contribution to local conservation targets as identified in the City's Biodiversity Network (Benn, 2008).
- The habitat value also takes into account a gap analysis (how much is in reserves), whereby habitat types that exists largely outside of protected areas receive a higher value.

Broad habitat value is a poor indication of the value of a particular site if a reserve has a history of significant transformation or degradation. Where a reserve includes transformed and/or degraded areas these need to inform the adjustment of the broad habitat value to reflect:

- The level and type of transformation that has occurred at a particular site.
- The rehabilitation/restoration potential of a site. Areas that are likely to revert, with a minimum of management intervention, to a natural or near natural state should be allocated a higher value than areas where extensive management intervention is required.
- Degraded or developed areas were considered to have lower habitat values. The habitat values were adjusted downwards according to the level and type of degradation or habitat loss that has occurred.

Data Inputs (GIS methods and sources)

Base habitat map:

The broader vegetation types as listed in the South African Vegetation Map (Rebelo *et a*l, 2006) were used as the smallest vegetation unit (see Figure 1) as there was little difference in the sensitivity values allocated to vegetation communities within these broader units.

The values used to adjust the base habitat scores are the listed in Table 2. This is necessary in order that critically endangered ecosystems are accurately reflected in the scoring in terms of protection status and, % transformation of the vegetation types.

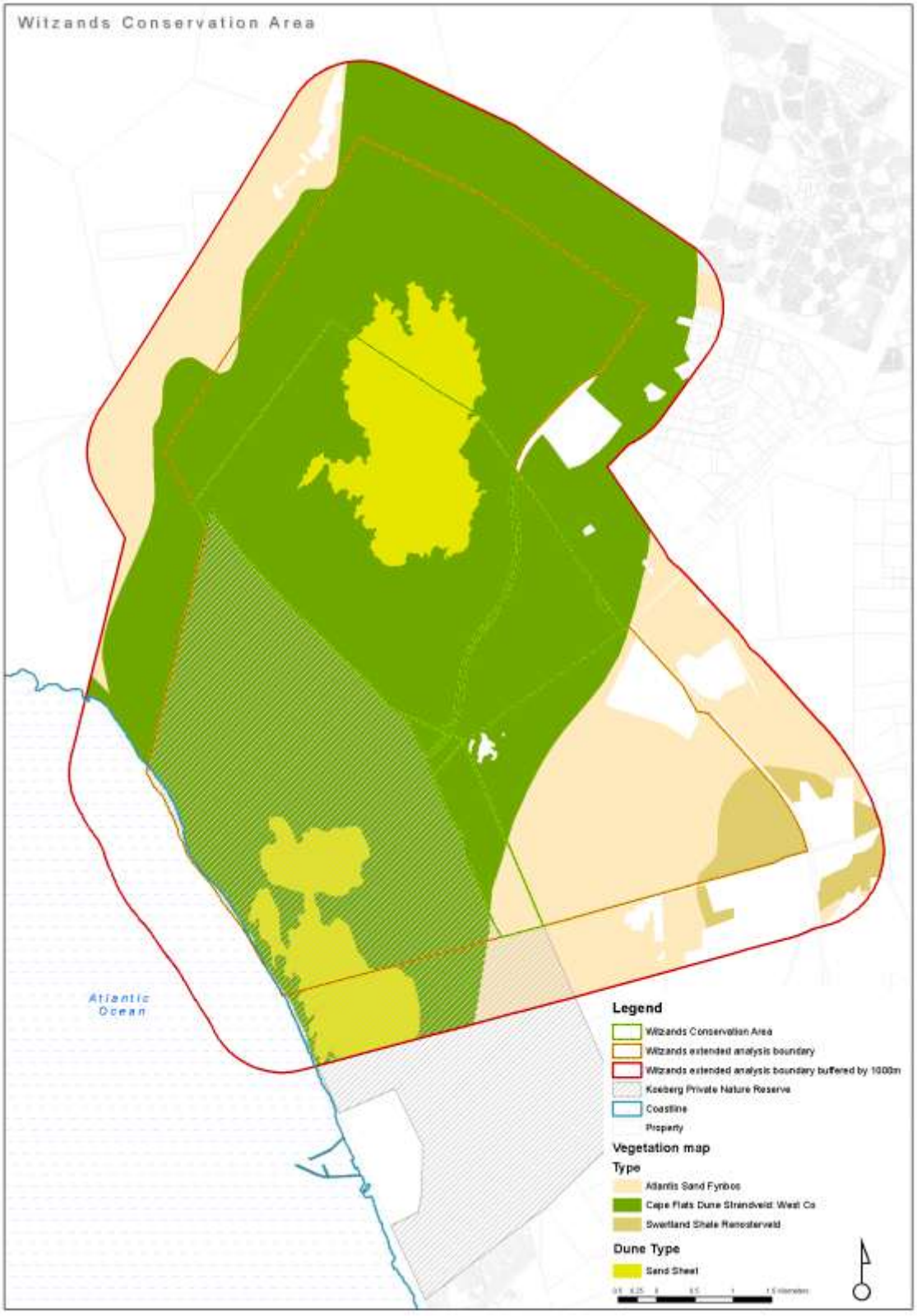


Figure 1: Witzands Aquifer Nature Reserve: Study Area and Vegetation Types

4.1.2 3.1.1b: Transformation # Degradation Map:

Habitat transformation and degradation was mapped from recent aerial photography (2005, 2007 and 2008). Habitat modifiers are listed in Table 1 and Figure 2 shows their types and spatial extent.

Table 1: Habitat Modifiers

Type	Category	Description
Transformed	Facilities	Facilities for use by public within the reserve (Ablutions, displays, benches etc.)
	Housing and hard surfaces	Formal and informal housing, incl. old sites that still have hard surfaces etc.
	Quarries	Open excavation or burrow pits – can be current or historic
	Road & paths	The road (management and access roads), trail and boardwalk network
	Dams	Artificial water impoundments and Bulk water infrastructure
	Recreational Open Space	Primarily areas where lawns are maintained for public recreation. Often associated with non-indigenous tree planting for shade etc.
Degraded Heavy, moderate or Low	Firebreaks/fencing	Strips of cleared land maintained for fire management. Including the boundary fencing which usually incorporates a firebreak.
	Invasive Alien vegetation	These areas include sites that have an Invasive Alien Plant infestation density of more than 75%. Sites need to be assessed in terms of their restoration potential. This would also include plantation

		(Forestry) sites.
	Disturbed	Areas where the natural habitat is not in a near-natural state, but is also not irreversibly transformed. These areas still perform important habitat and ecosystem functions.

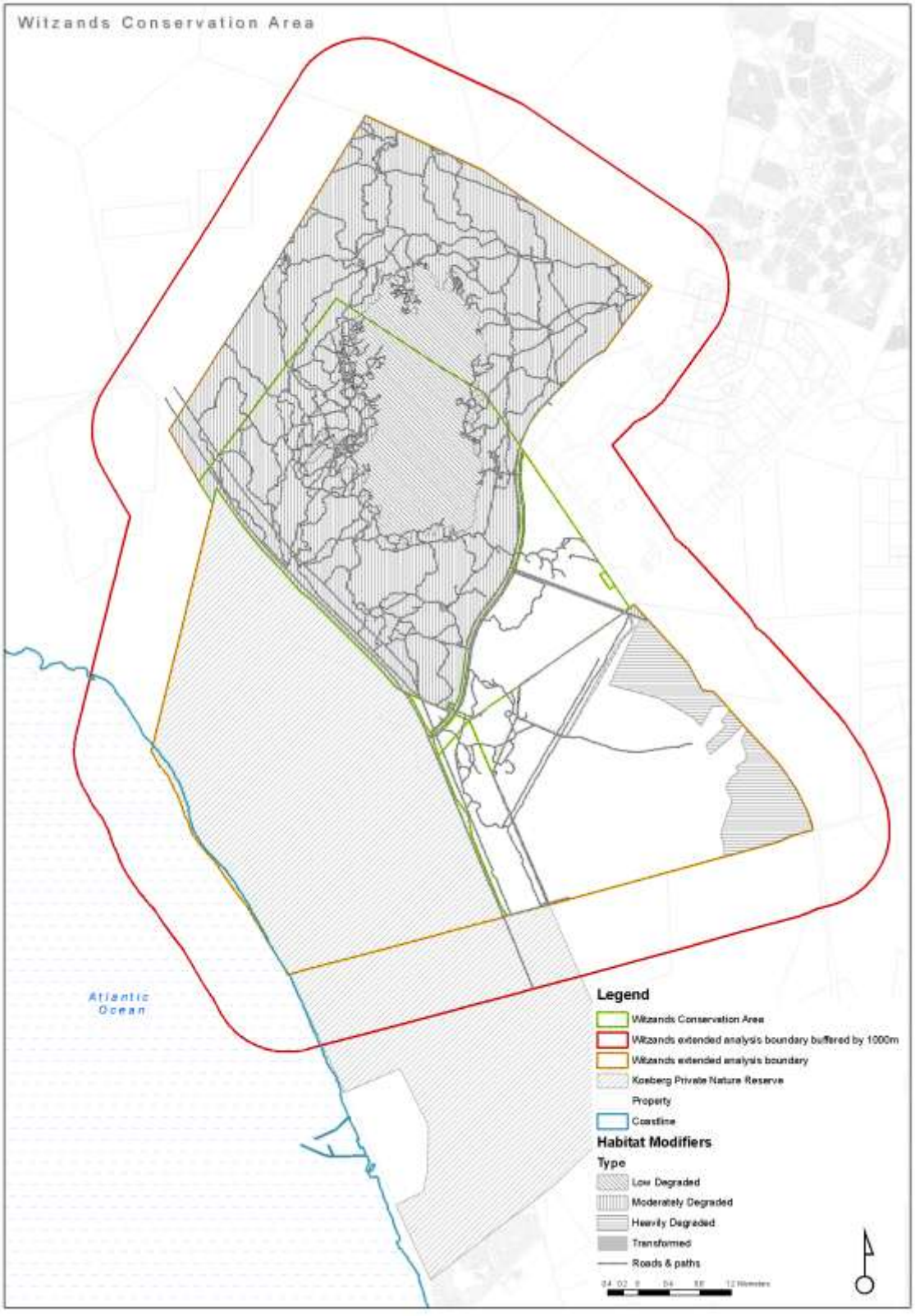


Figure 2: Witzands Aquifer Nature Reserve : Habitat Modifiers

Scoring, Logic and rationale

The scoring method derived was as follows:

1. Base values were assigned to the study area according to the ecosystem status of the vegetation types (Table 2).
2. The Base values were adjusted on the basis of habitats that are likely to receive an adjusted conservation status under the "Criterion D" listing of threatened ecosystems in terms of NEMBA (2004). This reflects vegetation types with high numbers of rare and endangered plant species. This value replaced the NSBA Conservation Status where higher and was not used in addition to them (Table 2).
3. Base values were adjusted according to the protection status of the vegetation type (Gap Analysis) as determined in the fine scale conservation plan for the City (see Appendices, Table 9).
4. Base values were adjusted according to the % Transformation that has occurred within each vegetation type within the City. (See Appendices, Table 10).
5. The values of all degraded sites were reduced according to the type of habitat degradation (Table 3); and
6. The values of all transformed areas were reduced to zero
7. Once these values were determined, the values were converted to a 0-10 range using a linear conversion method in ArcGIS.

Table 2: Habitat Value summary for each vegetation type before local adjustment for transformation/degradation

Vegetation Type	NSBA Conservation Status Score	Criterion D Score*	SANBI Conservation Status	% Transformed Score	Unmodified Score
Atlantis Sand Fynbos	6	10	5	3	18
Boland Granite Fynbos	8	6	3	3	14
Cape Estuarine Salt Marshes	4	0	-1	3	6
Cape Flats Dune Strandveld: False bay	8	8	3	10	21
Cape Flats Dune Strandveld: West Coast	4	8	3	2	13
Cape Flats Sand Fynbos	10	10	4	10	24
Cape Lowland Freshwater Wetlands	4	0	-1	2	5
Cape Winelands Shale Fynbos	8	0	3	3	14
Elgin Shale Fynbos	10	0	4	6	20
Hangklip Sand Fynbos	6	6	-1	4	9
Kogelberg Sandstone Fynbos	4	10	2	0	12
Lourensford Alluvium Fynbos	10	10	3	10	23
North Peninsula Granite Fynbos	4	0	-1	2	5
Peninsula Sandstone Fynbos	4	8	-1	0	7
Peninsula Shale Fynbos	6	0	-1	4	9
Peninsula Shale Renosterveld	10	0	3	10	23
South Peninsula Granite Fynbos	8	0	2	6	16
Southern Afrotemperate Forest	4	0	-1	0	3

Swartland Alluvium Fynbos	10	0	5	10	25
Swartland Granite Renosterveld	10	10	4	10	24
Swartland Shale Renosterveld	10	10	4	10	24
Swartland Silcrete Renosterveld	10	0	-1	10	19
Western Shaleband Vegetation	4	0	3	0	7
**This value only replaces NSBA Conservation Status Value when it's a higher value*					

Table 3: Habitat Value Summary table

Type	Source	Category	Value	Notes
Base Values	NSBA Conservation Status	Critically Endangered	10	
		Endangered	8	
		Vulnerable	6	
		Least Threatened	4	
	Criterion D Status	Critically Endangered	10	Criterion D Status overrides NSBA where the value is higher
		Endangered	8	
		Vulnerable	6	
		Least Threatened	4	
Broad adjustors	Vegetation remnants	0-14%	0	This criterion highlights the critically endangered vegetation types within the City without considering protection status.
	% Transformed	15-29%	2	
		30-39%	3	
		40-49%	4	
		50-59%	5	
		60-69%	6	
		70-99%	10	
	Ecosystem protection Status (Gap Analysis)	Not Protected	5	Currently not represented in formal reserves
				>5% of target in reserves
		Hardly Protected	4	5->50% of target in reserves
		Poorly Protected	3	50->100% of target in reserves
		Moderately Protected	2	100% + of target conserved in formal protected areas
		Well Protected	-1	
Modifiers				
Local adjustors	Overriding values for transformed sites	Artificial water bodies	0	Value reduced to 0
		Quarries/roads	0	Value reduced to 0

		Developed Recreational Open Space (ROS)	0 0	Value reduced to 0 Value reduced to 0
	Adjusting values for degraded sites	Heavily degraded Moderately degraded Low degraded	-6 -2 -1	High density aliens – depleted seed bank with low restoration potential Previously ploughed old fields High density aliens – intact seed bank with high restoration potential Forestry (Pine, Gum) plantations High density non-locally indigenous species Area is recovering from historic disturbance, to a near natural state. Cleared fire belt areas Modified wetlands with NB habitat value

GIS Procedure:

Habitat Value Unmodified Score

1. Export vegetation data to separate shapefile
2. Delete all fields except the "SANBI_VEG" field
3. Dissolve on field "SANBI_VEG"
4. Add fields, NSBA Conservation Status Score (NSBA_SCR), Criterion D Score (Crit_D), SANBI Conservation Status (SANBI_Cons), % Transformed (PERC_TRANS), Unmodified Score (UNMod_SCR). Use Short Integer field type.
5. Populate the attribute table with the relevant scores
6. Calculate the Unmodified Habitat Value Score. Note: The Criterion D score will override the NSBA score if the latter is a higher value.

Habitat Transformation

1. All roads, trails and boardwalks are buffered by 1 meter.
2. All transformation types were digitised from aerial photography at a scale of 1:700. Artificial water bodies were extracted from the wetlands layer.
3. All transformation layers were unioned.
4. Values were assigned as per the table. Type in field “TRANSCLASS” and the score in the field “VALUE”

Habitat Value Modified Score

1. Union the above two layers
2. Clip the union layer to the study area
3. Delete all unnecessary fields.
4. Add field “MOD_SCR”
5. Calculate the value for “MOD_SCR”. Remember to reduce the over-riding transformation values to 0
6. Covert to a 1-10 range using equal intervals and label 1-10. Ensure sampling uses all records (set to 25000).
7. Export to shapefile and label WITZ_Habitat_Value.shp
8. Create map for report and export

Outputs

See Figure 3

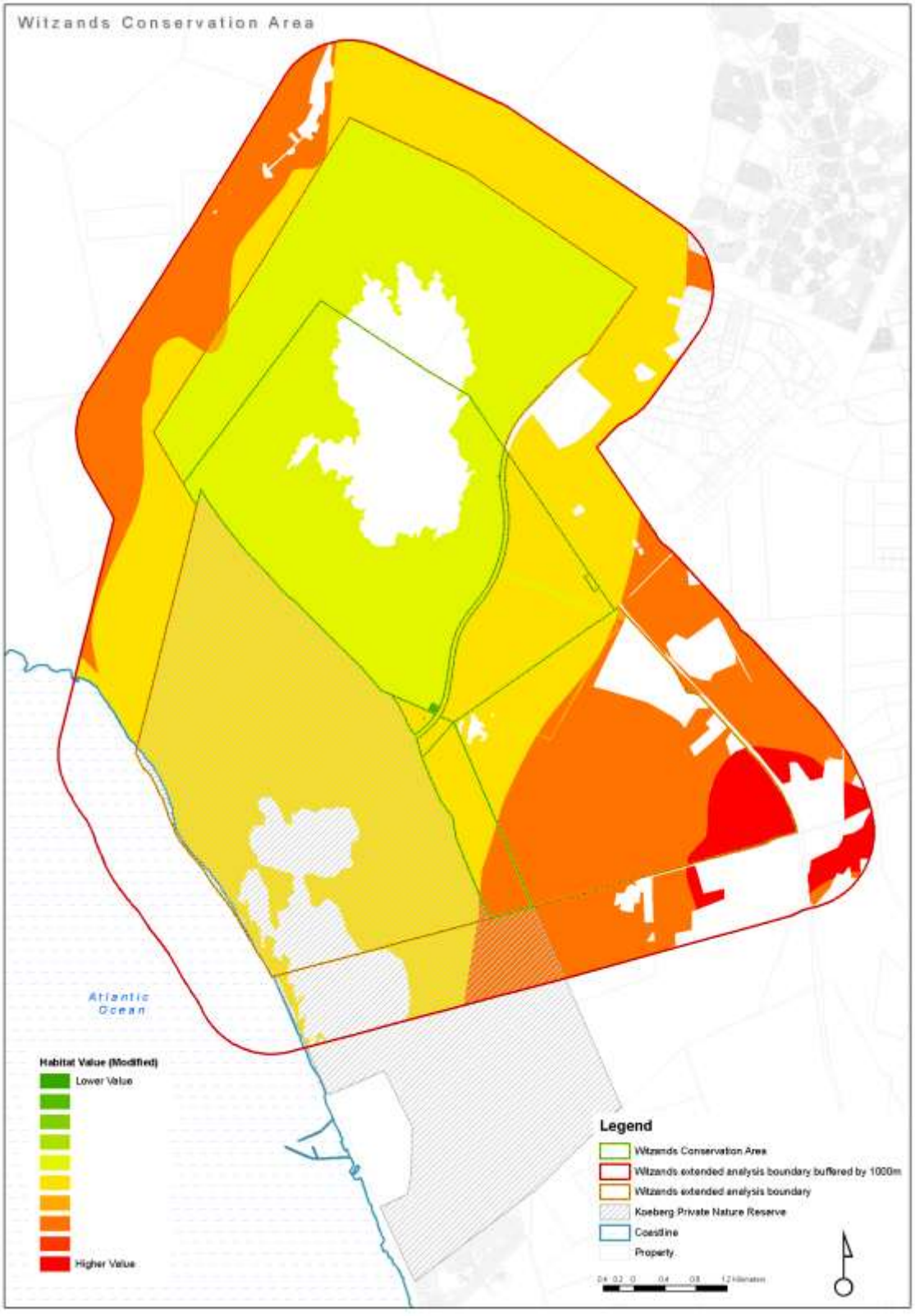


Figure 3: Witzands Aquifer Nature Reserve : Habitat Value (Vegetation Proxy)

Interpretation in a local context

The majority of the vegetation type is Cape Flats Dune Strandveld (West Coast Type), which is listed as Least Threatened (LT), but this vegetation type is poorly protected within formal conservation areas. The Atlantis Sand Fynbos is listed as Vulnerable and none of it is protected in formal conservation areas. The Swartland Shale Renosterveld that occurs on the Brakkefontein (Militar6y Shooting Range) property is Critically Endangered, and also poorly protected in formal conservation areas. These vegetation types are all poorly represented in nature reserves in the City. It should also be noted that the status of Cape Flats Dune Strandveld (West Coast Type) is uncertain as the rapidly diminishing extent of the False Bay type could result in its status increasing in importance.

Showstoppers#fatal flaws and special management area informants

Development of Greenfield sites within any critically endangered or endangered vegetation type or ecosystems should be approached with extreme caution, as by definition one cannot afford further biodiversity loss in these areas within the City.

Degraded areas that have residual seed banks should receive the highest restoration priority. The uncontrolled destruction of the dunes and associated vegetation is having a major impact on the status of the Witzands Aquifer Nature Reserve vegetation.

4.1.3 3.1.1c Special Habitat Value

The value of some areas of a reserve to the biodiversity estate may not be fully reflected by the habitat proxy (vegetation units). It is critical that these areas are identified and included. However, care must be taken not to allow flawed data, selective data availability, perceptions and species/taxa bias to skew the biodiversity value of one site over another.

Key aspects that should be taken into account in this layer:

- Habitats important for supporting populations of special species.
    - Care must be taken to ensure that this input fairly reflects the distribution of special species across the reserve.

- Where detailed and comprehensive data are available this can be based on actual distributions, but in all likelihood this will be based on expert assessment of likely habitat requirements for identified species.

- Areas containing significant biodiversity assets such as Leopard, Black eagles, Leopard toads etc. that are not specifically linked to entire habitats.
- Other habitats that have significant biodiversity value that have been omitted from the broad conservation value layer as a result of scale issues or type of habitat.

Dune Fields

The sand sheets (mobile sand dunes) were extracted from the sand dunes layer. These sand sheets do not contribute to vegetation targets, but are an important biodiversity feature. Although the rest of the areas are vegetated parabolic, embryo and transverse dunes the sand sheets are generally void of vegetation. The sand sheets have been allocated a relative importance value, as the rest of the dunes are vegetated and receive the value of their overlying vegetation type.

Data Inputs (GIS methods and sources)

1. Dunes layer was clipped to the study area.
2. Dissolved on Dune Type
3. Add Field “SPL_HAB_VAL
4. Populate field with value
5. Create map and export WITZ_SPL_HAB_VAL.shp

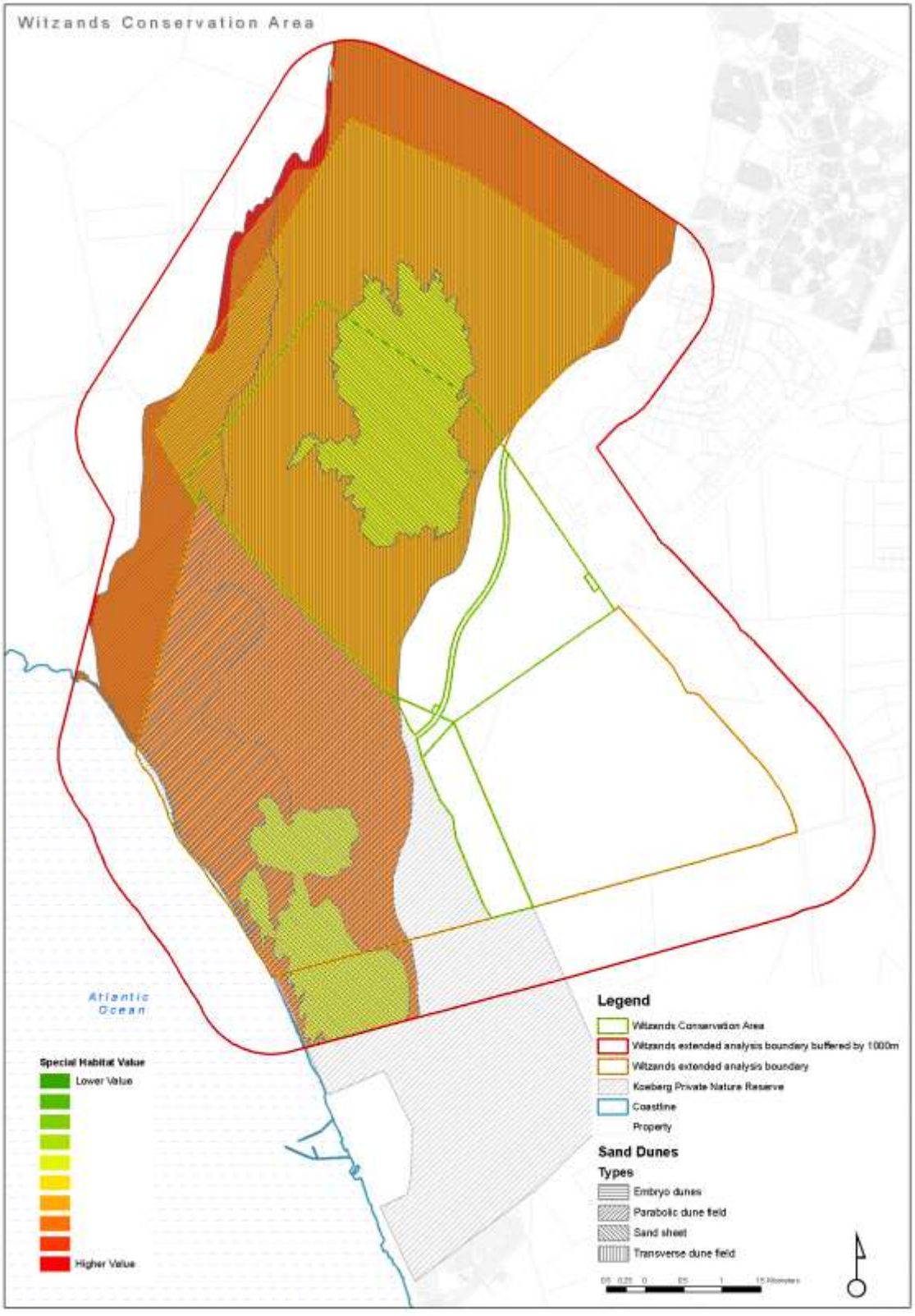


Figure 4: Witzands Aquifer Nature Reserve : Special Habitat Value (Sand Dunes)

Interpretation in a local context

Some of the largest parabolic dune fields on the West Coast are found at Yzerfontein and in

the Koeberg-Witzand area (Tinley, 1985; sensu Low & Pond, 2006). These dunes perform an important ecosystem function and are a unique landscape feature.

Showstoppers#fatal flaws and special management area informants

Although, from a pure biodiversity perspective the sensitivity of the mobile sand sheets may be interpreted as being fairly low, the fact that they overlay the Witzands aquifer and comprise course grained, highly permeable sands makes the underlying aquifer zone extremely vulnerable and sensitive to above ground impacts (pollution etc.). This value is captured in the hydrological sensitivity.

5 3.1.2 TOPOGRAPHIC SENSITIVITY

This layer is used to identify areas with steep slopes or with sensitive geological or geomorphologic features. Significant impacts (such as accelerated soil erosion or landslides) may occur during construction in, or with improper management.

Sensitivity to erosion was not considered in this report. The steepness and habitat values provide a good enough proxy for sensitivity to erosion.

Data Inputs (GIS methods and sources)

This layer is derived from a triangular irregular network (TIN) created in ArcView 9.3.1 using the 3D Analyst extension and ArcInfo licence level. The 2m Contour layer for the City was used to calculate the base heights for the TIN. Slope angles were calculated using the 3D Analyst extension.

Scoring, logic and rationale

Slope angles were split into categories that relate to potential impacts and the limits of construction without significant cut and fill.

Procedure:

- Buffer study area by 1000m
- Clip the 2m contour layer with the buffered boundary layer
- Calculate Slope angles
- Reclassify according to Table 4 using 3D Analyst - reclassify
- Convert raster layer to vector shapefile and clip to the reserve boundary
- Create new field "VALUE"
- Assign values according to attribute field "GRIDCODE" to shapefile field "VALUE"
- Create and export map
- Final Topographic Sensitivity layer: WITZ_topo_sensitivity.shp

Table 4: Topographic sensitivity

Source	Category	Value	Note

Slope angles calculated from 2m contour layer	45° - <90°	10	Very high potential for erosion and slope instability
	30° - <45°	9	Strong potential for erosion and slope instability
	15° - <30°	8	High risk of erosion following disturbance
	10° - <15°	6	Moderate risk of erosion following disturbance
	5° - <10°	2	Low sensitivity
	0° - <5°	0	No special topographical sensitivity

Outputs

See Figure 4

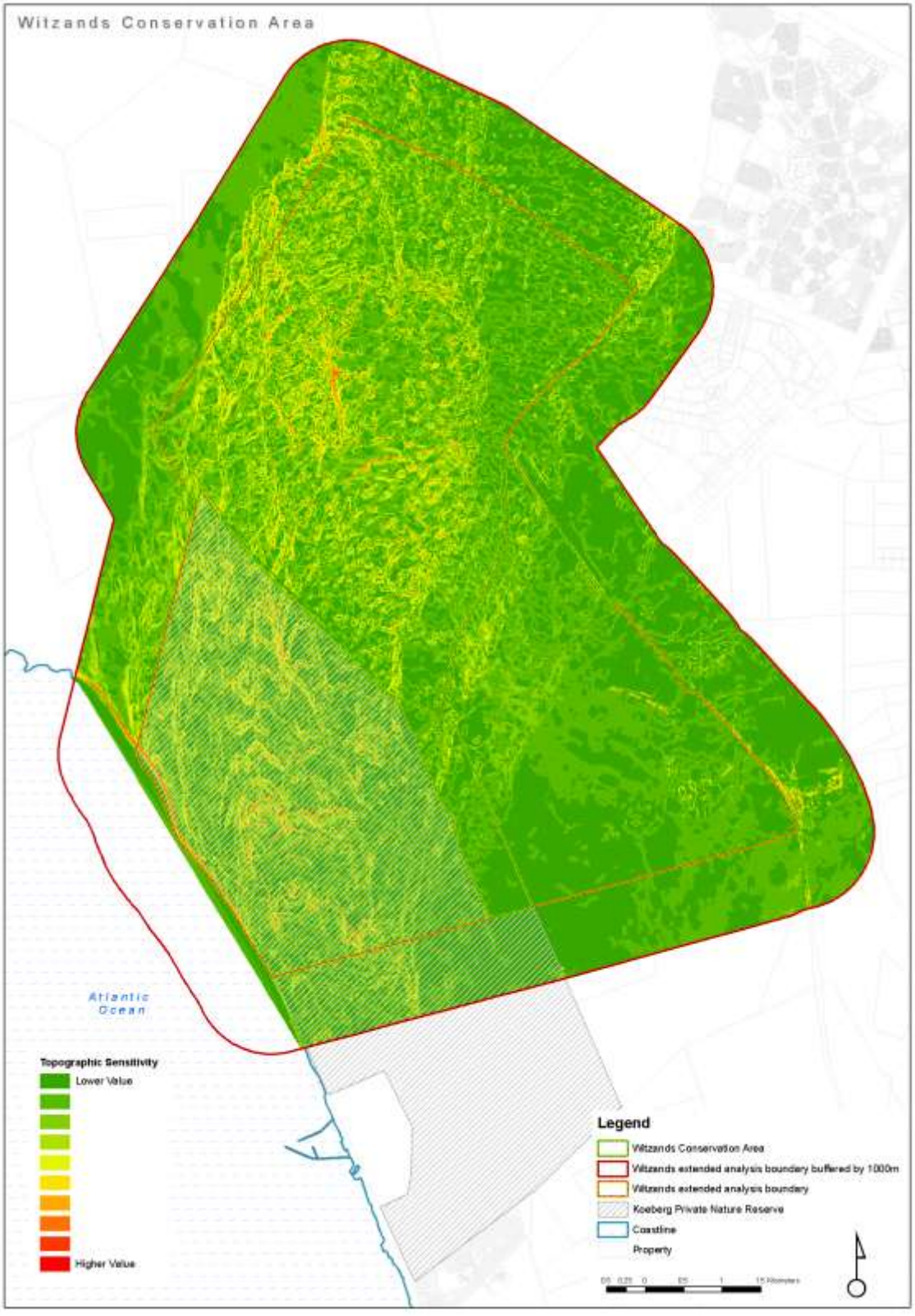


Figure 5: Witzands Aquifer Nature Reserve : Topographic Sensitivity

Showstoppers/fatal flaws and Special Management Area Informants

Structures or development on steeps slopes should be avoided. Generally flat, scenic landscapes should be protected from unsightly developments that could impact on the scenic value of the site.

6 3.1.3 HYDROLOGICAL SENSITIVITY

The hydrological sensitivity layer has several purposes: to identify areas important for maintaining hydrological processes and to identify areas where infrastructure could be damaged by flooding or high water events.

Data inputs (GIS methods and sources)

The footprint within which the hydrological sensitivity is determined is defined by buffering the wetlands by pre-determined distances.

Wetlands data was extracted from the City's wetland layer.

Aquifer data was sourced from the Bulkwater Department.

Scoring, logic and rationale

There are semi-natural and natural wetlands occurring in the study area. The wetlands were buffered and scored as detailed in Table 5.

Procedure (Wetlands)

- Clip the wetlands layer to the buffered boundary layer
- Create separate shapefiles for Natural/Semi-natural wetlands and Artificial/Modified wetlands
- Buffer natural and semi-natural wetlands by 50m (ensure use dissolve all)
- Buffer natural and semi-natural wetlands by 100m (ensure use dissolve all)
- Union the three wetlands shapefiles, create a new field "BUFFER", populate with the buffer distance value
- On the output shapefile create a field "WETNAT_VAL" and populate according to the value in Table 4.
- Delete all unnecessary fields.
- Clip the shapefile to the reserve boundary

Procedure (Aquifer)

- Clip the aquifer yield layer to the buffered boundary layer
- Add a field "AQUA_VAL" and populate according to the value in Table 5b.
- Delete all unnecessary fields.

Hydro sensitivity

- Union the wetlands sensitivity layer and the aquifer yield layer.
- Add values and covert to 1-10 range using a linear conversion.
- Clip the shapefile to the reserve boundary
- Create and export map
- Final Hydrological sensitivity layer: WITZ_hydro_sensitivity.shp

Table 5a: Hydrological sensitivity (Wetlands)

Source	Category	Value	Note
City Wetlands layer	Natural wetlands, seeps and pans – actual area	10	Actual wetland area - potential for direct disturbance.
	Wetlands, seeps and pans 50m buffer	8	Close proximity to wetland. Disturbance to faunal species.
	Wetlands, seeps and pans - 100m buffer	7	High sensitivity to disruption of hydrological and sediment transfer processes

Table 5b: Hydrological sensitivity (Aquifer)

Source	Category	Value	Note
Wtsands Aquifer	Yield - >5 Litres per second	8	NB Placement of well fields
	Yield – 2- 5 Litres per second	6	
	Yield – 0.5-2 Litres per second	4	

Outputs

See Figure 6

Figure 6a: Witzands Aquifer Nature Reserve : Hydrological Sensitivity (Wetlands)

Interpretation in local context

The buffers applied in the analysis are generous and should be refined at a local, site level if required. The inclusion of the aquifer yield value into the hydrological sensitivity implies that areas with a higher yield are more sensitive to developments/disturbance than areas with a lower yield. The placement of well fields is more likely to occur in these high yield areas.

7 3.1.4 VISUAL SENSITIVITY

This layer examines the value of the study area from a visually aesthetic perspective. Visually intrusive development should not occur in areas with a high visual aesthetic value.

The visual sensitivity layer examines how visually intrusive a development will be in a landscape.

Data inputs (GIS methods and sources)

A viewshed analysis was run on the TIN created for the study area, using ArcMap 9.3.1 and the 3D Analyst extension.

Scoring, logic and rationale

The visual analysis examined how visually intrusive a development or structure would be at a particular point. Three separate variables were calculated (see Table 6).

- Slope steepness was calculated based on the TIN for the study area. Slope angles were divided into 10 equal width categories (the range was 0°-40°). These were scored in the range 1-10.
- An analysis of the visibility of each site from every other site in the reserve was undertaken. A 200m grid of points within the reserve was used to define 714 viewpoints with a Z value of 1.5m (the grid was created using the “Special Raster Tools” in Hawth’s Tools extension for ArcMap 9.3).

The viewshed examines (on a proportional basis) which sites are most visible. Similar to slope steepness, these values were divided into 10 equal width categories and scored on a 0-10 basis.

- A viewshed analysis from all roads, paths and trails was undertaken. The analysis parameters used were the same as above except for the viewpoints used.
- These 3 values were added together and reclassified into the range 0-10 equal width categories to ensure compatibility with other layers.

Table 6: Visual Sensitivity Procedure

Source	Category	Value	Note
1. Slope Steepness			
❑ Slopes modeled in ArcGIS using Spatial Analyst		0-10	Slope angles calculated TIN created from 2m Contours
❑ Slopes reclassified	10 equal width categories		
	Scored 1 to 10		Values converted into ten integer based classes, with the maximum value equivalent to slopes of over 45°
2. Grid visibility			
❑ 200m grid of reserve area used as viewpoints 714 Viewpoints		0-10	Analysis based on the TIN
❑ Reclassified	10 equal width categories		Values converted into ten integer based classes, with the maximum value equivalent to visibility from 2.5% of park viewpoints.
3. Tourist viewpoint and public road visibility			
❑ All tourist roads, paths and trails used as viewpoints		0-10	Analysis based on the TIN
❑ Reclassified	10 equal width categories		Values converted into ten integer based classes, with the maximum value equivalent to visibility from 5% of park viewpoints.

Procedure:

Visual Sensitivity

- Create a 100m point grid covering the buffered reserve boundary layer. Hawths tools have an easy tool for this.
- Create a point shapefile using the roads and paths shapefile. Using the “feature vertices to points” tool.

- Run the viewshed analysis using the two shapefiles above as the view points. Use a Z factor of 1.5m.
- Reclassify into 10 equal width categories and export the raster to feature class.
- Clip to the reserve boundary
- Intersect the 3 shapefiles and delete all unnecessary fields. Add field “VISUAL_VAL” .Add up the 3 “VALUE” fields using the field calculator and populate the “VISUAL_VAL” field
- Reclassify into 10 equal class categories
- Create and export map
- Final Visual Sensitivity layer: WITZ_visual_sensitivity.shp

Outputs

See Figure 7

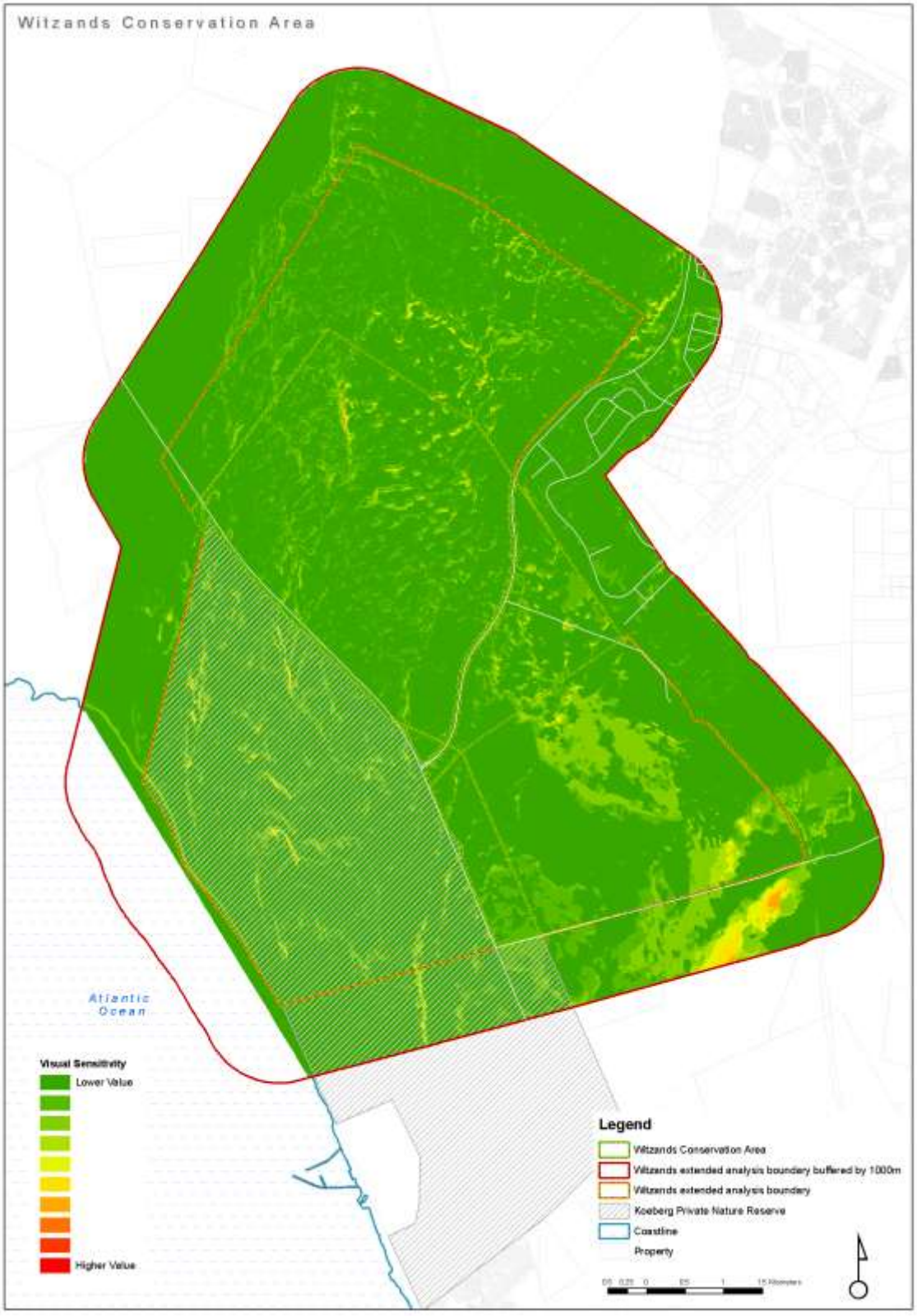


Figure 7: Witzands Aquifer Nature Reserve : Visual Sensitivity

Interpretation in local context

Visually intrusive structures or development should be avoided, especially where the Scenic value of an area could be compromised.

Showstoppers/Fatal flaws and Special Management Area Informants

The viewshed analysis determines the visibility of areas from predefined observation points. However, the visibility of a development is only one of the components that determine its visual impact. Other factors, such as the development's design, construction and layout also contribute to the overall impact on the aesthetic character of its environment. Special consideration should be given to developments that are proposed in highly visible areas.

8 4. SENSITIVITY-VALUE ANALYSIS PROCESS (INCLUDING WEIGHTINGS) AND SUMMARY LAYERS

The sensitivity-value analysis process has two key parts:

- The preparation of the input layers in a consistent and easy to analyze format (as outlined in the previous sections)
- The preparation of a summary layer which allows all the input layers to be easily accessed, interrogated, combined in a range of weightings (if necessary), and then used as a decision support tool in a workshop situation.

Data inputs (GIS methods and sources)

The GIS process is geared to keeping the dataset flexible enough for use in a workshop situation. All input and summary data need to be available within a single vector shapefile. The GIS method is as follows:

- Clip all input summary datasets to the spatial footprint of the smallest layer. This should correspond to the extent of the study area boundary. It is critical that all the clipped layers have the spatial extent, even though not all the area within the layer may be included within a polygon. Areas outside the polygons receive a 0 value in the union process so it is critical that these represent true 0 values and not gaps in the dataset.

- Union all datasets. This produces a composite vector shapefile containing all the data from the underlying summary layers.
- Delete all unnecessary attribute fields from the union shapefile.
- Summary information is calculated for each of the fragmented polygons using simple field calculations. A new attribute field is added for each summary weighting. Values are calculated using the field calculator. Complex calculations can be saved as expressions.
- Details of the summary calculations are given in Table 7.
- Export final sensitivity layer as WITZ_sensitivity.shp

Table 7: Sensitivity-Value Weightings*

Name	Field Name	Composition	Notes
Linear summary	LINEAR	Habitat Value + Special Habitat Value + Topographic Sensitivity + Hydrological Sensitivity + Visual sensitivity + Heritage Value	Equal weighted summary of all layers
Biodiversity Value	BIODIV_VAL	Habitat Value + Special Habitat Value	Equal weighted summary of biodiversity value layers
Biodiversity sensitivity value	BIODIVSEN	2x(Habitat Value) + 2x(Special Habitat Value) + Hydrological Sensitivity + Visual sensitivity	Equal weighted summary of biodiversity value and sensitivity layers
Biodiversity Value driven summary	BIOVALHEAV	4x(Habitat Value) + 4x(Special Habitat Value) + Hydrological Sensitivity + Visual sensitivity + Heritage sensitivity	Layer which emphasizes the biodiversity value of a site, and hence is strongly influenced by the distribution of rare and threatened habitats and species, as well as by patterns of transformation across the landscape.
Balanced summary	BALANCED	2x(Habitat Value) + 2x(Special Habitat Value) + Topographic Sensitivity + Hydrological Sensitivity + Visual sensitivity + Heritage Sensitivity	This is the favoured layer which emphasizes biodiversity value and aesthetic considerations, and de-emphasizes biodiversity sensitivities

*Not all layers may be required as in the table

Outputs

See Figure 8

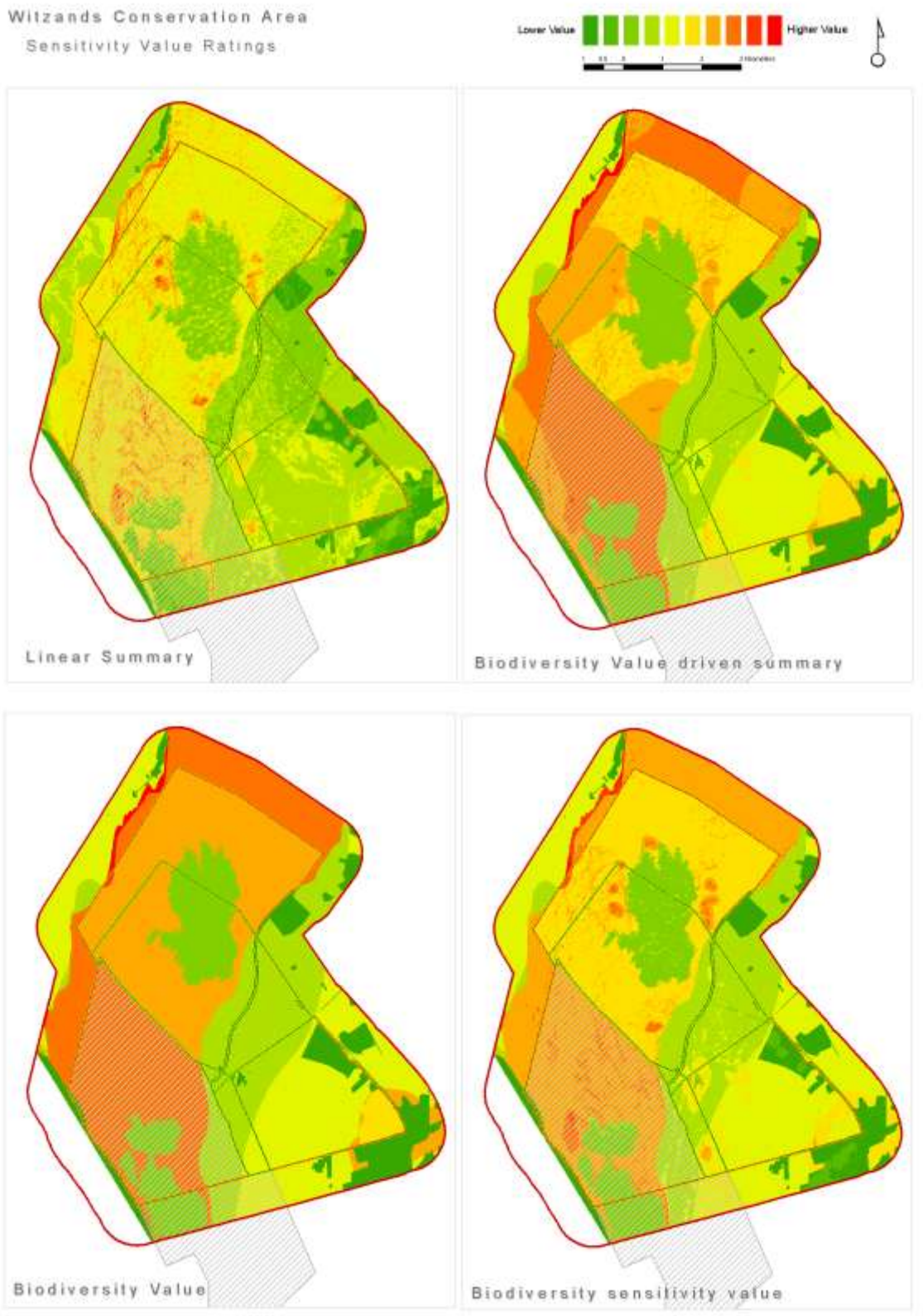

Witzands Conservation Area
Sensitivity Value Ratings
Lower Value
Higher Value
Linear Summary
Biodiversity Value driven summary
Biodiversity Value
Biodiversity sensitivity value

Figure 8: Examples from the outputs from the sensitivity–value analysis process using different weightings (See Table 7)

Interpretation in local context

The combined range of weightings presented in Table 6 and Figure 7 indicate no significant difference in outcome of the summary layers. This is a typical scenario of areas with high levels of biodiversity sensitivity and relatively uniform topographic variability (Holness, 2008).

The inclusion of the aquifer yield value in the hydrological sensitivity value has attempted to account for the underlying importance and critical link between, water resource protection, aquifer dependant ecosystem protection and ecosystem functioning at a landscape level.

The Balanced Summary weighting (see Figure 8) was used as the sensitivity analysis input for the zonation process.

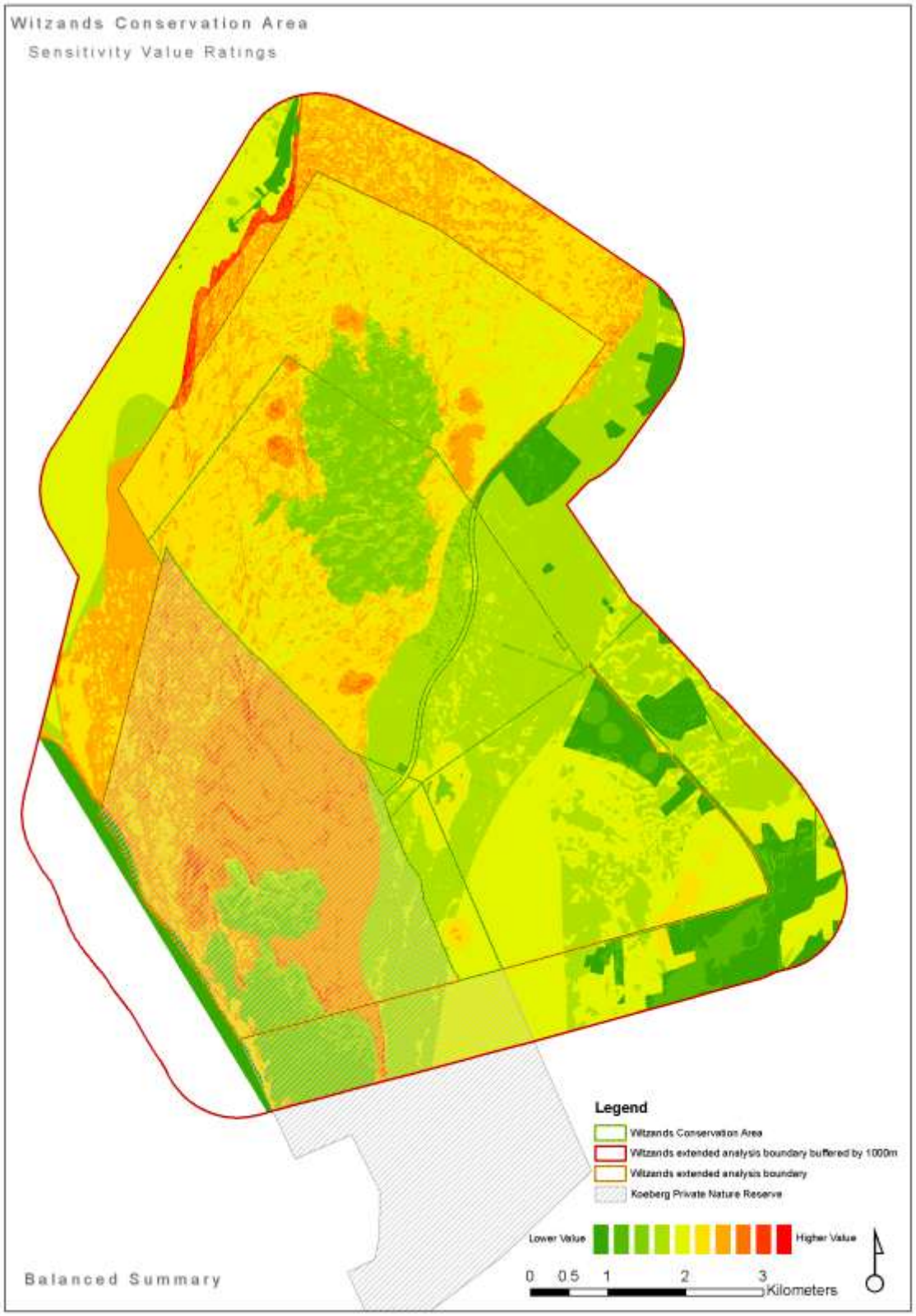


Figure 9: Sensitivity Analysis: Balanced Summary

9 5. ZONING PROCESS

9.1 5.1 ZONING INFORMANTS

This section briefly outlines the values underlying the identification of broad tourism use zones. It is important to remember that the landscape/biodiversity analysis is just one of the informants in the zonation process. Although the biodiversity analysis is intrinsically a relatively objective scientific process, other informants to the zoning process are not. Although every attempt is made to place high sensitivity-value sites into more protected zones where possible, the zoning process is in its essence a compromise between environment and development. In particular, often the identified high value sites are the key biodiversity assets that need to be made available in an appropriate manner to the ecotourism market. Direct links between the biodiversity layers and the spatial management of the reserve are made during the identification of special management areas (Where applicable). Even within broad high tourist use zones, there are likely to be areas subject to very tight conservation controls (potentially including complete exclusion of human impacts from an area).

Underlying decision making rules used in the zonation process:

- The zonation process is aimed a striking a *balance* between environmental protection and the development required to meet the broader economic and social objectives of the reserve.
- The zoning process takes into account existing development footprints and tourism access routes.
    - This is based on the underlying principle that all else being equal, an existing transformed site is preferable to a greenfields site from a biodiversity perspective.
    - Infrastructure costs are dramatically increased when developments take place away from existing infrastructure.
    - Existing tourism nodes and access routes are a reality of the economic landscape, and it is would not be possible to shut down existing tourism sites compromising the development objectives of the reserve.
- Where existing development nodes, tourist sites and access routes occur in areas with high sensitivity-value, then the broad use zoning aims to keep the development footprint as small as is realistically possible, preferably within the existing transformed site.
- Where possible, sites with high biodiversity sensitivity-value are put into stronger protection zones.

- Peripheral development is favoured and where possible should be located outside of the conservation area.

Two key points need to be emphasized:

- The designation of a broad use zone does not imply that all sites within that zone would be suitable for all the development types anticipated within that use zone. Detailed site level planning is still required, and many sites may prove to be unsuitable at a site/precinct/EIA level of planning.
- Special Management Areas/Overlays need to be formalized and the links made to the management plans.

(Adapted from Holness, 2008)

9.2 5.2 ZONING DEFINITIONS AND DESCRIPTIONS

The zonation definitions and descriptions were workshopped with reserve and area managers. Four categories were decided on, namely; Primary Conservation zone, Conservation zone, Low Intensity leisure zone and High Intensity leisure zone. Table 11 outlines the proposed zonation and zone descriptions. The link is still made to the Zonation used for the CapeNature Reserves (Holness, 2008) as there should be general alignment of the broader use zones for ease of comparison and integration if required in Provincial documents.

9.3 5.3 DRAFT ZONING OUTPUTS

A zonation workshop was held at the 38 Wale Street on the 20th November 2010. The zonation for the Witzands Aquifer Nature Reserve was drawn up using the balanced summary weighting as an input in applying the Zonation categories as defined in Table 11. Figure 10 shows the draft zonation for the Witzands Aquifer Nature Reserve.

Table 8 shows the breakdown per zonation category and the % of the total per category.

Table 8: Breakdown (in HAs and % of Area) of the 5 Zonation Categories in the reserve

Zonation category	Area Has	% of Area
Conservation	1724.16	97
Utility	52.2	3
Total	**1776.4**	

Figure 10: Draft Zonation for the Witzands Aquifer Nature Reserve

9.4 5.4 SPECIAL MANAGEMENT OVERLAYS

Overlay zones are applied to different areas of the reserve requiring special management intervention. Overlay management zones are applied to areas of national, regional or reserve based importance for example: RAMSAR SITE or IBA (important Bird Areas), NB cultural sites or Natural resource consumptive use areas (Medicinal Plants) and specific recreational use areas that are located with conservation zones.

The potential special management overlays are:

1. Heritage
2. Special Conservation
    a. This special management overlay defines areas around known locations of critically endangered species or species requiring specific management interventions.
3. Rehabilitation
    a. Areas identified for restoration and rehabilitation
4. Recreation Overlay
    a. Recreational Activities on and surrounding the mobile dune sand sheets.
5. Well Field and pipeline Management
    a. Areas requiring specific management around utility infrastructure.

5.4.1 Well Field and Pipeline Special Management Area

The Witzands well field is located within the Conservation Zone, however the management requirements for each well site (Borehole) needs to be accommodated.

The area surrounding the well field is also extremely vulnerable to pollution from external sources and for this reason this area should remain a restricted access area.

The associated water pipelines also require routine maintenance and management.

Activities include:

- Maintaining the areas around the immediate vicinity of the well points free and clear of vegetation and obstructions.
- Maintaining of access routes to well sites.

- Maintenance of the actual boreholes (to prevent or rehabilitate if they have become clogged.
- The placement of new borehole sites may also occur within this zone (subject to all necessary authorisations etc.)

5.4.2 Oil pipeline Special Management Area

The Caltex oil pipeline which runs down the R27 inside the conservation area must remain a restricted area. Contingency and emergency response plans need to be put in place with immediate effect.

5.4.3 Recreational Use Special Management Area

The use of the dune fields by recreational users is having an impact on the landscape. The potential for groundwater contamination from pollutants is great, but needs to be investigated and quantified. At present there are no facilities for recreational users, meaning ablutions etc are happening all over. There is also a lack of control and illegal access onto the dunes and surrounding areas. The destruction of sensitive Dune Strandveld vegetation is also a huge concern.

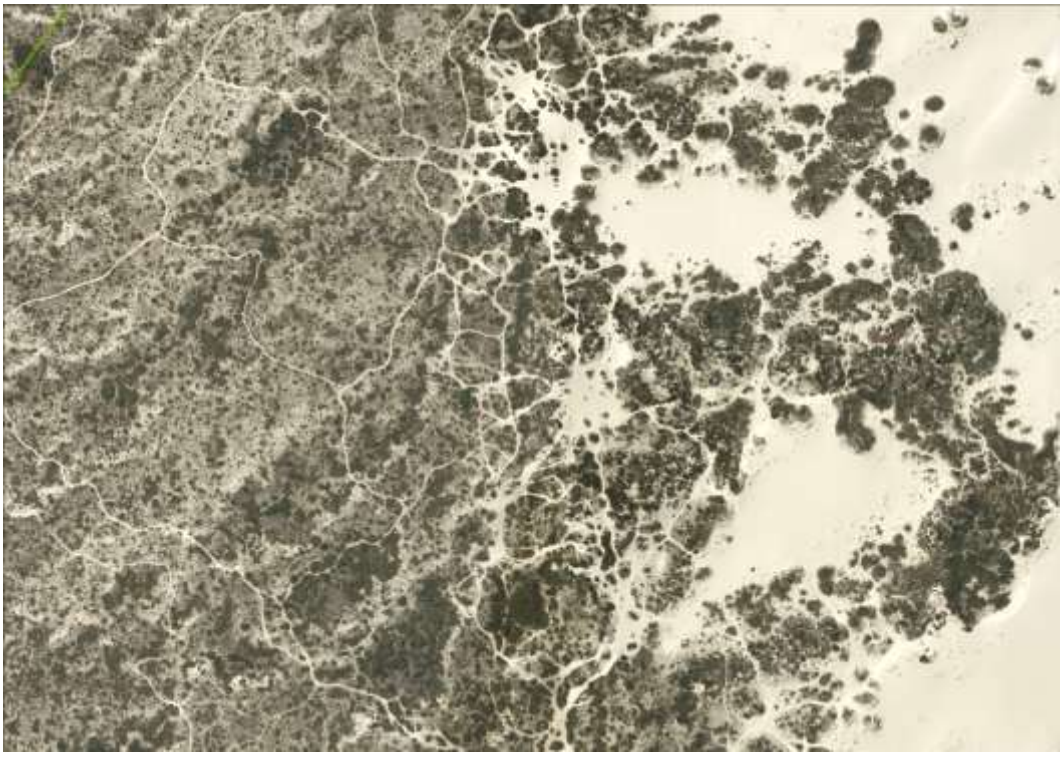
This area has been zoned for conservation as it is an extremely important feature in the landscape. However, it has been noted that the recreational value of this area for 4X4 users, film/location shoots and other recreational uses should be accommodated, but in a manner than has the smallest possible impact on the environment.

The unconfined nature of the Atlantis Aquifer and the shallow depth to the water table, make the groundwater resource particularly vulnerable to pollution.

At present the impact of recreational use of the dune fields is unquantified, however there exists serious potential of a disastrous pollution event from a vehicle burning out or releasing contaminants (oil or fuel) into the aquifer.

Immediate measures need to be put in place to restrict the number of vehicles accessing the dune field to a minimum, until such time as an operational plan is developed for this activity.

January 2005



March 2009

Figure 11: Uncontrolled destruction of sensitive dune vegetation by vehicles

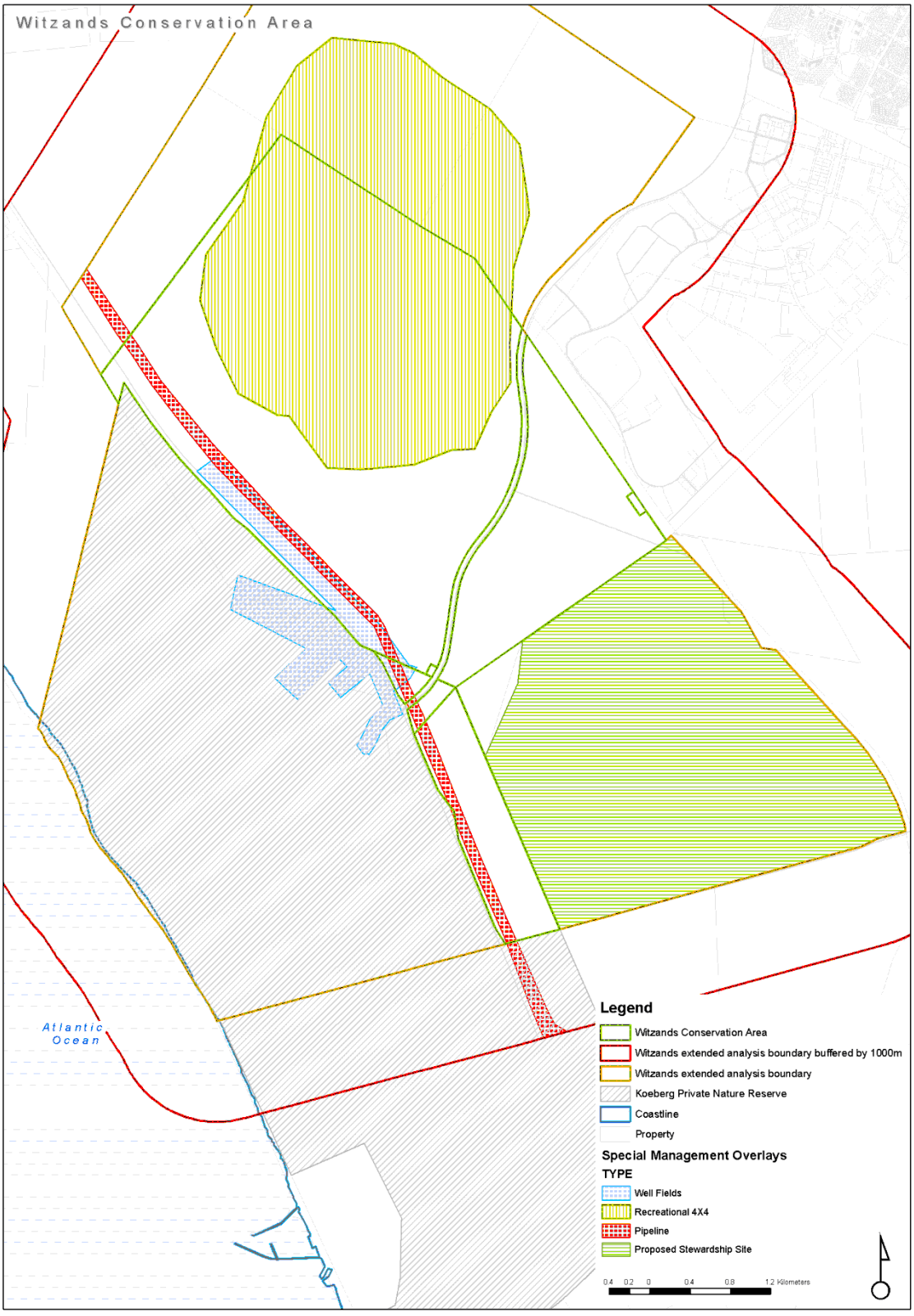


Figure 12: Witzands Aquifer Nature Reserve Special Management Overlay zones

10 6. CONCLUSIONS AND RECOMMENDATIONS

The importance of the Witzands aquifer cannot be underestimated. It has an estimated replacement cost of R257 466 667 for a pipeline from the Voelvlei dam or a staggering R675 300 000 for the installation of a desalination plant.

The control of 4X4 vehicles requires urgent attention and action.

The expansion of the reserve to include the entire open dune sheet should be a priority conservation action.

The reserve also requires a perimeter fence and staff to control access.

11 7. REFERENCES

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12 APPENDICES

12.1.1 Table 9: Base values: Ecosystem Status of National vegetation types occurring in the City

Vegetation Type	NSBA Conservation Status	NSBA Conservation Status - Score	Criterion D Status	Criterion D score	SANBI Conservation Status (% target Conserved in City)	Conservation Status Score
Atlantis Sand Fynbos	Vulnerable	6	Critically endangered	10	Not Protected	5
Boland Granite Fynbos	Endangered	8	Vulnerable	6	Poorly Protected	3
Cape Estuarine Salt Marshes	Least threatened	4			Well Protected	-1
Cape Flats Dune Strandveld: False bay	Endangered	8	Endangered	8	Poorly Protected	3
Cape Flats Dune Strandveld: West Coast	Least threatened	4	Endangered	8	Poorly Protected	3
Cape Flats Sand Fynbos	Critically endangered	10	Critically endangered	10	Hardly Protected	4
Cape Lowland Freshwater Wetlands	Least threatened	4			Well Protected	-1
Cape Winelands Shale Fynbos	Endangered	8			Poorly Protected	3
Elgin Shale Fynbos	Critically endangered	10			Hardly Protected	4
Hangklip Sand Fynbos	Vulnerable	6	Vulnerable	6	Well Protected	-1
Kogelberg Sandstone Fynbos	Least threatened	4	Critically endangered	10	Moderately Protected	2
Lourensford Alluvium Fynbos	Critically endangered	10	Critically endangered	10	Poorly Protected	3
North Peninsula Granite Fynbos	Least threatened	4			Well Protected	-1
Peninsula Sandstone Fynbos	Least threatened	4	Endangered	8	Well Protected	-1
Peninsula Shale Fynbos	Vulnerable	6			Well Protected	-1
Peninsula Shale Renosterveld	Critically endangered	10			Poorly Protected	3
South Peninsula Granite Fynbos	Endangered	8			Moderately Protected	2
Southern Afrotemperate Forest	Least threatened	4			Well Protected	-1

Swartland Alluvium Fynbos	Critically endangered	10			Not Protected	5
Swartland Granite Renosterveld	Critically endangered	10	Critically endangered	10	Hardly Protected	4
Swartland Shale Renosterveld	Critically endangered	10	Critically endangered	10	Hardly Protected	4
Swartland Silcrete Renosterveld	Critically endangered	10			Not Protected	-1
Western Shaleband Vegetation	Least threatened	4			Poorly Protected	3

12.1.2 Table 10: National vegetation types for the City of Cape Town showing historic extent, remaining extent, targets and targets achieved inside and outside Protected Areas

National Vegetation Type	Historic extent (ha)	Current extent (ha)	Selected in Bionet (ha)	Target %	Target (ha)	Extent in proclaimed Protected Areas	Target met in selected Bionet	% Target conserved	% Target met in proclaimed Protected Areas	% Selected in Bionet from current extent	% Remaining from historic extent	15% of historic extent	% that is not selected in Bionet	Conservation Status	SANBI Conservation Status
Atlantis Sand Fynbos	25234.63	15711.95	12695.95	30	7570.39	0.00	Yes	168	0	81	62	3785.19	19	VU	Not Protected
Boland Granite Fynbos	9575.31	6064.19	4807.17	30	2872.59	354.52	Yes	167	12	79	63	1436.30	21	EN	Poorly Protected
Cape Estuarine Salt Marshes	39.86	25.79	25.64	24	9.57	25.64	Yes	268	268	99	65	5.98	1	LT	Well Protected
Cape Flats Dune Strandveld: False Bay	27260.11	8467.86	7272.84	24	6542.43	1855.58	Yes	111	28	86	31	4089.02	14	EN	Poorly Protected
Cape Flats Dune Strandveld: West Coast	12700.27	10603.88	6892.82	24	3048.07	964.79	Yes	226	32	65	83	1905.04	35	LT	Poorly Protected
Cape Flats Sand Fynbos	54410.34	8466.70	8464.75	30	16323.10	464.07	No	52	3	100	16	8161.55	0	CE	Hardly Protected
Cape Lowland Freshwater Wetlands	1463.98	1095.47	1068.83	24	351.36	786.66	Yes	304	224	98	75	219.60	2	LT	Well Protected
Cape Winelands Shale Fynbos	2666.97	1706.19	1388.97	30	800.09	217.89	Yes	174	27	81	64	400.05	19	EN	Poorly Protected
Elgin Shale Fynbos	841.18	321.14	282.77	30	252.35	4.58	Yes	112	2	88	38	126.18	12	CE	Hardly Protected
Hangklip Sand Fynbos	3301.60	1910.25	1489.88	30	990.48	1363.63	Yes	150	138	78	58	495.24	22	VU	Well Protected
Kogelberg Sandstone Fynbos	9499.63	9260.73	8814.04	30	2849.89	1944.47	Yes	309	68	95	97	1424.94	VU	LT	Moderately Protected
Lourensford Alluvium Fynbos	4819.25	409.97	409.97	30	1445.77	190.30	No	28	13	100	9	722.89	0	CE	Poorly Protected
North Peninsula Granite Fynbos	1997.35	1439.12	1343.54	30	599.21	986.44	Yes	224	165	93	72	299.60	7	LT	Well Protected
Peninsula Sandstone Fynbos	21896.12	21348.95	20761.60	30	6568.83	17306.57	Yes	316	263	97	98	3284.42	3	LT	Well Protected
Peninsula Shale Fynbos	1262.79	690.37	688.96	30	378.84	686.97	Yes	182	181	100	55	189.42	0	VU	Well Protected

Peninsula Shale Renosterveld	2374.81	316.89	316.89	26	617.45	261.67	No	51	42	100	13	356.22	0	CE	Poorly Protected
South Peninsula Granite Fynbos	7148.66	2481.74	2290.70	30	2144.60	1770.19	Yes	107	83	92	35	1072.30	8	EN	Moderately Protected
Southern Afrotemperate Forest	347.52	346.79	346.79	34	118.16	276.80	Yes	294	234	100	100	52.13	0	LT	Well Protected
Swartland Alluvium Fynbos	1742.41	75.91	75.91	30	522.72	0.00	No	15	0	100	4	261.36	0	CE	Not Protected
Swartland Granite Renosterveld	8059.16	1951.89	1951.89	26	2095.38	35.64	No	93	2	100	24	1208.87	0	CE	Hardly Protected
Swartland Shale Renosterveld	46712.40	4019.33	4018.76	26	12145.22	408.13	No	33	3	100	9	7006.86	0	CE	Hardly Protected
Swartland Silcrete Renosterveld	1066.65	188.43	188.43	26	277.33	0.00	No	68	0	100	18	160.00	0	CE	Not Protected
Western Shaleband Vegetation	328.59	328.57	328.57	30	98.58	31.11	Yes	333	32	100	100	49.29	0	LT	Poorly Protected
	244749.59	97232.12	85925.67		68622.40	29935.65						36712.44			

12.1.3 Table 11: City of Cape Town Nature Reserves and Conservation Areas: Visitor Use Zoning - Desired State* & Experiential Qualities

Experience	Zone	Desired State*	Conservation objectives	Secondary objective	Experiential Qualities	Activities	Interaction between users	Frequency of use	Group size	Sophistication and type of facilities	Primary user movement within the zone	Roads & footpaths	Equivalent Provincial zone
Close To Nature **Activities tend to be at landscape level**	**Primary conservation**	Natural or near-natural areas (or areas that can be rehabilitated to this state) that are managed primarily for biodiversity conservation. The experience is one of relative solitude and wildness. The nature of the experience is dependant on the quality of the natural environment. The main accent of management is biodiversity conservation and "Pack it in Pack it out" principles are applied to all activities including management. There may be some signs of infrastructure mainly of a heritage nature. In the longer term, unused utility infrastructure (e.g. reservoirs) should be phased out and the site rehabilitated.	Natural areas should be kept intact in order to protect habitat required to meet biodiversity targets for various vegetation types and to provide undisturbed habitat for a range of species. Where possible degraded areas should be rehabilitated.	Managed to provide visitor experiences in a way that does not impact on the biodiversity objective. Where appropriate heritage values are managed as required	Relative sense of isolation	Controlled access** Research and monitoring. Accompanied small groups. The size and frequency of groups to be specified for each reserve.	None or very low	None -Very low	Small	No new facilities. Existing structures should be phased out where appropriate. Heritage assets are managed where appropriate	Pedestrian access in accompanied small groups Motorised for essential management only.	Absolutely essential management tracks and footpaths in accordance with the foot path and road management plan Ongoing restoration of old paths/roads to be prioritized and monitored.	Quiet
	Conservation	Natural or near-natural areas (or areas that can be rehabilitated to this state) that are managed for biodiversity conservation. This zone provides experiences of a relative sense of relaxation in an environment that is openly exposed to the sights and sounds of the city. Although it is a place of quietness and naturalness, there will be more interaction between users than in the Primary Conservation Zone. The quality of the experience is less dependant on the quality of the natural environment.	Natural areas should be kept intact in order to protect habitat required to meet biodiversity targets for various vegetation types and to provide undisturbed habitat for a range of species. Where possible degraded areas should be rehabilitated.	Managed to provide visitor experiences in a way that does not impact on the biodiversity objective.	Relaxation	Self guided hiking, non-motorised access***, bird watching, etc. In reserves where access to water bodies is allowed, this area is limited to non-motorized vessels only in accordance with the Vlei By-Laws.	Moderate	Moderate	Small	Low impact, eco-friendly facilities that facilitate ecologically sustainable activities and visitor experiences may be permitted under certain circumstances. These are strictly for achieving the social and development objectives of the reserve where appropriate and are subject to a stringent internal approval process and must be inline with an approved reserve management plan.	Pedestrian Non motorised Motorised access for management only.	Management tracks/roads and footpaths. Minimal footpath construction to prevent ecological damage. Boardwalks may be permitted where appropriate to protect sensitive areas. The footpath system should be designed so as to control access into the Primary Conservation zone. Off road wheelchair access may be provided where appropriate.	
Outdoor Natural Experience **Activities tend to be at precinct level**	**Low Intensity leisure**	Natural, near-natural or managed landscapes which are primarily managed to promote recreational and educational objectives. The main accent is on recreational activities which are more reliant on the quality of the facilities provided than in a Conservation Zone. By their nature these zones are placed in more transformed landscapes. Interaction and socialisation are an integral part of the experience.	Although some areas will be impacted by a range of activities and limited infrastructure, most areas should be kept largely intact and ecological processes should remain functioning. Where possible degraded areas should be rehabilitated.	Recreation and education Managed to provide a largely natural outdoor area to support the recreational and education objectives of the reserve.	Socialisation	Walking, non-motorised access, bird watching. In reserves where access to water bodies is allowed, motorized vessels are only allowed under strict control (e.g. no waterskiing, low speed limits and wake-free zones) in accordance with the Vlei By-Laws.	Frequent	Moderate -high	Small-moderate	Low-Medium impact, eco-friendly facilities that facilitate ecologically sustainable activities and visitor experiences. E.g. Benches, bird hides, informative signage, lookouts. Parking for access to this and other zones.	Pedestrian Non motorised Motorised access for management only	Appropriate foot paths with directional signage Boardwalks should facilitate access and protect sensitive areas. Normal wheelchair access where appropriate Parking with no facilities for access to this and other zones	Low intensity leisure
	High Intensity Use	High use landscapes, which are often largely transformed, which are managed largely to support visitor activities more dependent on facilities, education and administrative functions of reserves. High intensity visitor facilities with modern commercialised amenities with very concentrated, activities. The quality of the visitor experience is heavily dependant of the quality of the facilities which enable the visitor to experience the environment with a minimum of effort. Due to the high impacts these are concentrated at specific nodes. These nodes are generally situated at existing facilities including historic buildings and precincts. The main focus of management is to ensure a high quality visitor experience whilst ensuring that the activities have a minimal impact on the surrounding environment and that heritage	The activities and infrastructure in these areas should be managed to minimize impacts on biodiversity and visitor experience in other zones. Where feasible, non-crucial infrastructure should over time be removed from the reserve and the sites rehabilitated.	Facilities are managed to facilitate and promote appropriate visitor activities and educational use of the reserve. Administration; provides appropriate management infrastructure to facilitate other objectives of the reserve.	Entertainment	Events, self guided walks, wheelchair accessible trails, parking, picnicking. In reserves where access to water bodies is allowed, this area is appropriate for high intensity uses such as power boating and waterskiing in accordance with the Vlei By-Laws.	Very frequent	Very high	Small - Large	Picnic areas, parking areas, restaurants, information centers, ablutions, environmental education facilities, nurseries etc. Provides parking from which pedestrian access is gained to other zones.	Motorised Access People movers & Pedestrian access	Access roads and associated parking. Footpaths constructed to a higher standard for the comfort of the user. Design standards to be set in the footpath and road management plan Wheelchair access encouraged in this zone.	High Intensity Leisure

		resources are respected and celebrated.											
Site Specific Level	**Utility zone**	Area used for utility functions such as bulk water provision, landfill sites within the protected /conservation areas etc.	The activities and infrastructure in these areas should be managed to minimize impacts on biodiversity and visitor experience in other zones. Where feasible, non-crucial infrastructure should over time be removed from the reserve and the sites rehabilitated.	Administration Conservation where appropriate	Utility	Determined at site	Determined at site	Determined at site	Determined at site	Determined at site	Determined at site level	Access roads and associated parking as required by the Utility Function	

* Note. The "Desired State" is the long term objective of the zone and these desired conditions may not actually exist at the time of zoning. Achieving the" Desired State" will be informed by many factors and may only be reached after many years.

** Accompanied access refers to controlled access. The level and type of control is determined at reserve level.

*** Non-motorised access refers to mountain bikes, horses, paragliding etc. These activities are reserve specific and reference must be made to the reserve management plan for a list of acceptable activities per reserve.

Appendix 9: Security Audit

CITY OF CAPE TOWN

BIODIVERSITY MANAGEMENT BRANCH

Executive Brief

Comprehensive Security Audit of the Biodiversity Management Branch of the City of Cape Town

MARCH 2010

Project Order No.: **4501377564**

Project Manager:

Bongani Mnisi

Biodiversity Management Branch

Area Manager: Northern District

Tel: 021 – 5144164

Fax: 021 – 5111951

Cell: 0835917791

E-mail: bongani.mnisi@capetown.gov.za

Lead Consultant	**Conservation Management Consultant**	**Technology Consultant**
Jan Phelan	**Harold Thornhill**	**Jens von Fintel**
Plan-It	**Thorn-Ex**	**Titan Security**
Tel: 033 - 3302948	Tel: 033 - 3431814	Tel: 033 - 3943776
Fax: 033 - 3302948	Fax: 088 - 0333431819	Cell: 5762406
Cell: 082 - 8760003	Cell: 0824618043	E-mail: jens@titantech.co.za
E-Mail: mwplanit@mweb.co.za	E-mail: thornhillh@thorn-ex.co.za	

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13 INTRODUCTION

The City of Cape Town' Biodiversity Management Branch, in wishing to ensure the safety of visitors and staff, requested assistance on conducting a security audit of all (25) its managed (and envisaged) Nature Reserves.

The need was based on the following assumptions:

- That the areas are poorly managed
- Security Agencies are inefficient in their operations
- The lack of tools to measure management effectiveness
- Safety and security of visitors as well as that of personnel are threatened.

Plan-It, in collaboration with Thorn-Ex and Titan Security, agreed to undertake the project. Owing to the budgetary constraints, it was agreed that the audit would encompass 12 priority Reserves, as selected by the Biodiversity Management Branch.

The following outcomes were proposed and accepted:

- A desktop exercise to evaluate existing information and identify gaps
- A physical Audit of the listed facilities
- Consultation with public user groups
- Recommendations in respect of security technology and infrastructure
- A comprehensive report on all findings
- A basic entry level conservation security training session for staff

The project was to be completed by the end of April 2010.

14 APPROACH

The focus was to be on the safety and security of staff working in the different reserves, of visitors to theses reserves and of the biodiversity within the reserves.

The audit was to involve the reserve managers, site managers and any other staff the Biodiversity Management Branch deemed necessary to provide information for the audit.

The Project commenced with the Branch being approached to supply maps of each reserve with as much information as possible on all types of infrastructure, bio-physiographic information etc e.g. boundaries of reserves and kind of fence along these, access points, roads, tracks, paths, power lines, telephone lines, buildings, cell phone towers, masts, aerials, bridges, streams, rivers, contours, vegetation, adjacent land use, habitation or settlements in close proximity.

Questionnaires were then drawn up and sent to all the Reserve Managers as well as separate questionnaires which were sent to the various public interest groups, via the Reserve Managers.

Upon receipt of the above the project team drafted a preliminary working document to guide and focus the audit.

The audit commenced on the 15th of February 2010 with a workshop with the various Managers and a presentation of the findings from the questionnaires to the Biodiversity Branch.

The audits commenced on the 16th of February 2010 with a visit to each Reserve..

During each audit the manager and staff were interviewed and a physical inspection of infrastructure was conducted. The audits focused on existing security systems, security infrastructure, activities, incidents, job descriptions, training and manpower

In addition to the audits workshops were scheduled, via the Reserve Manager with relevant external safety and security institutions and public interest groups. The workshops were then held with various District and Reserve-specific public interest groups.

On conclusion of the audit phase, the security technology specialist visited the Reserves to inspect the systems and infrastructure in place at each reserve. Based on and with reference to the initial draft Audit Report, the specialist undertook an assessment of technology short-comings in order to arrive at feasible recommendations for practicable improvements.

The completed report was then circulated to all the Reserve Managers as a Draft Report for comment, prior to the Final Comprehensive Report incorporating such comment being presented to the Branch.

The Project was then concluded with a basic entry level security training session for nominated staff covering aspects such as:

- Information gathering and reporting
- Patrol structuring, planning and safety
- Preparedness and response
- Handling of transgressors (armed or un-armed)
- Incident handling
- Charge office procedures
- Evidence and Statements
- Record keeping and dossier development

15 EXECUTIVE SUMMARY

A safety and security audit was carried out on twelve Reserves under the jurisdiction of the Biodiversity Branch of the Directorate Environmental Resource Management.

The Audit was aimed at doing a rapid and verifiable analysis of the current security situation, security services, infrastructure, staffing, and social contexts. The information allowed for a “threat” level to be determined for each reserve.

Information acquired through a questionnaire survey with the Reserve Mangers, and information provided by the Branch was used as a baseline to guide and provide focus for the individual Reserve audits.

The Audits very quickly revealed that the location of the various reserves with their own unique social contexts primarily dictated the level of threat of each Reserve.

Some Reserves perceived as being “dangerous” were found to be “safe” with very low key incidents actually occurring. Although social ills do tend to spill over into Reserves the occurrence thereof is very localised and relate to prostitution, substance abuse, theft and illegal plant harvesting for the muti trade.

General security observations revealed that any metal infrastructure or equipment and solar panels are at greatest risk and are stolen on a regular basis. Trespassing, vagrants traversing the reserves and the harvesting of plants for the commercial flower industry and commercially driven herbal medicine /”muthi” industry are linked to an associated threat to staff and visitors. However incidents of visitors and staff being accosted by vagrants are rare.

Security activities were generally viewed as an add-on function when incidents are reported, with some Reserve Managers and Field staff trying to fit security patrols and activities into their management work schedule. The Visitor Controller Officers, on the other hand are essentially Access Control Officers who may be called on to perform some Law Enforcement function if their training enables them to do so. However staff does carry out combined operations with Law Enforcement bodies like Marine and Coastal Management, SAPS or City Law Enforcement when activities in the vicinity of the reserves warrant this in the interests of conservation.

One of the most evident security shortcomings found was that Reserves were “abandoned”, for all practical purposes, after hours, on weekends and on public holidays.

The investigation also found that very few Reserves actively patrol the Reserve and fences on a regular basis.

The Findings of each audit, including the responses received form the public interest groups were used to determine the threat level of each Reserve. The threat levels are based on a combination of factors which may affect security to the reserve, its staff and visitors as well as these threats in relation to other reserves.

The threat levels low, medium, and high reflects the safety threat to visitors, staff, and infrastructure. Further to which the threat level provides an indication in respect of intervention priority (staffing, infrastructure, equipment).

The results were as follow:

Reserve	Threat Level	Threat	Primary Cause
Witzands ACA	Medium	Illegal Access / Trespassing	Lack of fencing
Blaauwberg CA	Medium	Illegal Access / Trespassing	Lack of coverage
Rietvlei WR	Low	Illegal Access / Trespassing	Lack of coverage
Durbanville NR	Low	Theft	Lack of presence
Bracken NR	Low	Trespassing	Lack of coverage
Tygerberg NR	High	Trespassing / poaching	Lack coverage
Zandvlei NR	Low	Illegal Access / Trespassing	State of infrastructure
Falls Bay EP	High	Violent crime	Lack of fencing /coverage
Edith Stephens WP	Low	Theft	Lack of fencing
Wolfgat & Macassar NR	Severe	Violent crime	Location & Social
Kogelberg NR	Medium	Illegal Access / Trespassing	Extent / coverage
Helderberg NR	Low	Illegal Access / Trespassing	Lack coverage

Understaffing and poor or non-existent boundaries were found to be the primary cause of compromised Reserve security. The provision of “feet on the ground” or a management presence is therefore viewed as the first step towards improving the current situation.

The Investigation did conclude that technology solution options entailed fairly low key equipment such as Day-Night or Peak Inversion monitoring cameras, basic building alarm systems, external building detection beams, lighting, etc.

Infrastructure requirements were predominantly in respect of fencing.

Fencing is not always the preferred solution for safeguarding and demarcating an urban Reserve. However, it is suggested that failure to demarcate the boundaries of a Reserve compromises the authority’s ability to manage a designated area and severely limits the authority’s ability to prosecute transgressors. Simple in-expensive measures such as signage and markers will greatly aid in addressing these matters.

The relative “newness” of the Branch was found create various generic management challenges which negatively affect the efficiency and effective of Reserve management.

The aforesaid institutional matters included:

- Lack in consistency of staff designations
- Lack of consistency in functional content (job descriptions)
- Lack of career pathing and skills development program
- Lack of measurable performance standards
- Lack of training and capacity building
- Lack of uniform operational procedures and protocols
- Un-clear performance objectives of Advisory Boards
- Jurisdictional uncertainties in respect of cooperation with other environmental law enforcement agencies
- Lack of memorandums of Understanding with Utility Service Branches active in Reserves

The apparent absence of a clear and definitive Branch Policy on Reserve Safety and Security was viewed as a contributing shortcoming. Further to which, no consistency was found in respect of operational procedures or protocols. Some stations had a Management Plan whilst others were still going to develop such plans. Some stations had developed their own safety procedures.

In respect of Procedures and Protocols it is suggested that the Biodiversity branch consider the developing the following procedures and protocols;

- Incident response (poaching, trespassing, theft, fire, attack, medical emergency, land invasion, pollution, un-wanted pets)
- Reserve patrols
- Fence and gate security
- Visitor control

It is suggested that the above procedures and protocols be developed in conjunction with an auditable reserve management system which is linked to the personnel and finance performance requirements. It is also recommended that the Branch conduct an Institutional “Governance Audit” to guide the above protocols, relationships with other government institutions and law enforcement bodies as well as the Branch’s legal obligations.

Consultation with public interest groups and reserve managers highlighted the benefits of “friend” groups. Some stations financial ability and conservation maintenance activities were greatly enhanced by such “friends” groups. Further to which, the social role that urban reserves play as “safe areas” for people to walk their pets, have picnics or conduct social functions was highlighted at several public meetings. It was also mentioned that in some areas where “gang turf” issues were dominant the reserves were viewed as “neutral” territories.

Advisory Boards are a requirement in terms of reserves proclaimed under the Protected Areas Act although no clarity could be defined with respect to the extent, role and responsibilities of the various Reserves Advisory Boards. Some Reserves indicated that they played an active role whilst others were not aware of their existence. The development of clear responsibilities and objectives for each Board is viewed as imperative to contributing to the achievement of the Reserve objectives whilst providing a formal link to neighbouring communities and local government.

Most Reserves have other City Utility Departments executing functions within the Reserve, share boundaries with them, or manage large tracts of land under their jurisdiction. None of the Reserves were aware of any Memorandums of Understanding which clarify joint management matters. This was viewed as institutional shortcoming requiring attention at higher level.

A variety of Security Service providers render various levels of security to Reserves. These services vary from private security firms providing uniformed guards to provide a static or gate control service to services where such guards are used as Bushrangers. It was the investigation's conclusion that each District or Reserve negotiates their own contract conditions with such service providers, a situation which does not contribute to clear and measurable security service provisioning.

The City Law Enforcement Services and structures were generally viewed as not being able to respond to conservation related incidents. Only a few Reserves reported adequate responses to call-outs or incidents with most Reserves saying they rely on the local SAPS for assistance.

Reserves which have installed alarm systems linked to the City Law Enforcement Control Rooms, reported that in the event of alarm activation the Reserve manager is phoned to investigate. No direct service benefit could be found in respect City Law Enforcement.

What was most evident during the investigation was the risk posed by staff acting outside their areas of jurisdiction. These transgressions are not through ill intent and staff is not necessarily aware that they are exceeding their authority. Urgent attention should be paid to the authority necessary for the role staff plays in enforcing provincial conservation laws, fisheries laws, and National laws. This should be done in cognisance of the criminal Procedures Act. It is further suggested that cooperation agreements and execution delegations be formalised with other environmental and conservation agencies.

Due to several reserves having a coastal boundary and the ever present activities of highly organised and dangerous Abalone poaching gangs the involvement of staff in curbing these activities need to clearly defined and coordinated. It is suggested that this should be the preserve of a highly trained and well equipped District based Law Enforcement Component conducting their duties in collaboration with other authorities and with the necessary jurisdiction.

It is the opinion of this investigation team that the establishment of a District based Law Enforcement Component will greatly contribute in addressing some of the security shortcomings highlighted. In addition, such a component will also alleviate some of the external enforcement requirements placed on Reserve staff thus allowing them to focus on reserve management and security.

16 CONCLUSION AND GENERIC RECOMENDATIONS

The audit results correlated closely with the location and management capacity of each Reserve. High concentrations of un-employed people living in dense informal settlements adjacent to reserves do pose a greater risk to the Reserves. Staff was found to be more exposed to violent crimes in such circumstances than those located in rural or medium to high income areas.

Although social ills do tend to spill over into Reserves the occurrence thereof is very localised and relates to prostitution, substance abuse, theft and illegal plant harvesting for the muti trade.

The Findings of each audit, including the responses received form the public interest groups were used to determine the threat level of each Reserve.

The threat levels low, medium, and high reflects the safety threat to visitors, staff, and infrastructure. Further to which the threat level provides an indication in respect intervention priority (staffing, infrastructure, equipment).

The results were as follow:

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Helderberg NR	Low	Illegal Access / Trespassing	Lack coverage

Understaffing and poor or non-existent boundaries were found to be the primary cause of compromised Reserve security. The provision of “feet on the ground” or a management presence is therefore viewed as the first step towards improving the current situation.

The Investigation did conclude that technology solutions entail fairly low key equipment such as Day-Night or Peak Inversion monitoring cameras, basic building alarm systems, external building detection beams, lighting, etc.

Infrastructure requirements were predominantly in respect of fencing.

Fencing is not always the preferred solution for safeguarding and demarcating an urban Reserve. However, it is suggested that failure to demarcate the boundaries of a Reserve compromises the authority’s ability to manage a designated area and severely limits the authority’s ability to prosecute transgressors. Simple in-expensive measures such as signage and markers will greatly aid in addressing these matters.

In areas where fencing is vandalised on a regular basis the use of electric fencing (long distances, or Diamond Razor Mesh (short distances) is recommended. However it is recommended that spring-steel barb wire be used in all other instances.

The relative “newness” of the Branch was found to create various generic management challenges which negatively affect the efficiency and effective of Reserve management.

The apparent absence of a clear and definitive Branch Policy on Reserve Safety and Security was viewed as a contributing shortcoming.

A great inconsistency was found in staff designations, with some staff fulfilling similar conservation functions being called Conservation Officers whilst other were called Site Managers or Assistant Managers. The same problem was evident within the junior staff ranks. On some stations “labourers” conducted similar duties to those of Bushrangers.

The appointment and use of Contract staff was found to be a management challenge to most Reserves. Contract staff are generally employed by an external service provider whilst The Branch is responsible for the day to day management of said staff including the provision of uniforms and training. The opinion is held that the cost of these services could very well be such that the Branch could employ these contract staff directly to a greater benefit.

Several instances were found of junior staff being employed for several years as “Small Plant operators” or “Foreman” and having developed a keen interest and expertise in various conservation matters. The provision of career pathing opportunities to staff will not only contribute to the goals of the Branch but also provide an incentive to junior staff.

No evidence was found of a clear skills development program for officers and the impression was created that each officer arranges and sees to his or her own training. This was especially evident with some officers having been trained as Peace officers and appointed whilst others had been trained but not appointed and some still needed to be trained. Some Officers were also expressing the need to be appointed as Fisheries Officers whilst other believed they should be trained and appointed as Environmental Inspectors.

Most reserves had Conservation Students and Interns fulfilling a variety of roles and responsibilities, in some instances un-paid. The rotation of Students and interns was thought to be a good means of exposing them to various experiences and opportunities.

The investigation also found that most staff lacked basic equipment such as binoculars, handcuffs, batons or mace thereby limiting their ability to execute their duties.

The apparent lack of a dress code was viewed as a factor which contributed to the public's sense of security or respect when coming into contact with officers. The wearing of T-shirts, overalls, or golf shirts should not be promoted whilst on duty in the public eye.

No consistency was found in respect of operational procedures or protocols. Some stations had a Management Plan whilst others were still going to develop such plans. Some stations had developed their own safety procedures.

One of the most evident security shortcomings found was that Reserves were "abandoned", for all practical purposes, after hours, on weekends and on public holidays. It is understood that staff work standard working hours. However, the provision of accommodation, which most Reserves have, to either Site managers or Bushrangers are seen as a simple cost effective measure. Where there are operational staff resident on the Reserves (mostly students) it acts as a definite deterrent to illegal activities. Staff stationed on Reserves can then work on a "conservation standard" shift schedule of 20 days on 5 days off.

The investigation also found that very few Reserves actively patrol the Reserve and fences on a regular basis. Although staff shortage is a contributing factor, careful planning and allocation of available resources will ensure that Reserves are patrolled on a regular basis. It is further suggested that the sharing of resources between Reserves will allow for more frequent patrols.

With regard to Procedures and Protocols it is suggested that the Biodiversity branch consider developing the following;

- Incident response (poaching, trespassing, theft, fire, attack, medical emergency, land invasion, pollution, un-wanted pets)
- Reserve patrols
- Fence and gate security
- Visitor control

It is suggested that the above procedures and protocols be developed in conjunction with an auditable Reserve management system which includes a personnel and finance performance aspect.

Consultation with public interest groups and reserve managers highlighted the benefits of “friend” groups. Some stations’ financial ability and conservation maintenance activities were greatly enhanced by such “friends” groups. It is accepted that not all Reserves have the opportunity to have well capacitated “friends”. However, the neighbouring community’s sense of ownership was found to be a primary contributor to a Reserves state of security.

Further to which the social role that urban reserves play as “safe areas” for people to walk their pets, have picnics or conduct social functions was highlighted at several public meetings. It was also mentioned that in some areas where “gang turf” issues was dominant the reserves were viewed as “neutral” territories.

Advisory Boards are a requirement in terms of reserves proclaimed under the Protected Areas Act. The aim of which is to allow participation by interested parties and to ensure their continual engagement. With regard to reserves not yet proclaimed under the Protected Areas Act but which have Advisory Boards their role is much the same with the possible addition of raising and allocation of funds. This investigation could not clearly define the extent, role and responsibilities of the various Reserves Advisory Boards. Some Reserves indicated that they played an active role whilst others were not aware of their existence. The development of a clear responsibilities and objectives for each Board is viewed as imperative to contributing to the achievement of the Reserve objectives whilst providing a formal link to neighbouring communities and local government.

The removal of Spare tyres from Reserve vehicles by the Transport Sections should be halted as it poses a significant risk to staff operating in remote areas or providing law enforcement services.

Most Reserves have other City Utility Departments executing functions within the Reserve, share boundaries with them, or manage large tracts of land under their jurisdiction. None of the Reserves were aware of any Memorandums of Understanding which clarify joint management matters. This was viewed as institutional shortcoming requiring attention at higher level.

A variety of Security Service providers render various levels of security to Reserves. These services vary from private security firms providing uniformed guards to providing a static or gate control service to services where such guards are used as Bushrangers. It was the investigations conclusion that each District or Reserve negotiates their own contract conditions with such service providers, a situation which does not contribute to clear and measurable security service provisioning.

The City Law Enforcement Services and structures were generally viewed as not being able to respond to conservation related incidents. Only a few Reserves reported adequate responses to call-outs or incidents with moth Reserves saying they rely on the local SAPS for assistance.

Reserves which have installed alarm systems linked to the City Law Enforcement Control Rooms, reported that in the event of an alarm activation, the Reserve manager is phoned to investigate. No direct service benefit could be found in respect of City Law Enforcement.

What was most evident during the investigation was the risk posed by staff acting outside their areas of jurisdiction. These transgressions are not through ill intent and staff are not necessarily aware that they are exceeding their authority. Urgent attention should be paid to necessary authority and the role staff play in enforcing provincial conservation laws, fisheries laws, and National laws. This should be done in cognisance of the criminal Procedures Act. It is further suggested that cooperation agreements and execution delegations be formalised with other environmental and conservation agencies.

Due to several reserves having a coastal boundary and the ever present activities of highly organised and dangerous Abalone poaching gangs, the involvement of staff in curbing these activities need to be clearly defined and coordinated. It is the opinion of this team that this should be the preserve of a highly trained and well equipped District based Law Enforcement Component conducting their duties in collaboration with other authorities and with the necessary jurisdiction.

It is the opinion of this investigation team that the establishment of a District based Law Enforcement Component will greatly contribute in addressing some of the security shortcomings highlighted. In addition, such a component will also alleviate some of the external enforcement requirements placed on Reserve staff thus allowing them to focus on reserve management and security. The current practice of Law enforcement staff working a daily night shift is questioned as no evidence could be found on its effectiveness. It is suggested that through information gathering, coordination with other authorities and planning, such nightly activities could take place on a sporadic basis with much greater successes.

The investigation team was also of opinion that the management requirements of the various Reserves need to be included in the Municipal Spatial Development Framework so as to ensure that the Reserve - Neighbourhood interface receive adequate attention.

17 SUMMARY OF RECOMMENDATIONS

INSTITUTIONAL		
Aspect	**Issue**	**Recommendation**
Governance	1. Relationship with other National & Provincial Conservation/Environmental institutions 2. Relationship with other City Institutions 3. Obligations in respect of By-laws, Municipal Systems Act (2000) and the Municipal Finance Management Act (2003) 4. Working agreements with other Utility Services	1. Conduct Institutional Governance Audit 2. Draft MOU's
Policy & Procedures	1. Management Policies, Goals, Objectives 2. Operational Procedures &Protocols	1. Develop management Policies Goals & Objectives 2. Develop Procedures and Protocols
Management	1. Consistency in personnel designations 2. Consistency in personnel functional content 3. Career pathing 4. Skills development 5. Reserve Management Standards	1. Develop consistent Job Descriptions 2. Develop Skills Development and career pathing Protocol 3. Develop Auditable Reserve Management System linked to Personnel & Financial Performance Management System

Reserve	Additional Staffing	Security and Equipment	Infrastructure
NORTH			
Witzands	1. 3x Bushrangers 2. Small labor team 3. Staff must be trained in 4 wheel driving 4. Officers appointed as Peace Officers	1. Establish a MOU with Bulk Water 2. Replace damaged fences 3. Monitor Wood cutter activities 4. Permits must contain more information 5. Reserve map required 6. Curb illegal access 7. Regular perimeter patrols.	1. 4x4 vehicle in good condition 2. Office Trellidor and burglar bars 3. Demarcation of boundaries 4. Erect signage 5. Electric fence along north and north-eastern boundary 6. Basic staff equipment
Blaauwberg	6. 6x Bushrangers (2 x3-member teams) 7. 2 x Permanent Visitor Controller Off's 8. Officers appointed as Peace Officers 9. Station District Law Enforcement Component	4. Staff be appointed as Peace Officers 5. Law Enforcement Component duties expanded to cover "hot spots" in district. 6. Daily night shifts limited to conduct patrols across district and do ad hoc night time	1. Link present alarm system to security service provider. 2. Mount Day-Night camera to cover main resort area. 3. Active Monitor to monitor activities during peak periods. 4. Erect signage 5. Basic staff equipment
Rietvlei	1. 2 x Bushrangers 2. Officers appointed as Peace Officers	1. Regular perimeter patrols 2. Co-ordinate with MCM	1. Fence along R27 road. 2. Alarm systems at new facilities 3. Peak Inversion camera with recording facility for main gate 4. Fence open residential property boundaries 5. Patrol boat 6. Basic staff equipment

CENTRAL			
Bracken	1. 1x EE Officer/Community Officer. 2. 1x Labourer	1. Visible patrols 2. Liaison with Everite Hostel.	1. Ablutions at gate 2. Day-night camera for main access area. 3. Removal of derelict buildings 4. Guard monitoring 5. Clear alien vegetation along fences 6. Basic staff equipment
Durbanville	1. 2x Visitor Controller Officers 2. Officers appointed as Peace Officers	1. Boundary fence cleared of vegetation 2. Erect signage iro handling of unwanted pets	1. Steel gate at offices to be kept locked, and fitted with buzzer and solenoid access control 2. Video monitor for door 3. Service counter inside front door 4. Alarm system to include response 5. Long-range mobile panic buttons 6. Lighting at offices and main gate 7. Peak Inversion camera for main gate 8. Guard Monitoring system 9. Basic staff equipment
Tygerberg	1. Employ current 3 Contract Bushrangers 2. 2x Bushrangers 3. 1x Site Manager 4. 1x Foreman 5. 5x Llabourers 6. 1x Additional EE Officer/Community Liaison 7. 2x Visitor Controller Officers 8. Officers appointed as Peace Officers 9. Station District Law Enforcement	1. Attend Community Police Forum and Crime Watch meetings. 2. Bushrangers obtain drivers licenses 3. Staff presence over week-ends and after hours 4. All gate remotes currently issued be recovered immediately and re-issued under a new access signal code 5. Keys handed out should be retrieved and locks	1. Replace existing camera at main entrance gate with a Peak Inversion camera with recording facility 2. Present cameras be replaced with Day-Night cameras. 3. Plattekloof and Quarry area be re-fenced with electric fence 4. Perimeter road should be constructed where feasible 5. Flatrap razer coils installed on top of all fences and along bottom of select fences 6. Accommodation for Bushranger teams 7. Installation of trigger operated floodlight in darker area of parking 8. Additional mountain bike 9. Basic staff equipment

	Component	changed. 6. Kanonberg be afforded controlled access in the event of a fire.	
SOUTH			
Zandvlei	1. 3x Visitor Controller Officers 2. 3x Bushrangers 3. 4x Labourers 4. Officers appointed as Peace Officers	1. Cease involvement in public amenity facilities on eastern side 2. Formal gate control required during open hours 3. Formalise relationship with Mountain Men Security Services 4. Evening security at offices by private security service provider 5. Introduce ad hoc evening patrols 6. Formalise co-operation with Marine and Coastal Management regarding control at the estuary.	1. Northern access well designated and controlled access point 2. Signage at the entrance, parking areas & along the water 3. Re-fence office area with Diamond Razor Mesh 4. Provide appropriate security lighting 5. Replaced northern and western fence with Diamond Razor Mesh fence 6. New offices need to be completed & fitted with monitored alarm system and BX Outdoor Beams 7. Guard Monitoring system 8. Motorized boat 9. Basic staff equipment
False Bay	1. 9x Bushrangers 2. 4x Static Guards 3. Officers appointed as Peace Officers 4. Station District Law Enforcement Component	1. Regular patrols supported 2. Bushrangers and Visitor Control officers should be circulated & deployed to cover peak periods of public use within the Park. 3. Change permanent night shift to a planned basis during periods of specific risk or in response to specific incidents	1. Establish two or three Bushranger bases 2. Re-fence southern and eastern boundary electric fence 3. Motorised patrol 4. 2x Quad 5. Install Guard Patrol Monitoring system 6. Fence Rondevlei offices and EE Centre with Diamond Razor Mesh Install additional trigger 7. Install flood lights at all facilities 8. Day-Night camera to Rondevlei Viewing Tower for office and entrance area 9. Upgrade all existing cameras to Day-Night cameras with recording 10. Additional cameras for Zeekoevlei entrance gate and new office complex 11. Buildings should be alarmed with a siren and linked to a security service provider

		4. Co-ordinate night activities with other law enforcement bodies 5. Visitor Controller Officers patrol Zeekoevlei picnic area during peak periods.	12. Buildings which do not have security staff at night should be fitted with BX80 13. Erect signage 14. Basic staff equipment
Edith Stephens	1. Replace "small plant operator" with a fence maintenance post.	1. The reserve fence needs to be patrolled daily or at least twice a week 2. Walk-in access should be controlled and documented at the gate 3. Office gate should remain locked	1. Northern and southern fences must be replaced with Razor Diamond Mesh be considered or electric fence using spring steel wire 2. Management track should be created along the fence 3. Basic staff equipment
EAST			
Wolfgat & Macassar	1. 8 x Bushrangers. 2. 3x District Law Enforcement Officers 3. 2 x Community Liaison Officers 5. Officers appointed as Peace Officers 6. Station District Law Enforcement Component	1. Weltevreeden office security system should include a response system 2. City employed private security with mobile support to patrol coastal road esp. parking areas 3. Investigate sand mining permits	1. Demarcate reserve using cement poles 2. Erect signage 3. Move Macassar Gate 4. Basic staff equipment
Kogelberg	1. 1x Visitor Controller Officer 2. 3x Bushrangers 3. Officers appointed as Peace Officers	1. Improve communication services	1. Construct Bushranger camp 2. Erect signage 3. Fence Erf 19 and north-west boundary using electric fence 4. Install alarm at all buildings 5. Install trigger lighting 6. Install depot fence at rear

			7. Install Reed Switches for solar panels 8. Peak Inversion Camera for entrance gate to depot 9. Basic staff equipment
Helderberg	1. 6 existing Labourers trained to level of Bushrangers 2. Officers appointed as Peace Officers	1. Develop system for evening monies 2. Regular perimeter patrols	1. Erect signage 2. Electric fence be retained 3. Peak Inversion camera at main gate 4. Day –Night camera to cover parking area 5. Basic staff equipment

18 COSTING

The equipment costing listed below are based on actual quotes provided.

Fencing:

Diamond Razor mesh fencing installed per 100m	R 440,00/meter
1,8m, 12 strand electric fencing installed at 100m (Au Alloy wire)	R 55,00/meter
12 Joule Nemtek energizer with built in fence monitor	R 3400,00 excl

Alarm Equipment:

To supply and install an 8-zone alarm Paradox alarm system complete with battery back-up, keypad, 15 watt siren, four internal infra red passives, two fixed panic buttons and two reed switches. Alarm system can be zone doubled to a 16 zone system.

R 3600,00 excl.

To supply and install one outdoor BX80 beam	R 1500,00 excl.

GSM 4 channel radio, programmed to four cellular phone numbers and linked to fence energizers, Alarm systems, Solar panels and standalone panic systems R 1800,00 excl

Long Range remote panic – one long range remote	R 250,00 excl.
Long Range receiver – installed	R 1100,00 excl.

Cameras:

To supply and install one gate camera – Peak inversion camera, auto-iris lens, 40m co-axial cable, power supply, 4-channel embedded digital recorder (250 G) hard drive and one 17 inch monitor. Price includes camera housing and installation R 11 900,00 excl.

To supply and install one day/night camera – Day/Night camera, auto-iris lens, 40m co-axial cable, power supply, 4-channel embedded digital recorder (250 G) hard drive and one 17 inch colour monitor. Price includes housing and installation R 12 900,00 excl.