



KNERSVLAKTE NATURE RESERVE

Protected Area Management Plan 2020 – 2030

DATE APPROVED: 05 March 2020

MOST RECENT UPDATE: 27 February 2020

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AUTHORISATIONS

In terms of section 41(4) the Member of Executive Council (MEC) hereby approves the Protected Area Management Plan for the Knersvlakte Nature Reserve designated as a Provincial Nature Reserve (See Table 2.1).

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Recommended:

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CHIEF EXECUTIVE OFFICER: CapeNature	Dr Razeena Omar		05/03/2020

Review Date: 10 years from the date of approval by the MEC.

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GLOSSARY

Derived from: Conservation Measures Partnership (2013).

Term	Explanation
Adaptive Management	The incorporation of a formal learning process into conservation action. Specifically, it is the integration of knowledge, management, and monitoring, to provide a framework to systematically test assumptions, promote learning, and supply timely information for management to make decisions and adjust actions based on outcomes of monitoring.
Factor	A generic term for an element of a conceptual model including direct and indirect threats, opportunities, and associated stakeholders. It is often advantageous to use this generic term since many factors – for example tourism – could be both a threat and an opportunity. Also known as root causes or drivers.
Focal Value	An element of biodiversity (natural value) or heritage (cultural value) of the protected area, which can be a species, habitat, ecological system, or heritage feature, that management strives to protect, and threats towards which management should strive to minimise. All focal conservation values at a site should collectively represent the biodiversity and heritage features of concern at the site.
Goal	A formal statement detailing a desired impact of a project, such as the desired future status of a target/value. A good goal meets the criteria of being linked to targets, impact oriented, measurable, time limited, and specific.
Indicator	A measurable entity related to a specific information need such as the status of a value / factor, change in a threat, or progress toward an objective. A good indicator meets the criteria of being: measurable, precise, consistent, and sensitive.
Key (Ecological) Attribute	An aspect of a focal value's biology or ecology that if present, define a healthy focal value and if missing or altered, would lead to the outright loss or extreme degradation of that focal value over time.
Objective	A formal statement detailing a desired outcome of a project such as reducing a critical threat. A good objective meets the criteria of being: results oriented, measurable, time limited, specific, and practical. If the project is well conceptualized and designed, realization of a project's objectives should lead to the fulfilment of the project's goals and ultimately its vision. Compare to vision and goal.
Results Chain	A graphical depiction of management's core assumptions, the logical sequence linking project strategies to one or more targets/values. In scientific terms, it lays out hypothesized causal relationships. A results chain is depiction of a 'theory of change', i.e. the state of the system after action.
Vision	A description of the desired long-term future or ultimate condition that stakeholders see and management strives to achieve for the protected area.
Heritage Resources	Means any place or object of cultural significance as per the HRA
Living Heritage	Means the intangible aspects of inherited culture, and may include - (a) cultural tradition; (b) oral history; (c) performance;

Term	Explanation
	(d) ritual; (e) popular memory; (f) skills and techniques; (g) indigenous knowledge systems; and (h) the holistic approach to nature, society and social relationships; in terms of the Heritage Resources Act.
Situation analysis	The purpose of a situation analysis is to understand the relationships between the biological environment and the social, economic, political, and institutional systems and drivers that affect the focal values of the protected area.

ACRONYMS AND ABBREVIATIONS

CMP	Conservation Measures Partnership
DEA	Department of Environmental Affairs
FEPA	Freshwater Ecosystem Priority Area
FTE	Fixed Term Employee
IDP	Integrated Development Plan
IUCN	International Union for Conservation of Nature
LHSTK	Leslie Hill Succulent Karoo Trust
MEC	Member of Executive Council
METT-SA	Management Effectiveness Tracking Tool - South Africa
MTEF	Medium Term Expenditure Framework
NEM: BA	National Environmental Management: Biodiversity Act
NEM: PAA	National Environmental Management: Protected Areas Act
NFEPA	National Freshwater Ecosystem Priority Area
NPAES	National Protected Area Expansion Strategy
PAAC	Protected Area Advisory Committee
SANBI	South Africa National Biodiversity Institute
SAPS	South African Police Service
SASSCAL	Southern African Science Service Centre for Climate Change and Adaptive Land Management
SDF	Spatial Development Framework
SG	Surveyor-General
WCDM	West Coast District Municipality
WCPAES	Western Cape Protected Area Expansion Strategy
WWF-SA	World Wide Fund for Nature – South Africa

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EXECUTIVE SUMMARY

In compliance with the National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) and Chapter 4 of the World Heritage Convention Act, 1999 (Act No. 49 of 1999), the management authority of a protected area is required to develop management plans for each of its protected areas.

Both the national minister and MEC in a particular province has concurrent jurisdiction to approve a management plan for a protected area submitted under section 39(2) of the National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003).

In developing the management plan for the Knersvlakte Nature Reserve, CapeNature as the management authority strives to establish biodiversity conservation as a foundation for a sustainable economy, providing ecosystem services, access and opportunities for all.

An Overview of the Knersvlakte Nature Reserve

The planning scope of the Knersvlakte Nature Reserve covers an area of 90 057 ha*, made up of 32 land portions, all (except one portion) of which was proclaimed as a nature reserve during 2014. All land parcels are owned by the World Wide Fund for Nature - South Africa and managed by CapeNature as part of a notarial lease and management agreement. The reserve falls within the Western Cape Province of South Africa, and is 20 km north of Vanrhynsdorp, approximately 320 km north of Cape Town. The reserve is in a state of development and not all land portions are currently consolidated.

The reserve falls within the winter-rainfall zone of South Africa, with hot, dry summers and mild winters. Temperatures are generally mild in winter but summer days are hot and dry. Mean annual rainfall is approximately 187 mm per annum. It is likely that the Knersvlakte will become hotter and drier as a result of climate change. The undulating plains of the Knersvlakte have a complex mosaic of quartz fields, exposed shale beds, dolomite outcrops, and red sand plumes. Highly conspicuous are the pebble-strewn quartz fields, characterised by a dense layer of white, angular quartz stones. The Succulent Karoo Biome is one of 25 internationally recognised biodiversity hotspots and is the world's only arid hotspot. Within the Succulent Karoo Biome there are four centres of endemism, of which the Knersvlakte Bioregion is one. The reserve harbours 10 vegetation units with a rich diversity of plants, notably miniature succulents; most of which are highly endemic and many of conservation concern. Apart from the plant and associated animal diversity, the area is also rich in cultural historical heritage.

The primary land use adjacent to the Knersvlakte Nature Reserve is agriculture, mainly small stock farming. A mix of commercial and communal land is in use around the reserve. Unemployment and poverty is a serious concern in the local municipality and the reserve strives to contribute to job creation and social upliftment within the region by employing and training additional staff through the various Expanded Public Works Programmes.

* As calculated from the CN_reserve_cadastre_2018.shp layer.

Planning, Policy, Implementation and Review

The Open Standards for the Practice of Conservation is a Strategic Adaptive Management framework that is robust, yet flexible, multi-disciplinary in approach, and inclusive of internal and external stakeholders, as well as the public at large. It enables management teams to develop effective conservation plans, based on the best available traditional, expert and scientific information. Furthermore it promotes stakeholder and public engagement throughout the planning and implementation phase of the management plan. Key to this process is identifying the ecological and human wellbeing values representative of the protected area, determining what state they are in, and what threats they face. This forms the basis for establishing clear goals, strategies and objectives that are time bound.

This management plan provides the basis for the management, development and operation of the Knersvlakte Nature Reserve over a timeframe of 10 years. The implementation of the management plan is subject to legislation, regulations, policies and guidelines to ensure and promote sound financial and biodiversity management, effective compliance, safety, good neighbour relations and to promote sustainable access to the reserve.

Fundamental to implementation is pursuing the achievement of conservation outcomes and regular review thereof. Strategic Adaptive Management integrates planning, management, and monitoring, and is used to systematically evaluate results, thus enabling management to “change direction” when required. Key to this process is the sharing of results, respectfully, honestly and transparently to facilitate learning through critical appraisal of conservation efforts. CapeNature uses an internationally recognised review system - The Management Effectiveness Tracking Tool for South Africa, adopted by the National Department of Environment, Forestry and Fisheries, to assess the management effectiveness of all of its protected areas at a strategic level. Additionally, mechanisms for monitoring and evaluation are built into each aspect highlighted in the strategic plan.

Purpose, Vision and Desired State

CapeNature manages the Knersvlakte Nature Reserve in accordance with its organisational vision, and in agreement with the vision, goals and strategies derived through the planning process. The vision of the reserve is:

“To protect, promote and enhance the unique landscape, succulent plant diversity, wildlife and cultural heritage of the arid Knersvlakte corridor, through partnership, and respect and care to benefit future generations.”

Protected area values include healthy catchments, providing ecosystem services and human wellbeing benefits. Six focal natural values that incorporate a number of nested aspects have been selected for the Knersvlakte Nature Reserve, these include:

1) Catchments 2) Connectivity 3) Quartz Vygieveld 4) Vlakte Vygieveld 5) Heritage 6) Ground and Surface Water.

As the public entity responsible for biodiversity conservation in the Western Cape Province, CapeNature delivers a suite of core services to the public in support of the following outcomes: resilient ecosystems; the promotion of local economic development, job creation and skills development; growing diversified nature-based revenue streams; access to environmental education, advocacy and education, and access to natural and cultural heritage. Seven focal human wellbeing values have been identified for the Knersvlakte Nature Reserve. These include:

1) History 2) Culture 3) Economic Development 4) Social Upliftment 5) Environmental Education and Awareness 6) Sustainable Natural Resource Use 7) Physical and Spiritual Health.

Thirteen goals have been formulated to maintain or enhance the focal values of the Knersvlakte Nature Reserve. An asterisk * indicates the availability of detailed information in section 5.

1. By 2030, the riparian vegetation composition of the Knersvlakte Nature Reserve catchments will comprise at least 99% indigenous species.
2. By 2030, a minimum of eight boreholes and thirteen earth dams will be functional* and appropriately* distributed throughout the Knersvlakte Nature Reserve.
3. By 2030, the integrity of nano-succulent populations within the Quartz Vygieveld, inside the Knersvlakte Nature Reserve, will be intact*.
4. By 2030, the integrity of Vlakte Vygieveld, inside the Knersvlakte Nature Reserve, will be intact*.
5. By 2030, all unnatural disturbances to heritage features within the Knersvlakte Nature Reserve are limited to maintain current conditions.
6. By 2030, at least three priority properties will have signed stewardship agreements and at least one priority property will be purchased and declared under the Protected Areas Act.
7. By 2030, male, female and juvenile Steenbok will be present throughout the Knersvlakte Nature Reserve.
8. By 2030, all infrastructure development applications within the Knersvlakte Nature Reserve, zone of influence, will be commented on in order to promote and maintain the Knersvlakte sense of place.
9. By 2030, the cultural identity and history of the Knersvlakte is locally available, known and appreciated.
10. By 2030, all Fixed Term Employees (FTEs) in the Knersvlakte Nature Reserve will receive quality functional* and life-skills* training interventions during their full* employment cycle.
11. By 2030, more than 50% of all visitor access to the Knersvlakte Nature Reserve will be issued under a permit.
12. By 2030, the Knersvlakte Nature Reserve environmental interpretation and awareness plan will promote all* ecological and human wellbeing values.

13. By 2030, the Knersvlakte Nature Reserve will provide and support job opportunities and in partnership with role players, contribute to economic development and social upliftment in and around the reserve.

Threats

Threats and contributing factors that degrade or destroy the Knersvlakte Nature Reserve focal values were identified and unpacked in a conceptual model to illustrate the current conservation situation and to guide the formulation of mitigating strategies. The following seven threats identified had a high and medium impact on the focal values of the reserve:

1) Lack of Available Water for Animals 2) Climate Change 3) Inappropriate Infrastructure Development 4) Protected Area Fragmentation 5) Mining and Prospecting 6) Invasive Alien Plants 7) Historical Farm Practices.

In order to assist the Knersvlakte Nature Reserve to mitigate and manage threats and contributing factors effectively, both inside and outside the reserve boundaries, the reserve will incorporate spatial planning tools which include the **Sensitivity, Zonation and Zone of Influence**.

Strategic Plan

A thorough analysis of the Knersvlakte Nature Reserve's conservation situation, inclusive of the biological, social, economic, cultural and institutional systems that affect the protected area's focal values, formed the basis for developing conservation strategies and action plans. The aim was to identify opportunities and strategic points where intervention is feasible and likely to have the biggest positive impact towards achieving goals. CapeNature will lead the implementation of the management plan, although achieving the reserve's vision requires coordinated effort between various key external stakeholders. Thirteen key strategies have been identified to assist the Knersvlakte Nature Reserve, these are:

Strategy 1: Ensure that natural resource use and access is in line with the CapeNature Natural Resource Utilisation policy and permit system.

Strategy 2: Facilitate the compilation and public promotion of the diverse Knersvlakte history and cultural heritage.

Strategy 3: Develop and implement an integrated environmental education and awareness programme aimed at neighbours, resource users, school groups and visitors to nurture respect and care for the values of the Knersvlakte Nature Reserve.

Strategy 4: Contribute to economic and social development by providing jobs, training and work opportunities to staff, contractors and small, medium and micro enterprises.

Strategy 5: Develop and implement a comprehensive Concept Development Framework to guide infrastructure development, access, tourism and non-consumptive utilisation to safeguard biodiversity and enhance human wellbeing benefits.

Strategy 6: Develop and implement a water resource management plan for the Knersvlakte Nature Reserve.

Strategy 7: Through partnerships, promote and facilitate pro-active law enforcement and compliance within the Knersvlakte.

Strategy 8: Assess and strengthen the capacity of the Knersvlakte Nature Reserve to effectively implement operational, ecological and compliance requirements.

Strategy 9: In partnership, facilitate Damage Causing Animal research within the Knersvlakte and encourage local farmers, associations and communities to form part of relevant knowledge and management initiatives.

Strategy 10: Develop and implement a restoration plan for the Knersvlakte Nature Reserve.

Strategy 11: In partnership, develop and implement a heritage resource management plan for the Knersvlakte Nature Reserve.

Strategy 12: In partnership, re-evaluate the expansion domain of the Knersvlakte Nature Reserve to facilitate protected area expansion and consolidation through stewardship, land purchases and state land transfer.

1 INTRODUCTION

In working towards CapeNature's vision of conserving nature for a sustainable future, CapeNature's protected area management, in accordance with the purpose of the protected area, strives to:

- Conserve and represent natural habitats and indigenous biodiversity including threatened species for their scientific and conservation value in the Western Cape Province;
- Conserve representative samples of significant ongoing ecological processes in the evolution and development of ecosystems and communities of plants and animals;
- Provide ecosystem services that benefit people of the Western Cape;
- Manage protected areas effectively and efficiently, including the interrelationships between biophysical, social and economic environments;
- Ensure that protected area planning and management is integrated and participatory; and
- Provide for sustainable use and equitable access.

The management plan is a Strategic Adaptive Management framework for the protected area, guided by the Open Standards for the Practice of Conservation (hereafter referred to as the Open Standards) (Conservation Measures Partnership (CMP) 2013) adaptive management paradigm. The Open Standards is dependent upon, and promotes stakeholder engagement and participatory planning in the development of the plan. The framework further stimulates the incorporation of mechanisms to facilitate stakeholder engagement and participation during operationalisation of the plan.

The Knersvlakte Nature Reserve protected area management plan serves as a reference to the management and development of the protected area in its current and envisaged future state. It directs management at all levels. The management plan addresses:

- The mandate, human capacity and financial resources that are required to meet goals and objectives based on the condition of natural and cultural values, and core service areas requiring a focused effort;
- The delivery of socio-economic benefits to neighbouring communities;
- Flexibility of service delivery that encourages innovation and involvement by a wide range of government, community and non-government sectors;
- Performance indicators and accountability measures that provides for regular review and adaptive management.

2 LEGAL STATUS AND BACKGROUND

This section provides a record of the legal status of the protected area, as well as its description, location and includes any areas designated by South Africa in terms of international agreements. Furthermore, it also provides an overview of the biophysical, biodiversity, heritage and socio-economic context.

2.1 Legal Status

2.1.1 Name and legal designations

The Knersvlakte Nature Reserve was established as a provincial nature reserve in terms of section 23(1) of the National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) (NEM: PAA), on 12 September 2014, Proclamation No. 10/2014, Provincial Gazette No. 7307.

The reserve currently comprises 32 land portions of which one portion (Uitspanrug) is in the process of declaration. A full list of the declarations and status of land appears in Table 2.1.

The spatial boundaries for the individual land parcels within the CapeNature reserves layers were extracted from the cadastral boundaries spatial layer provided by the Surveyor-General (SG) (Office of the Chief Surveyor-General, 2011). According to the Land Survey Act, 1997 (Act No. 8 of 1997), and The South African Spatial Data Infrastructure, established as per the Spatial Data Infrastructure Act (Act No. 54 of 2003), the Surveyor-General is the custodian of all cadastral surveying and land information.

Each land parcel boundary was verified against available proclamations and SG diagrams. Any differences between the SG cadastral boundaries and the proclaimed areas or the SG diagrams were corrected accordingly. The areas for each land parcel were calculated using a geographical information system with the projection set to Universal Transverse Mercator, zone 34 south.

Table 2.1: Land parcels and status that make up the Knersvlakte Nature Reserve.

Title Deed	Farm Name	Farm No.	Portion No.	Extent (ha)	Registration Division	SG Code	Landowner	Proc. Date	Proc. No.	Govt. Gazette	Status	Period (years)
T83351/1999	Moedverloren	208	Remainder	7473.70	Vanrhynsdorp	C0780000000 0020800000	WWF-SA	9 Sept 2014	10/2014	7307	Provincial	In Perpetuity
T124578/2004	Quagga Kop	213	Remainder	5969.19	Vanrhynsdorp	C0780000000 0021300000	WWF-SA	9 Sept 2014	10/2014	7307	Provincial	In Perpetuity
T124578/2004	Quagga Kop	214	N/A	43.29	Vanrhynsdorp	C0780000000 0021400000	WWF-SA	9 Sept 2014	10/2014	7307	Provincial	In Perpetuity
T124578/2004	Varsche Rivier Extension B	226	Remainder	3187.41	Vanrhynsdorp	C0780000000 0022600000	WWF-SA	9 Sept 2014	10/2014	7307	Provincial	In Perpetuity
T1383/2005	Wolvenest	212	Portion 2	128.27	Vanrhynsdorp	C0780000000 0021200002	WWF-SA	9 Sept 2014	10/2014	7307	Provincial	In Perpetuity
T12366/2005	Wolvenest	212	Portion 5	842.91	Vanrhynsdorp	C0780000000 0021200005	WWF-SA	9 Sept 2014	10/2014	7307	Provincial	In Perpetuity
T91740/2005	Zoutfontein	178	Portion 2	2553.42	Vanrhynsdorp	C0780000000 0017800002	WWF-SA	9 Sept 2014	10/2014	7307	Provincial	In Perpetuity
T95410/2005	Wolvenest	212	Remainder	3050.61	Vanrhynsdorp	C0780000000 0021200000	WWF-SA	9 Sept 2014	10/2014	7307	Provincial	In Perpetuity
T103259/2005	Wolvenest	212	Portion 1	120.80	Vanrhynsdorp	C0780000000 0021200001	WWF-SA	9 Sept 2014	10/2014	7307	Provincial	In Perpetuity
T103259/2005	Wolvenest	212	Portion 4	149.42	Vanrhynsdorp	C0780000000 0021200004	WWF-SA	9 Sept 2014	10/2014	7307	Provincial	In Perpetuity
T103259/2005 & T99456/2007	Moedverloren	208	Portion 1	19.05	Vanrhynsdorp	C0780000000 0020800001	WWF-SA	9 Sept 2014	10/2014	7307	Provincial	In Perpetuity
T102490/2005	Groot Graaf Water	210	Portion 1	4400.38	Vanrhynsdorp	C0780000000 0021000001	WWF-SA	9 Sept 2014	10/2014	7307	Provincial	In Perpetuity

Title Deed	Farm Name	Farm No.	Portion No.	Extent (ha)	Registration Division	SG Code	Landowner	Proc. Date	Proc. No.	Govt. Gazette	Status	Period (years)
T102490/2005	Flamink Vlake	111	Portion 6 (of Portion 2)	858.37	Vanrhynsdorp	C0780000000011100006	WWF-SA	9 Sept 2014	10/2014	7307	Provincial	In Perpetuity
T69464/2006	Quagga's Kop	215	Remainder of Portion 2	255.07	Vanrhynsdorp	C07800000000021500002	WWF-SA	9 Sept 2014	10/2014	7307	Provincial	In Perpetuity
T27816/2006	Zoutfontein	178	Portion 6 (of portion 4)	848.82	Vanrhynsdorp	C07800000000017800006	WWF-SA	9 Sept 2014	10/2014	7307	Provincial	In Perpetuity
T94665/2006	Groot Graaf Water	210	Portion 4 (of portion 2)	2171.49	Vanrhynsdorp	C07800000000021000004	WWF-SA	9 Sept 2014	10/2014	7307	Provincial	In Perpetuity
T1918/2007	Vinkels Kolk	118	N/A	2587.68	Vanrhynsdorp	C07800000000011800000	WWF-SA	9 Sept 2014	10/2014	7307	Provincial	In Perpetuity
T1918/2007	Thiaarts Vley	117	N/A	3981.39	Vanrhynsdorp	C07800000000011700000	WWF-SA	9 Sept 2014	10/2014	7307	Provincial	In Perpetuity
T99256/2007	Helpmekaar	101	N/A	2252.67	Vanrhynsdorp	C07800000000010100000	WWF-SA	9 Sept 2014	10/2014	7307	Provincial	In Perpetuity
T99256/2007	Graatjies Gat	106	N/A	4437.87	Vanrhynsdorp	C07800000000010600000	WWF-SA	9 Sept 2014	10/2014	7307	Provincial	In Perpetuity
T99255/2007	Uitkyk	107	N/A	4315.26	Vanrhynsdorp	C07800000000010700000	WWF-SA	9 Sept 2014	10/2014	7307	Provincial	In Perpetuity
T10991/2008	Bushmans Grave	112	N/A	4031.41	Vanrhynsdorp	C07800000000011200000	WWF-SA	9 Sept 2014	10/2014	7307	Provincial	In Perpetuity
T10991/2008	Trekkers Draai	109	Portion 1	4210.78	Vanrhynsdorp	C07800000000010900001	WWF-SA	9 Sept 2014	10/2014	7307	Provincial	In Perpetuity
T10991/2008	Karee Berg	113	Portion 1	4374.46	Vanrhynsdorp	C07800000000011300001	WWF-SA	9 Sept 2014	10/2014	7307	Provincial	In Perpetuity

Title Deed	Farm Name	Farm No.	Portion No.	Extent (ha)	Registration Division	SG Code	Landowner	Proc. Date	Proc. No.	Govt. Gazette	Status	Period (years)
T24728/2011	Zand Kraal C	98	N/A	6487.75	Vanrhynsdorp	C0780000000009800000	WWF-SA	9 Sept 2014	10/2014	7307	Provincial	In Perpetuity
T41232/2011	Flamink Vlake	111	Portion 1	1350.44	Vanrhynsdorp	C07800000000011100001	WWF-SA	9 Sept 2014	10/2014	7307	Provincial	In Perpetuity
T41232/2011	Flamink Vlake	111	Portion 5 (of portion 2)	806.11	Vanrhynsdorp	C07800000000011100005	WWF-SA	9 Sept 2014	10/2014	7307	Provincial	In Perpetuity
T4137/2012	Luiperskop	211	Remainder	2118.18	Vanrhynsdorp	C07800000000021100000	WWF-SA	9 Sept 2014	10/2014	7307	Provincial	In Perpetuity
T35141/2013	Drooge Kraal	100	N/A	3831.19	Vanrhynsdorp	C078000000000100000000	WWF-SA	9 Sept 2014	10/2014	7307	Provincial	In Perpetuity
T35141/2013	Klipdrift Extension	93	N/A	3882.86	Vanrhynsdorp	C078000000000093000000	WWF-SA	9 Sept 2014	10/2014	7307	Provincial	In Perpetuity
T35141/2013	Jakhals Draai	92	N/A	5004.97	Vanrhynsdorp	C078000000000092000000	WWF-SA	9 Sept 2014	10/2014	7307	Provincial	In Perpetuity
T59680/2014	Uitspanrug *	110	N/A	4347.62	Vanrhynsdorp	C078000000000110000000	WWF-SA	N/A	N/A	N/A	Private	In Perpetuity

* Property in the process of being proclaimed.

2.1.2 Contractual agreements

Table 2.1 provides a full description of all land parcels purchased by the World Wide Fund for Nature - South Africa (WWF-SA) that make up the Knersvlakte Nature Reserve. All properties are managed by CapeNature as part of an open ended management agreement that are registered against the title deeds of the properties.

2.1.3 Location, extent and highest point

The Knersvlakte Nature Reserve with an extent of 90 057 ha, is situated between latitudes 31° 00' and 31° 34' South and longitudes 18° 25' and 18° 28' East. The reserve falls within the West Coast of the Western Cape Province of South Africa, and is 20 km north of Vanrhynsdorp, approximately 320 km north of Cape Town.

Currently the reserve comprises 32 land portions which lies between Bitterfontein and Vanrhynsdorp (north/south extent) and to the west (below) the Bokkeveld Escarpment. The north/south extent of the reserve is approximately 63 km and the east/west extent 33 km. The reserve is in a state of development and not all land portions are currently consolidated. The main access route through the reserve is the national N7 tar road that dissects the reserve through the middle. The DR02230 gravel road leading towards Kliprand provides access to the northern parts of the reserve. The reserve office is situated in Vanrhynsdorp.

The Knersvlakte Nature Reserve is characterised by undulating arid plains generally between 200-300 metres above sea level, which becomes higher towards the north-west and north-east. The highest point is Flaminkberg at 593 meters above sea level. The Sout River flows along the eastern boundary with the Varsche and Hol rivers along the southern boundary. The location and extent of the Knersvlakte Nature Reserve is illustrated in Appendix 1, Map 1.

2.1.4 Municipal jurisdiction

The Knersvlakte Nature Reserve is situated within the following district and local municipal boundaries (Appendix 1, Map1):

- West Coast District Municipality:
 - Matzikama Local Municipality

2.1.5 International, national and provincial listings

The Succulent Karoo Biome is one of 25 internationally recognised biodiversity hotspots and is the world's only arid hotspot (Mittermeier *et al.* 2005). The biome extends from the south-west through the north-western areas of South Africa and into southern Namibia. The Knersvlakte is one of 12 bioregions recognised in the overarching Succulent Karoo Biome (Mucina & Rutherford 2006). This biome has been identified by both South Africa and Namibia as a potential World Heritage Site and a study is underway to determine the feasibility and recommendations for declaration.

2.2 Biophysical Description

2.2.1 Climate

The Knersvlakte Nature Reserve falls within the winter-rainfall zone of South Africa, with hot, dry summers from September to April, and mild winters from May to August. Temperatures are generally mild in winter but can drop as low as 5°C during night time (Figure 2.1). Summer days are hot and dry and average maximum temperatures recorded at Lutzville are generally around 30°C, however extremes as high as 40°C inside the reserve is not uncommon. Figure 2.1 indicates the average maximum and minimum monthly temperatures recorded at Lutzville Bo weather station which is located towards the southern end of the reserve. The Lutzville Bo station is located at an altitude of 50 meters above sea level and slightly lower than the reserve altitudinal average. Generally temperature conditions inside the reserve are hotter than those indicated for the Lutzville Bo weather station.

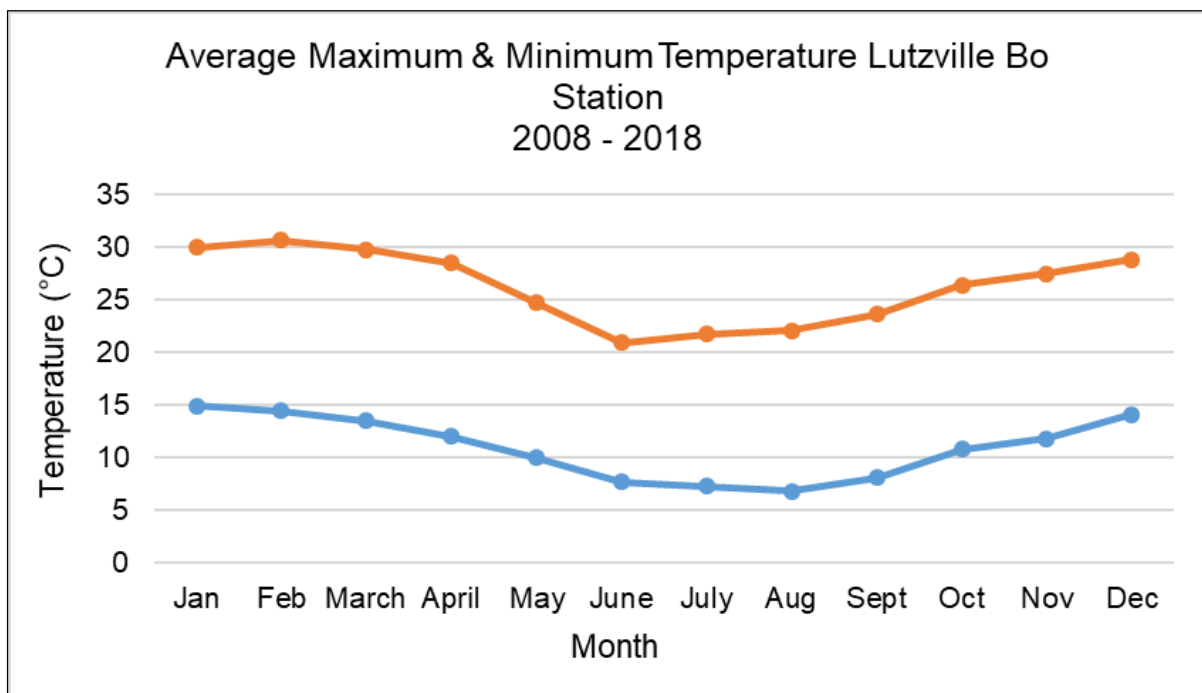


Figure 2.1: Average maximum and minimum temperatures for the Lutzville Bo station for the period 2008 – 2018. Data provided by the Agricultural Research Council (2019, unpublished data).

Frost is a rare occurrence within the Knersvlakte Nature Reserve but when it does occur it plays a significant role in plant hydration. Mean annual rainfall recorded at Lutzville Bo station is 187 mm per annum over the last 10 year period (2008-2018) but data indicates that there is considerable variability in annual rainfall (Figure 2.2). In 2012 a total of 270 mm was recorded whereas during the height of the drought in 2017 only 78 mm was recorded. Total annual rainfall is seen decreasing over the reporting period (Figure 2.2). It is expected that climate change will disrupt rainfall patterns throughout the winter-rainfall regions which is expected to hold dire negative consequences for many specialised endemic species found in the Knersvlakte and Succulent Karoo in general (Helme 2016).

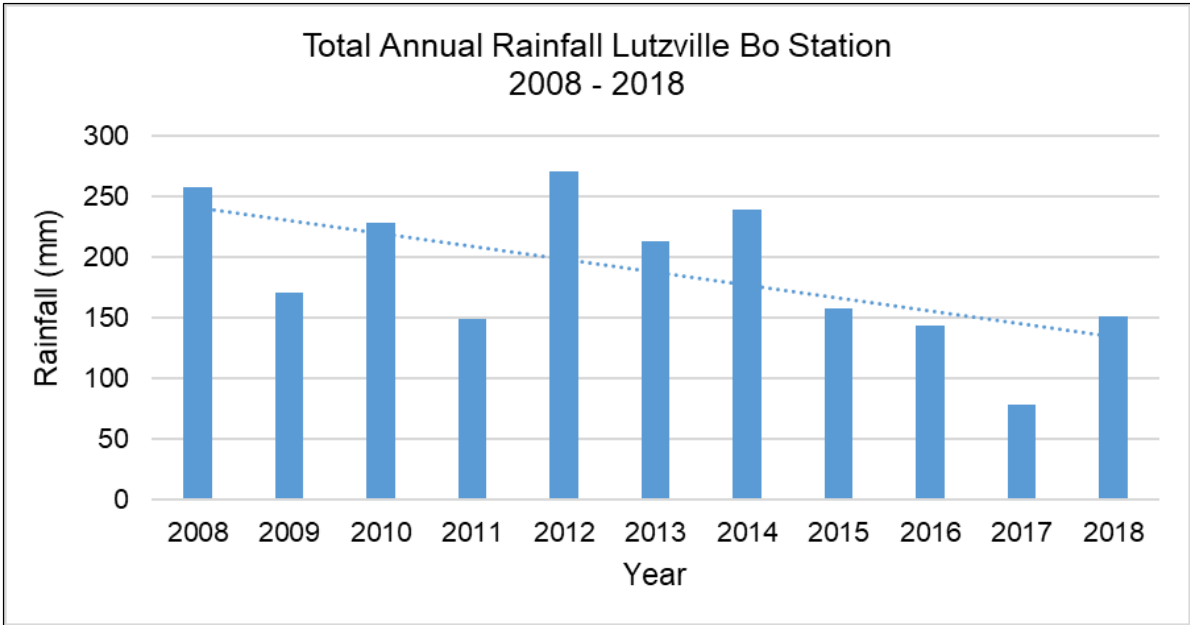


Figure 2.2: Total annual rainfall for the Lutzville Bo station for the period 2008 – 2018. Data provided by the Agricultural Research Council (2019, unpublished data).

The average monthly rainfall recorded at the Lutzville Bo station indicates a distinct peak during May-August. Rainfall data compared between the Lutzville Bo station and the Vanrhynsdorp station indicates a slight decline in monthly average rainfall from west to east across the reserve. This difference is expected to be more pronounced across the northern parts of the reserve. Due to summer rainfall events experienced during the reporting period, a higher than average rainfall was experienced for the months of November (2009 - 30,48 mm; 2012 - 41,40 mm; 2014 - 37,34 mm) and December (2010 - 108,72 mm; 2012 - 68,33 mm) (Figure 2.3).

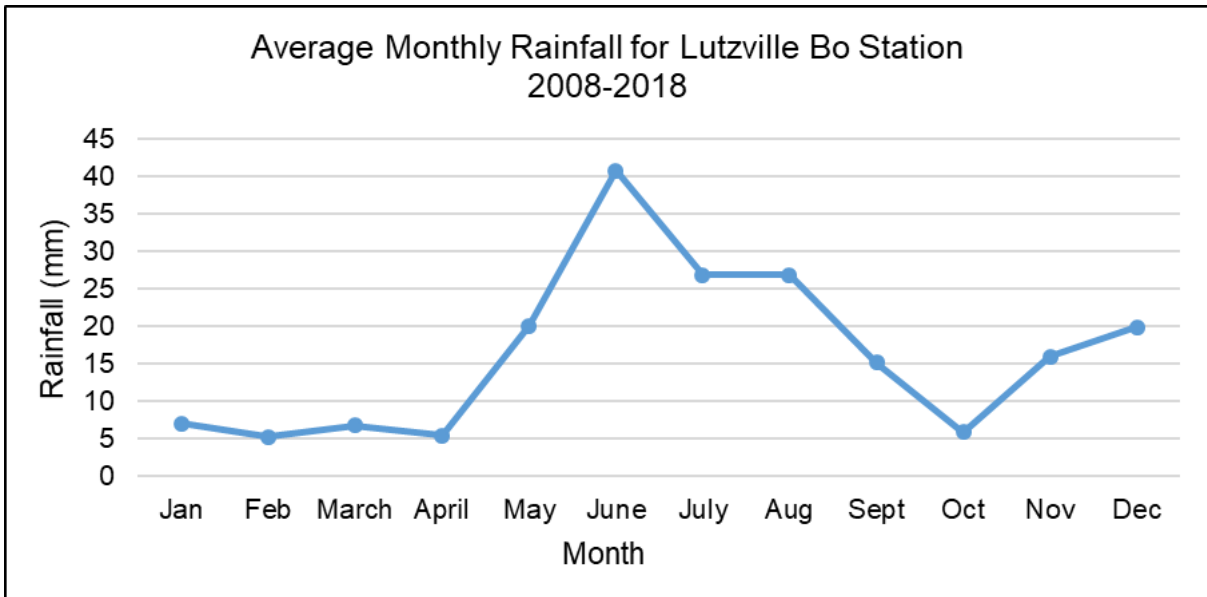


Figure 2.3: Average monthly rainfall for the Lutzville Bo station for the period 2008 – 2018. Data provided by the Agricultural Research Council (2019, unpublished data).

A correlation is noted between the recorded temperatures and the evapotranspiration experienced in the area (Figures 2.1; 2.4). Significant evapotranspiration rates are experienced during summer months with some reduction during winter months (Figure 2.4).

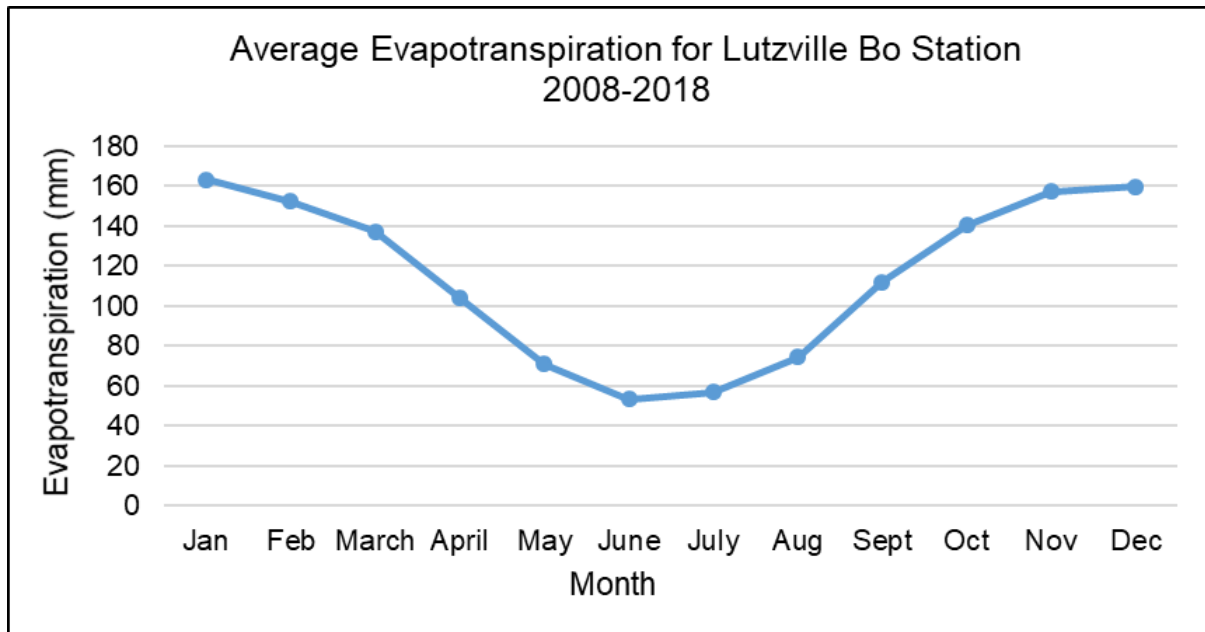


Figure 2.4: Average evapotranspiration for the Lutzville Bo station for the period 2008 – 2018. Data provided by the Agricultural Research Council (2019, unpublished data).

Higher summer evapotranspiration rates are linked to a slight increase in wind speeds during summer months. During summer the wind direction is predominantly south-westerly while in winter it is mainly south/south-east, switching to north-westerly during winter frontal systems (Figure 2.5).

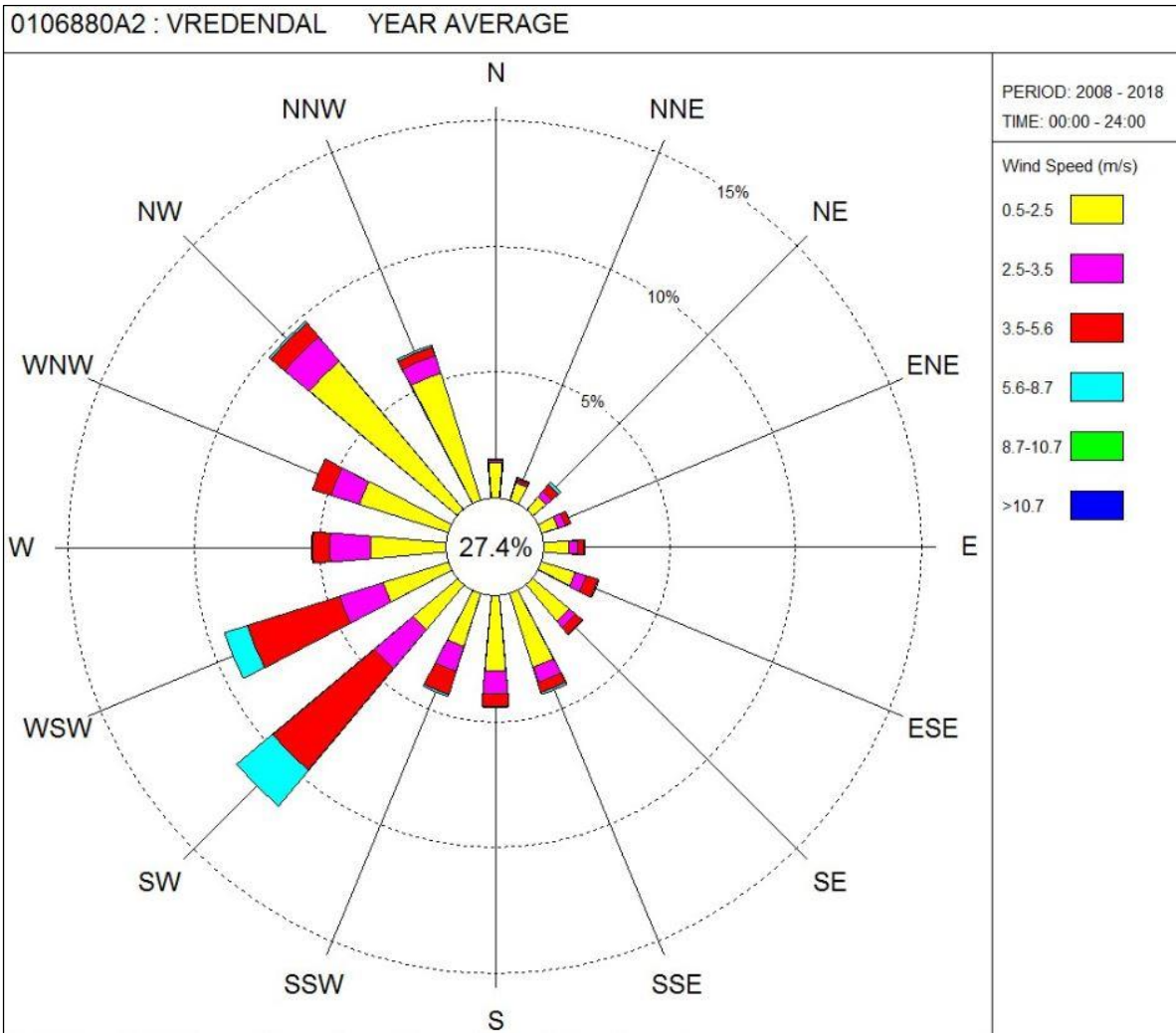


Figure 2.5: Average wind speed and direction for the Vredendal weather station for the period 2008 – 2018. Data provided by the South African Weather Service (2019, unpublished data).

2.2.2 Topography

The Knersvlakte spatial extent covers approximately 10 000 km² and is characterised by wide gently undulating dry plains that lie between and separate the Cape Fold Mountains of the Western Cape from the rocky mountains and hills of the central Namaqualand (Figure 2.6). There are a multitude of small drainage channels which drain the Knersvlakte basin, via the Hol River, south-west towards the Olifants River. The eroded landscape along these river channels are particularly pronounced through the central parts of the reserve. Helme (2016) highlights a combination of topographic variability, soil types and underlying geology as a driver of species diversity and endemism in the Succulent Karoo.

The Knersvlakte regional boundary is generally accepted to be the Olifants River valley towards the south, the granitic-gneiss highlands of Namaqualand in the north, the steep Bokkeveld Escarpment of the Cape Fold Belt to the east and the Atlantic Ocean to the west (Desmet 2004).



Figure 2.6: View from Kareeberg east over the Knersvlakte with the Bokkeveld Escarpment in the background. Photo: Marius Wheeler.

The Hardeveld occurs towards the north and north-west part of the reserve where the lowlands of the Knersvlakte meets the granitic-gneiss highlands of Namaqualand (Appendix 1, Map 2). The Sandveld is characterised by the typical dry coastal vegetation and occurs along the coast in the southern region with various 'tongues' penetrating towards the interior and into the reserve.

The highest point within the Knersvlakte Nature Reserve is Flaminkberg at 593 meters above sea level (Appendix 1, Map 2). Other high peaks include Kareeberg (401) Mostertskop (340) and Moedverloor Kop (384) meters above sea level. The lowest elevations occur along the southern Zoutfontein property, at approximately 30-35 meters above sea level.

2.2.3 Geology and soils

The Knersvlakte Nature Reserve spans a stratigraphically diverse array of lithologies, given its large surficial coverage (Appendix 1, Map 3). The southernmost extent of the reserve comprises rocks of the Neoproterozoic-aged Gariep Supergroup (Tonian-Cryogenian) and latest Neoproterozoic-earliest Phanerozoic Vanrhynsdorp Group (Ediacaran-Cambrian). Rocks of the Gariep Supergroup in the reserve are represented by metasedimentary rocks of the Gifberg Group that were deposited some 770 to 650 million years ago within a seaway that extended from the South African west coast into South America during the rifting of the supercontinent of Gondwana. The lowermost Karoetjes Kop Formation comprises basal conglomerates and quartzites that unconformably overlies gneisses of the Namaqua Metamorphic Province. These deposits, in turn are overlain by diamictites and biotite sericite schists.

The Widouw Formation is characterised by limestone, dolostone and marbles with minor greywackes, quartzites and phyllites. These deposits are gradationally overlain by black graphitic and sericitic schists and phyllites that are interbedded with greywackes and quartzites with occasional dolostones, limestones and marbles. With respect to preceding units, the Bloupoort Formation is lithologically diverse and comprises graphitic schists and phyllites, limestones, dolostones, diamictites and quartzites in addition to iron-rich cherts and iron formations (De Beer *et al.* 2002).

Between 650-480 million years ago, Africa and South America collided once more to form the western component of Gondwanan supercontinent. Rocks of the Gariep Supergroup as well as the underlying Namaqua Metamorphic Province were metamorphosed, folded and thrust, forming the Gariep Orogen. The Gariep Orogen (or Gariep Belt) itself being a component of a larger chain of mountain belts of similar age associated with the amalgamation of several continental fragments to form the supercontinent of Gondwana. Collectively, these mountain belts are referred to as the “Pan African-Brasiliano Belt”, all of which involved the metamorphism and deformation of similar aged deposits of the Gariep Supergroup and older. In western Gondwana, the Gariep Belt wrapped around South Africa and into South America, forming the Dom Feliciano Belt, extending north-westwards between Namibia and Angola forming the Damara Belt, and along the Angolan coast forming the Kaoko Belt. The Kaoko Belt, in turn, extended north-eastwards into South America forming the Brasiliano Belt. The Gariep Belt extended south and eastwards along the seaboard of proto-South Africa to form the Saldania and Mozambique Belts (De Beer *et al.* 2002).

At the foot of the Gariep Belt, a broad shallow marine basin gradually developed in response to the formation of this mountain, gradually deforming itself with the creation of the Gariep Mountains. This basin is broadly referred to as the Nama Basin that extended southwards from around Mariental in Namibia into South Africa. In South Africa, these deposits are referred to as the Vanrhynsdorp Group that were deposited some 570-540 million years ago. These rocks are of immense importance in South Africa as they comprise among the earliest evidence for the evolution of multicellular animal life in South Africa, most notably in the form of complex trace fossils (fossil spoor of marine organisms). In the Knersvlakte Nature Reserve, rocks of the Flaminkberg Formation and Knersvlakte Subgroups (the Knersvlakte region itself being the type region for these rocks) are present.

The Flaminkberg Formation is characterised by quartzites, greywackes and conglomerates which were deposited in a series of braidplain and fluvio-marine settings as the Gariep Mountains rose. Rocks of the overlying Knersvlakte Subgroup comprise mudstones, shales, siltstones, sandstones with minor limestones and cherts that were deposited in an essentially shallow marine to deltaic setting as the basin deepened. As time passed, these rocks became caught up in the Gariep Orogeny and too became metamorphosed, folded and thrust as Africa and South America accreted (De Beer *et al.* 2002).

The northernmost extent of the reserve is dominated by quartzitic gravels, sands and silts of the Quagga’s Kop Formation. These gravels are present in low-lying plains that are interspersed by occasional low-lying hills and give the Knersvlakte its characteristic geomorphological attributes. The Quagga’s Kop Formation formed as a result of prolonged weathering and fluvial incision of the underlying, and much older,

Knervlakte Subgroup of the Vanrhynsdorp Group sometime in the geologically recent past (late Neogene to Quaternary) that produced extensive terrace deposits (De Beer *et al.* 2002).

Cole (2012) lists fifteen mineral commodities occurring in the broader Knervlakte region, most of these deposits are found within the southern reaches of the Knervlakte basin. These include limestone, dolomite, gypsum, diamonds, marble, granite, kaolin, brick clay, iron, nickel, silica, kyanite, building sand, manganese and monazite containing rare earth elements. The latter is found in deposits north of the reserve towards Steenkampskraal. All of these mineral commodities were assessed for their provincial economic importance and only limestone was identified as important. Fortunately large limestone deposits are also available outside of the Knervlakte Nature Reserve (Cole 2012).

The undulating plains of the Knervlakte have a complex mosaic of quartz fields, exposed shale beds, dolomite outcrops, and red sand plumes. Highly conspicuous are the pebble-strewn quartz fields, characterised by a dense layer of white, angular quartz stones (Snijman 2013). Local differences in the quartz stones and soils give rise to two forms of quartz fields. The non-saline quartz fields have shallow, strongly acidic underlying soil and high stone content on the surface, whereas the saline quartz fields have deeper, neutral to slightly acidic soils with a relatively sparse covering of large gravel but a dense cover of small-sized gravel (Schmiedel & Jürgens 1999; Ellis & Weis 2006). The quartz patches have sharply defined borders that create conspicuous, island-like habitats (Schmiedel *et al.* 2015). The surface temperatures of quartz patches are often relatively cooler than those of surrounding areas in summer and inversely so in winter (Schmiedel & Jürgens 2004).

Mucina & Rutherford (2006), describes the soils of the Knervlakte as generally shallow, base-rich to calcareous and reddish in colour, with a duripan occurring at a shallow depth from the soil surface. A large area of the soils of the high-altitude plateau to the east of the reserve consists of shallow to moderately deep, reddish coloured base-rich sands on granite/gneiss parent material and shallow calcareous loams with desert pavement on the surface, where shales form the parent material. Another important feature is the deep pre-weathering, which can be encountered in many places, usually with a silcrete or ferricrete capping still preserved. Three major soil groups, with their associated soil units, are represented within the Knervlakte Nature Reserve, namely the Arenosols (Calcaric Arenosols and Ferralic Arenosols), Cambisols (Calcaric Cambisols and Chromic Cambiosols), and Durisols (undifferentiated) (Driessen *et al.* 2001).

Within the Knervlakte Nature Reserve context the vegetation types found in the reserve is inextricably linked with the underlying soil (Appendix 1, Map 4). Within the north-eastern part of the reserve, the soils are shallow to deep, with a low stone content, and with shallow underlying bedrock or duripan crusts. The soils chemical characteristics range from acidic to neutral. Soils, along the eastern side of the reserve, have been characterised as shallow, with a high stone content, that are moderately acidic to slightly alkaline. The northern to the southern parts of the reserve, contains soils that are loamy-sandy soils that are shallow to moderately deep with a low to high stone content, especially quartz. The chemical characteristics of this soil has been identified as being slightly alkaline. Within the central and southern parts of

the reserve, certain areas contains soils that are identified as shallow to moderately deep, which are low in salinity, as well as the occasional deep, coarse and unstructured red, aeolian, sandy soil that has a very low skeletal content. Furthermore, some areas in the southern part of the reserve, contains soils that are cenozoic aeolian, deep, coarse, unstructured, red, and sandy with a very low stone content. These soils have a pH that are more or less neutral, with a low salinity, and with no or very low carbonate content (Mucina & Rutherford 2006).

2.3 Biodiversity Context: Ecosystems

2.3.1 Vegetation

One of the six floristic regions in the world, the Greater Cape Floristic Region (Manning & Goldblatt 2012; Mucina & Rutherford 2006), comprises the winter rainfall region in South Africa. This floristic region consists of the Core Cape Subregion and the Extra Cape Subregion (Manning & Goldblatt 2012; Snijman 2013), respectively better known as the Fynbos Biome and the Succulent Karoo Biome (Mucina & Rutherford 2006). These biomes are considered as two of Earth's biologically richest and most endangered terrestrial ecoregions or biodiversity hotspots (Mittermeier *et al.* 2005). To date, only four centres of endemism have been recognised in the Succulent Karoo: the Gariiep, Kamiesberg, Knersvlakte and Western Mountain Karoo (Van Wyk & Smith 2001; Snijman 2013).

The geological, geographical and soil characteristics have resulted in the sparse vegetation of the Knersvlakte that is globally unique with many endemic, miniature succulents, usually less than 10 cm high, often only a few millimetres above ground. The plant species are highly adapted to a very drought stressed environment as well as to the very acidic and alkaline soils (Schmiedel 2004). These different stresses are handled in many diverse adaptations, making the plant diversity truly unique. Very high summer temperature can be limiting to plant survival and species have adapted to survive in microhabitats, e.g. in between white quartz pebbles where the ambient temperature can be cooler than above the pebbles due to the reflection of the heat off the white quartz. Dew also forms quicker on the quartz that cools down at night, providing water for the microhabitat between the pebbles. Any disturbance of the layer of quartz gravel destroys the microhabitat. The soils are only leached for a few centimetres where the plants can grow, resulting in very shallow roots. Any physical disturbance of the soil results in changes of the micro-topography and the soil chemistry, thus making it inaccessible to the plants that are specialised to quartz field habitats. It is almost impossible, if not impossible, to rehabilitate physically disturbed quartz field habitats.

South Africa recognises that different ecosystems have differing species compositions and to effectively conserve biodiversity, the country has set targets for each ecosystem. The biodiversity target is the minimum proportion of each ecosystem type that needs to be kept in a natural or near-natural state over the long term to maintain viable representative samples of all ecosystem types and the majority of species associated with those ecosystems. The biodiversity target is calculated based on species richness, using species–area relationships, and varies between 16% and 36% of the original extent of each ecosystem type (Desmet & Cowling 2004).

Threat status is provided for each ecosystem according to two assessments:

- CapeNature’s 2014 assessment of criterion A1 (habitat loss);
- The Western Cape Biodiversity Spatial Plan Assessment (Pool-Stanvliet *et al.* 2017). This latter category is considered the best available status for the Western Cape Province.

As the Knersvlakte Bioregion is of international importance and situated in both the Northern and Western Cape Provinces, the national protection targets are used in this management plan (Table 2.2). Some vegetation types found in the Knersvlakte Nature Reserve have not undergone formal status assessment yet due to the fact that these have only been mapped recently (SANBI 2018). These are preliminary listed as Least Threatened (A. Dayaram 2019, SANBI: VegMap Project Scientist, pers. comm.). The following 10 vegetation units are found within the Knersvlakte Nature Reserve (Appendix 1, Map 4; Table 2.2).

Table 2.2: Summary of the vegetation types conserved within the Knersvlakte Nature Reserve.

Vegetation Type and Extent of Occurrence *	National Protection Target (ha)	% of National Protection Target conserved in Knersvlakte Nature Reserve	Ha conserved in Knersvlakte Nature Reserve	Ecosystem Status (2017 & 2019)	Bioregion (2006)
Northern Knersvlakte Vygieveld (WC & NC)	46 865.93	59.08	27 686.65	Least Threatened	Knersvlakte
Central Knersvlakte Vygieveld (WC)	3 636.86	118.61	4 313.68	Least Threatened	Knersvlakte
Knersvlakte Quartz Vygieveld (WC)	36 984.38	95.83	35 442.21	Least Threatened	Knersvlakte
Knersvlakte Shale Vygieveld (WC & NC)	27 539.58	35.08	9 659.58	Least Threatened	Knersvlakte
Vanrhynsdorp Gannabosveld (WC & NC)	27 679.46	0.07	19.64	Least Threatened	Knersvlakte
Knersvlakte Dolomite Vygieveld (WC)	1 675.18	55.25	925.46	Least Threatened	Knersvlakte
Southern Namaqualand Quartzite Klipkoppe Shrubland (WC & NC)	27 920.21	7.31	2 041.85	Least Threatened	Namaqualand Hardeveld
Namaqualand Heuweltjieveld (WC & NC)	141 136.64	2.08	2 930.77	Least Threatened	Namaqualand Hardeveld

Vegetation Type and Extent of Occurrence *	National Protection Target (ha)	% of National Protection Target conserved in Knersvlakte Nature Reserve	Ha conserved in Knersvlakte Nature Reserve	Ecosystem Status (2017 & 2019)	Bioregion (2006)
Namaqualand Spinescent Grassland (WC)	12 217.87	16.95	2 070.49	Least Threatened	Namaqualand Sandveld
Namaqualand Riviere (WC & NC)	32 732.22	15.28	5 002.41	Least Threatened	Inland Azonal Vegetation

* Extent of occurrence is indicated for the Western Cape (WC) and Northern Cape (NC) Provinces.

Of the 10 vegetation units found in the Knersvlakte Nature Reserve, six are represented in the Knersvlakte Bioregion, mostly contributing a large percentage to the national protection status (Table 2.2). There is some representation of the Namaqualand Hardeveld and Namaqualand Sandveld bioregions, as well as some representation to the Inland Azonal Vegetation (dry river beds and floodplains). None of these vegetation units are considered threatened, mainly because of the low agricultural value of the land and the protection status provided by the Knersvlakte Nature Reserve.

2.3.1.1 Knersvlakte Bioregion

Northern Knersvlakte Vygieveld *Least Threatened*

Found in the north-eastern Knersvlakte east of the N7, it is a slightly undulating to flat landscape covered with open-canopy (10-30% cover) succulent shrubland, in mostly alluvium with calcrete, shallow to deep soils (Figure 2.7). The species are mostly less than 50 cm high and dominated by vygie dwarf shrubs with succulent leaves from the Aizoaceae. Heuweltjies occur in places and these are dominated by *Stoeberia frutescens* and/or *Lampranthus otzenianus*. Annuals and geophytes (some endemic to the Knersvlakte) can change the appearance of the vegetation in spring after good winter rains (Mucina & Rutherford 2006). Stretches that are severely disturbed can be covered by *Augea capensis* and the invasive alien shrub *Atriplex lindleyi inflata*, in places dominating the vegetation cover. The Knersvlakte Nature Reserve contributes 59% of the national protection target (Table 2.2).



Figure 2.7: Northern Knersvlakte Vygieveld, Graatjiesgat section. Photo: Llewellyn Jacobs.

Central Knersvlakte Vygieveld *Least Threatened*

Found in the central Knersvlakte west of the N7, it is a lightly undulating landscape covered with low succulent shrubland with low canopy cover (5-30%) dominated by dwarf shrubs mostly vygies from the Aizoaceae. In contrast to the Northern Knersvlakte Vygieveld, this unit is characterised by alluvial sandy soils with increased abundance of graminoid species. The invasive alien shrub *Atriplex lindleyi inflata* is common in places, especially in disturbed areas (Mucina & Rutherford 2006; Helme 2009). The Knersvlakte Nature Reserve contributes approximately 118% of the national protection target (Table 2.2).

Knersvlakte Quartz Vygieveld *Least Threatened*

Found in the central Knersvlakte east and west of the N7, it is a slightly undulating landscape with slopes and broad ridges covered by a prominent, though very patchy, white layer of low to high stone coverage (especially quartz) on loamy-sandy shallow to moderately deep, slightly alkaline soils (Figure 2.8). The white quartz debris originates from weathered quartz veins which are embedded within the bedrock matrix. The quartz veins weather and are spread downhill by alluvial transport. It is one of the core elements of the Knersvlakte succulent diversity. The succulent shrublands comprise mostly dwarf, with a high proportion of compact and subterranean vygies (Aizoaceae), often imitating their surroundings. This is probably

the most extensive area of 'living stones' in the world. The mosaic of floristically and ecologically distinct quartz vygieveld communities and the matrix of low succulent shrublands, with succulent leaved dwarf shrubs from the Aizoaceae, are very intricate and small-scale in places. Spectacular flower displays of both perennial and annual species flowering simultaneously or staggered at times, can be found after good winter rain.

This vegetation unit carries one of the largest local densities of endemic plants, counting more than 60 species and two genera (*Argyroderma* and *Oophytum* from the Aizoaceae). The genera *Dicrocaulon*, *Monilaria* (Aizoaceae) and *Tylecodon* (Crassulaceae) score high numbers of endemic species here. It should be noted that although the vegetation itself often looks sparse and depauperate it is actually extremely rich in localised endemics, notably dwarf succulents, many of which are cryptic and hard to see, and all of which are very vulnerable to disturbance of any type, notably trampling, being squashed by vehicles, and disturbance of their quartz pebble habitat. At least 70 dwarf succulent and geophyte plant species are known to be endemic (restricted) to this vegetation type, an astonishingly high level of endemism for a localised, arid vegetation type (Mucina & Rutherford 2006; Helme 2009). The Knersvlakte Nature Reserve contributes approximately 96% of the national protection target (Table 2.2).



Figure 2.8: Knersvlakte Quartz Vygieveld on the Moedverloren section. Photo: Annelise le Roux.

Knersvlakte Shale Vygieveld *Least Threatened*

Found in the eastern Knersvlakte at the western foot of the Bokkeveld Escarpment, it is found on shale bands on level plains or hilltops and moderate to steep slopes

covered by shallow soils, moderately acid to slightly alkaline with a high stone content. The vegetation with a low canopy cover (10-20% cover) is a low shrubland formed by mat-forming and cushion-forming dwarf shrubs, mainly with succulent leaves and high incidence of spinescence (Figure 2.9). There is a fairly high diversity of geophytes and annuals. This vegetation unit houses a number of Karoo elements typical of the summer-rainfall region and shows traits of transition between the summer-rainfall and winter-rainfall regions (Mucina & Rutherford 2006; Helme 2007). The Knersvlakte Nature Reserve contributes 35% of the national protection target (Table 2.2).

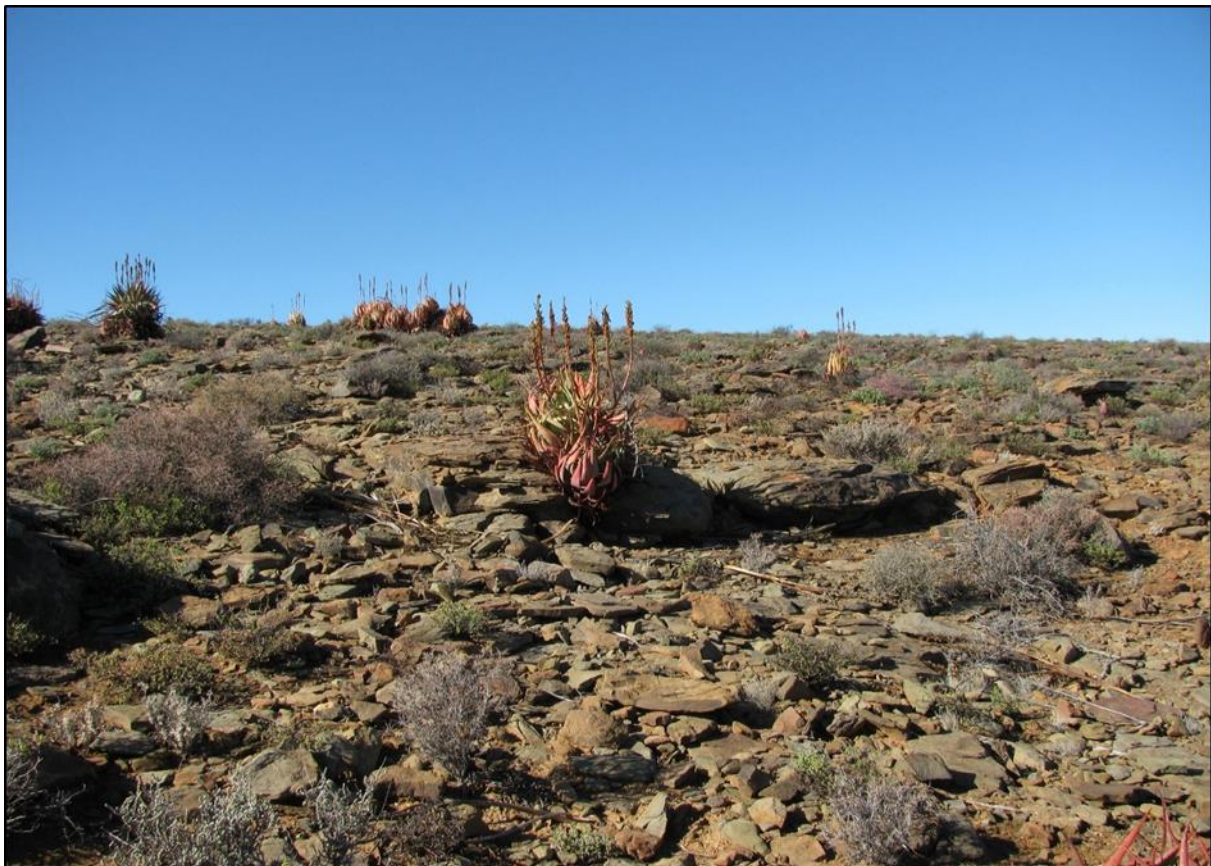


Figure 2.9: Knersvlakte Shale Vygiveld on the Jakkalsdraai section with *Aloe knersvlakensis*, endemic to this vegetation unit. Photo: Annelise le Roux.

***Vanrhynsdorp Gannabosveld* Least Threatened**

This vegetation unit is mainly found in the eastern and southern Knersvlakte at the foot of the Bokkeveld Escarpment, the Matzikama and Gifberg Mountains as well as east of Vanrhynsdorp. The sandy-loamy, moderately deep, slightly acid to alkaline soils are recent superficial deposits of alluvium and duripan crusts (calcrete). The landscape is mainly flat, or only slightly undulating, supporting succulent shrubland dominated by *Salsola* species (ganna), including representatives of the genera *Galenia*, *Psilocaulon*, *Caulipsolon* and *Mesembryanthemum*. In the southern parts of the Knersvlakte, the shale plains can acquire a grassland appearance through seasonal dominance of *Stipa capensis* and *Bromus pectinatus*. *Stipa capensis* (steekgras) is a highly invasive species on overgrazed veld and is now dominant over large stretches with subsequent negative impacts on indigenous plant species. The indigenous soetdoring thorn tree *Vachellia karroo* is found along the seasonal drainage lines.

The alien invader *Prosopis glandulosa* is becoming dominant in some sections of the Gannabosveld, especially towards the southern parts of the Knersvlakte. This vegetation unit is not only highly susceptible to overgrazing with the resulting alien plant and grass invaders but also to cultivation and open-cast gypsum mining. The Knersvlakte Nature Reserve contributes less than 1% of the national protection target (Table 2.2) and the expansion of the Knersvlakte Nature Reserve to improve the conservation status for this vegetation unit is important.

***Knersvlakte Dolomite Vygieveld* Least Threatened**

This is the smallest vegetation unit restricted to the Knersvlakte Bioregion (just under 6 000 ha in total) with very small patches 1) east of Vanrhynsdorp at the foot of the Bokkeveld Mountain; 2) from Vanrhynsdorp westwards along the Troe-Troe River to Vredendal; 3) and small patches near the Rooiberg, Sout and Varsche rivers. Approximately 55% of the national protection target is represented inside the Knersvlakte Nature Reserve (Table 2.2).

It is only found on small patches of exposed dolomitic limestone with moderately deep soils in between, typically slightly alkaline with a high carbonate content. This sparse succulent shrubland (canopy cover 10-30%) is dominated by erect shrubs lower than 30 cm with succulent leaves. In between the cracks and crevices of the flattish dolomite rock sheets many geophytes and dwarf, compact or subterranean vygies endemic to the dolomite are found (*Brunsvigia radula*, *Bulbine margarethae*, *Ixia acaulis*, *Babiana carminea*, *Moraea deserticola*, *Antimima dualis*, *A. turneriana*, *A. evoluta*, *Colchicum albofenestratum*, *Eriospermum calcareum* and *Eriospermum arachnoideum*) (Figure 2.10). In overgrazed habitats annual weeds and spiny, non-succulent dwarf shrubs can become dominant (Mucina & Rutherford 2006; Helme 2009).



Figure 2.10: Endemic species to the Knersvlakte Dolomite Vygieveld, top to bottom: *Ixia acaulis*, *Antimima evoluta* and *Colchicum albofenestratum*. Photo: Annelise le Roux.

2.3.1.2 Namaqualand Hardeveld Bioregion

Southern Namaqualand Quartzite Klipkoppe Shrubland *Least Threatened*

This vegetation unit occurs in the Western Cape between the Knersvlakte and the southern Kamiesberg foothills, centred around the towns of Nuwerus and Bitterfortein, mostly on the west of the N7 and formerly mapped as Namaqualand Klipkop Shrubland. Found on quartzite koppies and rocky outcrops in sandy-loam soils. Dominated by leaf-succulent shrubs (0.4-1.5 m) from Asteraceae and Aizoaceae (vygies) with numerous endemic species (Desmet & Dayaram 2016). This unit has little representation in the Knersvlakte Nature Reserve; only 7% of the national protection target (Table 2.2).

Extending the reserve to the west to incorporate more of the Southern Namaqualand Quartzite Klipkoppe Shrubland is recommended as this unit together with the

interspersed Namaqualand Heuweltjieveld and the Northern Knersvlakte Quartz Vygieveld have many endemic plant species in common (Desmet & Dayaram 2016). The many different habitats and microclimates in these three units could facilitate the survival of endemic species during climate change.

***Namaqualand Heuweltjieveld* Least Threatened**

The Namaqualand Heuweltjieveld has been enlarged considerably from the original vegetation extend from Steinkopf to Kotzesrus, to north and west of the Knersvlakte from Steinkopf to Kliprand in the east and to just north of Koekenaap in the south (Mucina & Rutherford 2006). This brings this vegetation unit to the northern and western boundaries of the Knersvlakte Nature Reserve with small patches in the reserve. The landscape is an undulating plain with a mosaic of communities on heuweltjies (slightly raised, rounded prehistoric termite mounds up to 10 m in diameter) and in between the heuweltjies on deep red loamy soils. The vegetation structure is a low shrubland (canopy cover 20-45%) dominated by leaf-succulent shrubs less than 0.5 m high. Heuweltjies are mostly dominated by *Lampranthus otzenianum* and *Mesembryanthemum leptarthron*. In other places the heuweltjies are turned into bare circles by overgrazing, often with *Oncosiphon suffruticosus* as the only species occurring here. The heuweltjies are often the home of burrowing animals like aardvark (*Orycteropus afer*), porcupine (*Hystrix africaeaustralis*) and Brants' whistling rat (*Parotomys brantsii*) (Mucina & Rutherford 2006). This vegetation unit has little representation in the Knersvlakte Nature Reserve, only 2% of the national protection target (Table 2.2). As mentioned above, extending the reserve to the west will incorporate more of this vegetation unit.

2.3.1.3 Namaqualand Sandveld Bioregion

***Namaqualand Spinescent Grassland* Least Threatened**

This grassland is found in the sandveld from Lutzville and Koekenaap, extending eastwards into the Knersvlakte to north-east of Vanrhynsdorp on red, deep, coarse, unstructured, sandy soils with very low stone content and low salinity on a level landscape. It is covered with vegetation dominated by a spiny grass (*Cladoraphis spinosa*) and a few scattered emergent taller shrubs with succulent and non-succulent leaves. Geophytes and annuals (especially obvious in wet years) occur in the shrub-grass matrix (Mucina & Rutherford 2006). The Knersvlakte Nature Reserve represents 17% of the national protection target (Table 2.2).

***Namaqualand Riviere* Least Threatened**

This vegetation unit is found in the Northern and Western Cape along dry riverbeds with coarse alluvial sand throughout Namaqualand and is biologically an important feature for all wildlife in the Knersvlakte. It comprises shrubland (0.5-1 m) with *Suaeda fruticosa*, *Galenia africana*, *Zygophyllum morgsana*, *Ballota africana* and *Didelta spinosa* and patches of tussock graminoids occupying riverbeds and banks. In places low thickets of *Vachellia karroo*, *Tamarix usneoides* and *Euclea undulata* can be encountered (Mucina & Rutherford 2006) with a low to high cover of alien invasive trees (*Prosopis glandulosa* and *Nicotiana glauca*) (Figure 2.11). The Knersvlakte Nature Reserve represents 15% of the national protection target for the Namaqualand Riviere (Table 2.2).



Figure 2.11: Vegetation of the Namaqualand Riviere with *Galenia africana*, *Euclea undulata* (in the foreground) and *Vachellia karroo* further back. Photo: Adrian Fortuin.

2.3.1.4 Plant endemism and species of conservation concern

The vegetation of the Knersvlakte Bioregion is predominantly represented by the subfamilies (Mesembryanthemoidea and Ruschioidea) of the Aizoaceae. Asteraceae and Crassulaceae as well as various winter growing bulbous or cormous species of Asphodelaceae, Hyacinthaceae and Iridaceae that contribute to high levels of endemism, including two genera (*Argyroderma* and *Oophytum*). Some of these endemic plants are indicated in Figure 2.12. Helme (2016) indicates that many of the rare and endemic species are extreme habitat specialists and restricted to specific soil types or habitats such as quartz patches and rocky and or dolomite outcrops.



Figure 2.12: A selection of endemic plant species recorded in the Knersvlakte Nature Reserve, top left to bottom right: *Argyroderma delaetii*, *Colchicum scabromarginatum*, *Mesembryanthemum digitatum digitatum*, *Cephalophyllum spissum*, *Tylecodon pygmaeus*, and *Oophytum nanum*. Photos: Marius Wheeler.

Of the 1 349 plant species recorded in the Knersvlakte Bioregion a total of 38% of the total species; 50% of the endemic species; 70% of the dolomite endemic species; and 74% of the quartz endemic species are found in the Knersvlakte Nature Reserve (Table 2.3).

Table 2.3: Summary of endemic plant species found within the Knersvlakte Bioregion and Knersvlakte Nature Reserve.

Endemic Species	Knersvlakte Bioregion	Knersvlakte Nature Reserve	% in Knersvlakte Nature Reserve
Total species recorded	1 349	509	37.7
Knersvlakte endemic	197	98	49.7
Dolomite endemic	23	16	69.6
Quartz endemic	39	29	74.4

The Knersvlakte Nature Reserve is furthermore home to 40% of the Knersvlakte Bioregion species of conservation concern (Table 2.4). Some of these species are yet to be described.

Table 2.4: Summary of conservation categories for plant species found within the Knersvlakte Bioregion and Knersvlakte Nature Reserve.

National Redlist Status (SANBI 2015)	Knersvlakte Bioregion	Knersvlakte Nature Reserve	% in Knersvlakte Nature Reserve
Critically Endangered	2	1	50.0
Endangered	14	6	42.9

National Redlist Status (SANBI 2015)	Knersvlakte Bioregion	Knersvlakte Nature Reserve	% in Knersvlakte Nature Reserve
Vulnerable	57	32	56.1
Critically Rare	4	0	0
Near Threatened	8	3	37.5
Rare	51	23	45.1
Data Deficient - Insufficient Information	13	2	15.4
Data Deficient - Taxonomically Problematic	43	9	20.9
Total Species of Conservation Concern	192	76	39.6

2.3.2 Freshwater ecosystems

The Knersvlakte Nature Reserve is located within the greater Olifants-Doring Water Management Area (now Berg-Olifants) and more specifically, in the Knersvlakte sub-catchment (quaternary catchments E33A, E33B, E33D and E33E) (River Health Programme 2006). The rivers draining the Knersvlakte region flows south-west via two main tributaries (Geelbeks and Sout) into the Hol River which drains into the Olifants River close to Lutzville (Appendix 1, Map 5). Due to the low rainfall and arid nature of the area, all rivers are of a seasonal nature. These rivers generally only flow during high rainfall events, sometimes leading to flash floods that quickly recede after precipitation. Based on the National Freshwater Ecosystem Priority Area's (NFEPA) wetlands spatial layer, most of the wetlands that occur on the reserve are associated with watercourses (Nel *et al.* 2011a & b; Appendix 1, Map 5). These consist mainly of channelled valley-bottom and bench or depression flat wetland types, which are mostly seasonal. Riparian and wetland buffer zones are generally intact with exception of some invasive alien plants; generally in relatively low densities. These systems provide habitats for numerous indigenous floral and faunal species, and serve as migration corridors for several species into and out of the Knersvlakte Nature Reserve.

2.3.2.1 Groundwater

The groundwater systems of the Knersvlakte Nature Reserve in general have underlying geology comprising tillites and shales from the Vanrhynsdorp Groups. The river systems of the reserve are generally underlain by alluvium deposits, with sediments from the Gifberg and Knersvlakte formations dominating the groundwater systems. These sediments have some water quality impacts on the groundwater of the general area (River Health Programme 2006). Less than 0.1 % of the area of the reserve consists of formations of the Table Mountain Group (DWAF 2012a).

The aquifers in the Knersvlakte area varies from being both intergranular and fractured (yield of 0.0 – 0.1 l/s) in the northern sections to being fractured with yields varying between 0.1 – 0.5 l/s to 0.5 – 2.0 l/s further south (DWAF 2012b). The aquifer system is mostly minor, referring to a moderately yielding system of variable water quality. The aquifer system near Lutzville and Klawer is classified as being poor, indicating a low or negligible yielding system of moderate to poor water quality (DWAF 2012c). Here,

the groundwater has conductivity of > 520 mS/m, resulting in an extremely salty and bitter taste. The salinity decreases slightly towards Klawer (370-520 mS/m) and Vredendal (150-370 mS/m) (DWAF 2012c).

The likelihood for aquifer contamination to reach a specific position over time (vulnerability) together with the classification, provides a susceptibility range for pollution by anthropogenic impacts (DWAF 2013b). In the case of the aquifer systems supporting the freshwater ecosystems of the Knersvlakte Nature Reserve, the susceptibility ranges from mostly low (Bitterfortein down to Vanrhynsdorp and Klawer) to medium near Lutzville (DWAF 2013c).

Currently there are approximately 24 boreholes on the reserve that has the potential to provide water to farmsteads and wildlife in the area (Appendix 1, Map 5). For several of these boreholes, infrastructure maintenance or significant capital investment is required to get them functional again. At present only six boreholes are in active use (Kareeberg, Thiaartsvlei, Uitspanrug, Groot Graafwater, Goedehoop and Jakkalsdraai). The groundwater found within the reserve is generally of a poor quality and not used for human drinking application, and as such only used for wildlife and domestic cleaning application. Resource over abstraction and possible pollution has been raised as threats; although of a minimal nature currently. The Knersvlakte Nature Reserve aims to increase its understanding of groundwater viability through monitoring quantity and quality over the next few years.

2.3.2.2 Rivers

The Knersvlakte catchments value includes the three main seasonal rivers of the Sout, Geelbeks and Hol rivers as well as the smaller seasonal tributaries which includes Spitskop, Nabeeb, Rooiberg, Groot Graafwater, Kraalboskolklaagte, Volstruisleegte and Moedverloor tributaries. The Geelbeks and Sout rivers along with their tributaries become the Hol River, which is the major Knersvlakte tributary of the Olifants River (appendix 1, Map 5). With exception of one or two minor tributaries, most of the rivers originate outside the reserve. Few of these rivers have a Freshwater Ecosystem Priority Area (FEPA) status (Nel *et al.* 2011a & b; Table 2.5). No significant threats were identified for individual rivers, but rather for the catchments as a whole. This is especially important for rivers and sub-quaternaries that are national priorities (Nel *et al.* 2011a & b). The reserve's focus will be on removing invasive alien plant species from rivers and associated wetlands.

Table 2.5: Listed National Freshwater Ecosystem Priority Area Rivers and their estimated health condition. Health scores are defined as follows; natural (A), good-natural (AB), good (B), fair (C), degraded (D). All other rivers in the reserve have a health condition between (AB) and (C).

River	Condition *	FEPA Status
Nabeeb	AB	FEPA catchment
Spitskop	AB	FEPA catchment
Kraalboskolkhoog-te (Groot Graafwater)	AB	FEPA catchment
Rooiberg	AB	FEPA catchment
Tributary: Rooiberg	AB	FEPA catchment

River	Condition *	FEPA Status
Lower Groot Graafwater	C	FEPA catchment
Lower Rooiberg	AB	FEPA catchment

* Condition estimated through a combination of real data, desktop study and specialist input.

2.3.2.3 Wetlands

Few priority wetlands, those found in Critical Biodiversity Areas including National Freshwater Priority Areas were mapped in the Knersvlakte Nature Reserve (Nel *et al.* 2011a & b; Appendix 1, Map 5). These only include single wetlands, with a few wetland clusters mapped adjacent to the reserve. The mapped wetlands found in the reserve include channelled and a few un-channelled valleybottom wetlands, bench depressions and bench flats and some valleyhead seeps (Nel *et al.* 2011a; see Ollis *et al.* 2013 for wetland type descriptions). These systems are mainly ephemeral, or at most, seasonal wetland systems, with expected health conditions ranging from good/natural to modified ecological health. Current impacts on these systems are likely related to historical land use practices.

The regional wetland types include Knersvlakte Succulent Karoo and Namaqualand Sandveld wetlands. Of these, the Knersvlakte channelled valleybottom and flat wetlands, associated with the Geelbeks, upper Sout and Rooiberg river catchments, are considered least threatened and moderately protected. In contrast, the Knersvlakte un-channelled valleybottom wetlands are considered to be vulnerable and poorly protected and the depressional wetlands are mapped as endangered and also poorly protected (Gouws *et al.* 2012; Nel & Driver 2012).

Of the Namaqualand Sandveld regional wetland types, which is generally found in the lower lying catchment of the Hol River, the channelled valleybottom, bench flat and depressional wetlands are considered least threatened, but not protected. The Namaqualand Sandveld un-channelled wetlands are an endangered ecosystem that is not protected (Gouws *et al.* 2012; Nel & Driver 2012). No significant threats were identified for these ecosystems and therefore no specific management actions are considered at present.

2.4 Biodiversity Context: Taxa

2.4.1 Invertebrates

The south-western Cape represents a distinct zoogeographic zone, characterised by the phylogenetic antiquity of much of its invertebrate fauna. Invertebrates are a vital component of terrestrial and aquatic ecosystems (McGeoch 2002; Samways *et al.* 2010; Samways *et al.* 2012) and constitute more than 80% of all animal diversity, yet they are grossly under-represented in studies of African diversity (Veldtman *et al.* 2017). They are essential for nutrient recycling via leaf-litter and wood degradation, carrion and dung disposal and soil turnover. Moreover, they play integral roles in plant pollination, especially in the Cape Floristic Region where the flora is dependent on specialised pollination guilds. In addition, this group maintains plant community structure via phytophagy (including seed feeding), and supports insectivorous animals, such as many birds, mammals and reptiles.

It is speculated that the area in which the Knersvlakte Nature Reserve is situated constitutes the southern end of a south-west African centre of tenebrionid endemism and diversity (Scholtz & Holm 1985; Penrith 1986a & b; Penrith & Endrödy-Younga 1994). Furthermore, narrow flowers of plants such as *Lycium cinereum*, *Hermannia cuneifolia* and *Conophytum* spp. that occur in the Knersvlakte will attract specialist pollinators with long mouth parts (Struck 1995). Struck (1995) observed a wide range of bees (14 solitary species plus the honey bee), masarine wasps (eight species), flies (seven species), beetles (13 species) and butterflies (three species) that pollinate flowers in the area. Bees, masarine wasps and bee flies (Bombyliidae) were the most important in terms of diversity and abundance, while butterflies occurred in a highly erratic fashion. However, some plant species (e.g. *Conophytum* spp.) are dependent on butterfly species as pollinators (Struck 1995). In addition, *Fidelia paradoxa* bees are specialist pollinators of *Mesembryanthemum fastigiatum* (Whitehead 1984). Many of these pollinators are endemic to the area, possibly because their distributions are restricted by their host plants, many of which also show a high degree of endemism.

The butterflies of South Africa were assessed according to International Union for Conservation of Nature (IUCN) criteria as part of the South African Butterfly Conservation Assessment project (Mecenero *et al.* 2013). There are 38 species of Lepidoptera that are endemic to the Western Cape. Mecenero and others (2013) argued that, in the South African context, it is not just the threatened taxa that are of importance, but also those taxa that are intrinsically rare or localised but not currently threatened. One of these species, *Pseudonympha southeyi kammiesbergensis*, occurs in the Knersvlakte. The species is classified as Rare – Habitat specialist with a restricted range (Mecenero *et al.* 2013).

Another ecologically important invertebrate group is the Arachnida. A total of 966 species represented by 365 genera and 68 families have been recorded in the Western Cape (Dippenaar-Schoeman *et al.* 2015) of which 361 species are endemic to the Western Cape (37.4%). Unfortunately to date very little information has been collected in the Knersvlakte Nature Reserve and there is no spider species list available for the reserve. Given the information generated by the South African National Survey of Arachnida, it is highly likely that the reserve might harbour endemic spider species.

Several scorpion species have been recorded inside the Knersvlakte Nature Reserve. Species include *Uroplectes carinatus*, *Parabuthus capensis*, *Opisthophthalmus granifrons* and a possible new species of *Opisthophthalmus*. Observations in the field revealed that scorpions like *Parabuthus capensis* prefer red sand with leafy succulent shrubs e.g. *Drosantheropsis diversifolia* and *Drosantherum pulverulentum* as habitat. *Uroplectes carinatus* is more likely to be found on *Phyllobolus* spp. where they hide or wait during full moon nights for prey to pass by. On cold moonless nights *Uroplectes carinatus* predominates because they can cope better with low temperatures. In contrast, *Opisthophthalmus granifrons* are more common in areas with clay soil where they occur out in the open between shrubs. They are mainly found during warm nights with a light breeze (R. Christiaan 2019, Biodiversity Monitoring Transect Analysis in Africa, pers. comm.).

Uroplectes ansiedippenarae is endemic to the Succulent Karoo Biome in the Northern Cape and Western Cape provinces of South Africa (Prendini 2015). It is

known from eight localities in the Calvinia and Sutherland districts of the Northern Cape Province, and the Vanrhynsdorp District of the Western Cape Province (Prendini 2015). This species is the smallest species in the genus *Uroplectes* and among the smallest scorpion species in southern Africa, with adults ranging from 16-20 mm in total length (Prendini 2015). The species occurs at an altitudinal range of 370-860 m in Central Knersvlakte Vygieveld and Northern Knersvlakte Vygieveld (Prendini 2015).

Aquatic macro-invertebrates are highly sensitive to environmental change and are thus used extensively as indicators of river health (Dickens & Graham 2002). One of the taxa used to monitor health of freshwater systems is the Odonata (dragonflies and damselflies) (Samways & Simaika 2016). A total of 27 species of Odonates have been recorded in the Knersvlakte Nature Reserve area since 1980 (Underhill *et al.* 2018). All the species are listed as Least Concern, except the Cape thorn-tail (*Ceratogomphus triceraticus*), which is listed as Near Threatened and last recorded in 2010 (Underhill *et al.* 2018).

In the context of the Knersvlakte Nature Reserve the main threats to invertebrate populations include habitat destruction and/or degradation and illegal collections as part of the pet trade. This critically important group can be protected by managing ecosystems within set parameters and proactive law enforcement.

2.4.2 Amphibians

The Knersvlakte Nature Reserve is a particularly arid area that is generally not suited to a high frog diversity given their typical dependence on water or moisture for reproduction. Despite this limitation, there are five species of frogs recorded from the reserve, Cape River frog (*Amietia fuscigula*), Namaqua dainty frog (*Cacosternum namaquense*), clicking stream frog (*Strongylopus grayii*), Cape sand frog (*Tomopterna delalandii*) and the paradise toad (*Vandijkophrynus robinsoni*). None of these species are of conservation concern and none are endemic to the reserve. Currently all are listed as Least Concern based on IUCN assessments (Turner & De Villiers 2017). These species can be conserved in the Knersvlakte Nature Reserve by ensuring that the vegetation is well managed (vegetation type diversity maintained) and that surface water management includes maintenance of existing natural and artificial water bodies, even if these are only temporary, and that existing seeps and streams in the area are not over-abstracted.

2.4.3 Fish

The Knersvlakte Nature Reserve is situated within the Olifants-Doring River system that has 10 described indigenous freshwater fish species of which eight are endemic, making it the most species-rich river system within the Cape Fold Ecoregion (Skelton *et al.* 1995). Of the 10 fish species, five are listed as threatened based on the 2016 Red List Assessment. Despite its location within the Olifants-Doring River system, the reserve does not contribute to the conservation of the native fish fauna of this system. This is as a result of the arid climate of the region and the absence of perennial rivers and permanent lakes. The Hol and Sout rivers flow during the wet season (April to October) but typically have brackish water with high conductivity as a result of the underlying geology and high evaporation rates. There are no indigenous fish records for the reserve but extralimital Mozambique tilapia (*Oreochromis mossambicus*) is

present throughout permanent pools in in the Hol, Sout and Varsche rivers. This species is hardy and tolerant of the habitat conditions typical of these rivers.

2.4.4 Reptiles

The Knersvlakte Nature Reserve currently have 17 reptile species recorded. In addition to these, there are at least as many or more species that are expected to occur within the reserve that have not yet been formally recorded. Continued surveillance and formal surveys should be used to compliment the inventory. In particular, an effort should be made to survey rocky areas for the speckled padloper (*Chersobius signatus*) as one of the few threatened reptile species in this area. This species was evaluated as Endangered during a recent assessment (Hofmeyr *et al.* 2018). Several reptile species in the reserve are desirable in the pet trade and vigilance is required to prevent illegal collection of these species, for example armadillo girdled lizard (*Ouroborus cataphractus*), including associated damage to their rocky outcrop habitat (Figure 2.13). Other than this specific intervention, good management of the veld will ensure persistence of the reptile diversity of this area.



Figure 2.13: Armadillo girdled lizard (*Ouroborus cataphractus*). Photo: Stuart Nielsen.

2.4.5 Avifauna

The Knersvlakte Nature Reserve has very little to offer in terms of bird habitat diversity with the majority of the area dominated by low growing karroid type vegetation interspersed with gravel/quartz areas. The species (e.g. lark and korhaan species) recorded for the reserve are typical of these arid areas. A number of avifaunal species

associated with riverine habitat e.g. African Reed-warbler (*Acrocephalus baeticatus*) have been recorded in the reserve, but in very low numbers.

The number of South African Bird Atlas surveys undertaken in this area since 2007 is very low, averaging just over four surveys per pentad for the 19 pentads that hold data for the reserve. The poor coverage makes it difficult to interpret the data and a number of species were excluded from the list based on low recording rates. The number of species recorded on the reserve excluding those removed is 90, but this may increase if the data is improved through increased surveys. An added complexity is that the reserve is situated just north of the Succulent Karoo/Fynbos interface. The distribution of a number of species e.g. Levaillant's Cisticola (*Cisticola tinniens*), Cape Spurfowl (*Pternistis capensis*) and Cape White-eye (*Zosterops virens*) ends relatively abruptly along the escarpment just south of the reserve. With the poor survey coverage, it is hard to determine the importance of the reserve for these species.

Seven threatened bird species have been recorded in the Knersvlakte Nature Reserve (Taylor *et al.* 2015). These include Black Harrier (*Circus maurus*), Ludwig's Bustard (*Neotis ludwigii*), Secretarybird (*Sagittarius serpentarius*), Southern Black Korhaan (*Afrotis afra*), Lanner Falcon (*Falco biarmicus*), Verreaux's Eagle (*Aquila verreauxii*) and Karoo Korhaan (*Eupodotis vigorsii*). In terms of distribution, however, two species that were recorded over a large area were the Ludwig's Bustard and Karoo Korhaan, suggesting that the reserve could be important for these two species. In the case of the Ludwig's Bustard, evidence for this was presented by Shaw (2013) who found that the species occurred in higher concentrations within the Succulent Karoo Biome.

There is also evidence of Black Harrier breeding in the river courses to the east of the reserve (M. Garcia-Heras 2018, Percy FitzPatrick Institute of African Ornithology, pers. comm.). Verification of the importance of the reserve for threatened bird species can only be achieved with additional data and it is recommended that further bird atlas surveys be carried out throughout the reserve.

Given their highly mobile nature the impacts of climate change on birds may be less than for other taxa (Simmons *et al.* 2004). However, studies undertaken as part of the 'Hot Birds Research Project' of the Percy FitzPatrick Institute of African Ornithology at the University of Cape Town has shown that behaviour and physiology of many bird species are impacted by high temperatures. Despite being highly mobile it is expected that should the current trend of climate warming continue that the birds within the Knersvlakte Nature Reserve may be subjected to this global threat.

2.4.6 Mammals

The Knersvlakte Nature Reserve has a diverse mammal species community but no species endemic or near-endemic to the province. Most species are representative of the arid landscape and well adapted to survive in the Succulent Karoo Biome.

Currently there are 20 mammal species recorded from the Knersvlakte Nature Reserve (some indicated in Figure 2.14) with at least 14 additional species expected to occur in the reserve. The majority of the mammal species known from the reserve are small to medium sized carnivore species (e.g. small spotted genet (*Genetta genetta*), bat-eared fox (*Otocyon megalotis*) etc.), with shrews, rodents, even-toed ungulates such as springbok (*Antidorcas marsupialis marsupialis*), hares and aardvark

(*Orycteropus afer*) making up the rest of the species component. Two ecotypical games species occur on the reserve, namely the common duiker (*Sylvicapra grimmia grimmia*) and the steenbok (*Raphicerus campestris*). These species are currently listed as Least Concern but are a priority for data collection and monitoring on population trends to inform the next red list assessment.

A number of other species may be present or migratory within the Knersvlakte Nature Reserve. The reserve is located within the historical range of the brown hyena (*Parahyaena brunnea*) (Stuart & Stuart 1988). No records post 1999 has been detected in or near the reserve (Yarnell *et al.* 2016) and their presence has not been recorded to date. This species is currently listed as Near Threatened (Yarnell *et al.* 2016). Species listed as Vulnerable that may occur on the reserve include the leopard (*Panthera pardus pardus*) and the black footed cat (*Felis nigripes*) (C Birss 2017). Leopards are unlikely to be resident as this species is dependent on available open water, but dispersing animals may cross through the reserve. Similarly, greater kudu (*Tragelaphus strepsiceros strepsiceros*) is likely to disperse through the reserve and a single distribution record was recorded in the Bitterfortein area just north of the reserve (CapeNature 2018).



Figure 2.14: A selection of mammal species recorded in the Knersvlakte Nature Reserve, top left to bottom right: Aardvark, common duiker, bat-eared fox, steenbok, black-backed jackal and springbok. Photos: Knersvlakte Nature Reserve field staff.

The availability of surface water has been identified as critical for the survival of various mammal species, most notably the small springbok population found in the reserve. The development of a water management that guides water availability throughout the reserve has been identified as a priority for the protected area (section 10).

The small springbok populations found on the Graatjiesgat, Jakkalsdraai, Uitspanrug, Kareeberg, Groot Graafwater, Goedehoop and Vinkelskolk portions of the reserve should be actively managed as separate ecological units until there is better consolidation between the current properties that make up the reserve. Currently there are between 100-150 animals in total. In order to prevent veld damage, the springbok

numbers must be monitored and kept within the ecological grazing capacity of the reserve. A suitable habitat and water availability assessment will be done to set accurate stocking guidelines.

The presence of black-backed jackal (*Canis mesomelas*) and caracal (*Caracal caracal*) on the reserve may lead to human-wildlife conflict from neighbouring small stock farmers. This needs to be addressed as per CapeNature standard guidelines (section 3.5) where and when it arises.

Other than these specific interventions, good management of the veld and water resources will ensure persistence and resilience of the mammal diversity found within the reserve.

2.5 Heritage Context

Section 5 of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) outlines general principles for heritage resources management while Section 9 of this Act outlines responsibilities of the state and supported bodies.

2.5.1 Heritage resources

Heritage has been identified as one of the key ecological values of the Knersvlakte Nature Reserve. The Knersvlakte area is particularly rich in terms of palaeontological, archaeological and historical heritage. Trace fossils that were found within the Vanrhynsdorp Group include the *Planolites* (Gannabos Formation), *Oldhamia geniculata* (Besonderheid Formation), and *Treptichnus pedum* (Kalk Gat Formation). As yet, no trace fossils have been found within the Flaminkberg Formation. The trace fossils found within the Gannabos Formation is described as large 1-2 cm wide horizontal burrows, which is characteristic for an offshore storm-influenced marine environment (Almond *et al.* 2008). The trace fossils of the Besonderheid Formation is comprised of complex sub-horizontal burrow systems, and wrinkle marks which show a sophisticated foraging behaviour (Almond *et al.* 2008; Aceñolaza *et al.* 2009). (Figure 2.15).

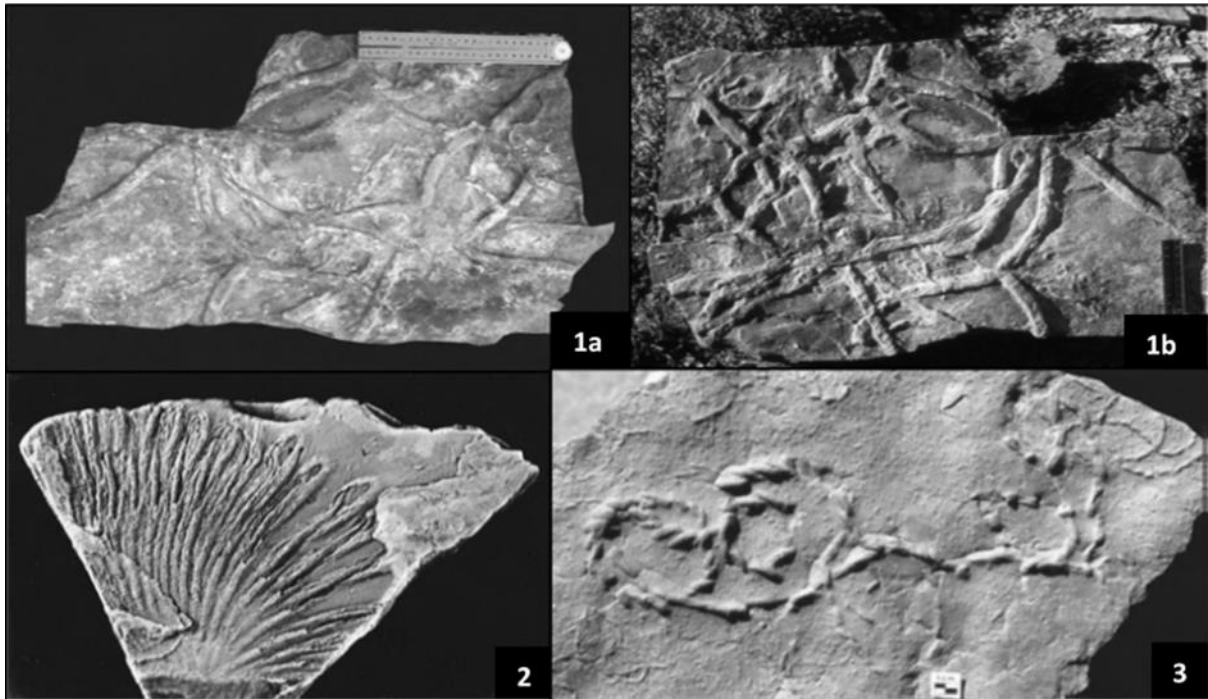


Figure 2.15: The Ediacaran-Early Cambrian trace fossils found within the Vanrhynsdorp Group formations: 1a) *Planolites* sp., Gannabos Formation; 1b) Large horizontal hyphichnial burrows, Gannabos Formation; 2) *Oldhamia geniculata*, Besonderheid Formation; 3) *Treptichnus pedum*, Kalk Gat Formation (reprint from Almond *et al.* 2008; Aceñolaza *et al.* 2009).

The Vanrhynsdorp Group formations (Kalk Gat, Besonderheid, Gannabos), as well as the Flaminkberg Formation fall within the boundary of the Knersvlakte Nature Reserve and it is likely that these palaeontological features will be present in the reserve.

The archaeological context of the Knersvlakte area was poorly known, until various archaeological surveys were conducted on several farms within the area between 1995 and 2011. During these surveys various Early-, Middle- and Late Stone Age artefacts were found. These comprised of hand-axes and rare cleavers, flakes and blades, retouched tools, pottery sites and a bifacial point manufacturing site, shell pendants, bone tools, string and netting, wood shavings, threaded shell, seed and ostrich eggshell beads, an adze and two backed bladelets with mastic and fragments of painted ostrich eggshell. Historical findings comprised of fabric, matches, iron, wheat grains and a button (Orton *et al.* 2011) (Figure 2.16).

The abovementioned archaeological survey sites fall outside of the boundary of the Knersvlakte Nature Reserve but due to its proximity to the reserve, it will be of importance to broaden the research and knowledge base around these features within the reserve.

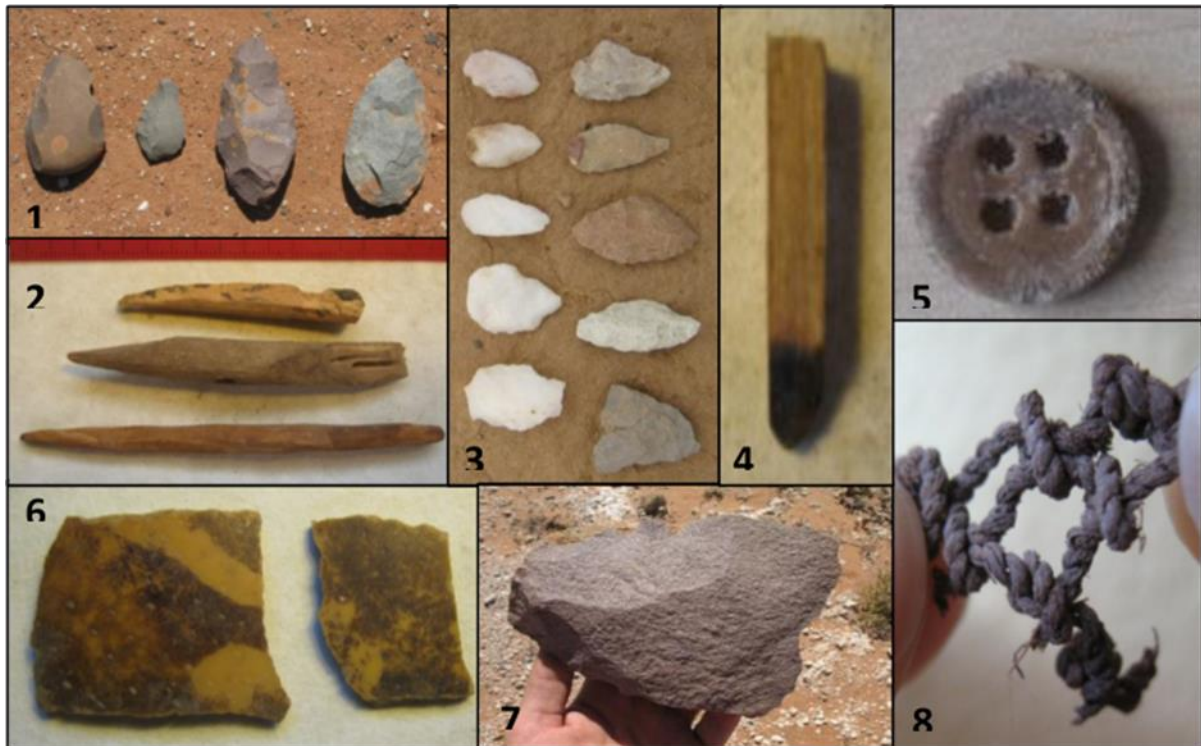


Figure 2.16: The various artefacts found within the survey sites in the Knersvlakte: 1) Early Stone Age hand-axes; 2) Late Stone Age wood artefacts; 3) Middle Stone Age bifacial point manufacturing site; 4) Late Stone Age matches; 5) Late Stone Age button; 6) Late Stone Age fragments of painted ostrich eggshell; 7) Early Stone Age rare cleavers; and 8) Late Stone Age netting (reprint from Orton *et al.* 2011).

Historical heritage include active sites found where pre-colonial and colonial pastoralists lived and moved through the Knersvlakte. The ancient routes followed were mostly between known water points, as travellers could not move great distances within the Knersvlakte area without allowing for water replenishment. Some historical artefacts, old structures and implements and a number of grave sites have been discovered on the reserve. These sites are recorded through informal heritage surveys conducted by staff, local landowners, historians and archaeologists. A formal archaeological survey has been prioritised (section 10) to fully understand the rich cultural and historical heritage found in the reserve. As heritage sites become known, or are located, they are recorded onto the reserve heritage inventory and conserved in situ.

2.5.2 Living heritage

There are three alternative theories as to where the name of the Knersvlakte derived from. Firstly, it is speculated that it was so named by the transporters of old because of the sound made as their carriages' iron wheels crunched "*knors*" over the area's distinctive white quartz pebbles (Cowling & Pierce 1999). The quartz pebbles found all over the surface make a grating noise when one steps on them (Erasmus 1995) – "*Die vlakte van die knersende tande*". A second explanation is that due to the dry soil and tremendous summer heat as well as the high salinity of this seemingly endless plain, humans and animals had to grind their teeth due to great thirst to move over the almost waterless plain (Le Roux 2005). A third alternative theory refers to the

transformation of “*Kneg se Vlakte*” named after Mr Willem Kneg, a Dutch nomad farmer who grazed livestock on the Knersvlakte plains during winter months. At the time he rented the land from the state (Le Roux 2005).

The Knersvlakte has a rich history and culture dating back centuries. The name Trutro is derived from “toru” “toro”, which means “dry land” in the Klein Namaqua language. The word “toru” is Karoo which translates to dry and/or thirsty and “toro” means soil (Scholtz 1964). This is a most apt and culturally significant description of the Knersvlakte region. The Sonqua (San) were likely the first inhabitants in the Trutro region (Namaqualand and more specifically Vanrhynsdorp). Their Late Stone Age implements can still be seen in the area (Boonzaier *et al.* 1996). They led a nomadic existence, living off the resources of the environment and moved over the plains to the more mountainous areas (Dennis Moss Partnership 2004). It is estimated that the ancestors of the San moved into the region around 100 000 years ago (Boonzaier *et al.* 1996).

There are indications that the Namaqua tribes (Khoikhoi stock-farmers and herdsman) visited the area from around 2 000 years ago (Slingsby & Coombe 2001). For more than a 1 000 years before the vessel of Bartolomeüs Dias de Novaes, in 1487, a Portuguese navigator and explorer, saw the Matzikama Mountains from the sea (Dennis Moss Partnership 2004), the Khoikhoi visited all the areas north of the Tharrakamma (Olifants River). Evidence of this can be found in the stone tools, rock drawings and clay pots found in the area. The pots indicate shepherd activities of the Khoikhoi, while the rock art and Late Stone Age implements indicate San activities. The Early and Middle Stone Age implements confirm the existence of many early (ancient) inhabitants of the area (Thackeray *et al.* 1990; Boonzaier *et al.* 1996).

Another Khoikhoi tribe, the Grigriqua were found along the Olifants River in the second half of the seventeenth century (Scholtz 1964). The Grigriqua were peaceful livestock farmers that travelled around in small groups within the greater area. They were a small tribe and often turned to the bigger and stronger Namaqua tribe. By the middle of the seventeenth century there appeared to be a division in the ranks of the Grigriqua tribe and it is claimed that the Great Grigriqua was north of the Olifants River in 1652 while the Little Grigriqua was located between the Olifants River and Saldanha Bay. The Great Grigriqua maintained in most respects the same way of life as the Namaqua tribe and was sometimes recorded by the Europeans as a Namaqua tribe (Scholtz 1964).

During 1652 the Dutch East India Company founded a refreshment post near the Cape of Good Hope. Shortly after arriving, European settlers started exploring the interior including the Cape West Coast and Namaqualand (Boonzaier *et al.* 1996). The Trutro and north-western frontier (Figure 2.17) was further made known by explorers such as Pieter van Meerhoff, Olof Bergh and Christoffel Henningh's travels inland, in search of copper, after a number of Namaqua travellers visited Commander Simon van der Stel in the Cape with samples of copper during 1681 (Scholtz 1964; SAHO 2011a).



Figure 2.17: Historical drawing (1779) by Colonel Robert Jacob Gordon of the Troetoe fountain in de Caroo between Oliphants River and the northern Bokkeveld. Drawing housed in the Rijksmuseum, Amsterdam, Nederland.

As a result of the northward movement of European settlers since the early 1700s, settlers found themselves as migrants north of the confluence of the Olifants and Doring rivers. By the time the forefront of settlers entered the Olifants River area, with the exception of a few kraals, little Khoikhoi remained in the area. The Smallpox epidemic of 1713 resulted in many deaths among the local Khoikhoi which saw their numbers and strength severely reduced (Scholtz 1964; SAHO 2011b).

Between 1730 and 1740 various skirmishes broke out between settler farmers and nomadic Bushmen located between the Olifants River and Bokkeveld Mountains. During 1734 the Olifants River mouth was declared the boundary of the Cape Colony. The border ran from the Matzikama Mountains along the Olifants River to the river mouth. As a result the Trutro region (greater Knersvlakte) was beyond the Cape Colony border (Scholtz 1964). For almost two decades thereafter, no settler farms were officially recorded here, even though the land was occupied by “owners”. The dry and “bare” Knersvlakte and Hardeveld landscape temporarily stopped the movement of people, forcing travellers north-eastwards towards the Bokkeveld escarpment and Hantam areas (Scholtz 1964). The Trutro mission station (modern day Vanrhynsdorp) was completed by Hendrik van Rhijn during 1751.

The Griqua community have a long association with the Trutro region. Their presence in the region dates back to the time when paramount Chief, Die Kneg, Andrew Abraham Stockenstrom le Fleur I (1867-1941) led his people to escape English colonialist at the time. They are direct descendants of the indigenous San and Khoikhoi. Their first leader was Adam Kok I. Today the farm Ratelgat belongs to the

Griqua National Conference Development Trust and it holds significant spiritual and cultural significance for them as a community; it is also a declared provincial heritage site (SKEP 2011; Natural Justice 2016). Apart from the significant cultural heritage of the Ratelgat farm, it also contributes to the protection of biodiversity in the greater Knersvlakte Bioregion.

2.6 Socio-Economic Context

In terms of the Municipal Systems Act, 2000 (Act No. 32 of 2000), municipalities are required to use integrated development planning to plot future development in their mandated management areas. The municipal Integrated Development Plan (IDP) sets the strategic and budget priorities for development and aims to co-ordinate the work of local and other spheres of government. The IDP should also address how the environment will be managed and protected, and is supplemented by a Spatial Development Framework (SDF).

IDPs and SDFs are tools for integrating social, economic, and environmental issues. As biodiversity is a fundamental component of sustainable development, IDPs and SDFs offer an opportunity to ensure that biodiversity priorities are incorporated into municipal planning processes through consultation. In turn, the identification of biodiversity-related projects for the IDP can support local economic development and poverty alleviation. The Knersvlakte Nature Reserve occurs within the local Matzikama Municipality, which forms part of the greater West Coast District Municipality (Appendix 1, Map 1).

The primary land use adjacent to the Knersvlakte Nature Reserve is agriculture, mainly small stock farming (sheep and goats) and a very small proportion of grain farming. A mix of commercial and communal land is in use around the reserve. There are two communities adjacent to the reserve (Rooiberg and Beeswater) that practice subsistence small stock farming. The towns surrounding the reserve are mostly dependent on agricultural and mining related business. Businesses are mainly service providers to the community. Table 2.6 provides a breakdown of the socio demographics for the Matzikama Municipality (Matzikama Municipality 2018).

Table 2.6: Socio-economic information for the Matzikama Municipality.

Local Municipality	No of Residents	Households	Unemployment Rate *	Indigent Households (2016)
Matzikama	71 403	20 821	12%	2 926

* Economic active people.

According to the Matzikama Municipality IDP (2018), the municipality currently has a population of 71 403, rendering it the third smallest municipal area within the West Coast District. The total population of the Matzikama Municipality is estimated to account for 16% of the district population. This total is estimated to increase to 77 926 by 2024 which equates to a 1.5% growth rate, compared to the estimated population growth of the West Coast District (2.8%) (WCDM 2017).

It is clear that unemployment and poverty is a serious concern in the local municipality and the reserve therefore strives to contribute to job creation in order to help mitigate unemployment and poverty in the region. Provincial treasury funding allows for

permanent staff appointments. Additional staff are also appointed through other funding mechanism such as the national Expanded Public Works Programme and the Environmental Protection and Infrastructure Programme. These programmes strive to employ a high number of un-skilled and semi-skilled youth (55%), women (55%) and disabled persons (2%). The above initiative aims to contribute to local economic and social development within the region, particularly communities surrounding the reserve. In return, the reserve receives work opportunities for various operational tasks such as alien clearing, infrastructure maintenance, ecological monitoring and administration services; enhancing both service delivery to the public and ecosystem services.

During the employment of local people, un-skilled workers are also up-skilled through specific training sessions in order to make them more competitive in the job market.

3 POLICY FRAMEWORK

CapeNature is subject to the framework of the Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996), national legislation including the National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) (NEM: PAA), and all associated regulations and norms and standards for the management of protected areas in South Africa and all other relevant requirements as set out in the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM: BA).

3.1 Purpose of Protected Area Management

The declaration of protected areas is part of a strategy to manage and conserve South Africa's biodiversity. Accordingly, the object of the management plan is to ensure the protection, conservation and management of the natural and cultural historic heritage in a manner that is consistent with the objectives of the NEM: PAA, and for the purpose for which protected areas were declared.

3.2 Guiding Principles

The following guiding principles underpin the management plan for the Knersvlakte Nature Reserve:

- Articulate desired results in terms of conservation outcomes, not actions.
- Articulate how management responses will lead to desired results.
- Monitor progress towards achieving desired results.
- Consider monitoring programme design at the onset of planning.
- Consider expected outcomes of management at the outset of planning.
- Invest in management response appropriate to the risk.
- Adapt strategies based on lessons learnt understanding that measuring effectiveness alone may not resolve uncertainty; data and analyses are necessary to guide management towards doing more of what works and less of what does not work.
- Share results to facilitate learning, acknowledging that although success is not a given, learning can be, through honest appraisal of efforts.

The protected area is also subject to the principles and provisions of relevant international treaties and conventions, national and provincial legislation and policy, and any local contractual or co-management agreements.

3.3 Strategic Adaptive Management

Strategic Adaptive Management integrates planning, management and monitoring to provide a framework for:

- Testing assumptions;
- Learning through monitoring and evaluation; and
- Adapting strategies or assumptions.

Strategic Adaptive Management bridges management and decision science by systematically evaluating results and using this information in a community of practice (CMP 2013) enabling management to change course when it becomes evident that it is necessary, rather than waiting until the end of a strategy to determine whether an intervention worked (Conservation Coaches Network 2012).

CapeNature has adopted, and applies, the Open Standards for the Practice of Conservation adaptive management framework (CMP 2013) as illustrated in Figure 3.1. The Open Standards facilitates Strategic Adaptive Management through a systematic evidence based participatory process with stakeholders (CMP 2013). The systematic approach makes explicit the links between goals, focal values, threats, strategies and actions, enabling management to define and measure success of their actions in the protected area over time.

The Open Standards framework is comprised of five stages (Figure 3.1):

- Conceptualising the protected area (i.e. defining the purpose of the protected area, establishing scope and vision; selecting focal values and assessing threats, and analysing the conservation situation (i.e. assessing contributing factors in terms of opportunities and challenges);
- Planning actions and monitoring (i.e. drafting the plan based on theories of change using results chains);
- Implementing actions and monitoring (i.e. drafting work plans, doing the work and monitoring the work);
- Analysing and using results to adapt (i.e. deciding if what was planned is working); and Capturing results, sharing and learning (i.e. learning and sharing what is learned).



Figure 3.1: Strategic Adaptive Management framework adapted from The Open Standards for the Practice of Conservation (CMP 2013).

The framework works on the rationale that effective conservation of carefully selected focal values will ensure the conservation of all indigenous biodiversity and cultural historic heritage within the protected area that in turn contributes to a functional landscape. At the same time, the rationale follows that healthy focal values deliver ecosystem services essential for human wellbeing. An assessment of the current condition of focal values serves as a baseline against which to measure condition over the next 10 years and guides the formulation goals and conservation strategies with associated objectives, indicators and work plans.

As such, step one of the adaptive management framework illustrated in Figure 3.1 is foundational to effective management of the area.

Focal values are classified as follows:

- Natural values can be species, habitats or ecological systems, which collectively represent and encompass the biodiversity of the protected area. They can include the physical, natural features from which ecosystem services flow, benefitting humans in a variety of ways.
- Cultural historic values are described in terms of the tangible features that collectively represent and encompass the cultural historic heritage of the protected area. They can also include the physical, cultural and/or historic features from which human wellbeing values are derived.
- Human wellbeing values are the intangible or non-material values derived from tangible values, and which collectively represent the array of human wellbeing needs dependent on natural and cultural features; they can be defined in terms of the benefits delivered to humans by healthy ecosystems, or by intact cultural or historical features.

3.4 Protected Area Management Effectiveness

Management effectiveness evaluation is the assessment of how well a protected area is being managed, primarily the extent to which management is protecting values and achieving objectives (Hockings *et al.* 2015). The following questions underpin management effectiveness evaluation (Leverington & Hockings 2004):

- Is the protected area effectively conserving the values for which it exists?
- Is management of the area effective and how can it be improved?
- Are specific projects, interventions and management activities achieving their objectives, and how can they be improved?

The monitoring and evaluation framework applied (Figure 3.2) measures compliance and management effectiveness of the protected area in terms of the NEM: PAA and associated norms and standards for protected area management. Management effectiveness is assessed over time using the Management Effectiveness Tracking Tool – South Africa (METT-SA) which is based on the six elements of good management:

- It begins with understanding the **context** of existing values and threats;
- progresses through **planning**;
- and allocation of resources (**inputs**);
- and as a result of management actions (**processes**);
- eventually produces products and services (**outputs**); that
- result in impacts or **outcomes**.

Management effectiveness is measured at the strategic level as a percentage, drawing upon the results of fine scale monitoring linked to management actions, objectives, goals and focal values articulated in this plan (Figure 3.2). Management effectiveness includes the measurement of administrative processes such as capacity and budgets that, when adequate, are likely to result in positive conservation outcomes.

Mechanisms for monitoring and evaluation are built into each aspect of the strategic plan (Section 10) through the inclusion of verifiable indicators of progress. The protected area monitoring and evaluation programme, supplementary to the

management plan, monitors site level implementation of the plan, status of values and effectiveness of strategies. Results contribute to the Western Cape State of Biodiversity report, produced at five-year intervals.

Furthermore, management reports annually on implementation of the plan through CapeNature’s strategic performance management system. The performance management system ensures that implementation of the protected area management plan is embedded in individual staff performance agreements.

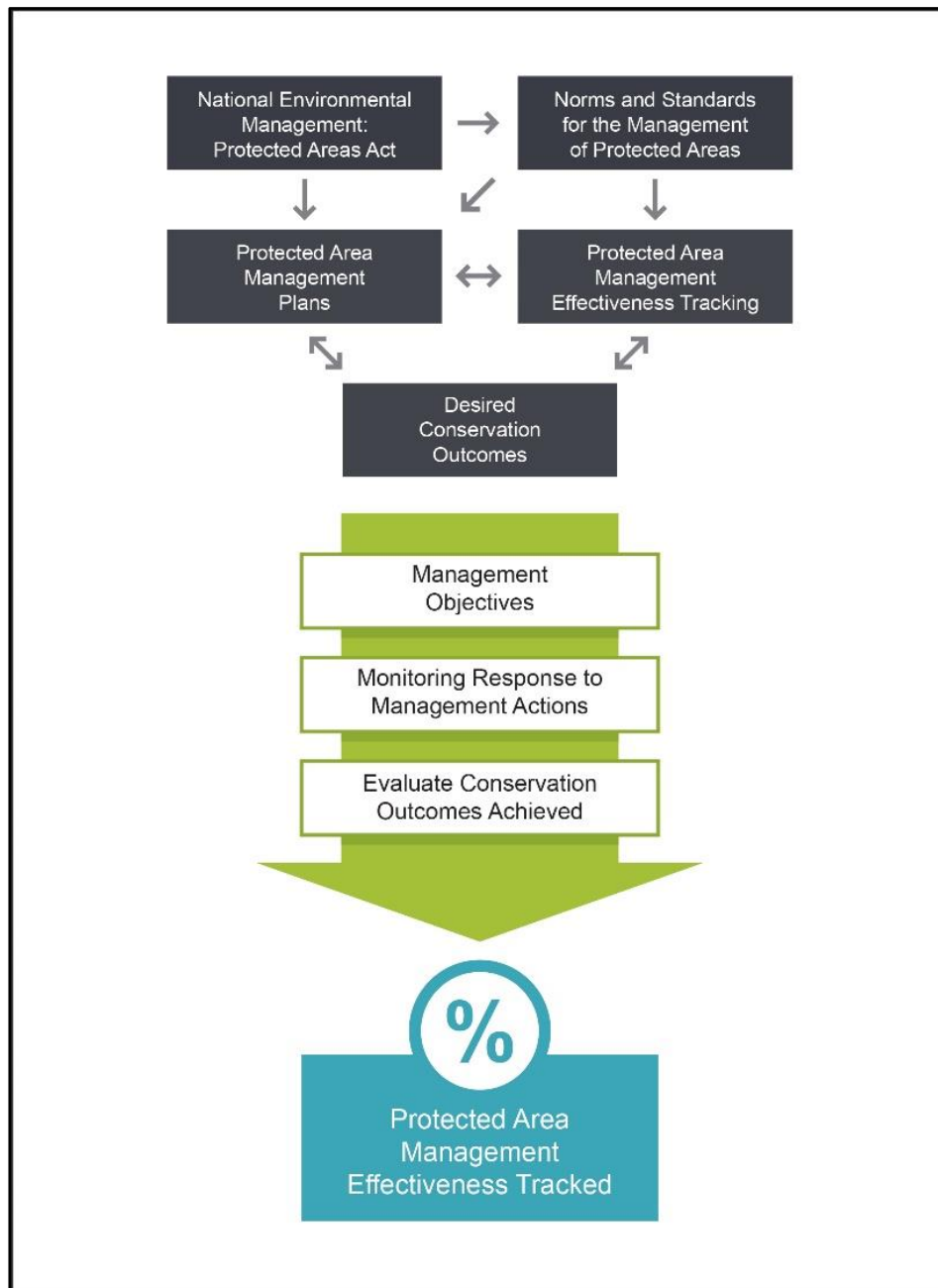


Figure 3.2: Protected area monitoring and evaluation framework.

3.5 Policy Frameworks

Protected area management is guided by CapeNature policies, procedures and guidelines for use across the organisation. Policies, procedures and guidelines applicable to this management plan are referenced here and in Section 10.

3.5.1 Internal rules

In terms of Section 52 of NEM: PAA, as amended, the management authority of a nature reserve may, in accordance with prescribed norms and standards, make rules for the proper administration of the area.

In addition to the Regulations for the Proper Administration of Nature Reserves, as gazetted on 12 February 2012 in Government Gazette 35021, the protected area implements the Nature Conservation Ordinance, 1974 (Ordinance No. 19 of 1974) and Provincial Notice 955 of 1975.

3.5.2 Financial

CapeNature is a schedule 3C public entity responsible for nature conservation in the Western Cape. CapeNature is the executive arm of the Western Cape Nature Conservation Board, established in terms of the Western Cape Nature Conservation Board Act, 1998 (Act No. 15 of 1998) as amended. The objectives of the Board as per the Board Act are:

- To promote and ensure nature conservation and deal pro-actively with related matters in the province;
- To render services and provide facilities for research and training that would inform and contribute to nature conservation and related matters in the province; and
- To generate income, within the framework of the applicable policy framework.

Funding for the entity comprises three main revenue streams. The majority of funding, which equates to approximately 80% of funding, is received in terms of a provincial allocation received in terms of Vote 9. Secondary funding, which is approximately the further 20%, is received from external donors and own revenue. Own revenue generation consists mainly of tourism income generated through activities and accommodation available on various nature reserves managed by the entity.

The organisation prides itself on its strong internal controls, sound financial management and practicing of good corporate governance. Corporate governance within the entity embodies sound processes and systems and is guided by the Public Finance Management Act, 1999 (Act No. 1 of 1999) and the principles contained in the King 4 Report of Corporate Governance.

3.5.3 Safety and security

Business Continuity Plan: The CapeNature business continuity plan establishes and provides emergency response procedures and protocols which need to be implemented should an event significantly disrupt the operations of the organisation or an emergency situation is declared by management. The plan identifies critical services, how it will be maintained, how to minimise the impact, increase preparedness and initiate an effective response.

Integrated Compliance Plan: The integrated compliance plan for the Knersvlakte Nature Reserve details how compliance and enforcement will be implemented in the reserve in order to:

- Prevent biodiversity loss caused by human activities on the protected area through the implementation of active and passive compliance and enforcement operations.
- Ensure compliance with legislation through the monitoring of activities in the protected area.
- Address and combat illegal activities through the institution of criminal proceedings.
- Report illegal activities to the delegated authority where activities have a negative impact on the protected area (e.g. listed activities in terms of the National Environmental Management Act).
- The integrated compliance plan is a dynamic reference document which is continually updated and improved, using the data that is gathered in the course of the implementation thereof in order to achieve the management objectives of the protected area.

3.5.4 Resource use

Resource utilisation is governed by CapeNature’s policy on consumptive use of wild flora from CapeNature managed protected areas (CapeNature 2019a). The policy implementation framework and protocol provides guidelines on how access to natural resources inside the protected area should be managed.

According to NEM: PAA, Section 50, the management authorities of protected areas, including World Heritage Sites may, subject to the management plan of the protected area or site, allow or enter into a written agreement with or authorise a local community inside or adjacent to the protected area or site, to allow members of the community to use in a sustainable manner biological resources in the protected area or site. Section 50, however also states that an activity allowed in terms of this section may not negatively affect the survival of any species in, or significantly disrupt the integrity of the ecological systems of the protected area or site.

CapeNature undertakes to build the capacity of natural resource users and other relevant stakeholders on the sustainable utilisation of natural resources and its environmental regulatory framework in and outside protected areas.

3.5.5 Biodiversity management

Integrated Catchment Management Strategy: Integrated catchment management is regarded as improving and integrating the management of land, water and related natural biological resources in order to achieve the conservation, and sustainable use of these resources. The CapeNature integrated catchment management strategy (CapeNature 2016) will focus on three key areas including; catchments, freshwater and coastal management. All of these contribute to socio-economic development and are underpinned by key principles including knowledge, advocacy, awareness and an enabling environment.

The integrated catchment management strategy is aligned to national and provincial priorities and has five strategic objectives to guide implementation namely:

- To integrate the management of the physical, ecological and man-made components of the environment to ensure sustainability and integrity of the ecosystems and the services that they provide in order to ensure long-term climate change resilience.
- Management of biodiversity assets, ensuring their contribution to the economy, rural development, job creation and social wellbeing is enhanced.
- To enhance biodiversity implementation through the development of strategic tools and knowledge management systems.
- People are mobilised to adopt practices that sustain the long-term benefits of biodiversity.
- The required enabling environment (including institutional and professional capacity, policy and legal framework, partnerships, strategic and operational alignment and stakeholder support) is established and sustained.

Invasive Species Monitoring, Control and Eradication Plan: The invasive species monitoring, control and eradication plan for the Knersvlakte Nature Reserve was compiled according to the requirements and regulations of the NEM: BA. The plan guides management action to reduce infestation densities and rates of invasive and alien fauna and flora species within the protected area through systematic integrated control methods.

Western Cape Protected Area Expansion Strategy: The Western Cape Protected Area Expansion Strategy and Implementation Plan 2015-2020 (WCPAES) (CapeNature 2015a) aims to expand the Western Cape protected area network to encompass a more representative and resilient suite of areas that support biodiversity and ecological infrastructure, especially those threatened species and ecosystems that remain as yet unprotected. The Knersvlakte Nature Reserve expansion will be achieved in line with the WCPAES.

Management of Large Game: All large game species in protected areas will be managed in accordance with the Fencing and Enclosure of Game and Predators in the Western Cape Province Policy (CapeNature 2015b) as well as the Game Translocation and Utilization Policy for the Western Cape Province (CapeNature 2019b). CapeNature advocates the following broad best practice guidelines:

- All game farms bordering the protected area that have extra-limital or historic alien animals, must be enclosed to the standards as stipulated in the CapeNature fencing policy. Protected area personnel must do regular inspections on the reserve side of the fence and escapees must be reported to the owner immediately.
- If the owner is in possession of a Certificate of Adequate Enclosure, they must be given reasonable time to remove the animals as soon as possible. Game animals escaping from properties without a valid Certificate of Adequate Enclosure are *res nullius* and must be dealt with accordingly. Protected area staff must stipulate and regulate the actions to remove the animals (*i.e.* flying with a helicopter to recapture or to chase back).
- In cases where *res nullius* game animals enter the protected area, reserve staff must report it immediately and a decision must be taken to either have the animals removed, culled or that they may remain on the protected area.

- All protected areas with game animals who wish to remove surplus animals, must follow protocol which includes approval at landscape level.
- Where alien invasive game (e.g. fallow deer) are observed in protected areas, staff must take immediate action by removing these animals in a humane manner.

Damage Causing Wild Animals: CapeNature’s position statement on human-wildlife conflict aims to ensure coexistence of humans and indigenous wild animals and considers human-wildlife conflict as situations where artificially induced interactions between humans and wildlife lead to situations requiring mitigation of loss, disturbance or damage. CapeNature requires that human-wildlife conflict be managed, taking into consideration all legal, ethical and welfare implications and that interventions are carried out within an ecologically sound framework. There is a provincial co-operative agreement between CapeNature and the Predation Management Forum to facilitate the management of predators on private land to ensure best practice and self-regulation.

CapeNature advocates the five-step approach to holistic wildlife management of damage causing wildlife namely (1) understanding the origin of the problem; (2) maintaining the correct attitude and respect towards the animal; (3) the responsible species must be identified correctly; (4) implement suitable mitigation measures; and (5) implement effective selective control methods. CapeNature advocates the following broad best practice guidelines:

- All reports of predators found on protected areas and causing stock losses on neighbouring properties must be reported to CapeNature. All actions against predators must be actioned on the property where the losses occurred and not within the protected area; no hunting or pursuing of predators on any protected area is legally allowed.
- Landowners are encouraged to form part of the Predation Management Forum through their local farmers association to obtain management and mitigation support.
- All other wildlife found on protected areas and causing losses or damage on neighbouring properties must be reported to and investigated by relevant CapeNature staff who will assist the landowner with mitigation management.
- Domestic animals (e.g. donkeys, goats, cattle, sheep and pigs) that roam onto protected areas from neighbouring properties must be addressed by relevant staff in conjunction with the local municipal authority through the draft National Animal Pounds Bill and/or any local authority bylaws.
- All feral animals (domestic animals that have become wild and without an owner) found within a protected area must be removed in a humane manner immediately.
- No confiscated, nuisance, damage-causing wildlife or rehabilitated wild animals may be released onto a protected area unconditionally.

3.5.6 Cultural resource management

CapeNature acknowledges that access to protected areas for traditional, spiritual, cultural and historical purposes has major benefits for people and accepts that

protected areas have intrinsic and extrinsic value for the people of the region. CapeNature therefore recognises the need to manage, conserve and promote natural assets for the benefit of all. CapeNature contributes towards the promotion of culture and heritage through the development and conservation of heritage resources as well as the facilitation of access.

3.5.7 Neighbour relations

In the context of the Knersvlakte Nature Reserve, adequate fencing is a key requirement to address boundary demarcation, stock and predator management. Currently there are no fence maintenance agreements with neighbouring land owners but this is a priority action.

Illegal access to the reserve and neighbouring landowners poses a security and biodiversity risk throughout. Agreements with neighbours as well as the local and district municipality that enhance controlled access throughout the Knersvlakte area is a priority to activate.

3.5.8 Research and development

The National Biodiversity Research Development and Evidence Strategy 2015-2025 highlights the increasing demand for knowledge and evidence to support policy and decision making for the protection of biodiversity and the realisation of benefits from our natural resources (DEA 2016a). In response to this CapeNature developed a biodiversity research and monitoring strategy. The overall goal of this strategy is to provide reliable data and knowledge to inform and facilitate the conservation of the biodiversity and sustained ecosystem functioning in the Western Cape Province.

Structured monitoring programmes need to be put in place and carried out consistently over time to monitor the state of biodiversity and ecosystem functioning. This allows tracking of ecosystem health and allows for critical evaluation of management practices by employing Strategic Adaptive Management. There is a strong focus on applied scientific research that is driven by protected area management requirements.

In partnership with Dr Ute Schmiedel from the Hamburg University in Germany, the Knersvlakte Nature Reserve forms part of the Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL) initiative. Annual long-term monitoring of the vegetation in the reserve commenced in 2001 and focusses on vegetation cover in permanently marked plots. In addition, individual plants are monitored annually on selected plots. The vegetation monitoring is also accompanied by weather monitoring. The monitoring aims to understand the drivers of the vegetation and plant population dynamics, the effects of annual seasonal weather variance and long-term climate change. The understanding of climatic drivers of plant population dynamics will inform management decisions and projections for future climate change on the effect it is likely to have on the diversity and performance of plants in the Knersvlakte.

The reserve has identified the following research needs as a priority:

- Human-wildlife interaction/conflict;
- Priority species – ecology/evolution/genetics;
- Succulent Karoo resource use – grazing/medicinal plants/groundwater;

- Landscape rehabilitation/building resilience;
- Climate change impacts;
- Heritage and history.

3.5.9 Access

CapeNature strives to establish a differentiated and leading brand of products in outdoor nature-based tourism across the Western Cape Province for all to enjoy. This is achieved by providing opportunities to the public and interacting in an environmentally responsible and sustainable manner specifically to:

- Optimise income generation for biodiversity conservation;
- Optimise shared growth and economic benefits, to contribute to national and provincial tourism strategies and transform the tourism operations within CapeNature; and
- Strengthening existing and developing new products with special attention to the provision of broader access for all people of the Western Cape Province.

Furthermore CapeNature strives to increase and improve stakeholder awareness, understanding and participation in environmental conservation through:

- Developing the capacity of local people to meaningfully and responsibly participate in the management and enjoyment of protected areas; and
- Educating relevant stakeholders and creating awareness around key environmental issues to increase knowledge about the environment, develop a deeper understanding about environmental principals and encourage environmentally conscious values that allow for more informed and environmentally responsible decision making.

As part of its multi-sectoral approach, CapeNature aims to support the Western Cape Education Department's efforts through presenting curriculum aligned environmental education programmes to schools and will endeavour to collaborate with like-minded partners in pursuit of environmental sustainable development goals as platforms for involving citizens and groups with the aim of expressing a "call to action". Behaviour change efforts will be optimised through targeting specific audiences with innovative, transformative, quality assured programmes and interventions.

3.5.10 Administrative framework

In terms of CapeNature's administrative operating footprint, the province is divided into two regions, namely region east and region west. Each region is further sub-divided into two landscapes; of which each landscape is divided into three units.

The Knersvlakte Nature Reserve is one of six protected area complexes that occurs within the organisation's west region. It falls into landscape west; located within the Matzikama unit. The reserve is supported primarily through head office as well as the landscape office located in Porterville.

The Knersvlakte Nature Reserve staff component is primarily based in the local Vanrhynsdorp office and report through the conservation manager through to the Landscape Manager. The staffing structure for the reserve is depicted in Figure 3.3.

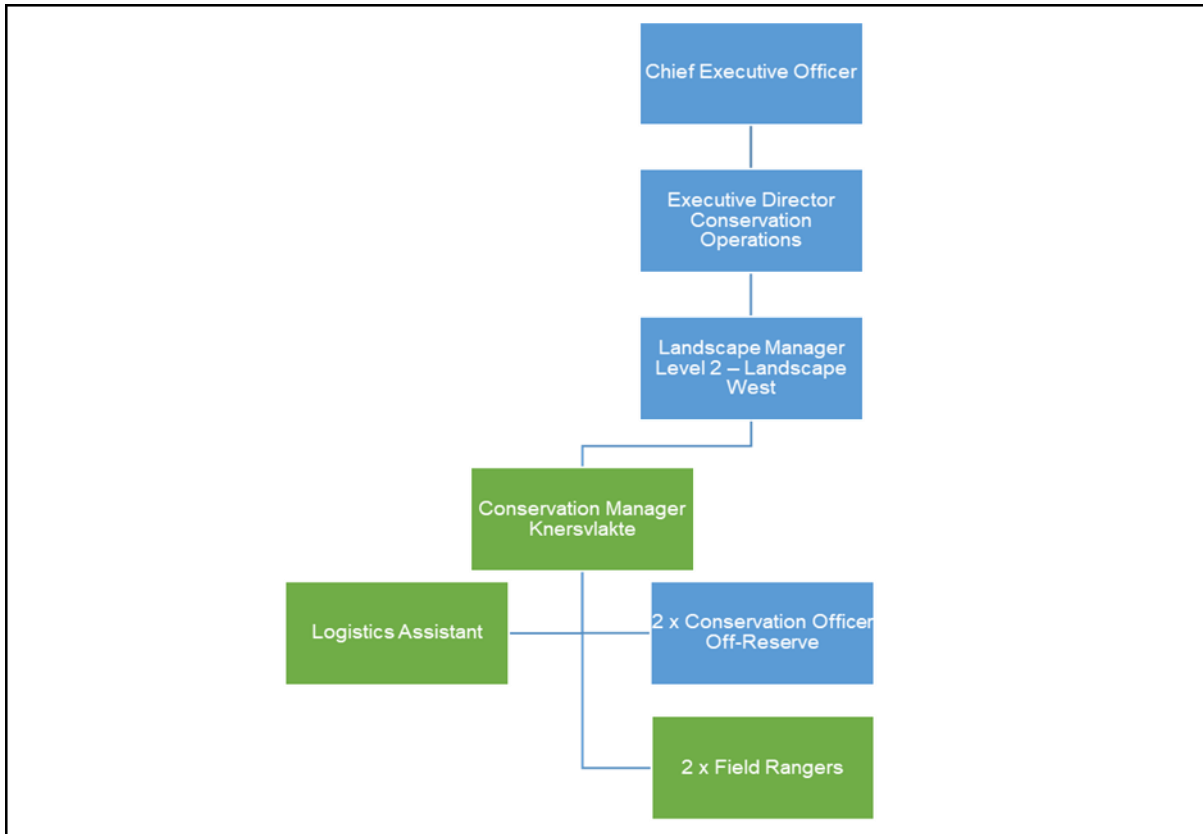


Figure 3.3: Approved organogram for the Knersvlakte Nature Reserve.

4 CONSULTATION

This section outlines procedures for public participation during the development of the management plan, including formal processes for public comment on the draft plan and establishes procedures for public participation during the implementation phase of this plan, Figure 4.1.

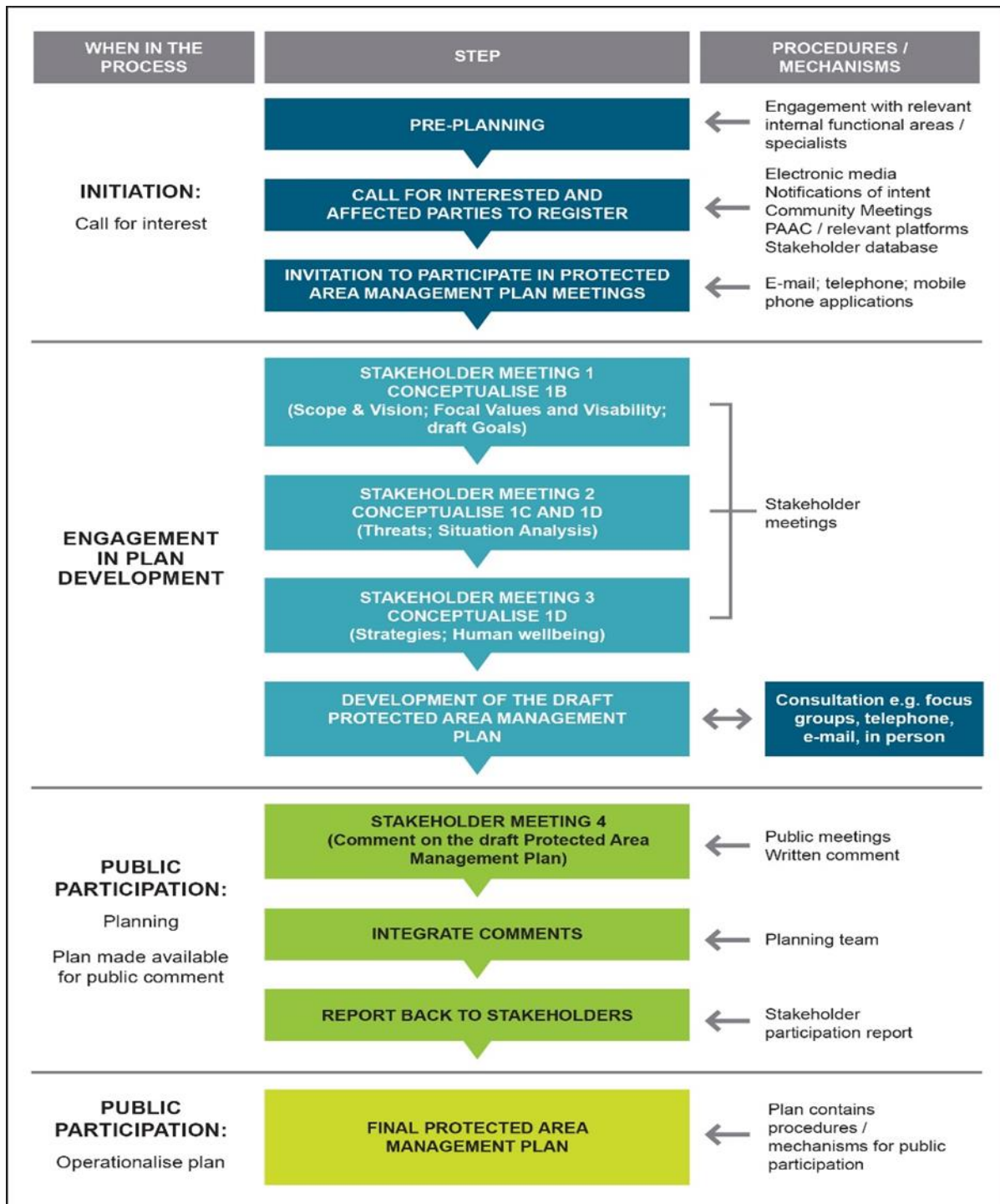


Figure 4.1: Process flow for protected area stakeholder engagement.

Stakeholder engagement takes place throughout the adaptive management cycle and enables public participation essential for sustainability, builds capacity and enhances responsibility. It promotes communication and the derivation of new information and/or expertise.

At the outset of the planning process for the protected area, a stakeholder analysis identified relevant internal and external stakeholders, and defined the scope and purpose of engagement.

4.1 Stakeholder Engagement

4.1.1 Participatory planning

Several approaches to engaging internally and externally with stakeholders were applied, including structured facilitated workshops, meetings, site visits and the provision and circulation of information for input. Different stakeholders were engaged using varied approaches during the stages of the planning process, from gathering and sharing information, to consultation, dialogue, working groups, and partnerships. The degree of engagement was guided by the stakeholder analysis and in response to the need (i.e. transparency of process/expert opinion/buy-in and support, etc.).

During 2018-2019 a series of expert-facilitated stakeholder workshops were coordinated and hosted by CapeNature. A range of stakeholders representing individuals or agencies with an interest in, and/or knowledge/expertise of the landscape, and individuals or agencies with the capability to support the implementation of the Knersvlakte Nature Reserve management plan were involved, see section 4.1.1.1. Workshops were aimed at developing a strategic framework for the reserve to help coordinate efforts in the landscape towards a common vision. The desired outcomes were to capacitate stakeholders in the understanding of the natural and cultural focal values in the Knersvlakte Nature Reserve and to identify mechanisms to maintain those values over time.

The outcomes of the above-mentioned process were precursors to the site-specific management planning process for the protected area and formed the foundation for smaller working groups towards the development of the management plan. The Knersvlakte Nature Reserve management planning process was further facilitated by the core planning team comprised of the CapeNature conservation manager, landscape conservation intelligence manager, landscape ecologist, ecological coordinator, off-reserve conservation manager/officer, stakeholder engagement manager/officer and landscape manager. A series of workshops and core planning team meetings were held with relevant internal stakeholders.

4.1.1.1 Key stakeholder groups engaged

- Communities (Vanrhynsdorp, Vredendal, Nuwerus and Strandfontein);
- Private landowners and neighbours (Griqua's, Rooiberg and Beeswater small farmers);
- Resource managers mandated to manage the land for conservation (CapeNature, various private landowners/neighbours);
- Landowner (WWF-SA);

- Government agencies mandated to support and regulate land and water management and other relevant affairs:
 - Department of Environment, Forestry and Fisheries;
 - Department of Agriculture (Western Cape);
 - Department of Minerals and Resources;
 - South African Police Services (SAPS) - (Vanrhynsdorp, Nuwerus);
 - Heritage Western Cape.
- Local authorities
 - West Coast District Municipality;
 - Matzikama Municipality.
- Tertiary Institutions
 - University of Hamburg.
- Other interested and affected parties who support and/or work in the planning domain
 - Namaqua tourism;
 - Kliprand, Landplaas and Bitterfortein farmers associations;
 - South African National Biodiversity Institute (SANBI);
 - Custodians of Rare and Endangered Wildflowers;
 - Research done by various other local and international universities.

To date 18 targeted stakeholder engagements have been initiated and facilitated with the eight above-mentioned stakeholder groupings through the following mechanisms:

4.1.1.2 Workshops

Stakeholder workshops had the following key themes:

- Planning purpose: introducing stakeholders to planning for adaptive management; planning scope and vision;
- Conceptualisation: capacitating stakeholders in adaptive management planning; selecting focal values and assessing the condition of focal values; threats assessment and conservation situation analysis;
- Planning actions: identifying strategies; developing theories of change and developing objectives and indicators;
- Internal stakeholder engagement: scientific and technical review.

4.1.1.3 Working groups and other input opportunities

In instances where specific input was required or stakeholders and/or experts were unable to participate in workshops, smaller teams engaged and/or public meetings were facilitated to:

- Share workshop outputs, progress, and test the rationale of situation analyses- for example meetings with scientists and specialists related to taxon, habitat, ecosystem or other specific planning or knowledge gaps;
- Provide opportunities for specific community engagements to reach as many individuals as possible via platforms such as the Knersvlakte Protected Area Advisory Committee (PAAC);
- Facilitate information sessions and registration of interest with community members and/or neighbours to gain local or site specific information.

4.1.2 Procedures for public comment

The formal stakeholder participation process was initiated on 14 November 2019 and was concluded on 15 December 2019. The process was facilitated by an external service provider – Footprint Environmental Services. A process inviting the public and interested and affected parties to register their interest and comment on the draft protected area management plan was initiated via the media and direct contact via email and telephone calls. Notifications were placed in one local newspaper (Ons Kontrei), electronic media e.g. CapeNature's website and Facebook page.

Furthermore, copies of the draft management plan was placed at public libraries in Bitterfontein, Nuwerus, Lutzville, Vredendal, Vredendal North and Vanrhynsdorp. The draft management plan was also available at the CapeNature office in Vanrhynsdorp, and on the CapeNature website for the duration of the stakeholder participation process. Written comment was invited on the draft protected area management plan for a period of 30 days.

Registered interested and affected parties were invited to public meetings and provided the opportunity to provide information and express their opinion. Four meetings were held:

- 29th November - Vergenoeg Primary School (Vredendal North) at 11:00;
- 29th November - Letsatsi Lodge Vanrhynsdorp at 15:00;
- 30th November - Lutzville Hotel at 10:00 and
- 30th November - Nuwerus Community Hall at 13:00.

Only the Vredendal meeting was attended by four stakeholders. A number of comments from the stakeholder meeting as well as the general public were received during the stakeholder participation process. Based on a comprehensive stakeholder engagement report containing all inputs received from the public meetings, written comments and comments and responses received by email, the draft management plan was amended where relevant. Feedback were provided to registered interested and affected parties.

A comprehensive stakeholder register, maintained by the Knersvlakte Nature Reserve lists all stakeholders and registered interested and affected parties, as well as comments received and responses provided. Refer to Appendix 2 - Stakeholder Engagement Process Report for the Knersvlakte Nature Reserve.

4.1.3 Procedures for participatory implementation

4.1.3.1 Protected Area Advisory Committee

Participatory management is facilitated through structures such as the PAAC with the aim of regular interaction with stakeholders and a mechanism to evaluate stakeholder feedback, to promote good neighbour relations and to influence beyond protected area boundaries.

The Knersvlakte Nature Reserve PAAC was established in 2010. As of 2018, the PAAC meetings are chaired by local land owner and neighbour to the reserve, Mr Kobus Visser. Meetings are convened bi-annually and open to any interested

stakeholder or partner. The PAAC allows for a reserve communication and engagement platform; allowing all stakeholders a platform for input into reserve management matters. Current representation is largely by local land owners neighbouring the reserve, Matzikama Municipality, LandCare and the Griqua community. Discussion points generally pertain to access, damage causing animals, funding for priority environmental projects, fencing protocols, environmental law enforcement, reserve operations and the expansion of the reserve.

4.1.3.2 Other mechanisms for stakeholder engagement

Enhancing engagement and participation by relevant stakeholders throughout the protected area is a key focus going forward. Current structures for stakeholder engagement, additional to the PAAC include:

- The Western Cape Stewardship Reference Group.
- District Assessment Panel for LandCare projects.
- Olifants River Estuary Forum.
- Steenkampskraal Water Advisory Committee.
- Greater Cederberg Biodiversity Corridor.
- The National People and Parks Programme implemented by CapeNature has established a regional structure in the area to enable community engagement. The primary objective is to link communities with relevant government departments that can assist with issues such as access for marine resource utilisation or for spiritual, recreational, educational, traditional and other purposes. The programme is also designed to capacitate communities with regard to relevant legislation, policies and regulations.
- Through the Comprehensive Rural Development Programme, CapeNature partners with non-governmental organisations, government departments and communities. The Council of Stakeholders is an elected structure of representatives from communities and focus areas include access, job creation opportunities, youth development, and small, medium and micro enterprise development.

5 PURPOSE AND VISION

This section makes provision for CapeNature to manage the protected area exclusively for the purpose for which it was declared. It presents the vision, purpose, focal values and key threats foundational to developing the desired state for the reserve.

The desired state, articulated as goals in this management plan, defines the outcome of management and directs management within and beyond protected area boundaries. This serves as a foundation for appropriate ongoing monitoring and evaluation to assess management effectiveness.

5.1 Management Intent and Desired State

The Knersvlakte Bioregion has long been recognised as a priority region for plant conservation (Hilton-Taylor & Le Roux 1989). It is one of the biological wonders of the world, with unrivalled levels of diversity and endemism for an arid area (EnviroAfrica 2005). The bioregion has an estimated 1 349 plant species with approximately 260

endemics and 130 threatened. It is world renowned for its rich flora of minute succulents associated with quartz fields. The Knersvlakte has a unique desolate character about it; creating a unique sense of place; and space. It supports a unique cultural heritage and history and its people are diverse; yet all of them are proud to be associated with this unique area called the – “Knersvlakte”.

The Knersvlakte Nature Reserve aims to strategically, and adaptively, manage biodiversity towards ensuring the expansion and persistence of an intact natural climate corridor, freshwater ecosystems, and unique cultural heritage and biological diversity of the region through: 1) the prioritised strategic management of threats 2) improving the condition of terrestrial ecosystems through integrated catchment management 3) ensuring that properties comprising the reserve are legally secured and protected area design is augmented by expansion/consolidation through stewardship or other effective means 4) cooperative governance 5) effective illegal resource use control 6) managed access to facilitate sustainable and sensitive access and tourism 7) providing a unique research and learning space for Succulent Karoo systems and 8) ultimately to contribute meaningfully to socio-economic development of the region and its people.

5.2 Purpose

Historically the motivation for the establishment of the Knersvlakte Nature Reserve was based on the small size of the conservation estate and its poor conservation status, at that time, despite it being identified as a global biodiversity hotspot.

In the process of determining the layout of the reserve, a strong emphasis was placed on the conservation of the patterns of biodiversity and ecological and evolutionary processes associated with the unique habitats and biota of the region, especially related to the dwarf succulents and quartz fields (Desmet *et al.* 1999). Through a systematic conservation planning process an initial “core area” of 57 724 ha of the Knersvlakte lying just to the north of the towns of Vanrhynsdorp and Vredendal was identified by botanists to be of extreme importance for long term ecological conservation (Desmet *et al.* 1999). The area support a broadly representative botanical make-up but also reflected those areas of the highest botanical value and that were exposed to the greatest perceived threats from mining and agriculture (Desmet *et al.* 1999).

During 1999 WWF-SA purchased the first property Moedverloren with funding provided by the Leslie Hill Succulent Karoo Trust (LHSKT). Between 1999 and 2014 an additional 31 properties were acquired by WWF-SA, with funding from the LHSKT, and currently the reserve area comprises 90 057 ha. During 2014 the Knersvlakte Nature Reserve was officially proclaimed. Through continued efforts between CapeNature, WWF-SA, and LHSKT; including various other partners, the aim is to continue to grow and consolidate the protected area to fully give effect to the original conservation intent. The conceptualisation, development and establishment of the Knersvlakte Nature Reserve over many years has been a remarkable conservation achievement.

CapeNature manages the Knersvlakte Nature Reserve in accordance with its organisational vision, and in accordance with the vision, goals and strategies derived in consultation with stakeholders, as set out in this section.

The Knersvlakte Nature Reserve was declared for the following purposes (Section 17 of the NEM: PAA):

- a) to protect ecologically viable areas representative of South Africa’s biological diversity and its natural landscapes and seascapes in a system of protected areas;
- b) to preserve the ecological integrity of those areas;
- c) to conserve biodiversity in those areas;
- d) to protect areas representative of all ecosystems, habitats and species naturally occurring in South Africa;
- e) to protect South Africa’s threatened or rare species;
- f) to protect an area which is vulnerable or ecologically sensitive;
- g) to assist in ensuring the sustained supply of environmental goods and services;
- h) to provide for the sustainable use of natural and biological resources;
- i) to create or augment destinations for nature-based tourism;
- j) to manage the interrelationship between natural environmental biodiversity, human settlement and economic development;
- k) generally, to contribute to human, social, cultural, spiritual and economic development; or
- l) to rehabilitate and restore degraded ecosystems and promote the recovery of endangered and vulnerable species.

5.3 Vision

The vision for the Knersvlakte Nature Reserve is:

To protect, promote and enhance the unique landscape, succulent plant diversity, wildlife and cultural heritage of the arid Knersvlakte corridor, through partnership, and respect and care to benefit future generations.

5.4 Focal Values

In consultation with stakeholders, natural and cultural historic focal values were identified, explicitly defined, and selected for their ability to represent the full suite of biodiversity and cultural historic heritage found within the protected area.

Focal values are summarised in Table 5.1. Features considered to be nested within or catered for by the conservation of the focal value, are noted. Key human wellbeing values derived from the tangible natural and cultural focal values are also noted. Since human wellbeing values are those components of wellbeing affected by the status of tangible natural or cultural values, their ‘health’ or status is not assessed separately, but seen as contingent upon the status of the natural and cultural focal values selected.

Table 5.1: Summary of the Knersvlakte Nature Reserve focal values and viability as at 2019.

Focal Value	Description, Nested Values, Key Attributes & Associated Human Wellbeing Values	Current Status
Knersvlakte Catchments	Description: The Knersvlakte catchments value includes the three main seasonal rivers of the Sout, Geelbeks and Hol rivers as well as the smaller seasonal tributaries which includes Spitskop, Nabeeb, Rooiberg, Groot Graafwater, Kraalboskolklaagte, Volstruisleegte and Moedverloor tributaries.	Good

Focal Value	Description, Nested Values, Key Attributes & Associated Human Wellbeing Values	Current Status
	<p>Nested values of note: Flora and fauna species associated with these rivers and catchment systems including animal species that use these as corridors.</p> <p>Key attributes: Indigenous vegetation species composition.</p> <p>Associated human wellbeing value(s): Economic development; Social upliftment.</p>	
<p>Knervlakte Reserve Connectivity</p>	<p>Description: The increase in the conservation estate through stewardship, land purchases and the transfer of state land will promote reserve consolidation/expansion and increase habitat connectivity/resilience. This approach is regarded as one of the best responses to climate change (Pool-Stanvliet <i>et al.</i> 2017). Furthermore it will also contribute to the conservation of priority Succulent Karoo habitat.</p> <p>Nested values of note: All flora and fauna species associated with the Knervlakte Nature Reserve and within its zone of influence.</p> <p>Key attributes: Expansion and consolidation; Eco-typical mammal species population.</p> <p>Associated human wellbeing value(s): Economic development; Sustainable natural resource use; Physical and spiritual health.</p>	<p>Fair</p>
<p>Quartz Vygieveld</p>	<p>Description: The Quartz Vygieveld value includes the two predominant vegetation types, Knervlakte Quartz Vygieveld and Knervlakte Dolomite Vygieveld. Helme (2016) identifies quartz and dolomite outcrops as particularly important for rare and endemic plant species. This value includes all associated rocky outcrops.</p> <p>Nested values of note: Faunal species associated with these vegetation units. This value also includes the eco-typically game species and springbok found in the reserve.</p> <p>Key Attributes: Integrity of nano-succulent populations.</p> <p>Associated human wellbeing value(s): Economic development; Social upliftment; Sustainable natural resource use; Environmental education and awareness; Physical and spiritual health.</p>	<p>Not Specified</p>
<p>Vlakte Vygieveld</p>	<p>Description: The Vlakte Vygieveld value covers the majority of the Knervlakte Nature Reserve and includes the three predominant vegetation types, Central Knervlakte Vygieveld, Knervlakte Shale Vygieveld and Northern Knervlakte Vygieveld.</p> <p>Nested values of note: Faunal species associated with these vegetation units. This value also includes the eco-typically game species and springbok found in the reserve.</p> <p>Key attributes: Indigenous vegetation cover; Indicator species of disturbance.</p> <p>Associated human wellbeing value(s): Economic development; Social upliftment; Sustainable natural resource use; Environmental education and awareness; Physical and spiritual health.</p>	<p>Good</p>
<p>Heritage</p>	<p>Description: Heritage values includes graves, fossils, artefacts and historical structures and ruins.</p> <p>Nested values of note: Fossilised fauna and flora, geological history, pre-colonial history, colonial history, cultural history and living heritage.</p> <p>Key attributes: Heritage condition.</p>	<p>Fair</p>

Focal Value	Description, Nested Values, Key Attributes & Associated Human Wellbeing Values	Current Status
	Associated human wellbeing value(s): Social upliftment; Diverse Knersvlakte history and identity; Environmental education and awareness; Physical and spiritual health.	
Ground and Surface Water	<p>Description: The ground and surface water value includes boreholes and surface water points that provides numerous animal species found within the reserve with drinking water. It is also used for staff accommodation needs.</p> <p>Nested values of note: Various faunal species that are dependent on water. Operational needs.</p> <p>Key attributes: Groundwater quantity; Groundwater quality; Groundwater availability; Surface water availability.</p> <p>Associated human wellbeing value(s): Economic development; Social upliftment; Environmental education and awareness; Physical and spiritual health; Sustainable natural resource use.</p>	Not Specified

As the public entity responsible for nature conservation in the Western Cape, CapeNature delivers a suite of core services to the public towards the following outcomes: resilient ecosystems; the promotion of local economic development, job creation and skills development; growing diversified nature-based revenue streams; access to environmental education, advocacy and education, and access to natural and cultural heritage.

Human wellbeing is articulated as an outcome of conservation and is illustrated in Table 5.2. These focus areas are essential to the effective execution of this management plan and achievement of goals.

Table 5.2: Human wellbeing values of the Knersvlakte Nature Reserve.

Human Wellbeing Values	Description and Associated Benefits	Current Status
Diverse Knersvlakte History	<p>Description: This value is focussed on the broader Knersvlakte history which is generally not well researched or easily available. The complete story, from the first living organism (fossils), the early San and Khoikhoi inhabitants as well as the arrival of the colonial era, should be documented and available and preserved in some or other secure (digital) way. The reserve aims to promote this rich history and make it available to anyone interested (locals, schools, neighbours and visitors to the reserve). The Griqua community story is an integral part of the broader Knersvlakte history.</p> <p>Key attributes: Indigenous Knersvlakte historical knowledge.</p>	Fair
Economic Development	<p>Description: The Knersvlakte Nature Reserve contributes to local economic development by providing a number of job opportunities to local people in the area, mostly of an operational nature. Tourism expansion in the reserve can increase employment availability in the reserve as well as attract additional tourists to the Knersvlakte region.</p> <p>Some concern have been raised by livestock farmers that an increase in Damage Causing Animals (as a result of the reserve) is having a negative impact on livestock farming viability.</p>	Fair

Human Wellbeing Values	Description and Associated Benefits	Current Status
	Key attributes: Operational/Tourism job opportunities; External job opportunities.	
Social Upliftment	<p>Description: Social upliftment of people within and surrounding the Knersvlakte Nature Reserve is critical. Collaboration and engagement with partners in the area is key to enhance training availability and opportunities; a lack of which ultimately has an impact on the whole area, including the reserve.</p> <p>The reserve aims to provide its contract staff component with meaningful functional and life-skills training during their employment period; contributing to their social upliftment and employability.</p> <p>Key attributes: Functional training opportunities; Life skills training opportunities.</p>	Fair *
Sustainable Natural Resource Use	<p>Description: The Knersvlakte Nature Reserve aims to promote and provide access for consumptive and non-consumptive natural resource use, underpinned by structures that promote and enable responsible, sustainable use. The unique location and biodiversity of the Knersvlakte provides ample resource use opportunities that are currently underdeveloped. Possibilities include alien wood harvesting, medicinal plant use, succulent nursery trade, guided plant tours, filming and accommodation, to name but a few.</p> <p>The reserve also serves as a global biodiversity hotspot; providing unique research and learning opportunities into Succulent Karoo ecosystems and species, including the associated social component.</p> <p>Key attributes: Access permits issued (research, day visitors, filming).</p>	Fair
Environmental Education and Awareness	<p>Description: The Knersvlakte Nature Reserve strives to provide an effective environmental education, awareness and interpretation programme that supports all the values of the reserve, and promotes respect and care for the natural environment. This is particularly relevant to local schools, communities and landowners. In many instances the Knersvlakte specific information for these awareness and education initiatives must still be developed.</p> <p>There is also a need to promote the Succulent Karoo among regional tourism partners. Additional aspects that need awareness action, especially among neighbouring landowners include invasive species, damage causing animal management and stewardship.</p> <p>Key attributes: Comprehensive environmental interpretation and awareness plan.</p>	Poor
Physical and Spiritual Health	<p>Description: The unique landscape, remoteness, open spaces and ecological diversity of the Knersvlakte Nature Reserve promotes a sense of place allowing for physical and spiritual health to be instilled. The Knersvlakte, particularly the farm Ratelgat, holds a significant spiritual value to the Griqua community. Sensitive development in and around the reserve is needed to protect this unique value.</p> <p>Key attributes: Aesthetic experience.</p>	Good
Diverse Knersvlakte Cultural Identity	<p>Description: This value is focussed on the broader Knersvlakte culture which is generally not well researched or easily available. The Knersvlakte has a unique cultural identity that has been built over many generations; stretching far back and involving a diverse group</p>	Fair

Human Wellbeing Values	Description and Associated Benefits	Current Status
	of people. It includes aspects such as Late Stone Age archaeology, historic farming practices, a rich linguistic heritage especially evident in the local plant names, historical travelling routes that crossed through the area and sites of cultural and spiritual significance. The Griqua community story is an integral part of the broader Knersvlakte culture. Key attributes: Indigenous Knersvlakte cultural knowledge.	

* Good for functional training opportunities but fair for life skills training opportunities.

5.5 Threats

CapeNature aims to mitigate threats to values, either through direct threat mitigation, or through mitigation or management of a factor contributing to or driving the threat. Threats to focal values and the relevant contributing factors of key threats need to be described in sufficient detail to support effective planning and management.

Threats assessment influences the direction and effectiveness of management options. Rating threats according to scope, severity and irreversibility of impact facilitates the allocation of limited resources, simplifies complex scenarios and provides a systematic decision support method to focus efforts (Table 5.3).

Table 5.3: Summary of critical threats highlighting the focal values of the Knersvlakte Nature Reserve at greatest risk.

Focal Values	Critical Threats	Threat Rating
Knersvlakte Catchments	Historical farm practices; Climate change; Invasive alien plants; Mining and prospecting; Pollution.	High
Knersvlakte Reserve Connectivity	Protected area fragmentation; Mining and prospecting; Inappropriate infrastructure development.	High
Quartz Vygieveld	Lack of available water for animals; Climate change; Inappropriate infrastructure development; Mining and prospecting; Invasive alien plants; Illegal collection; Trampling; Historical farm practices; Pollution.	High
Vlakte Vygieveld	Lack of available water for animals; Climate change; Inappropriate infrastructure development; Mining and prospecting; Historical farm practices; Trampling; Invasive alien plants; Illegal collection; Pollution.	High
Heritage	Lack of heritage maintenance; Vandalism; Pollution.	Medium
Ground and Surface Water	Climate change; Pollution.	Medium

The results of the above threat rating highlighted the following key threats affecting the focal values of the Knersvlakte Nature Reserve as outlined in Table 5.4 below:

Lack of Available Water for Animals (High): The lack of available water for wildlife in the Knersvlakte Nature Reserve has been identified as a high threat. It impacts a

number of nested faunal aspects under both the Quartz and Vlake Vygieveld values, most notably species dependent on daily water. These include springbok, eco-typical game, some reptiles and various bird species. This threat is impacting over a large area and without adequate access to drinking water animals such as springbok die of thirst, during extreme drought periods. The threat is further exacerbated by a warming and drying climate.

Although some open water pools are available in the Geelbeks, Sout and Hol rivers, the majority of water for wildlife is supplied from functional earth dams and boreholes. There are a number of small earth dams located on the reserve (Appendix 1, Map 5; Figure 5.1). These generally collect water during winter rain and dry out during summer. As dams dry, water is supplemented from boreholes. Dams and boreholes located on the reserve are in varying states of disrepair. Of the 47 existing potential points, the usage status of 21 are unknown and only eight are currently functional. The upgrading and maintenance of water infrastructure is a high priority management activity that will require significant capital investment over the next few years. The development of a water resource management plan has been identified as a priority (section 10).

The strategic placement and management of water sources throughout the reserve will be guided by the water resource management plan. This will include spatial and temporal aspects of water points to address concerns of localised overgrazing by especially springbok. Overgrazing has been identified by Helme (2016) as a critical threat for Succulent Karoo ecosystems.

Apart from the availability of water for wildlife, the use thereof for staff related use (cleaning and washing) is also of concern. Currently most water must be transported to site for teams working in-field. The availability of water (albeit non-potable) will assist in alleviating this pressure.



Figure 5.1: Earth dams located in the Knersvlakte Nature Reserve providing water for wildlife. Photo: Reserve staff.

Climate Change (High): Climate change, in this case warming, drying and increased rainfall irregularity, has been identified as a high threat affecting four of the Knersvlakte Nature Reserve values (Catchments; Ground and surface water, Quarts- and Vlake Vygieveld). Annual rainfall over the last 10 years has seen a decline with 78mm recorded in 2017 down from a 10 year annual average of 187mm (section 2).

Climate change will have significant environmental, social, cultural and economic consequences. Although the effects of climate change are speculative, in general, it is likely to have major negative impacts on the Succulent Karoo Biome and Knersvlakte by extension (Pool-Stanvliet *et al.* 2017). It is expected that rainfall patterns throughout the winter-rainfall regions will be disrupted (Helme 2016). This will have dire negative consequences for many specialised endemic species found in the Knersvlakte and Succulent Karoo in general due to their climatic envelope being relatively small (Helme 2016). This will most likely result in reduced geographic ranges and possible extinction of species (Pool-Stanvliet *et al.* 2017). Climate change is considered the most significant threat to catchments and their associated ground and surface water systems within the greater Knersvlakte area (Helme 2016).

In this context the reserve aims to build habitat resilience through increased reserve connectivity and reducing/mitigating contributing threat factors such as grazing pressure, invasive alien plant species and illegal collection of plants and animals.

Inappropriate Infrastructure Development (Medium): Pool-Stanvliet *et al.* (2017) lists the primary loss of biodiversity in the Western Cape is loss of habitat, mainly driven through transformation, degradation and fragmentation. Helme (2016) recommends that land-use activities and development within Succulent Karoo plant communities should be confined to previously disturbed footprints or kept to an absolute minimum as recovery is extremely slow, if at all possible.

Inappropriate infrastructure development has been rated as a medium threat, mainly affecting the vegetation and connectivity values of the Knersvlakte Nature Reserve. It also affects the human wellbeing value related to physical and spiritual health. It relates to the construction of infrastructure either inside or outside of the reserve that would compromise these values. Infrastructure development inside the reserve will be guided through the zonation and concept development plan (sections 6 and 9 respectively) and restricted to previously disturbed footprints.

Inappropriate development within the reserve zone of influence mainly relates to infrastructure that will have major "visual" and "auditory" impacts and may include developments such as major roads, high voltage distribution lines, towers or masts in excess of 30m, wind/solar farms, and mining activities. If these developments take place within the zone of influence it is likely that it would negatively affect the sense of place of the Knersvlakte as a whole i.e. the physical and spiritual value. It is important that this value be recognised and potential threats be mitigated through appropriate engagement with neighbouring landowners and communities, municipal partners through the integrated development plan and developers through the LandUse process.

It is also important to recognise that inappropriate development in the zone of influence and the greater protected area expansion zone, may impact ecological and human wellbeing values in ways that may make them unsuitable for future integration into the Knersvlakte Nature Reserve.

Protected Area Fragmentation (Medium): Protected area fragmentation has a medium direct threat on the Knersvlakte Nature Reserve connectivity value. Habitat fragmentation implies loss of habitat, reduced patch size and an increasing distance between patches. There is also an increased chance for habitat transformation and

degradation between protected areas (Hanski & Gilpin 1991; Andren 1999; Desmet 2004).

The reserve design was initially aimed at maximizing the amount of biodiversity i.e. unique species and habitats, represented within the reserve in the smallest area, while including large-scale ecological processes (Desmet 2004). Various properties were acquired since 1999 and today the reserve has a somewhat fragmented layout (Appendix 1, Map 1). Future land acquisition will focus on consolidation of the reserve footprint (section 8) to support and maintain viable ecosystem and evolutionary processes and enhancing habitat connectivity and resilience. This approach is regarded as one of the best responses to climate change (Pool-Stanvliet *et al.* 2017).

Apart from the ecological benefits of a consolidated reserve footprint, it will also greatly enhance operational management effectiveness; especially related to travelling distances, reduced fencing requirements and better access and compliance control.

Mining and Prospecting (Medium): Often the impacts of mining and prospecting operations are incompatible with biodiversity conservation objectives. This holds true for the Knersvlakte Nature Reserve and the surrounding zone of influence. Cole (2012) lists fifteen mineral commodities occurring in the broader Knersvlakte region, many of them found inside or in the adjacent vicinity to the reserve. Many of the habitats targeted by mining, such as quartz and dolomite patches are critical habitats for biodiversity (Desmet 2004; Helme 2016). Often the rare species are highly localised and if impacted by mining there is a chance of a complete loss of species. Once these sensitive habitats are physically disturbed they can never be rehabilitated (Helme 2016). Success of rehabilitation efforts after open-cast mining remains minimal due to a lack of viable topsoil (Mucina & Rutherford 2006; Helme 2007). There are a number of such open-pit mining sites located in the reserve that can never be rehabilitated (Figure 5.2).



Figure 5.2: Example of a small open-pit prospecting site and open-cast marble mine within the Knersvlakte Nature Reserve. Photos: Hilton Bocks and Marius Wheeler.

The ongoing threat of mining (Helme 2016) also impacts on the reserve zone of influence. Transformation of priority sensitive areas will render these unsuitable for conservation action in future. Mining also poses a threat to groundwater quality and availability; potentially affecting a large portion of the Knersvlakte through the over

abstraction of groundwater. Mining and prospecting has been rated a medium threat that will affect a number of ecological and human wellbeing values.

Invasive Alien Plants (Medium): Due to the aridity of the area, the Knersvlakte Nature Reserve, fortunately, does not harbour many or high densities of invasive alien plants. It has been classified as a medium threat affecting three of the ecological values of the reserve. Such species are mostly associated with river courses and include *Prosopis spp.*, *Nicotiana glauca*, *Ricinus communis* and *Argemone mexicana*. These plants reduce habitat quality through transformation and utilise groundwater in an already water stressed environment (Van Wilgen *et al.* 2008).

Atriplex lindleyi inflata is found in areas where saline quartz fields have been disturbed. Maintaining natural vegetation and clearing alien plants along watercourses is a priority, both for biodiversity conservation and groundwater recharge (Pool-Stanvliet *et al.* 2017).

Historical Farm Practices (Medium): All of the properties that comprise the Knersvlakte Nature Reserve have historically been farmed to some extent. Previous farming practices were mainly related to small livestock grazing and limited dry-land grain production. Associated with the previous land-use practices are a number of impacts that are still clearly visible today and in many respects will have lasting effects or take many years to remove or mitigate. Examples of these include the introduction of alien plants, fencing, jeep tracks, clearing of land for planting of crops, grazing by livestock and associated water and housing infrastructure etc. Some of these land-use practices or associated infrastructure have also resulted in secondary land impacts such as gully erosion, sheet erosion derelict infrastructure, areas cleared for previous fences, jeep tracks traversing the landscape and habitat modification. Historical cultivation of river courses and alluvial plains next to watercourses have for example resulted in much of these areas now being covered by Kraalbos (*Galenia africana*). The increased occurrence of indigenous *Mesembryanthemum rapaceum*, *Drosanthemum hispidum*, *Malephora purpureo-crocea*, *Mesembryanthemum guerichianum* as well as of the alien *Atriplex lindleyi inflata* are good indicators of local veld disturbance and historical overgrazing.

Arguably the biggest historical biodiversity impact came from past grazing practices. Grazing is a potentially biodiversity compatible land-use in Succulent Karoo however the need for carefully managing stocking rates is critical (Helme 2016). This may not always have been the case. According to (Haarmeyer *et al.* 2010) evidence suggest that species richness and abundance of endemic quartz species in the Knersvlakte decreases with grazing. Heavy grazing reduces plant cover and trampling of the biogenic soil crust (Helme 2016), leading to soil compaction, erosion and general land degradation (Figure 5.3). Recent ecological research has confirmed the negative impacts that grazing has on the vegetation of Namaqualand (Schmiedel & Oldeland 2018). Additional concern has also been raised about what impacts grazing will have on the Knersvlakte, in the presence of a warming and drying climate (U. Schmiedel, Institute for Plant Science and Microbiology, University of Hamburg, 2019, pers. comm.; A. Turner, Restoration Ecologist, CapeNature, 2019, pers. comm.). This is of particular relevance to the reserve, especially in areas previously impacted by over-

grazing and frequented by springbok. A monitoring and adaptive management approach is critical.



Figure 5.3: Example of land degradation inside the Knersvlakte Nature Reserve due to historical grazing impacts. Photo: Marius Wheeler.

Historical farming practices carries a medium threat rating affecting three of the ecological values (Catchments, Quartz Vygieveld and Vlakte Vygieveld). It almost certainly will have a negative impact on some of the human wellbeing values. The reserve has already started to address many of the negative impacts associated with previous land-use practices, examples include invasive alien plant management, jeep track maintenance, erosion control and the removal of internal fences. There however remains much to be done and mitigation measures may take many years to reach the desired state. The development of a comprehensive restoration plan to assist with prioritising restoration actions is a priority (section 10).

Trampling (Low): Trampling relates to the physical disturbance and trampling of sensitive vegetation through people, vehicles and to a minor extent animals. The threat affects the two vegetation values and is of a localised nature; hence a low rating.

A number of factors result in ease of access to the Knersvlakte Nature Reserve; an extensive area, many open access points/roads and the unconsolidated nature of the reserve. When people enter and start wandering off roads they inevitably cause trampling and damage to plants in particular. This could be intentional or completely unintentional due to the cryptic nature of many of the species. A lack of awareness to the sensitivity of the environment is a contributing factor. A number of interventions

have been highlighted in this management plan to address and promote controlled access to, and increased awareness of, the unique biodiversity in the reserve (section 10).

Illegal Collection (Low): The threat affects the two vegetation values (including the nested faunal targets) and is of a localised nature; hence a low rating. Many rare and endemic succulents and animals, particularly reptiles, are intentionally sought after by local and international collectors for the horticultural and wildlife trade (Helme 2016). Furthermore there is also a component of people that contribute to this problem unintentionally. A lack of awareness to the sensitivity of the environment and the ease of access to the reserve are contributing factors. Helme (2016) also warns that the proliferation of bio-prospecting and commercial interests in medicinal plants in the Succulent Karoo is of concern.

A number of interventions have been highlighted in this management plan to enhance compliance and to address and promote controlled access to, and increase awareness of, the unique biodiversity in the reserve (section 10).

Lack of Heritage Maintenance (Low): CapeNature acknowledges that heritage within the Knersvlakte is of great value. The Knersvlakte Nature Reserve is still in an early stage of development and to date very little knowledge has been generated on the significance of the heritage values found in the reserve. Some initial information has been generated as part of the development of this management plan. It must be noted that physical heritage features are often non-replaceable and once destroyed or altered their heritage significance diminishes.

Going forward the reserve aims to partner with relevant stakeholders to allow for a full heritage inventory and assessment to be compiled and for adequate heritage maintenance requirements to be developed (section 10).

Vandalism (Low): Some incidents of vandalism, especially related to damaging of heritage features, have occurred in the Knersvlakte Nature Reserve. A lack of awareness to the sensitivity of the environment, value of heritage features and the ease of access to the reserve are contributing factors. These incidents are of a localised nature.

At this stage it is difficult to fully understand the impact of these acts and how they relate to the heritage values of the reserve as a full heritage inventory and assessment still needs to be undertaken. However it must be noted that physical heritage features are often non-replaceable and once destroyed or altered their heritage significance diminishes. A number of interventions have been highlighted in this management plan to boost compliance action and to address and promote controlled access to, and increase awareness of, the unique heritage values in the reserve (section 10).

Pollution (Low): This threat mainly relates to surface pollution/litter and old dilapidated infrastructure. The source mainly relates to staff and/or contractors working in the reserve. In most instances the presence of old derelict infrastructure relates to previous farming activities and land-use practices. A number of interventions have been highlighted in this management plan to address this threat. It mainly relates to raising awareness and training among staff, better management of external contract staff and engaging with infrastructure maintenance partners (section 10).

Table 5.4: Summary rating of key threats for the Knersvlakte Nature Reserve.

Threats	Associated Focal Values	Summary Threat rating
Lack of available water for animals	Quartz Vygieveld; Vlakte Vygieveld	High
Climate change	Ground and Surface Water; Knersvlakte Catchments; Quartz Vygieveld; Vlakte Vygieveld	High
Inappropriate infrastructure development	Knersvlakte Reserve Connectivity; Quartz Vygieveld; Vlakte Vygieveld	Medium
Protected area fragmentation	Knersvlakte Reserve Connectivity	Medium
Mining and prospecting	Knersvlakte Catchments; Knersvlakte Reserve Connectivity; Quartz Vygieveld; Vlakte Vygieveld	Medium
Invasive alien plants	Knersvlakte Catchments; Quartz Vygieveld; Vlakte Vygieveld	Medium
Historical farm practices	Knersvlakte Catchments; Quartz Vygieveld; Vlakte Vygieveld	Medium
Trampling	Quartz Vygieveld; Vlakte Vygieveld	Low
Illegal collection	Quartz Vygieveld; Vlakte Vygieveld	Low
Lack of heritage maintenance	Heritage	Low
Vandalism	Heritage	Low
Pollution	Ground and Surface Water; Heritage; Knersvlakte Catchments; Quartz Vygieveld; Vlakte Vygieveld	Low

5.6 Goals

Clear and measurable outcome-based goals, strategies and objectives are fundamental for the assessment of protected area management effectiveness and to the whole process of management itself. Based on the viability and threats assessment, a desired future condition was established for focal values and core service areas by setting measurable, time-bound goals directly linked to the values and their key attributes.

Knersvlakte Nature Reserve Goals:

To maintain and build healthy and resilient ecological infrastructure that supports the biodiversity and human wellbeing values of the Knersvlakte Nature Reserve, management needs to achieve the following:

1. By 2030, the riparian vegetation composition of the Knersvlakte Nature Reserve catchments will comprise at least 99% indigenous species.
2. By 2030, a minimum of eight boreholes and thirteen earth dams will be functional¹ and appropriately² distributed throughout the Knersvlakte Nature Reserve.

¹Functional means that water is available for animal use.

²Appropriately means that water points are designed with ecological functioning in mind.

3. By 2030, the integrity of nano-succulent populations within the Quartz Vygieveld, inside the Knersvlakte Nature Reserve, will be intact¹.
¹Intact means no alien/invasive plant species present and the full suite of baseline indigenous plant species present.
4. By 2030, the integrity of Vlake Vygieveld, inside the Knersvlakte Nature Reserve, will be intact¹.
¹Intact means the percentage cover of indigenous perennial plant species will be between 20-24% and the percentage indicator species of disturbance will be less than 9%.
5. By 2030, all unnatural disturbances to heritage features within the Knersvlakte Nature Reserve are limited to maintain current conditions.
6. By 2030, at least three priority properties will have signed stewardship agreements and at least one priority property will be purchased and declared under the Protected Areas Act.
7. By 2030, male, female and juvenile Steenbok will be present throughout the Knersvlakte Nature Reserve.

Achieving human wellbeing, derived from healthy responsibly-managed ecological infrastructure and heritage, requires that:

8. By 2030, all infrastructure development applications within the Knersvlakte Nature Reserve, zone of influence, will be commented on in order to promote and maintain the Knersvlakte sense of place.
9. By 2030, the cultural identity and history of the Knersvlakte is locally available, known and appreciated.
10. By 2030, all Fixed Term Employees (FTEs) in the Knersvlakte Nature Reserve will receive quality functional¹ and life-skills² training interventions during their full³ employment cycle.
¹Functional training includes: health and safety, first aid, field safety and survival, brush cutter training, chainsaw training, gabion construction, herbicide application, fence maintenance, road maintenance, dryland rehabilitation and basic infrastructure maintenance.
²Life-skills training includes: life skills, hygiene and health, personal finance, computer training, report writing, conflict management, supervisory, substance abuse, gender based awareness and communication.
³Full employment cycle means an employee employed for a three-year cycle.
11. By 2030, more than 50% of all visitor access to the Knersvlakte Nature Reserve will be issued under a permit.
12. By 2030, the Knersvlakte Nature Reserve environmental interpretation and awareness plan will promote all¹ ecological and human wellbeing values.
¹Heritage, History, Cultural Identity, Water, Responsible Resource Utilisation, Succulent Plants.
13. By 2030, the Knersvlakte Nature Reserve will provide and support job opportunities and in partnership with role players, contribute to economic development and social upliftment in and around the reserve.

5.7 Sensitivity Analysis

Sensitivity analysis based on the protected area's biodiversity, heritage and physical environment is a key informant for spatial planning and decision-making in protected areas. Sensitivity analysis aims to:

- Highlight areas containing sensitive biodiversity and heritage features;
- Inform all infrastructure development e.g. location of management and tourism buildings and precincts, roads, trails, firebreaks;
- Facilitate holistic reserve planning and zonation; and
- Support conservation management decisions and prioritisation of management actions.

At the regional scale, sensitivity mapping also allows for direct comparison of sites both within and between protected areas to support organisational planning across CapeNature's protected areas network. The process elevates:

- Sites with the highest regional conservation value;
- Areas where human access or disturbance will have a negative impact on biodiversity or heritage, and specific environmental protection is required;
- Areas where physical disturbance or infrastructure development will cause greater environmental impacts, and / or increasing construction and maintenance costs;
- Areas where there is a significant environmental risk to infrastructure; and
- Areas that are visually sensitive and need to be protected to preserve the aesthetic quality of the visitor's experience.

Sensitivity analysis provides decision support to ensure that the location, nature and required mitigation for access, utilisation and infrastructure development in the protected area are guided by the best possible landscape-level biodiversity and heritage informants. The process is transparent, relying on defensible expert-derived information and scientific data. Sensitivity maps do not replace site-level investigation, although do allow for rapid assessment of known environmental risks, guiding planning to minimise negative impacts.

Sensitivity analysis uses a hierarchical approach. The method uses the premise that if a portion of the landscape is demarcated as highly sensitive in one of the categories considered in analysis then, regardless of the sensitivity in other categories, that portion is elevated as highly sensitive in the overall scoring. The approach thus allocates the highest allocated sensitivity in any of the input categories as the ultimate sensitivity class for that particular portion. As new and improved data become available, these data can be included.

Biodiversity, heritage and physical features are rated on a standard scale of one to five, where one represents 'no' or 'minimal sensitivity' and five indicates 'maximum sensitivity' (see Figure 5.2). Additional features such as visual sensitivity, fire risk and transport costs can be included. Higher scores represent areas that should be avoided for conventional access and infrastructure development, or where a specific strategy is applicable relative to sensitivity. A score of five typically represents areas where mitigation for conventional access or infrastructure development would be extensive,

costly or impractical enough to be avoided at all costs, or features so sensitive that they represent a 'no go' area.

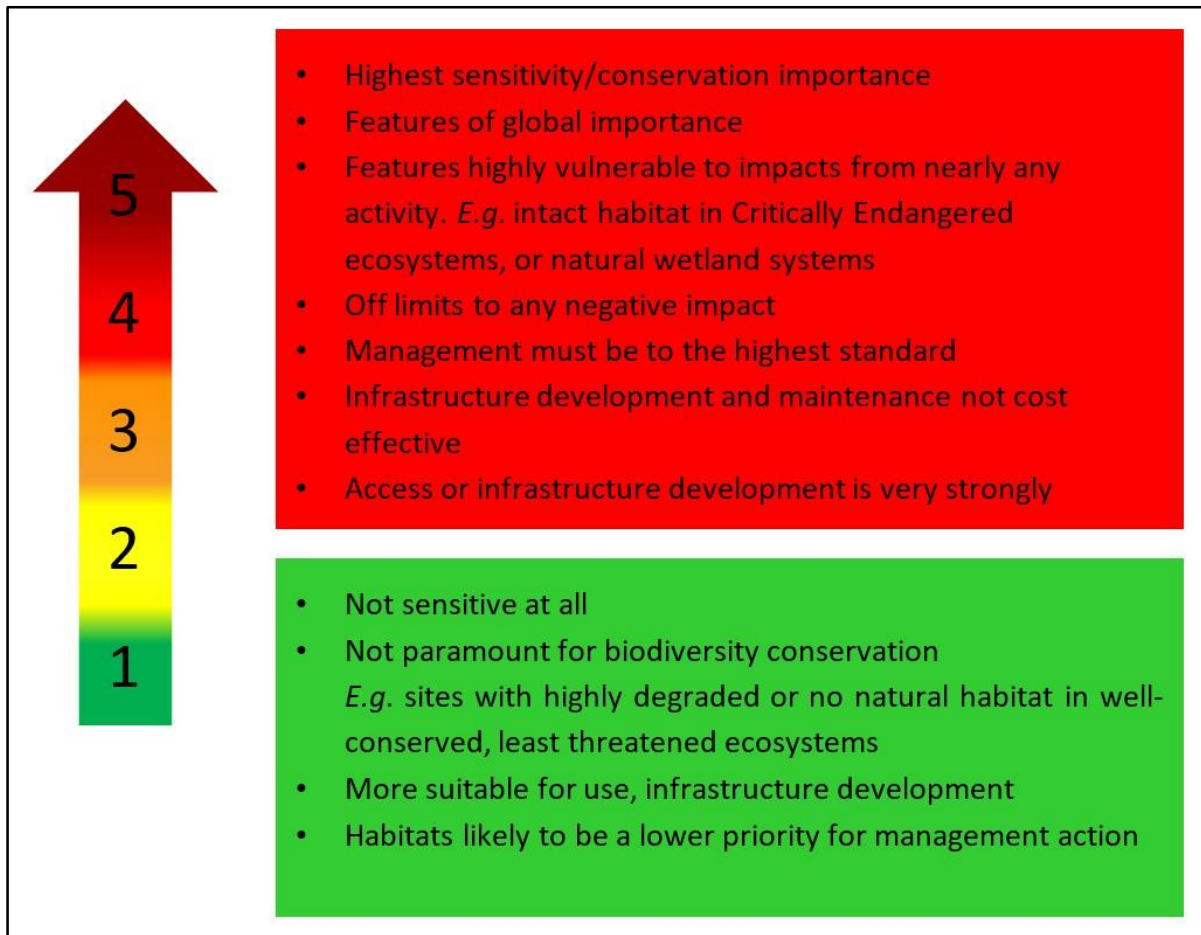


Figure 5.4: CapeNature method for sensitivity scoring and synthesis.

Physical, biodiversity and heritage features included in the sensitivity analysis for the Knersvlakte Nature Reserve is illustrated in Table 5.5.

Table 5.5: Physical, biodiversity and heritage factors included in the sensitivity analysis of the Knersvlakte Nature Reserve.

	Category	Dataset	Criteria	Sensitivity Score	
Physical	Slope (degrees)	Slope calculated from 5m resolution digital elevation model	> 30° Effectively off-limits for infrastructure development due to extreme risk of erosion and instability, or extreme engineering mitigation and associated construction costs required.	Highest sensitivity	5
			20°-30° Strongly avoid for infrastructure development – cut and fill or other difficult and expensive construction method required. Appropriate engineering mitigation essential to prevent erosion and slope instability. Highest initial and on-going cost	High sensitivity	4

	Category	Dataset	Criteria	Sensitivity Score	
			due to slope stabilization and erosion management required.		
			10°-20° Avoid for road, trail and firebreak construction if possible. Severe erosion will develop on exposed and unprotected substrates. Pave roads and tracks, and ensure adequate drainage and erosion management is implemented. May provide good views.	Moderate sensitivity	3
			5°-10° Low topographic sensitivity, likely still suitable for built infrastructure. Use of gentle slopes may provide improved views or allow access to higher areas.	Low sensitivity	2
			0°-5° Preferred areas for any built infrastructure, lowest risk of erosion or instability, lowest construction and on-going maintenance costs.	Lowest sensitivity	1
	Geology	Special features - quartz patches	Derived from the quartz mapping done by Mpehle (2015) using SPOT6 images and by Oldeland (2019) using RASTER.	Highest sensitivity	5
Biodiversity	Rivers	1:50 000 National Geo-Spatial Information Rivers	Within 200 m of perennial river.	Highest sensitivity	5
			Within 100 m of non-perennial river.	High sensitivity	4
	Wetlands and seeps	NFEPA wetlands (Nel & Driver 2012)	Natural wetlands and seeps.	Highest sensitivity	5
			Within 200 m of wetlands and seeps.	High sensitivity	4
	Vegetation status	Red-Listing ecosystems by Andrew Skowno, done for the NBA per vegetation type, SA Veg Map (SANBI 2006 & 2018)	Critically Endangered – None.	Highest sensitivity	5
			Endangered – None.	High sensitivity	4
			Vulnerable – None.	Moderate sensitivity	3
			Threatened – None.	Low sensitivity	2
			Least Concern – Central Knersvlakte Vygieveld, Knersvlakte Dolomite Vygieveld, Knersvlakte Quartz Vygieveld, Knersvlakte Shale Vygieveld, Namaqualand Heuweltjieveld, Namaqualand Riviere, Namaqualand Spinescent Grassland, Northern Knersvlakte Vygieveld, Southern Namaqualand Quartzite, Vanrhynsdorp Gannabosveld.	Lowest sensitivity	1

	Category	Dataset	Criteria	Sensitivity Score	
	Vegetation protection levels	Protection levels by Andrew Skowno, done for the NBA per vegetation type, SA Veg Map (SANBI 2006 & 2018)	Not Protected – Vanrhynsdorp Gannabosveld.	High sensitivity	4
			Poorly Protected – Knersvlakte Shale Vygieveld, Namaqualand Heuweltjieveld, Namaqualand Riviere, Namaqualand Spinescent Grassland, Southern Namaqualand Quartzite Klipkoppe Shrubland.	Moderate sensitivity	3
			Moderately Protected – Knersvlakte Dolomite Vygieveld.	Low sensitivity	2
			Well Protected – Central Knersvlakte Vygieveld, Knersvlakte Quartz Vygieveld.	Lowest sensitivity	1
	Special vegetation habitats	SA Veg Map (SANBI 2006 & 2018); Mucina & Rutherford (2006)	Knersvlakte Quartz Vygieveld and Dolomite Vygieveld have been highlighted as highly sensitive special habitats, containing high levels of endemic plant species.	Highest sensitivity	5
	Rare and endangered plant species	Rare and endangered plant species extracted from CapeNature State of Biodiversity Data Base; All threatened Species (SANBI 2015)	All plant species listed as Critically Endangered, Endangered, Vulnerable, Critically Rare, Near Threatened and Rare. Point localities buffered by 5 m.	Highest sensitivity	5
Heritage	Archaeological and cultural sites	Cultural and heritage sites (Knersvlakte Nature Reserve heritage inventory)	Heritage sites extracted from the reserve's heritage inventory and buffered by 100 m.	Highest sensitivity	5

Approximately 57% of the Knersvlakte Nature Reserve has a high sensitivity (Table 5.6), with the key drivers of sensitivity being rivers, geology (specifically the quartz patches) and special vegetation habitats (Table 5.5).

The central and western sections of the reserve are the most sensitive areas (Appendix 1, Map 6). These areas obtained the highest sensitivity score mainly due to the location of the quartz patches and special vegetation habitats. Knersvlakte Quartz and Dolomite Vygieveld have been highlighted as highly sensitive special habitats. These vegetation types contain high levels of endemic plant species (A. le Roux 2019, former CapeNature Succulent Karoo Botanist, pers. comm.; Helme 2016) and thus received the highest sensitivity score. These special habitats approximates 40.5% of the Knersvlakte Nature Reserve.

Approximately 15.2% of the reserve constitutes quartz patches which was rated as highly sensitive. This area coincides with Knersvlakte Quartz Vygieveld. These areas are highly sensitive to disturbance and take extremely long to recover, if ever. In addition, 33.9% of the reserve has a high sensitivity due to a large non-perennial river footprint.

The sensitivity based on ecosystem threat status per vegetation type resulted in the reserve being scored as low sensitivity (100%), with protection levels per vegetation type ranging from moderate (24.1%) to low (75.9%). Similarly, when considering the slope of the area (89.6%) of the reserve has a low sensitivity. These factors were thus not key drivers of the sensitivity of the reserve. Sensitivity for the Knersvlakte Nature Reserve is illustrated in Table 5.6 and Appendix 1, Map 6.

Table 5.6: Sensitivity scores for the Knersvlakte Nature Reserve.

Sensitivity Score	Area (ha)	Area (% of total)
1 = lowest sensitivity	3 329.20	3.70
2 = low sensitivity	24 349.10	27.00
3 = moderate sensitivity	10 894.00	12.10
4 = high sensitivity	13 401.00	14.90
5 = highest sensitivity	38 080.40	42.30

6 ZONING PLAN

This section outlines the zoning plan for the protected area. The reserve forms part of a planning matrix and locating the protected area in terms of the municipal IDP is aimed at minimising conflicting development in either the protected area or the neighbouring municipal area.

The primary objective of the zoning plan is to establish a coherent spatial framework within and around the protected area to guide and co-ordinate conservation, tourism and visitor experience, access and utilisation, and stakeholder and neighbour relations.

Zoning is intended to minimise user conflict by separating potentially conflicting activities such as wildlife viewing, recreational activities and tourism accommodation, whilst ensuring that activities and utilisation continues in appropriate areas and do not conflict with the goals and objectives of the protected area.

6.1 The Knersvlakte Nature Reserve in the Context of Municipal Integrated Development Planning

The municipal IDP is a 5-year strategic plan that sets the strategic and budget priorities for development. The current IDP cycle commenced on 1 July 2017 and will be effective up to 30 June 2022. There are two IDPs and associated SDFs which need to be taken into consideration for the Knersvlakte Nature Reserve to ensure alignment between statutory initiatives at the three tiers of government and management of the reserve, including the identification of risks and interventions required. The IDP and SDF should be taken into consideration in determining the zone of influence and

establishing potential threats and opportunities around the reserve. Similarly there is an opportunity for IDPs and SDFs to incorporate projects and interventions that can support the Knersvlakte Nature Reserve in its goals, where appropriate, and within the legislated stakeholder engagement processes.

West Coast District Municipality: The West Coast District Municipal IDP (WCDM 2017) identified environmental concerns including the lack of capacity in terms of human and financial resources to implement, fund and roll out projects and programmes within the region, including environmental compliance. Initiatives applicable to the Knersvlakte Nature Reserve include a climate change adaptation strategy, environmental sector job creation through the Expanded Public Works Programme, environmental rehabilitation and alien plant eradication. None of the major development projects will impact the reserve. The tourism programme does not include any nature-based tourism which could benefit CapeNature. The bioregional planning approach forms the basis of the current SDF (Ninham Shand 2006).

Matzikama Municipality: The IDP for the Matzikama Municipality (Matzikama Municipality 2018) refers to land use planning and management that promotes sustainable development. The Knersvlakte Bioregion has been delineated with the aim of conserving the Succulent Karoo vegetation of the area and to encourage the sustainable use of natural resources (Ninham Shand 2006). Other aspects include improving environmental governance (institutions, finance, legislation and capacity) the green economy and climate change response. Table 6.1 lists the IDP aspects applicable to the Knersvlakte Nature Reserve management plan strategies.

Table 6.1: Aspects of the municipal Integrated Development Plans applicable to the Knersvlakte Nature Reserve.

Municipality	Aspect in IDP to be Addressed	Proposed Intervention
West Coast District Municipality & Matzikama Municipality	District environmental integrity improvement & Develop and sustain the spatial, natural and built environment	<ul style="list-style-type: none"> In partnership, re-evaluate the expansion domain of the Knersvlakte Nature Reserve. Incorporate relevant conservation priorities into municipal IDPs and SDFs. Incorporate the Knersvlakte Nature Reserve concept development framework into municipal IDPs and SDFs. Incorporate Knersvlakte zone of influence into municipal IDPs and SDFs. Through partnerships, promote and facilitate pro-active law enforcement and compliance within the Knersvlakte landscape
West Coast District Municipality & Matzikama Municipality	Economic growth and job opportunities	<ul style="list-style-type: none"> Contribute to economic and social development by providing and supporting job and training opportunities.

Municipality	Aspect in IDP to be Addressed	Proposed Intervention
West Coast District Municipality	Social well-being and improvement among residents	<ul style="list-style-type: none"> Facilitate the compilation and promotion of the Knersvlakte history and cultural knowledge. Partners to support the initiative. Develop and implement an integrated environmental education and awareness programme. Partners to support the initiative. In partnership, facilitate damage causing animal research and management. Partners to support the initiative.

6.2 Protected Area Zonation

The primary function of the protected area is to conserve biodiversity. However, other functions such as ensuring access and providing benefits to neighbouring communities and local economies may conflict with this primary function.

The zonation plan is thus a standard framework and set of formal guidelines to balance conservation, access and utilisation within the protected area, and is informed by sensitivity analysis. Zonation:

- Is foundational to planning and development within the protected area;
- Provides a framework for development of the protected area;
- Recognises the purpose for which the protected area is established;
- Ensures ecosystem resilience by limiting human intrusion in the landscape;
- Mitigates user conflict and minimises the impact of utilisation on natural and cultural heritage through access and activity management;
- Accommodates a range of activities ensuring that nature based recreation and experiences for solitude do not conflict with social and environmental requirements or needs; and
- Confines development within the protected area to areas deemed appropriate to tolerate transformation without detracting from sense of place.

CapeNature's zonation categories, illustrated in Table 6.2, are derived from existing protected area zonation schemes worldwide, to develop a coherent scheme that provides for visitor experiences, access and conservation management needs.

Table 6.2: Guide to CapeNature conservation management zones.

Zonation Category	Explanation
Wilderness / Wilderness (declared)	Areas with pristine landscape, sensitive areas or threatened ecosystems. Very limited access.
Primitive	Areas providing natural landscape, solitude and limited access. Normally a buffer area to wilderness zones.
Nature Access	Providing easy access to natural landscape. Includes areas with roads and trails, and access to popular viewing sites and other sites of interest.
Development – Low intensity	Area with existing degraded footprint. Providing primarily self-catering accommodation and camping, environmental education facilities.

Zonation Category	Explanation
Development – High intensity	Area extensively degraded. Providing low and/or higher density accommodation, and maybe some conveniences such as shops and restaurants.
Development – Management	Location of infrastructure and facilities for reserve administration and management.
Development – Production	Commercial or subsistence farming (applicable to privately owned and managed nature reserves).
Development – Private Areas	Private dwellings and surrounds (only applicable to privately owned and managed nature reserve).
Species / Habitat / Cultural Protection	Areas for protection of species or habitats of special conservation concern.
Cultural Species / Habitat Visual Natural Resource Access	Special management overlays for areas requiring specific management interventions within the Species / Habitat / Cultural Protection Zone.

The following underlying decision-making rules are applied in determining zones:

1. Strike a balance between environmental protection and development of the protected area to meet broader economic and social objectives of the protected area.
2. Consider existing development footprints and tourism access routes based on:
 - The principle that all else being equal, an existing transformed site is preferable to a green fields site from a biodiversity perspective;
 - Increasing costs the further developments are from existing infrastructure;
 - The socio-economic benefit of existing tourism nodes and access routes; and
 - Infrastructure design and services with due consideration for focal values.
3. Where existing development nodes, tourist sites and access routes occur in areas with high sensitivity-value, associated zonation must aim to confine the development footprint as much as possible and preferably within the existing transformed site.
4. Sites with high biodiversity sensitivity value are put into stronger protection zones and peripheral development is favoured.

A summary of the zonation scheme applicable to the Knersvlakte Nature Reserve is depicted in Table 6.3 and illustrated in Appendix 1, Map 7.

Table 6.3: Summary of CapeNature zonation categories applicable to the Knersvlakte Nature Reserve.

Zonation Category	Explanation
Primitive	The largest portion of the Knersvlakte Nature Reserve is zoned as primitive. This zone reflects the remoteness of the area in general. It allows for limited access to the natural landscapes in the reserve, providing opportunities for solitude and a sense of place. This zone will support low level tourism activities such as hiking and mountain biking with limited visitor numbers.
Nature Access	Nature access areas have been zoned around the Kareeberg homestead as well as at the Groot Graafwater turn-off. These zones will facilitate nature access around the proposed environmental education centre and allow controlled visitor access along the national N7 road for visitors to enjoy and experience the unique biodiversity of the Knersvlakte. These zones also serve as a buffer between the primitive and development zones.
Development – Low intensity	The Kareeberg homestead and associated development footprint is zoned as “development – low intensity” to make provision for environmental awareness and education facilities and activities. Another two homesteads, Groot Graafwater and Uitspanrug are also zoned as such to make provision for low level tourism and rustic overnight facilities.
Development – Management	Infrastructure nodes utilized for operational management of the Knersvlakte Nature Reserve are zoned as “development – management”. These include Vinkelskolk, Graatjiesgat, Jakkalsdraai, Uitkyk, Klipdrift Extension, Gert Blou-oog, Zoutfontein, Goedehoop, Wolvenest, Moedverloren and Arizona zones. Two Sanral stockpile sites located in the reserve are similarly zoned. At Groot Graafwater turn-off a “development – management” zone will allow for infrastructure related to tourism access.

6.3 Protected Area Zone of Influence

CapeNature seeks to maximise positive influences and/or minimise direct and indirect negative pressures on values, with the aim of ensuring the persistence of species and biodiversity in general. Activities managed include those that might have direct impacts on values, and those that have only indirect effects, often at considerable distance from the location where the activity takes place.

The zone of influence is a mechanism that recognises, and activates the abovementioned principle. Three key informants (Figure 6.1) used to delineate the zone include:

- Viability of focal values;
- Threats assessment; and
- Protected area sensitivity and zonation.

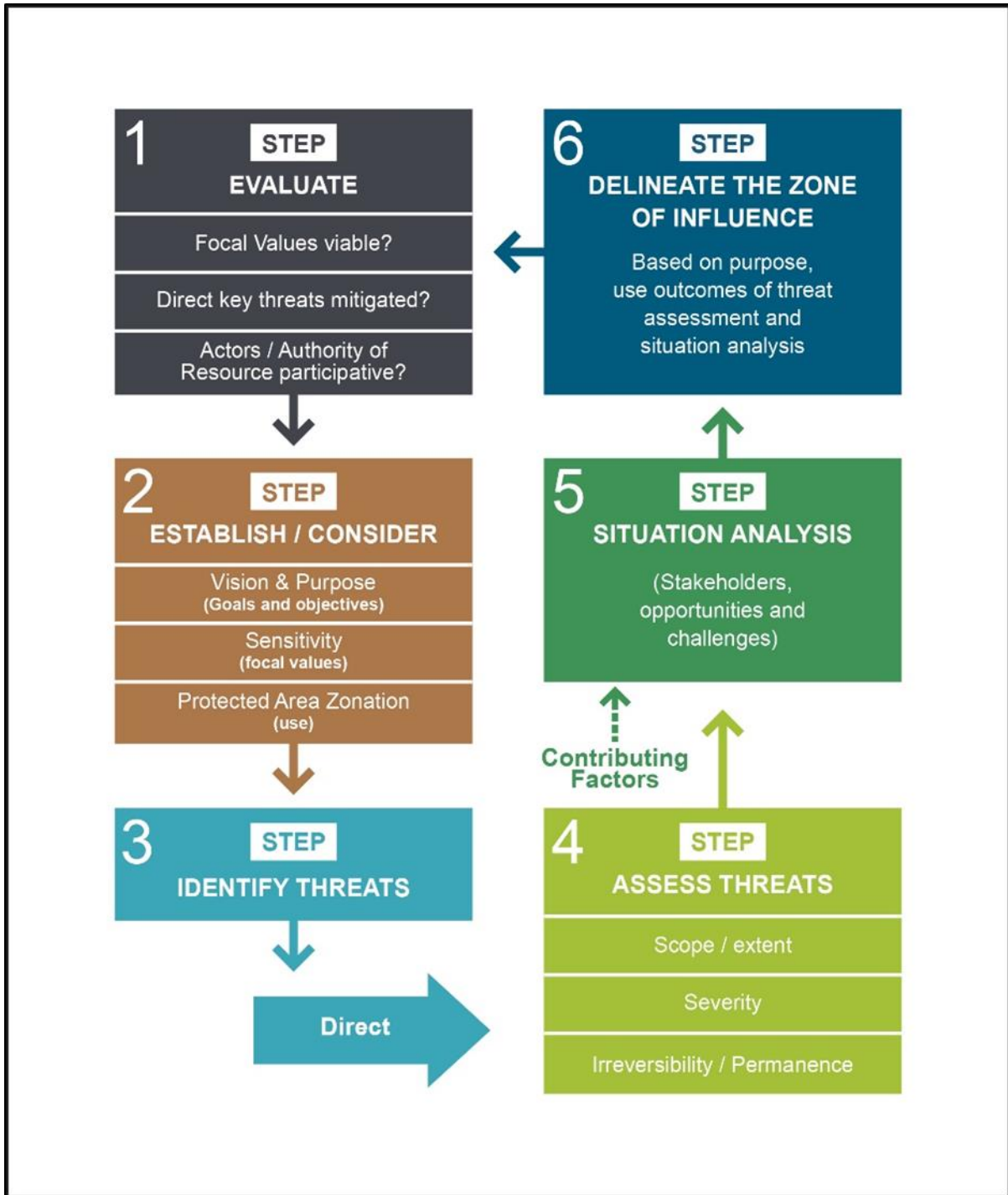


Figure 6.1: Process flow for the delineation of the zone of influence.

The zone of influence is a non-legislated area spatially depicted around the protected area. The zone ultimately aims to facilitate strategic stakeholder engagement by linking key stakeholders to prioritised influences to promote an ecologically functional landscape that supports goals and objectives of the reserve, and enhances the benefits derived from the protected area. The process of delineation helps to identify:

- 1) Actions to directly restore a value or mitigate a threat;

- 2) Actions designed for people to continue positive behaviours or halt direct threats; and/or
- 3) Actions to address enabling conditions.

The zone of influence is thus:

- A tool to guide resource allocation and investment outside of the protected area;
- A tool to marry stakeholder engagement / authorities of resource to activities;
- A spatial prioritisation of where to support compatible land and water use, and positive behaviours;
- A spatial prioritisation of where to collaborate and with whom;
- A mechanism to prioritise support to landowners or managers of priority landscapes; and
- All-encompassing mechanism that includes all or part of a buffer zone as prescribed in terms of legislative frameworks and conventions.

The spatial features used in the zone of influence calculation are rated on a standard scale of one to four: Low (1), Medium (2), High (3), and Very high (4). These ratings are assigned to each input feature within the zone of influence. Higher scores represent areas where many features overlap, elevating the necessity to engage stakeholders and positively influence neighbour relations and/or activities.

Table 6.4 lists the features, criteria and rating applied to delineate the zone of influence of the Knersvlakte Nature Reserve. Appendix 1, Map 8 illustrates the zone of influence for the reserve.

Table 6.4: The criteria used for defining the zone of influence of the Knersvlakte Nature Reserve.

Feature	Criteria	Rating	Zone area (ha)	% of zone
Illegal resource use	Illegal resource use, which include various unregulated human activities such as overgrazing by livestock and illegal harvesting of fauna and flora. The main routes and secondary public gravel roads are used by poachers as an entrance to the reserve. These roads were buffered with 100 m within the 5 km zone of influence.	High (3)	32 224.60	15.59
Illegal recreational access along routes	Transportation and service corridors dissect the reserve. Illegal access for recreational activities (mainly scramblers / vehicular) are reported along these corridors. These routes were buffered by 1 km.	High (3)	32 224.60	15.59
Water pollution from mining activities	Areas where there is a possibility for water pollution due to mining activities (mainly at Steenkampskraal mine) near rivers. Two	High (3)	314.10	0.15

Feature	Criteria	Rating	Zone area (ha)	% of zone
	levels of impact were identified using 1 km buffer for the area immediately around the mine where the impact is likely to be higher (High 3) and 1 to 2 km buffer for the area of lesser impact (Medium 2).	Medium (2)	942.40	0.46
Over abstraction of water (surface and groundwater)	Expansion of mining activities and the associated increase in water abstraction poses a threat. The location of the mine was buffered by 2 km.	Medium (2)	1 256.60	0.61
Community expansion and livestock farming	Expansion of community and growth in informal houses and livestock. The impact of the livestock on the reserve and illegal access are also aggravated by the poor fencing conditions.	Medium (2)	16 561.40	8.01
Invasive alien plants	Invasive alien plants mainly occur along river corridors. The Sout, Varsche and Geelbeks rivers were buffered by 300 m.	Medium (2)	7 377.20	3.57
Mining	All areas with past mining activities or areas where applications for mining activities were received, irrespective whether it was approved or not. Intersected these sites (applications) with the mineral resource area for diamonds (GeoScience). Includes possible expansion of existing mining activities.	Low (1)	13 057.30	6.32
Livestock farming	Presence of livestock on adjacent farms falling within the zone of influence. Livestock include sheep, cattle, game, ostriches, horses, and goats.	Low (1)	67 855.70	32.82
Properties under purchase negotiation by WWF-SA	Properties adjacent to the reserve that are currently under purchase negotiation by WWF-SA in order to assist in reserve consolidation. (Z. Brink 2019, Conservation Manager, Knersvlakte Nature Reserve, pers. comm.)	Low (1)	13 674.60	6.61
Protected area expansion	Areas identified for reserve expansion in the Western Cape Protected Areas Expansion Strategy (2015-2020).	Low (1)	155 469.60	75.19
Viewshed analyses	Viewshed analyses from critical viewpoints (Groot Graafwater, Uitspanrug, Kareeberg, Vinkelskolk, Jakkalsdraai, and Graatjiesgat) to protect "sense of place".	Low (1)	11 042.10	5.34

The zone of influence for the Knersvlakte Nature Reserve has a total extent of 206 765 ha (Appendix 1, Map 8). Approximately 30% of the zone of influence is impacted by illegal resource use (poaching of fauna and flora and illegal access for recreational purposes) mainly along major routes (Table 6.4). Even though possible water pollution due to mining activities could have a medium impact, less than 1% of the zone of influence will be affected. Factors such as stands of invasive alien plants bordering the reserve (source of re-infestation), over extraction of water through expansion of

mining activities and expansion of communities affects approximately 12% of the zone of influence. The spread of invasive alien plants, such as *Prosopis spp.* (River Health Programme 2006), are mainly an issue along the larger river courses.

Due to a lack of research and understanding on groundwater recharge of the aquifer system in the Knersvlakte region it is impossible to know if the current or increased groundwater abstraction through boreholes by neighbouring communities for personal and livestock use will have a negative impact in the Knersvlakte Nature Reserve. Expansion of mining activities in the zone of influence, due to the large volume of water utilised in mining, is likely to have a bigger impact on groundwater availability in the Knersvlakte region, and reserve, as opposed to groundwater use for livestock and community use. Expansion of communities and households with associated livestock affects approximately 8% of the zone of influence. The impact of illegal livestock on the reserve are exacerbated by substandard boundary fences along some parts of the reserve boundary. Approximately 33% of the zone of influence is affected by the presence of livestock on adjacent farms but it has been identified as a low risk (Table 6.4). More than 75% of the zone of influence is identified in the Western Cape Protected Areas Expansion Strategy (CapeNature 2015) as areas for possible expansion and consolidation (section 8). This will result in better reserve and biological connectivity.

It is important that aspects contained within the Knersvlakte Nature Reserve zonation and zone of influence are highlighted with local and district municipal partners as well as neighbouring landowners and communities so that they can support the protected area in the achievement of its goals and ultimately contributing to human wellbeing within the Knersvlakte region.

7 ACCESS AND FACILITIES

This section describes infrastructure and procedures necessary for management of the protected area, inclusive of operations and visitors. It provides information on access facilities, operational facilities, control measures as well as commercial and community use.

7.1 Public Access and Management

Access to the Knersvlakte Nature Reserve can be arranged through the main reserve office located in the regional library building in Matzikamma Street, Vanrhynsdorp. The reserve is currently fragmented over an area in excess of 90 000 ha with various public access roads through the area. The fragmented nature of the reserve design has been highlighted as a medium threat for the reserve. This contributes to additional problems such as vandalism, illegal access and species collections, including trampling of vegetation, at localised points; especially along popular access roads. Appendix 1, Map 9 outlines the scale of the problem. To mitigate this the reserve have identified various actions (section 10) to better manage access – some are short-term solutions for example the erection of temporary gate access control points and increased and focussed patrols. Long-term solutions include the consolidation of the reserve design and building strong relationships with local neighbours, partners and the local community to support the reserve with pro-active compliance.

The Knersvlakte Nature Reserve currently provides limited access to visitors and plans are underway to support local tourism access. Entry fees and access permits will be applicable. Access for researchers conducting approved studies within the reserve is managed through a permit system.

A number of access points are only accessible by management as it mostly crosses private land, or is enclosed with a 1.8 m jackal proof fence, with locked gates to prevent illegal access. Other access points for management purposes exist including servitude rights to private land owners, Sanral and Eskom. Controlled and uncontrolled access points to the reserve are listed in Table 7.1 and illustrated in Appendix 1, Map 9.

Table 7.1: Access points to the Knersvlakte Nature Reserve.

Map Ref. No.	Locality	Name	Type of Access	Activity
1	Vinkelskolk	Steenkampskraal road	Uncontrolled access	Public road crossing through the reserve
2	Vinkelskolk	Main homestead road	Uncontrolled access	Gate control point - for management access only
3	Vinkelskolk	Alternative homestead road	Uncontrolled access	No access – for management access only
4	Jakkalsdraai	Access road to Jakkalsdraai	Uncontrolled access	Gate control point - for management access only
5	Graatjiesgat	Main homestead road	Controlled access	No access – for management access only
6	Kareeberg	Springbok dam access	Controlled access	No access – for management and tourism access only
7	Uitspanrug	Alternative access to Kliprand road	Uncontrolled access	No access – for management access only
8	Uitspanrug	Uitspanrug/Jakkalsdraai road	Uncontrolled access	Gate control point - for management, tourism and landowner access only
9	Jakkalsdraai	Jakkalsdraai/Uitspanrug road	Uncontrolled access	Gate control point - for management, tourism and landowner access only
10	Jakkalsdraai	Access road to Jakkalsdraai	Uncontrolled access	Gate control point - for management, tourism and landowner access only
11	Goedehoop	Main homestead road	Controlled access	No access – for management access only
12	Groot Graafwater	Access road to Groot Graafwater	Uncontrolled access	Gate control point - for management, tourism and landowner access only
13	Groot Graafwater	Main homestead road	Controlled access	No access – for management and tourism access only

Map Ref. No.	Locality	Name	Type of Access	Activity
14	Wolvenest	Rooiberg access road	Uncontrolled access	No access – for management access only
15	Groot Graafwater	Groot Graafwater/Nuwerus road	Uncontrolled access	Gate control point - for management and landowner access only
16	Groot Graafwater	Mostertskop/Moedverloren road	Controlled access	No access – for management and landowner access only
17	Moedverloren	Moedverloren/Mostertskop road	Controlled access	No access – for management and landowner access only
18	Moedverloren	Main homestead road	Controlled access	No access – for management access only
19	Moedverloren	Grasduin/Hol River road	Uncontrolled access	Gate control point - for management and landowner access only
20	Moedverloren	Hol River /Grasduin road	Uncontrolled access	Gate control point - for management and landowner access only
21	Zoutfontein	Main homestead road	Uncontrolled access	No access – for management and landowner access only
22	Zoutfontein	Oom Soon	Controlled access	No access – for management and landowner access only
23	Varsche Rivier	Eskom servitude	Controlled access	No access – for management and Eskom access only
24	Arizona	Main homestead road	Uncontrolled access	No access – for management access only
25	Arizona	Access road to Flamink Vlake	Controlled access	No access – for management access only
26	Wolvenest	Ratelgat/Wolvenest road	Uncontrolled access	No access – for management and landowner access only
27	Wolvenest	Wolvenest access road	Controlled access	No access – for management and landowner access only
28	Varsche Rivier	Varsche Rivier access road - north	Uncontrolled access	No access – for management access only
29	Varsche Rivier	Varsche Rivier access road - south	Uncontrolled access	No access – for management access only
30	Zoutfontein	Main homestead road	Controlled access	No access – for management and landowner access only

Map Ref. No.	Locality	Name	Type of Access	Activity
31	Uitspanrug	Uitspanrug/Goedehoop road	Controlled access	No access – for landowner access only

7.2 Airfields and Flight Corridors

No formal airfields or flight corridors exist or cross the Knersvlakte Nature Reserve. In cases of emergencies that necessitate the use of helicopters, emergency landing areas will be allocated where and when landing is safe.

7.3 Administrative and Other Facilities

The Knersvlakte Nature Reserve is managed within the Matzikama landscape unit. The main office is located in Vanrhynsdorp. The reserve is supported by other centres including the landscape office in Porterville and head office in Cape Town. A number of homesteads are located throughout the reserve footprint that are utilised for operational and research purposes.

Infrastructure and associated building maintenance requirements are captured and managed in both the protected area infrastructure register and the annually updated CapeNature - User Asset Management Plan, administered in collaboration with the Western Cape Department of Transport and Public Works. Scheduled maintenance is implemented and funded by the provincial department, but minor maintenance and emergency repairs is carried out by CapeNature. Major infrastructure is illustrated in Appendix 1, Map 10. External funding is sourced through the Environmental Protection and Infrastructure Programme for the upgrading of specialised buildings and construction and upgrading of boundary fences. The concept development plan, associated zonation scheme and strategic framework guide the development of new infrastructure over the planning period.

7.3.1 Roads / Jeep Tracks

The national tar road (N7), connecting South Africa to Namibia passes through the middle of the Knersvlakte Nature Reserve. There are numerous other public gravel roads that traverse through the reserve which include Kliprand, Steenkampskraal, Groot Graafwater and Moedverloren/Rooiberg roads. The road maintenance for these roads fall to national and local government departments which include the local Matzikama Municipality, West Coast District Municipality and the South African National Roads Agency Limited.

Most of the reserve is accessible by gravel jeep tracks that is utilised for operational purposes. Some of these tracks are only accessible by 4x4 vehicle. The numerous tracks (Appendix 1, Map 10) is mainly as a result of legacy farming practices. Numerous jeep tracks within the reserve require extensive capital investment to upgrade. There are also numerous tracks that need to be closed and rehabilitated. The evaluation of all jeep tracks will form part of a bigger infrastructure/ecological rehabilitation initiative (section 10). Rehabilitation and maintenance of jeep tracks are a factor of operational need, finance availability and ecological sensitivity. At the current moment, maintenance of jeep tracks are focussed on tracks identified for critical operational reasons.

7.3.2 Hiking trails

Currently there are no hiking trails in the Knersvlakte Nature Reserve. The reserve is considering opening a guided hiking trail in future which may include the involvement of neighbouring properties such as Ratelgat, Rooiberg and possibly Beeswater. Part of the hiking trail is likely to be located within the nature access zone identified at the Groot Graafwater turnoff. This will form part of an initiative to make the reserve more accessible for tourists and to promote local economic development. A feasibility study will determine the locality and extent of the proposed hiking route.

7.3.3 Buildings

As with the jeep tracks, many of the existing buildings in the Knersvlakte Nature Reserve stem from legacy farming activities (Figure 7.1). Usually these are concentrated at old homesteads (Appendix 1, Map 10). Some of these buildings are utilised for operations and staff accommodation. Maintenance of these structures forms part of the Western Cape Department of Transport and Public Works – as per schedule outlined in the User Asset Management Plan. Minor maintenance is performed by CapeNature.

Future development and upgrading of buildings for management and tourism use will be guided by the concept development plan (section 9). The Groot Graafwater and Uitspanrug houses were renovated during 2019 and is primarily used for research accommodation purposes. These buildings may also be utilised for tourist accommodation in future, including potentially housing permanent staff located on the reserve. Buildings on the reserve include 10 homesteads, of which two have been upgraded, 12 stores and 14 smaller cottages.

7.3.4 Fences

The boundaries of the Knersvlakte Nature Reserve are mostly fenced (Appendix 1, Map 10). Recently, with funding received from the Environmental Protection and Infrastructure Programme, a total of 268 km of stock proof, 1.2 m boundary fence was replaced with 1.8 m jackal proof fence (Figure 7.1). Further upgrades will be carried out in future as funding becomes available and as the reserve footprint changes through expansion and/or consolidation. Boundary fences shared with neighbouring properties are being maintained by CapeNature and the relevant landowners. The purposes of fences are predominantly to prevent game from escaping, to prevent livestock from entering the reserve, to restrict movement of predators onto neighbouring land and to demarcate boundaries effectively. Internal fences are removed from the reserve as new land portions are acquired.



Figure 7.1: Examples of an old farm homestead and upgraded boundary fence within the Knersvlakte Nature Reserve. Photo: Wynand Pieters & Hilton Bocks.

7.3.5 High sites

A mobile communication repeater is located on Flaminkberg in the north-western part of the Knersvlakte Nature Reserve (Appendix 1, Map 10), allowing for staff communication across the reserve. Two Telkom towers are also located inside the reserve, one at Groot Graafwater and another at Uitspanrug.

7.3.6 Signage

Public entrance signs are located at major entrance points to the Knersvlakte Nature Reserve (Appendix 1, Map 10). Additional signs are needed at a few select points. Some “no access” signs are located in Jakkalsdraai, Vinkelskolk, Groot Graafwater and Moedverloren. No interpretive or visitor signage are currently placed in the reserve. As the reserve is utilised for tourism, environmental education and awareness activities, relevant signage will be expanded. Signage will be developed according to the relevant internal standards.

7.3.7 Utilities

7.3.7.1 Water supply

The primary water supply to the Knersvlakte Nature Reserve is groundwater from boreholes, and harvested rainwater. Existing operational boreholes utilised for human and animal water provision, mostly during summer, are located on Vinkelskolk, Jakkalsdraai, Goedehoop, Uitspanrug, Kareeberg and Groot Graafwater. Numerous small earth dams, some functional, others not, are also scattered throughout the reserve. The maintenance and upgrading of borehole water installations, and earth dams for the collection of winter rainwater, has been identified as a priority for the reserve, both for wildlife and human use (section 10). Significant capital investment is needed to upgrade borehole facilities with solar electric pump systems.

7.3.7.2 Electricity supply

No Eskom grid electricity is available at any of the operational centres inside the Knersvlakte Nature Reserve. There is an Eskom distribution line that runs along the N7 up to the Ratelgat community centre (Appendix 1, Map 10). As operational centres are upgraded, facilities are equipped with solar power systems to provide basic

electricity needs for accommodation facilities and water installations. Although initial capital investment for solar or wind electricity and water systems are high, the use of such systems are a sustainable alternative to grid electricity supply.

7.3.7.3 Waste management

There are no waste disposal sites within the Knersvlakte Nature Reserve. All waste is collected by reserve staff on a regular basis and transported to the closest municipal waste facility. No waste recycling programme currently exists in the Matzikama municipal area however the Vanrhynsdorp office does collect all paper and e-waste for recycling via the Porterville landscape office.

Sewage systems at operational centres located on the reserve mainly comprise historic septic tanks with soakaways and pit latrines. As operational centres are upgraded, facilities are equipped with composting toilet facilities that do not require any water and are well suited for use in an arid environment such as the Knersvlakte. Field staff that work away from operational centres during the day make use of portable toilet facilities. “Leave No Trace” waste management principles apply to all staff, researchers and visitors to the reserve.

7.3.8 Visitor facilities

Currently the Knersvlakte Nature Reserve does not provide any formal tourist accommodation or offer any tourist activities. The reserve is still in a development stage and tourism product development will be considered during the next few years, subject to financial and operational feasibility. The concept development plan (section 9) provides more details in this regard. Two existing old homesteads (Groot Graafwater and Uitspanrug) has received upgrades to make these facilities more suitable for operational and visitor use.

7.4 Commercial Activities

No commercial activities or agreements are applicable to the Knersvlakte Nature Reserve.

7.5 Community Use

No community use activities or agreements are applicable to the Knersvlakte Nature Reserve.

7.6 Servitudes

A number of servitude agreements are registered on properties that comprise the Knersvlakte Nature Reserve. Some registered servitudes are not applicable at present due to the property on which the servitude is registered belonging to the same party that owns the property; in this case WWF-SA, being the landowner and servitude holder. Conditional access regulated through servitudes includes agreements with neighbouring landowners for water user-rights, rite of passage, pipelines and access for infrastructure maintenance. All registered and known servitudes are listed in Table 7.2 and mapped in Appendix 1, Map 9.

Table 7.2: Servitudes applicable to the Knersvlakte Nature Reserve.

Date of Agreement	Type of Agreement	Partner	Duration of Agreement (years)	Area Affected	Conditions of Use
1941/10/02 & 1951/11/20	Road servitude	Roads department	In perpetuity	Moedverloren No. 208	Road access - a 15.24 m right of way
1964/12/15	Water pipeline and borehole servitude	Adjacent landowner	In perpetuity	Quagga Kop No. 213	Water access for livestock - maximum of three boreholes
1947/10/14	Road servitude	* Adjacent landowner	In perpetuity	Portion 4 of Wolenest No. 212	Road access - a 12.59 m right of way
1959/05/26	Road servitude	Adjacent landowner	In perpetuity	Remainder of Wolenest No. 212; Portion 1, 2 and 4 of Wolenest No.212	Road access - a 9.45 m right of way
1963/12/03	Road servitude	Roads department	In perpetuity	Groot Graaf Water No. 210	Road access - a 12.59 m right of way. Original servitude road has been relayed.
1928/03/22	Road servitude	Adjacent landowner	In perpetuity	Portion 6 (of portion 4) of Zoutfontein No. 178	Road access - a 91.44 m right of way. Only for adjacent landowner
1963/08/02	Water pipeline, dam and borehole servitude	* Adjacent landowner	In perpetuity	Portion 5 of Wolenest No. 212	Water infrastructure access
Unknown Captured: 1996/08/28	Water pipeline and borehole servitude	* Adjacent landowner	In perpetuity	Remainder of Bushmans Grave No. 112	Water infrastructure access
Unknown Captured: 1993/05/26	Road servitude	Eskom	In perpetuity	Remainder of Varsche Rivier Extension B No. 226	Road access - a 47 m right of way. Servitude for transmission line access.

* Properties belonging to WWF-SA therefore the servitude is not applicable.

8 EXPANSION STRATEGY

Protected area expansion in South Africa is guided by the National Protected Area Expansion Strategy (NPAES) (DEA 2016b). In response to the NPAES, CapeNature has produced the WCPAES (CapeNature 2015).

Mechanisms for protected area expansion include the promotion of stewardship options on private land in collaboration with landowners, regularising existing private nature reserves, and the consolidation of state land managed by conservation authorities such as municipalities and CapeNature as formal protected areas.

The Knersvlakte Nature Reserve expansion will be achieved in line with the WCPAES and the NPAES. Planned expansion and consolidation sites have been identified through systematic conservation planning that culminated in the Western Cape Biodiversity Spatial Plan Handbook. It includes sites that contain Critical Biodiversity Areas (Pool-Stanvliet *et al.* 2017; Appendix 1, Map 11). The Conservation Action Priority map, a spatial representation of the WCPAES, which includes a subset of Critical Biodiversity Areas, is used to guide expansion initiatives. During 2019-2020 the WCPAES will be under revision and as part of this process the planning and expansion domain for the reserve will be revised to align with updated spatial informants.

The establishment and expansion of the reserve has mainly been through the purchase of privately-owned conservation worthy land by WWF-SA, funded by the LHSKT. The approach going forward will include land purchases and a focus on biodiversity stewardship as a means of expanding the conservation estate and consolidating the reserve. The long-term desired outcome would be the protection of the endemic and sensitive fauna and flora in the Knersvlakte Bioregion and the creation of an upland-lowland climate change corridor stretching from the Bokkeveld Mountains to the Olifants River mouth.

Achieving the expansion goal and strengthening the relationship between CapeNature and its stakeholders within the reserve zone of influence (local community, neighbouring landowners and communal property associations), will contribute to the Knersvlakte Nature Reserve management plan expansion and consolidation targets. Through these mechanisms, the WCPAES objectives, and the national goal of achieving cost-effective protected area expansion for improved ecosystem representation and ecological resilience in the face of climate change can be achieved. The expansion map is indicated in Appendix 1, Map 11.

9 CONCEPT DEVELOPMENT PLAN

The concept development plan sets out the long-term plan for the development of the protected area in keeping with the purpose of the reserve and with due consideration for protected area expansion and the zoning plan.

Tourism products and related infrastructure developments in CapeNature are considered investments and are intended to:

- Harness and enhance the income generation potential of protected areas with a view to achieving long term business sustainability;

- The provision of safe, informative and purpose-built access to protected areas;
- To enhance the operational efficiency and management of protected areas.

9.1 Project Selection

Organisationally potential tourism product developments are selected based on internal consultation and approval where factors such as appropriateness, environmental authorisation, financial feasibility and the apparent return on investment are considered. Where external approvals for developments are required, these are sought from the relevant authorities prior to the commencement of any development activities (Figure 9.1).

CapeNature may elect to operate tourism products and services internally, or via other mechanisms described in the Public Finance Management Act, 1999 (Act No.1 of 1999) such as concessions or public private partnerships.

CONCEPT DEVELOPMENT FRAMEWORK

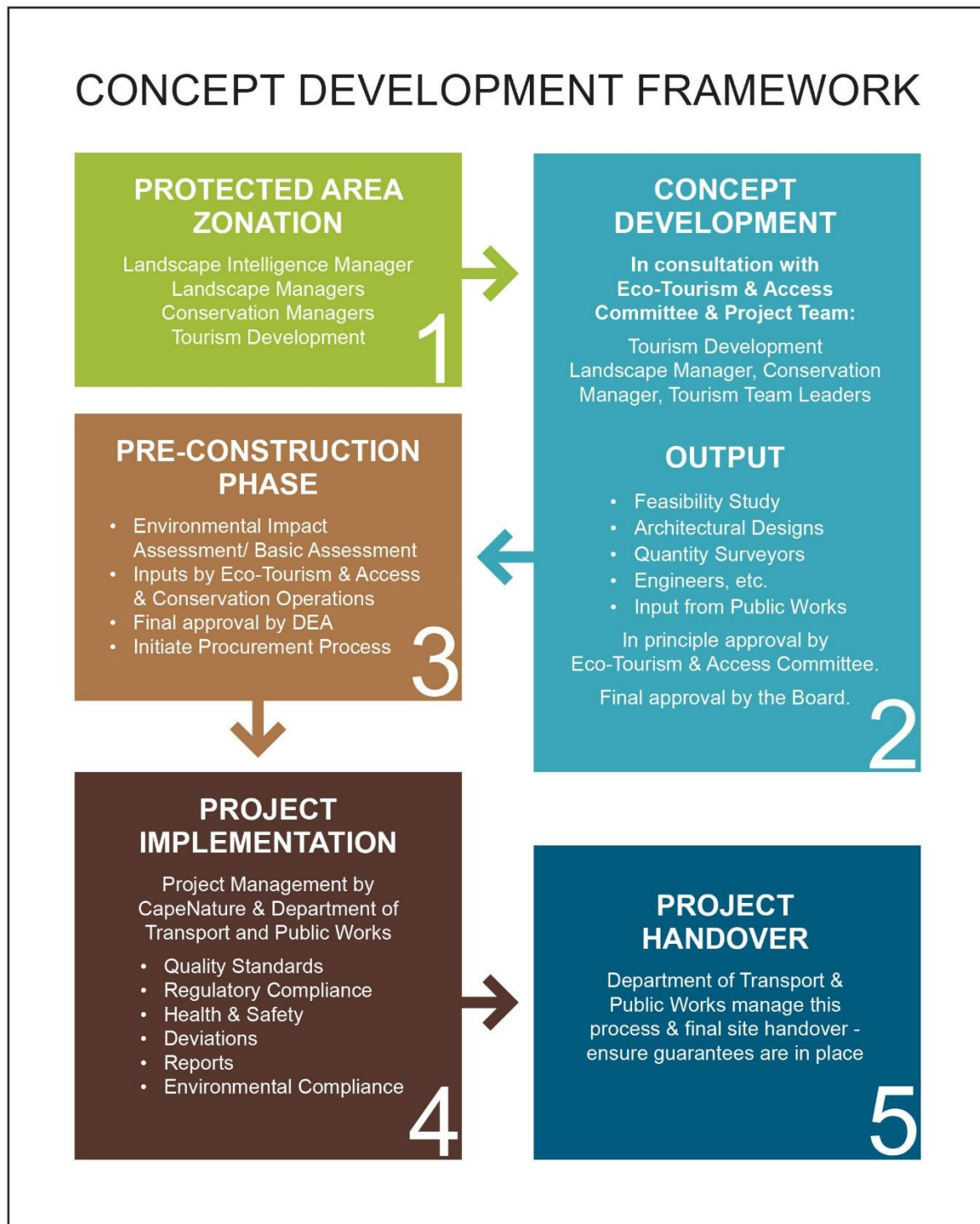


Figure 9.1: Concept development framework implemented by CapeNature.

9.2 Methodology

Tourism products and infrastructure within CapeNature protected areas are designed to be sensitive to their locations and are intended as prime examples of responsible and sustainable commercial developments. These include: off-grid bulk water and energy services; passive design efficiencies; enhanced resource utilisation and

resource-saving features. Tourism developments aim to comply with prevailing zonation schemes and sensitivity analysis unless approval to the contrary has successfully been sought.

Wherever possible, tourism products, developments and services are intended to provide training and employment opportunities to communities within and surrounding the protected area.

9.3 Infrastructure Management and Development

Taking sensitivity drivers into consideration, large parts of the Knersvlakte Nature Reserve have been zoned as being highly or moderately sensitive (section 5.7; Appendix 1, Map 6). In this context any future infrastructure considerations (tourism or operational) will be placed accordingly. Fortunately a number of old homestead footprints are already located inside the reserve that can be used as development footprints in future (see Appendix 1, Map 12). The zonation of the reserve has been developed with this in mind (Appendix 1, Map 7). Only minor tourism or operational infrastructure developments are envisaged for the next 10 years.

Apart from new developments, existing infrastructure which mainly include boundary fences, jeep tracks, operational and visitor facilities, earth dams and water installations will be maintained and/or upgraded as required. This infrastructure maintenance list is not exhaustive.

9.3.1 Visitor facilities

With funding from the Environmental Protection and Infrastructure Programme a small environmental interpretation centre with associated hosting and accommodation facilities are to be constructed at Kareeberg homestead. Visitor access and reception facilities are to be constructed at the Groot Graafwater turnoff along the N7 to enhance tourist access to the Knersvlakte Nature Reserve (Appendix 1, Map 12).

Infrastructure upgrades at Groot Graafwater and Uitspanrug have been implemented to enhance these facilities for operational and visitor use. Subject to feasibility, these facilities may be used as tourist accommodation in future. All developments upgrades will have solar/wind or eco solutions as the preferred alternatives.

The reserve lends itself to the development of a wilderness hiking trail. This would be compatible within the primitive zonation identified (Appendix 1, Map 7). A feasibility study will be conducted to determine the best placement taking into consideration sensitivity, neighbouring landowners and partners such as the Griqua National Conference Development Trust (Ratelgat property).

Tourism interpretation and signage have been identified as a need for the reserve. The focus of this will be to highlight the unique values of the Knersvlakte Nature Reserve and Knersvlakte area in general. A nature access zone (Appendix 1, Map 7) where visitors can get in-field and experience the unique biodiversity of the area is being considered along the N7 national road.

Buildings located at Moedverloren, Goedehoop, the Wolvenest school and the Kliphuis on Zandkraal may need to be upgraded to enhance the heritage value of these buildings and can serve for operational and or visitor use in future.

9.3.2 Operational facilities

With funding from the Environmental Protection and Infrastructure Programme the development of gate control access points will be considered at strategic sites within the Knersvlakte Nature Reserve (Appendix 1, Map 12).

Water security across the reserve is critical for animal and staff needs. There will be a focus on getting some existing boreholes operational. This will require the installation of associated infrastructure (windmill, solar and tank) at select sites. As part of this initiative there will also be a drive to maintain small existing earth dams across the reserve to allow surface water accumulation for animals during winter rains (Appendix 1, Map 5).

Some old homesteads are used by operational and/or research teams when working infield. Some of these sites require sanitation upgrades to upgrade old pit/soak away sewage systems. Eco friendly solutions such as composting toilets are preferred for some of these sites.

The Knersvlakte Nature Reserve is still in a state of expansion and consolidation (Appendix 1, Map 11). As such, the reserve boundary fence may require upgrade or re-alignment in the next 10 years. These fence upgrades are always associated within existing fence footprints.

10 STRATEGIC PLAN

This section presents the strategic plan for the protected area. The strategic plan was derived from an assessment of the conservation situation, inclusive of the biological environment and the social, economic, cultural and institutional systems that influence values. Strategic intervention points formed the basis for developing strategies; using results chains to test theories of change and establish short to medium term objectives. From these, detailed actions with timeframes were developed to guide implementation, monitoring and evaluation.

Strategies are aimed at:

- Focal value restoration / stress reduction;
- Behavioural change / threat reduction; and
- Establishing / promoting enabling conditions.

A summary of selected strategies and objectives for the Knersvlakte Nature Reserve is provided in Table 10.1. Table 10.2 details the actions and associated timeframes for each separate strategy.

CapeNature will lead the implementation of the management plan, although achieving the vision requires coordinated effort. Stakeholder groups and organisations identified in the strategic plan are key role players in successful delivery of this management plan.

Table 10.1: Summary of strategies and objectives identified for the Knersvlakte Nature Reserve.

Threats Abated	Strategy Type	Strategy	Objectives
Poaching	Threat reduction	Strategy 1: Ensure that natural resource use and access is in line with the CapeNature Natural Resource Utilisation policy and permit system.	Objective 1.1: By 2024, implement the Central Reservation System (visitor permits) and Permitz System (filming permits) within the Knersvlakte Nature Reserve.
			Objective 1.2: By 2024, CapeNature have revised and implemented the Natural Resource Utilisation policy and Permitting System.
Lack of written history; Damaging heritage resources	Enabling conditions / Behavioural change	Strategy 2: Facilitate the compilation and public promotion of the diverse Knersvlakte history and cultural heritage.	Objective 2.1: By 2030, the tangible and intangible cultural historic heritage of the Knersvlakte is preserved and promoted.
Poaching; Lack of awareness and environmental education at schools; Lack of awareness and knowledge; Lack of knowledge on medicinal plants; Damaging heritage resources; Illegal collection; Pollution; Invasive alien plants; Trampling; Vandalism	Behavioural change / Threat reduction	Strategy 3: Develop and implement an integrated environmental education and awareness programme aimed at neighbours, resource users, school groups and visitors to nurture respect and care for the values of the Knersvlakte Nature Reserve.	Objective 3.1: By 2023, the environmental interpretation and awareness plan have been revised to include all ecological and human wellbeing values identified for the Knersvlakte Nature Reserve.
Lack of job opportunities; Lack of educational opportunities; Lack of skill training opportunities; Lack of work opportunities after training; Lack of willingness to participate in training	Enabling conditions	Strategy 4: Contribute to economic and social development by providing jobs, training and work opportunities to staff, contractors and small, medium and micro enterprises.	Objective 4.1: By 2024, CapeNature have identified and prioritised viable economic development projects for implementation within the Knersvlakte Nature Reserve and its zone of influence.
			Objective 4.2: From 2021, all reserve employed staff will receive relevant functional and life-skills training.
			Objective 4.3: By 2024, CapeNature have engaged with relevant partners to promote small, medium and micro enterprise development and eligibility in surrounding communities.

Threats Abated	Strategy Type	Strategy	Objectives
Inappropriate infrastructure development	Threat reduction / Enabling conditions	Strategy 5: Develop and implement a comprehensive Concept Development Framework to guide infrastructure development, access, tourism and non-consumptive utilisation to safeguard biodiversity and enhance human wellbeing benefits.	Objective 5.1: By 2023, all operational infrastructure of the Knersvlakte Nature Reserve have been assessed and guides the development of a comprehensive Concept Development Plan.
			Objective 5.2: By 2025, the current and potential tourism infrastructure of the Knersvlakte Nature Reserve has been assessed and guides the development of a comprehensive Concept Development Plan.
			Objective 5.3: By 2027, a comprehensive Concept Development Plan has been approved for the Knersvlakte Nature Reserve.
			Objective 5.4: By 2027, the Knersvlakte Nature Reserve Concept Development Plan has been incorporated into Matzikama Municipality Integrated Development Plan.
Lack of available water for animals	Threat reduction / Enabling conditions	Strategy 6: Develop and implement a water resource management plan for the Knersvlakte Nature Reserve.	Objective 6.1: By 2024, water availability and monitoring requirements in the Knersvlakte Nature Reserve are guided by a comprehensive water management plan.
Illegal collection	Threat reduction / Enabling conditions	Strategy 7: Through partnerships, promote and facilitate pro-active law enforcement and compliance within the Knersvlakte.	Objective 7.1: By 2023, build formal partnerships with relevant compliance stakeholders and engage and encourage pro-active communication, awareness and compliance action.
Illegal collection; Pollution; Trampling; Vandalism; Lack of heritage maintenance	Threat reduction / Enabling conditions	Strategy 8: Assess and strengthen the capacity of the Knersvlakte Nature Reserve to effectively implement operational, ecological and compliance requirements.	Objective 8.1: By 2023, the staff capacity and training needs have been adequately assessed to address shortcomings.
Lack of job opportunities	Threat reduction / Enabling conditions	Strategy 9: In partnership, facilitate Damage Causing Animal research within the Knersvlakte and encourage local farmers, associations and communities to form part of relevant knowledge and management initiatives.	Objective 9.1: By 2024, address Damage Causing Animal management and research in the Knersvlakte Nature Reserve zone of influence.

Threats Abated	Strategy Type	Strategy	Objectives
Historical farm practices	Threat reduction / Value restoration	Strategy 10: Develop and implement a restoration plan for the Knersvlakte Nature Reserve.	Objective 10.1: By 2025, restoration requirements in the Knersvlakte Nature Reserve are guided by a comprehensive restoration plan.
Vandalism; Lack of heritage maintenance; Damaging heritage resources	Threat reduction / Value restoration	Strategy 11: In partnership, develop and implement a heritage resource management plan for the Knersvlakte Nature Reserve.	Objective 11.1: By 2030, the Knersvlakte Nature Reserve has an approved heritage management plan for implementation.
Illegal collection; Mining and prospecting; Trampling; Protected area fragmentation	Enabling conditions	Strategy 12: In partnership, re-evaluate the expansion domain of the Knersvlakte Nature Reserve to facilitate protected area expansion and consolidation through stewardship, land purchases and state land transfer.	Objective 12.1: By 2030, the Knersvlakte Nature Reserve will have an approved expansion domain and reserve expansion activities will be focussed in this area.

Table 10.2: Strategic Plan for the Knersvlakte Nature Reserve.

STRATEGY 1:	Ensure that natural resource use and access is in line with the CapeNature Natural Resource Utilisation policy and permit system.				
LINKED GOALS:	3; 4; 11; 12				
THREATS:	Poaching				
Objectives	Actions	Responsibility	Time-frame	Measurable Indicators / Outputs	References / Existing Procedures
Objective 1.1: By 2024, implement the Central Reservation System (visitor permits) and Permitz system (filming permits) within the Knersvlakte Nature Reserve.	Register the reserve and implement both permit systems through the Vanrhynsdorp office.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Tourism Development Manager	Year 1	Permit systems implemented; Permits being issued.	Central reservation system; Permitz System.
	Identify and implement the permit system at relevant sites throughout the reserve.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Conservation Manager On-Reserve (Knersvlakte)	Year 1-4	Permits being issued.	Central reservation system; Permitz System.
Objective 1.2: By 2024, CapeNature have revised and implemented the Natural Resource Utilisation policy and Permitting System.	If needed, revise and approve the Natural Resource Utilisation Policy to ensure that resource use (consumptive and non-consumptive) in Succulent Karoo ecosystems are adequately addressed.	Lead: Operations Director Region West Enablers: Stakeholder Engagement Officer	Year 4	Approved policy; Amended permit system.	Current policy; Current permit system.
	Implement the revised Natural Resource Utilisation Policy and Permitting System.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Stakeholder Engagement Officer; Conservation Manager Off-Reserve	Year 4	Approved policy; Amended permit system.	Current policy; Current permit system.

STRATEGY 2:	Facilitate the compilation and public promotion of the diverse Knersvlakte history and cultural heritage.				
LINKED GOALS:	5; 9; 12				
THREATS:	Lack of Written History; Damaging Heritage Resources				
Objectives	Actions	Responsibility	Time-frame	Measurable Indicators / Outputs	References / Existing Procedures
Objective 2.1: By 2030, the tangible and intangible cultural historic heritage of the Knersvlakte is preserved and promoted.	Identify the relevant partners that can assist with the identification and compilation of cultural and historical knowledge for the Knersvlakte.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Landscape Conservation Intelligence Manager	Year 1-3	Formal communication with partners.	National Heritage Resources Act; South African Policy on Living Heritage.
	Facilitate the development of a document to include the cultural and historical knowledge of the Knersvlakte.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: South African Heritage Resource Agency; Heritage Western Cape; Academic Institutions	Year 4-6	Document produced.	
	Promote the cultural and historical knowledge of the Knersvlakte through environmental education and awareness interventions with relevant forums and partners.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Stakeholder Engagement Officer	Year 7 and beyond	Number of environmental education and awareness interventions.	Integrated Work Plan.

STRATEGY 3:	Develop and implement an integrated environmental education and awareness programme aimed at neighbours, resource users, school groups and visitors to nurture respect and care for the values of the Knersvlakte Nature Reserve.				
LINKED GOALS:	3; 4; 5; 6; 9; 11; 12				
THREATS:	Poaching; Lack of EE at schools; Lack of Awareness and Knowledge; Lack of Knowledge on Medicinal plants; Damaging Heritage Resources; Illegal Collection; Pollution; Invasive Alien Plants; Trampling; Vandalism				
Objectives	Actions	Responsibility	Time-frame	Measurable Indicators / Outputs	References / Existing Procedures
Objective 3.1: By 2023, the environmental interpretation and awareness plan have been revised to include all ecological and human wellbeing values identified for the Knersvlakte Nature Reserve.	Revise and implement the approved plan.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Stakeholder Engagement Officer	Year 3 and beyond	Amended environmental interpretation and awareness plan; Number of environmental education and awareness interventions.	Environmental interpretation and awareness plan; Integrated Work Plan.

STRATEGY 4:	Contribute to economic and social development by providing jobs, training and work opportunities to staff, contractors and small, medium and micro enterprises.				
LINKED GOALS:	1; 2; 10; 12; 13				
THREATS:	Lack of Job Opportunities; Lack of Educational Opportunities; Lack of Skill Training Opportunities; Lack of Work Opportunities after training; Lack of willingness to participate in training				
Objectives	Actions	Responsibility	Time-frame	Measurable Indicators / Outputs	References / Existing Procedures
Objective 4.1: By 2024, CapeNature have identified and prioritised viable economic development projects for implementation within the Knersvlakte Nature Reserve and its zone of influence.	Implement existing and additional economic development opportunities as funding becomes available.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Landscape Manager L2; Stakeholder Engagement Officer	Year 4	Management Information System report; Small, medium and micro enterprises register.	Municipal Integrated Development Plan.
Objective 4.2: From 2021, all reserve employed staff will receive relevant functional and life-skills training.	Assess staff training needs and submit training request internally to Human Resources department.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Training Projects Specialist	Year 1 and beyond	Number of training events.	Expanded Public Works Programme training request.
Objective 4.3: By 2024, CapeNature have engaged with relevant partners to promote small medium and micro enterprise development and eligibility in surrounding communities.	Investigate opportunities for engagement with local and national partners to promote socio-economic development.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Stakeholder Engagement Officer	Year 4	Minutes of relevant meetings.	Municipal Integrated Development Plan.

STRATEGY 5:	Develop and implement a comprehensive Concept Development Framework to guide infrastructure development, access, tourism and non-consumptive utilisation to safeguard biodiversity and enhance human wellbeing benefits.				
LINKED GOALS:	2; 3; 4; 5; 8; 11; 13				
THREATS:	Inappropriate Infrastructure Development				
Objectives	Actions	Responsibility	Time-frame	Measurable Indicators / Outputs	References / Existing Procedures
Objective 5.1: By 2023, all operational infrastructure of the Knersvlakte Nature Reserve have been assessed and guides the development of a comprehensive Concept Development Plan.	Conduct an operational infrastructure assessment to determine infrastructure development and maintenance requirements for the reserve.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Landscape Ecologist; LandUse Scientists; Integrated Catchment Specialist	Year 3	Infrastructure assessment.	Reserve zonation; Concept Development Plan.
	Conduct a public road and servitudes assessment for the reserve to set priorities for de-proclamation and access management, and engage with relevant stakeholders and neighbours on identified actions.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Land Use Advice Legal Officer	Year 3	Infrastructure assessment.	Road legislation.
Objective 5.2: By 2025, the current and potential tourism infrastructure of the Knersvlakte Nature Reserve has been assessed and guides the development of a comprehensive Concept Development Plan.	Conduct a tourism and commercial infrastructure assessment to determine infrastructure development and maintenance requirements for the reserve.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Landscape Ecologist; LandUse Scientist; Integrated Catchment Specialist; Infrastructure Specialist	Year 5	Infrastructure assessment.	Reserve zonation; Concept Development Plan.
Objective 5.3: By 2027, a comprehensive Concept Development Plan has been approved for the Knersvlakte Nature Reserve.	Develop and approve a comprehensive Concept Development Plan for the reserve.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Landscape Ecologist; LandUse Scientist; Integrated Catchment	Year 7	Approved Concept Development Plan.	Reserve zonation; Concept Development Plan.

STRATEGY 5:	Develop and implement a comprehensive Concept Development Framework to guide infrastructure development, access, tourism and non-consumptive utilisation to safeguard biodiversity and enhance human wellbeing benefits.				
LINKED GOALS:	2; 3; 4; 5; 8; 11; 13				
THREATS:	Inappropriate Infrastructure Development				
Objectives	Actions	Responsibility	Time-frame	Measurable Indicators / Outputs	References / Existing Procedures
		Specialist; Infrastructure Specialist			
Objective 5.4: By 2027, the Knersvlakte Nature Reserve Concept Development Plan has been incorporated into Matzikama Municipality Integrated Development Plan.	Engage with Matzikama Municipality and incorporate the reserve Concept Development Plan and zone of influence into the municipal Integrated Development Plan.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: LandUse Scientist	Year 7	Minutes of relevant meetings.	Municipal Integrated Development Plan.

STRATEGY 6:	Develop and implement a water resource management plan for the Knersvlakte Nature Reserve.				
LINKED GOALS:	1; 2; 3; 4; 7				
THREATS:	Lack of Available Water for Animals				
Objectives	Actions	Responsibility	Time-frame	Measurable Indicators / Outputs	References / Existing Procedures
Objective 6.1: By 2024, water availability and monitoring requirements in the Knersvlakte Nature Reserve are guided by a comprehensive water management plan.	Identify and obtain baseline informants and information to guide the development of the reserve water restoration plan.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Landscape Ecologist; Freshwater Ecologist	Year 3	Baseline data.	Groundwater monitoring protocol.
	Compile and implement the reserve water resource management plan.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Landscape Ecologist; Fauna Ecologist; Integrated Catchment Specialist	Year 4	Water resource management plan.	Protected Area Management Plan; Integrated Work Plan.

STRATEGY 7:	Through partnerships, promote and facilitate pro-active law enforcement and compliance within the Knersvlakte.				
LINKED GOALS:	3; 4; 5; 7; 8; 11				
THREATS:	Illegal Collection				
Objectives	Actions	Responsibility	Time-frame	Measurable Indicators / Outputs	References / Existing Procedures
Objective 7.1: By 2023, build formal partnerships with relevant compliance stakeholders and engage and encourage pro-active communication, awareness and compliance action.	Investigate, develop, implement and update a quick and effective communication mechanism to enable compliance communication within the stakeholder network.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Conservation Manager Off-Reserve; Stakeholder Engagement Officer; Compliance and Enforcement Specialist	Year 3	Communication mechanism included into the reserve Integrated Compliance Plan.	Reserve Integrated Compliance Plan.
	Promote compliance awareness and action through relevant forums such as the reserve PAAC, farmers associations and SAPS offices in the areas surrounding the reserve.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Conservation Manager Off-Reserve; Stakeholder Engagement Officer; Compliance and Enforcement Specialist	Year 1 and beyond	Minutes of relevant meetings.	Reserve Integrated Compliance Plan.
	Promote and roll-out pro-active compliance and ecological awareness with reserve staff, visitors, contractors and researchers to the reserve.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Conservation Manager Off-Reserve; Stakeholder Engagement Officer, Compliance and Enforcement Specialist	Year 1 and beyond	Reduced number of compliance transgressions.	Reserve compliance and enforcement database.

STRATEGY 8:	Assess and strengthen the capacity of the Knersvlakte Nature Reserve to effectively implement operational, ecological and compliance requirements.				
LINKED GOALS:	1; 2; 3; 4; 5; 6; 8; 9; 10; 11; 12; 13				
THREATS:	Illegal Collection; Pollution; Trampling; Vandalism; Heritage Maintenance				
Objectives	Actions	Responsibility	Time-frame	Measurable Indicators / Outputs	References / Existing Procedures
Objective 8.1: By 2023, the staff capacity and training needs have been adequately assessed to address shortcomings.	Critically assess staff capacity and associated financial needs to improve effective management of the reserve.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Landscape Manager L2; Human Resources General Manager	Year 1	Operational capacity assessment.	Protected Area Management Plan.
	Motivate for and appoint additional staff as indicated in the reserve staff assessment, subject to budget availability.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Landscape Manager L2; Human Resources General Manager	Year 3	Approved submission; Restructured reserve organogram.	Protected Area Management Plan.
	Implement a training programme to develop staff skill and capability.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Training Projects Specialist; Human Resources Specialist: Talent Optimisation	Year 1 and beyond	Number of trained and capacitated reserve staff.	Staff performance agreements.

STRATEGY 9:	In partnership, facilitate Damage Causing Animal research within the Knersvlakte and encourage local farmers, associations and communities to form part of relevant knowledge and management initiatives.				
LINKED GOALS:	12; 13				
THREATS:	Lack of Job Opportunities				
Objectives	Actions	Responsibility	Time-frame	Measurable Indicators / Outputs	References / Existing Procedures
Objective 9.1: By 2024, address Damage Causing Animal management and research in the Knersvlakte Nature Reserve zone of influence	Facilitate Damage Causing Animal workshops between CapeNature, relevant farmer association chairpersons and Predation Management Forum.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Compliance and Enforcement Specialist; Conservation Manager Off-Reserve	Year 4	Minutes of relevant meetings.	CapeNature Damage Causing Animal protocol; Predation Management Forum guidelines.
	Initiate Damage Causing Animal scat collection project in the reserve.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Ecological Coordinator	Year 1	Appropriately collected scat samples stored.	Reserve eco-matrix.
	Initiate a Damage Causing Animal research project in the reserve and/or landscape to generate scientific knowledge with regards to the scope of the problem.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Landscape Ecologist	Year 2	Interactions with academic partners.	Protected Area Management Plan.
	Communicate and disseminate relevant Damage Causing Animal research findings and manage Damage Causing Animal incidents accordingly.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Conservation Manager Off-Reserve	Ongoing	Number of Damage Causing Animal incidents responded to.	CapeNature Damage Causing Animal protocol; Predation Management Forum guidelines.

STRATEGY 10:	Develop and implement a restoration plan for the Knersvlakte Nature Reserve.				
LINKED GOALS:	1; 2; 3; 4; 5; 9; 10; 12; 13				
THREATS:	Historical Farm Practices				
Objectives	Actions	Responsibility	Time-frame	Measurable Indicators / Outputs	References / Existing Procedures
Objective 10.1: By 2025, restoration requirements in the Knersvlakte Nature Reserve are guided by a comprehensive restoration plan.	Identify and obtain baseline informants and information to guide the development of the reserve restoration plan.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Landscape Ecologist; Integrated Catchment Specialist; Restoration Ecologist	Year 1-3	Baseline data captured in reserve infrastructure register; Disturbed areas spatial data; Invasive alien plant register.	Protected Area Management Plan.
	Compile and implement a restoration plan for the reserve.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Landscape Ecologist, Integrated Catchment Specialist; Restoration Ecologist	Year 5	Reserve restoration plan	Protected Area Management Plan; Integrated Work Plan.

STRATEGY 11:	In partnership, develop and implement a heritage resource management plan for the Knersvlakte Nature Reserve.				
LINKED GOALS:	5; 9; 12				
THREATS:	Vandalism; Lack of Heritage Maintenance; Damaging Heritage Resources				
Objectives	Actions	Responsibility	Time-frame	Measurable Indicators / Outputs	References / Existing Procedures
Objective 11.1: By 2030, the Knersvlakte Nature Reserve has an approved heritage management plan for implementation.	Conduct a formal baseline heritage survey through the reserve.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Heritage Western Cape or other relevant heritage partners	Year 4-5	Updated reserve heritage inventory; South African Heritage Resource Information System.	National Heritage Resources Act.
	In partnership with Heritage Western Cape, draft and implement the heritage management plan for the reserve.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Heritage Western Cape or other relevant heritage partners	Year 6-10	Reserve heritage resource management plan; Integrated Work Plan.	Heritage management guidelines; Reserve eco-matrix; Integrated Work Plan.

STRATEGY 12:	In partnership, re-evaluate the expansion domain of the Knersvlakte Nature Reserve to facilitate protected area expansion and consolidation through stewardship, land purchases and state land transfer.				
LINKED GOALS:	3; 4; 6; 7; 8; 13				
THREATS:	Illegal Collection; Mining and Prospecting; Trampling; Protected Area Fragmentation				
Objectives	Actions	Responsibility	Time-frame	Measurable Indicators / Outputs	References / Existing Procedures
Objective 12.1: By 2030, the Knersvlakte Nature Reserve will have an approved expansion domain and reserve expansion activities will be focussed in this area.	In partnership with WWF-SA, re-evaluate the planning and expansion domain for the reserve and include this into the updated Western Cape Protected Area Expansion Strategy.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Conservation Planning Specialist; Landscape Conservation Intelligence Manager; Conservation Manager Off-Reserve	Year 1	Expansion priorities included into Western Cape Protected Area Expansion Strategy.	Protected Area Management Plan.
	Sign-up stewardship properties identified in the revised reserve planning domain.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Conservation Manager Off-Reserve	By year 10	Submission to the Minister.	Western Cape Protected Area Expansion Strategy; Revised reserve expansion domain.
	In partnership with WWF-SA, purchase and declare properties identified in the Western Cape Protected Area Expansion Strategy and reserve planning domain.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Conservation Manager Off-Reserve; Legal Advisor	By year 10	Submission to the Minister.	Western Cape Protected Area Expansion Strategy; Revised reserve expansion domain.
	Facilitate the transfer and declaration of identified State Land as part of the reserve.	Lead: Conservation Manager On-Reserve (Knersvlakte) Enablers: Landscape Manager L2; Legal Advisor	By year 10	Submission to the Minister.	Western Cape Protected Area Expansion Strategy; Revised reserve expansion domain.

11 COSTING

This section provides an overview of costing and fund allocation for strategies. It outlines the existing financial resources (current budget), funding shortfalls, sources of alternate funding and future financial projections.

11.1 Finance and Asset Management

In line with the legal requirement, the strategies identified for implementation within the protected area, to achieve the desired state, have been costed below.

The protected area will adhere to the guiding principles listed below:

- Responsibly manage the allocation of budget, revenue raising activities and expenditure;
- Ensure solid financial management supporting the achievement of the objectives of this plan; and
- Compliance with the Public Finance Management Act, 1999 (Act No. 1 of 1999) as well as CapeNature's financial policies and procedures.

Using a zero-based budgeting approach, a funding estimate was derived based upon the activities in this management plan. When estimating the costing, the following items were considered:

- Those costs and associated resources which could be allocated to specific activities and which were of a recurring nature;
- Those costs and associated resources which could be allocated to specific activities but which were of a once-off nature;
- Unallocated fixed costs (water, electricity, phones, bank fees, *etc.*);
- Maintenance of infrastructure; and
- Provision for replacement of minor assets, (furniture, electronic equipment, vehicles, *etc.*).

11.1.1 Income

CapeNature's budget is funded by the Medium Term Expenditure Framework (MTEF) allocation, other government grants and generated from own revenue sources derived from commercial activities. Any surplus revenue generated is used to fund shortfalls in management costs across the organisation.

CapeNature has overhead costs relating to support services such as human resources, marketing and eco-tourism, finance, biodiversity support, conservation services, people and conservation, legal services, *etc.* which is not allocated to individual protected area's and must also be funded through grant funding or own revenue generated.

This management plan is a 10-year plan, and thus straddles multiple MTEF periods that impact on actual budget allocation and projection.

Total income projected for 2020/21 is budgeted at R 22 934 304. This amount includes recurring and once-off funding. A summary is presented in Table 11.1.

Table 11.1: A summary of the total projected income for the Knersvlakte Nature Reserve.

Allocation	2018/19	2019/20	2020/21
Total Income	R 2 623 771	R 2 667 549	R 22 934 304
MTEF Allocation	R1 310 022	R 1 269 108	R 1 396 019
External Funding – Expanded Public Works Programme	R 1 313 749	R 1 398 441	R 1 538 285
External Funding – Environmental Protection and Infrastructure Programme	R 0	R 0	R 20 000 000

The Knersvlakte Nature Reserve has also benefitted from external funding received via the Environmental Protection and Infrastructure Programme, under the biodiversity and conservation sector including people and parks projects. This funding is earmarked for infrastructure development and upgrades.

11.1.2 Expenditure

11.1.2.1 Recurring costs

The annual directly allocated cost (includes staff, transport and travel, stores and equipment) is estimated at R 2 934 304 for 2020/21. These ongoing costs are split according to strategies as illustrated in Figure 11.1.

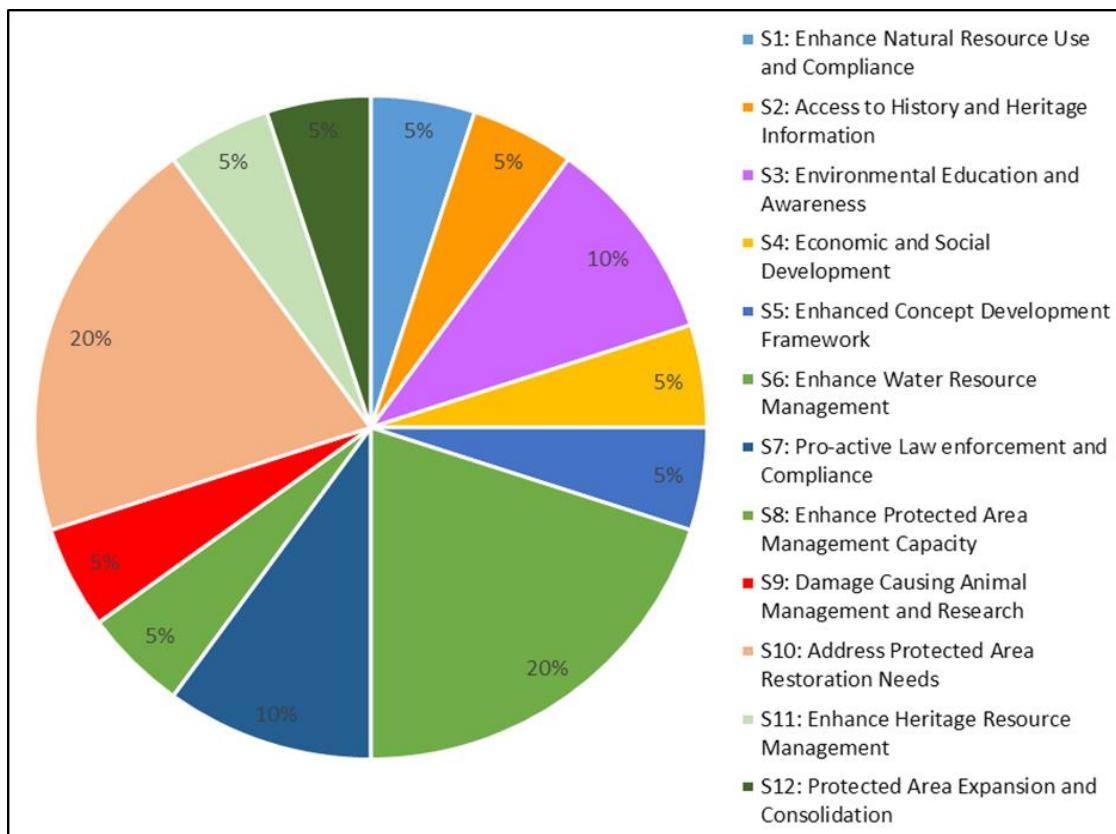


Figure 11.1: The estimated proportion of annual operational costs for the Knersvlakte Nature Reserve for year 2020/21 aligned with the identified and prioritised strategies.

11.1.2.2 Once off costs

In addition to the recurring costs there might be once-off replacement costs of assets, e.g. tractor, fencing equipment, field equipment, etc. that are aligned with the life span of the relevant assets being replaced.

11.1.2.3 Maintenance

The provincial Department of Transport and Public Works is responsible for and carries out maintenance on buildings in CapeNature managed protected areas as captured in the User Asses Management Plan, governed by the Government Immovable Asset Management Act, 2007 (Act No.19 of 2007).

Externally sourced income, specifically through the Environmental Protection and Infrastructure Programme, allows for specific infrastructure upgrades such as boundary fences and infrastructure. An annual earmarked allocation is provided for the development of new, and upgrades and maintenance of tourism infrastructure. Tourism projects are prioritised across all CapeNature facilities and maintenance is scheduled accordingly.

11.1.2.4 Summary

It is estimated that the Knersvlakte Nature Reserve will require an annual operating budget of R 2 934 304 for 2020/21, increasing at a projected annual rate of 10%.

11.1.2.5 Implications

Unsuccessful securing of external funding and replacement of crucial capital equipment could lead to potential shortfall and will have a negative impact on strategies throughout.

12 REFERENCES

- Aceñolaza G.F., Germs G.J.B. & Aceñolaza F.G. 2009. Trace fossils and the Agronomic Revolution at the Neoproterozoic-Cambrian transition in Southwest Gondwana. In: Gaucher C., Sial A.N., Halverson G.P. & Frimmel H.E., editors. Neoproterozoic-Cambrian Tectonics, Global Change and Evolution: a focus on southwestern Gondwana. *Developments in Precambrian Geology*, 16, Elsevier.
- Agricultural Research Council (ARC) 2019. Unpublished Raw Data. AgroClimatology Department, Stellenbosch.
- Almond J.E., Buatois L.A., Gresse P.G. & Germs G.J.B. 2008. Trends in metazoan body size, burrowing behaviour and ichnodiversity across the Precambrian-Cambrian boundary: ichnoassemblages from the Vanrhynsdorp Group of South Africa. Conference programme and abstracts, 15th Biennial Meeting of the Palaeontological Society of South Africa, Matjiesfontein.
- Andren H. 1999. Habitat fragmentation, the random sample hypothesis and critical thresholds. *Oikos* 84(2): 306-308.
- Birss C. 2017. Chapter 9: Mammals. In: Turner A.A., editor. Western Cape Province State of Biodiversity 2017. CapeNature Scientific Services, Stellenbosch. ISBN: 978-0-621-45962-3.
- Boonzaier E., Malherbe C., Berens P. & Smith A. 1996. The Cape Herders: A History of the Khoikhoi of Southern Africa. David Phillip Publishers, Cape Town. ISBN: 0-86486-311-X.
- CapeNature. 2015a. Western Cape Protected Area Expansion Strategy: 2015 – 2020. Internal report. CapeNature, Cape Town.
- CapeNature. 2015b. Fencing and Enclosure of Game and Predators in the Western Cape Province Policy. Internal report. CapeNature, Cape Town.
- CapeNature. 2016. CapeNature Integrated Catchment Management Strategy: 2016 – 2021. Internal report, CapeNature. Cape Town.
- CapeNature. 2018. State of Biodiversity Database. Unpublished Raw Data. CapeNature, Cape Town.
- CapeNature. 2019a. Consumptive use of Wild Flora from CapeNature managed Protected Area Policy. Internal report. CapeNature, Cape Town.
- CapeNature. 2019b. Game Translocation and Utilization Policy for the Western Cape Province. Internal report. CapeNature, Cape Town.
- Cole D.I. 2012. Revised Report on the Mineral Potential of the proposed Knersvlakte Biosphere Reserve. Council for Geoscience Report Number: 2012-0228, Council for Geoscience, Cape Town.
- Conservation Coaches Network. 2012. Harmonized Open Standards Presentations. URL: <http://cmp-openstandards.org/library-item/basic-open-standards-presentations-ccnet-2012/>.

- Conservation Measures Partnership (CMP). 2013. Open Standards for the Practice of Conservation. Version 3.0. URL: <http://cmp-openstandards.org/wp-content/uploads/2014/03/CMP-OS-V3-0-Final.pdf>.
- Cowling R. & Pierce S. 1999. Namaqualand: A Succulent Desert. Fernwood Press, South Africa. ISBN 13: 978-1-874950-41-7.
- De Beer C.H., Gresse P.G., Theron J.N. & Almond J.E. 2002. The Geology of the Calvinia area: Explanation of Sheet 3118 (Calvinia). Council for Geoscience, Pretoria.
- Dennis Moss Partnership. 2004. Knersvlakte Bioregion Spatial Plan. Report compiled for the West Coast District Municipality. Dennis Moss Partnership, Stellenbosch.
- Department of Environmental Affairs (DEA). 2016a. National Biodiversity Research Development and Evidence Strategy (2015-2025). Department of Environmental Affairs, Pretoria. URL: https://www.environment.gov.za/sites/default/files/docs/biodiversity_research_strategy.pdf
- Department of Environmental Affairs (DEA). 2016b. National Protected Areas Expansion Strategy for South Africa. Department of Environmental Affairs, Pretoria.
- Department of Water Affairs and Forestry (DWAf). 2012a. Olifants-Doorn WMA Classification Phase 3A – Groundwater Technical Report. Department of Water Affairs, Pretoria.
- Department of Water Affairs and Forestry (DWAf). 2012b. Aquifer Classification of South Africa. Map recompiled in 2012. Original map compiled CSIR (1999). Department of Water Affairs and Forestry, Pretoria.
- Department of Water Affairs and Forestry (DWAf). 2012c. Aquifer Vulnerability of South Africa. Map recompiled in 2012. Original map compiled CSIR (1999). Department of Water Affairs and Forestry, Pretoria.
- Desmet P.G. 2004. Designing a Living Landscape for Biodiversity Conservation in the Knersvlakte Region of the Succulent Karoo, South Africa: A Systematic Conservation Planning Approach. PhD Thesis. University of Cape Town, Cape Town.
- Desmet P. & Cowling R. 2004. Using the Species-Area Relationship to Set Baseline Targets for Conservation. *Ecology and Society* 9: 11.
- Desmet P. & Dayaram A. 2016. Integrated report of proposed changes to the VEGMAP for Bushmanland, Namaqualand and Sandveld as proposed by Dr Philip Desmet at the National Vegetation Map Committee Meeting 2012. Unpublished Technical Report.
- Desmet P.G., Barret T., Cowling R.M., Ellis A.G., Heijnis C., Le Roux A., Lombard A.T. & Pressey R.L. 1999. A systematic plan for a protected area system in the

- Knersvlakte region of Namaqualand. IPC Report Number: 9901. Institute for Plant Conservation, University of Cape Town.
- Dickens C.W.S. & Graham P.M. 2002. The South African Scoring System (SASS) Version 5 rapid bioassessment method for rivers. *African Journal of Aquatic Science* 27: 1-10.
- Dippenaar-Schoeman A.S., Haddad C.R., Foord S.H., Lyle R., Lotz L.N. & Marais P. 2015. South African National Survey of Arachnida (SANSA): Review of current knowledge, constraints and future needs for documenting spider diversity (Arachnida: Araneae). *Transactions of the Royal Society of South Africa* 70: 245-275.
- Driessen P.M., Deckers J., Spaargaren O. & Nachtergaele F., editors. 2001. Lecture Notes on the Major Soils of the World. Food and Agriculture Organization of the United Nations, Rome. ISBN: 925-104637-9.
- Ellis A.G. & Weis A.E. 2006. Coexistence and differentiation of 'flowering stones': the role of local adaptation to soil microenvironment. *Journal of Ecology* 94: 322–335.
- EnviroAfrica. 2005. Knersvlakte Priority Area (KPA) Initial Consolidation and Conservation Plan. Management plan compiled by EnviroAfrica in collaboration with CapeNature. Unpublished report.
- Erasmus B.P.J. 1995. Op Pad In Suid-Afrika. Jonathan Ball Publishers, Cape Town. ISBN 10: 1-86842-026-4.
- Gouws E.J., Malan D., Job N., Nieuwoudt H., Nel J., Dallas H. & Bellingan T. 2012. Chapter 2: Freshwater Ecosystems. In: Turner A.A., editor. Western Cape Province State of Biodiversity 2012. CapeNature Scientific Services, Stellenbosch. ISBN: 978-0-621-41407-3.
- Haarmeyer D.H., Schmiedel U., Dengler J. & Bösing B.M. 2010. How does grazing intensity affect different vegetation types in arid Succulent Karoo, South Africa? Implications for conservation management. *Biological Conservation* 143: 588-596.
- Hanski I. & Gilpin M. 1991. Metapopulation dynamics: a brief history and conceptual domain. *Biological Journal of the Linnean Society* 42: 3-16.
- Helme N.A. 2007. Botanical report: Fine scale vegetation mapping of the Bokkeveld Escarpment. Report compiled for CapeNature as part of the C.A.P.E. Fine-scale Biodiversity Planning Project. Unpublished. Nick Helme Botanical Surveys, Scarborough.
- Helme N.A. 2009. Botanical assessment of a proposed limestone prospecting area in the Knersvlakte (farms Luipers Kop, Mosterts Kop and Wolwenes), Western Cape. Report compiled for Stellenryck Environmental Solutions. Unpublished. Nick Helme Botanical Surveys, Scarborough.
- Helme N.A. 2016. Chapter 5: Ecosystem Guidelines: Succulent Karoo Ecosystems. In: Cadman M., editor. Ecosystems Guidelines for Environmental Assessment

- in the Western Cape. 2nd Edition. Fynbos Forum, Cape Town. ISBN: 978-0-620-72215-5.
- Hilton-Taylor C. & Le Roux A. 1989. Conservation status of the fynbos and karoo biomes. In: Huntley B.J., editor. Biotic Diversity in Southern Africa: Concepts and Conservation. Oxford University Press, Cape Town. ISBN 10: 0-19-5705491.
- Hockings M., Leverington F. & Cook C. 2015. Protected area management effectiveness. In: Worboys G.L., Lockwood M., Kothari A., Feary S. & Pulsford I., editors. Protected Area Governance and Management. ANU Press, Canberra.
- Hofmeyr M.D., Loehr V.J.T. & Baard E.H.W. 2018. *Chersobius signatus*. The IUCN Red List of Threatened Species 2018: e.T10241A115650943. URL: <https://www.iucnredlist.org/species/10241/115650943>.
- Le Roux A. 2005. South African Wild Flower Guide 1: Namaqualand. Botanical Society of South Africa, Newlands. ISBN: 1874999309.
- Leverington F. & Hockings M. 2004. Evaluating the effectiveness of protected area management: The challenge of change. In: Barber C.V., Miller K.R. & Boness M., editors. Securing protected areas in the face of global change: Issues and strategies. International Union for Conservation of Nature, Gland.
- Manning J. & Goldblatt P. 2012. Plants of the Greater Cape Floristic Region 1: The Core Cape Flora. *Strelitzia* 29. South African National Biodiversity Institute, Pretoria. ISBN: 978-1-919976-74-7.
- Matzikama Municipality. 2018. Matzikama Municipality Fourth Generation Integrated Development Plan (IDP) 2017-22. Matzikama Municipality, Vredendal. URL: <https://www.matzikamamunicipality.co.za/assets/StrategicDocs/idp/IDP%2028%20May%202019.pdf>. Accessed on 20 February 2019.
- McGeoch M.A. 2002. Insect conservation in South Africa: An overview. *African Entomology* 10: 1-10.
- Mecenero S., Ball J.B., Edge D.A., Hamer M.L., Henning G.A., Krüger M., Pringle E.L., Terblanche R.F. & Williams M.C. 2013. Conservation assessment of the butterflies of South Africa, Lesotho and Swaziland: Red List and atlas. Animal Demography Unit, University of Cape Town, Johannesburg.
- Mittermeier R.A., Gil P.R., Hoffman M., Pilgrim J., Brooks T., Mittermeier C.G., Lamoreux J. & Da Fonseca G.A.B. 2005. Hotspots Revisited: Earth's Biologically Richest and Most Threatened Terrestrial Ecoregions. Conservation International, Washington, DC.
- Mpehle S. 2015. Draft quartz mapping using Spot 6 imagery. CapeNature. Unpublished report.
- Mucina L. & Rutherford M.C., editors. 2006. The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria. ISBN 10: 1-919976-21-3.

- Natural Justice. 2016. A Griqua community's cultural and spiritual pilgrimage to their ancestral lands and sacred site. URL: <https://naturaljustice.org/a-griqua-communitys-cultural-and-spiritual-pilgrimage-to-their-ancestral-lands-and-sacred-site/>. Accessed on 29 September 2019.
- Nel J.L. & Driver A. 2012. National Biodiversity Assessment 2011: Technical Report. Volume 2: Freshwater Component. CSIR Report Number: CSIR/NRE/ECO.IR/2012/0022/A. Council for Scientific and Industrial Research, Stellenbosch.
- Nel J.L., Driver A., Strydom W., Maherry A., Petersen C., Hill L., Roux D.J., Nienaber S., Van Deventer H., Swartz E. & Smith-Adao L.B. 2011b. Atlas of Freshwater Ecosystem Priority Areas in South Africa: Maps to support sustainable development of water resources. WRC Report Number: TT 500/11. Water Research Commission, Pretoria.
- Nel J.L., Murray K.M., Maherry A.M., Peterson C.P., Roux D.J., Driver A., Hill L., Van Deventer H., Funke N., Swartz E.R., Smith-Adao L.B., Mbona N., Downsborough L. & Nienaber S. 2011a. Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report Number: 1801/2/11. Water Research Commission, Pretoria.
- Ninham Shand. 2006. Integrated Environmental Programme of the West Coast District. Report No 4110 / 401286. Report compiled for the West Coast District Municipality. Ninham Shand Consulting Services, Cape Town.
- Office of the Chief Surveyor-General. 2011. Spatial Data Notes Version 1.1, Updated January 2016.
- Oldeland J. 2019. Draft quartz mapping using ASTER imagery. University of Hamburg. Unpublished report.
- Ollis D.J., Snaddon C.D., Job N. & Mbona N. 2013. Classification System for wetlands and aquatic ecosystems in South Africa. User manual: Inland Systems. SANBI Biodiversity Series 22. South African National Biodiversity Institute, Pretoria.
- Orton J., Mackay A., Schwartz S. & Steele T.E. 2011. Archaeology in the Knersvlakte, southern Namaqualand. Poster presented at the 2011 Biennial Meeting of The Association of Southern African Professional Archaeologists. Mbabane, Swaziland.
- Penrith M.L. 1986a. Relationships in the tribe Adesmiini (Coleoptera: Tenebrionidae) and a revision of the genus *Stenodesia* Reitter. *Annals of the Transvaal Museum* 34: 275-302.
- Penrith M.L. 1986b. Revision of the Zophosini (Coleoptera: Tenebrionidae). Part 10. Key to the Subgenera, supplement, evolution and biogeography of the tribe, and catalogue. *Cimbebasia, ser. A* 6: 417-502.
- Penrith M.L. & Endrödy-Younga S. 1994. Revision of the subtribe *Cryptochilina* (Coleoptera: Tenebrionidae: *Cryptochilini*). *Transvaal Museum Monograph* 9: 1-144.

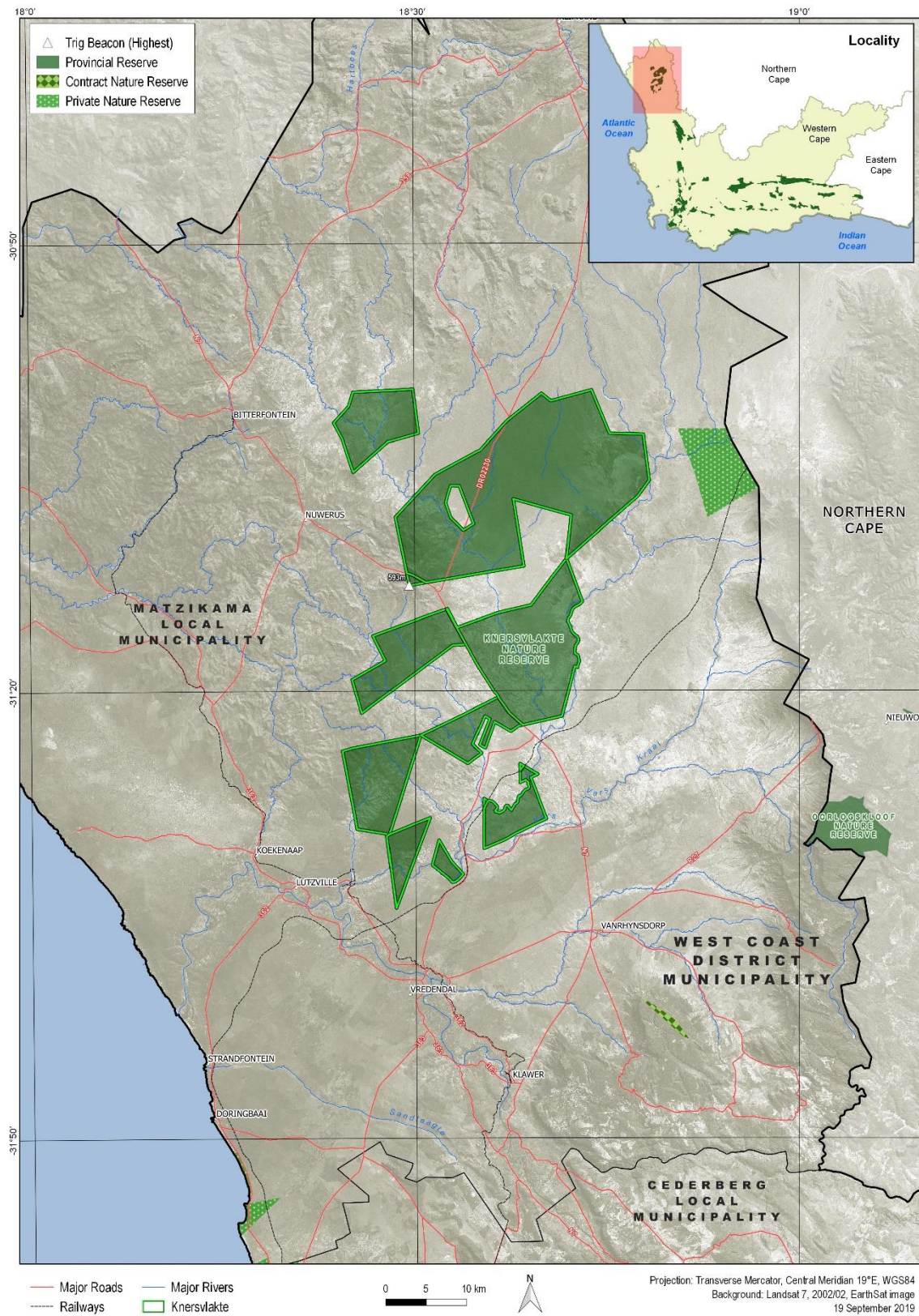
- Pool-Stanvliet R., Duffell-Canham A., Pence G. & Smart R. 2017. The Western Cape Biodiversity Spatial Plan Handbook. CapeNature, Stellenbosch.
- Prendini L. 2015. A remarkably small species of *Uroplectes* Peters, 1861 (Scorpiones: Buthidae), endemic to the Succulent Karoo of South Africa. *African Invertebrates* 56: 499-513.
- River Health Programme. 2006. State of Rivers Report: Olifants/Doring and Sandveld Rivers. Department of Water Affairs and Forestry, Pretoria. ISBN: 0-620-36021-6.
- Samways M.J., Bazelet C.S. & Pryke J.S. 2010. Provision of ecosystem services by large-scale corridors and ecological networks. *Biodiversity Conservation* 19: 2949-2962.
- Samways M.J., Hamer M. & Veldtman R. 2012. Development and future of insect conservation in South Africa. In: New T.R., editor. *Insect Conservation: Past, Present and Prospects*. Springer Publishing, Dordrecht.
- Samways M.J. & Simaika J.P. 2016. Manual of freshwater assessment for South Africa: Dragonfly Biotic Index. Suricata 2. South African National Biodiversity Institute, Pretoria. ISBN: 978-1-928224-05-1.
- Schmiedel U. 2004. The phytogeography of the obligate quartz field flora of southern Africa. *Schumannia* 4 / *Biodiversity & Ecology* 2: 181–205.
- Schmiedel U. & Jürgens N. 1999. Community structure on unusual habitat island: quartz-fields in the Succulent Karoo, South Africa. *Plant Ecology* 142: 57-69.
- Schmiedel U. & Jürgens N. 2004. Habitat ecology of southern African quartz fields: studies on the thermal properties near the ground. *Plant Ecology* 170: 153-166.
- Schmiedel U., Kühne N., Twerski A. & Oldeland J. 2015. Small-scale soil patterns drive sharp boundaries between succulent “dwarf” biomes (or habitats) in the arid Succulent Karoo, South Africa. *South African Journal of Botany* 101: 129-138. DOI: <http://dx.doi.org/10.1016/j.sajb.2015.05.001>.
- Schmiedel U. & Oldeland J. 2018. Vegetation responses to seasonal weather conditions and decreasing grazing pressure in the arid Succulent Karoo of South Africa. *African Journal of Range & Forage Science* 35:3-4, 303-310. DOI: [10.2989/10220119.2018.1531926](https://doi.org/10.2989/10220119.2018.1531926).
- Scholtz C.H. & Holm E. 1985. *Insects of southern Africa*. University of Pretoria Press, Pretoria.
- Scholtz P.L. 1964. Die Historiese Ontwikkeling van die Onder-Olifantsrivier, 1660–1902. `n Geskiedenis van die distrik Vanrhynsdorp. D. Litt thesis, University of South Africa, Pretoria.
- Shaw J.M. 2013. Power line collisions in the Karoo: Conserving Ludwig’s Bustard. PhD Thesis. University of Cape Town, Cape Town.

- Simmons R.E., Barnard P., Dean W.R.J., Midgley G.F., Thuiller W. & Hughes G. 2004. Climate change and birds: perspectives and prospects from southern Africa. *Ostrich* 75: 295-308.
- Skelton P.H., Cambray J.A., Lombard A. & Benn G.A. 1995. Patterns of distribution and conservation status of freshwater fishes in South Africa. *South African Journal of Zoology* 30: 71-81.
- Slingsby P. & Coombe E. 2001. Beyond the Cederberg: Agter-Pakhuis, Biedouw & Wupperthal. Baardskeerder, Cape Town. ISBN 13: 9780620273107.
- Snijman D.A., editor. 2013. Plants of the Greater Cape Floristic Region 2: The Extra Cape Flora. *Strelitzia* 30. South African National Biodiversity Institute, Pretoria. ISBN: 978-1-919976-77-8.
- South African History Online (SAHO). 2011a. Namaqualand. URL: <https://www.sahistory.org.za/place/namaqualand>. Accessed on 31 October 2019.
- South African History Online (SAHO). 2011b. Smallpox Epidemic Strikes at the Cape. URL: <https://www.sahistory.org.za/dated-event/smallpox-epidemic-strikes-cape>. Accessed on 29 September 2019.
- South African National Biodiversity Institute (SANBI). 2006. Vegetation Map of South Africa, Lesotho and Swaziland [vector geospatial dataset] 2006. Available from the Biodiversity GIS website, downloaded on 19 March 2019. URL: <http://bgis.sanbi.org/SpatialDataset/Detail/330>.
- South African National Biodiversity Institute (SANBI). 2015. Plant Redlist Status: Red List of South African Plants version 2017.1. URL: <http://redlist.sanbi.org/>
- South African National Biodiversity Institute (SANBI). 2018. Beta Vegetation map of South Africa, Lesotho and Swaziland (Shapefile) [vector geospatial dataset] 2018. Available from the Biodiversity GIS website, downloaded on 19 March 2019. URL: <http://bgis.sanbi.org/SpatialDataset/Detail/669>.
- South African Weather Service. 2019. Unpublished Raw Data. Cape Town.
- Struck M. 1995. Land of blooming pebbles: flowers and their pollinators in the Knersvlakte. *Aloe* 32: 56-64.
- Stuart C. & Stuart T. 1988. Veldgids tot die soogdiere van Suid-Afrika. Struik Publishers, Cape Town.
- Succulent Karoo Ecosystem Programme (SKEP). 2011. Case Study 4: Ratelgat Farm and the Consolidation of the Knersvlakte Conservation Area. URL: <https://www.sanbi.org/wp-content/uploads/2018/04/case-study-4-ratelgat-farm-consolidation-knersvlakte-conservation-area.pdf>. Accessed on 29 September 2019.
- Taylor M.R., Peacock F. & Wanless R.M., editors. 2015. The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. BirdLife South Africa, Johannesburg.

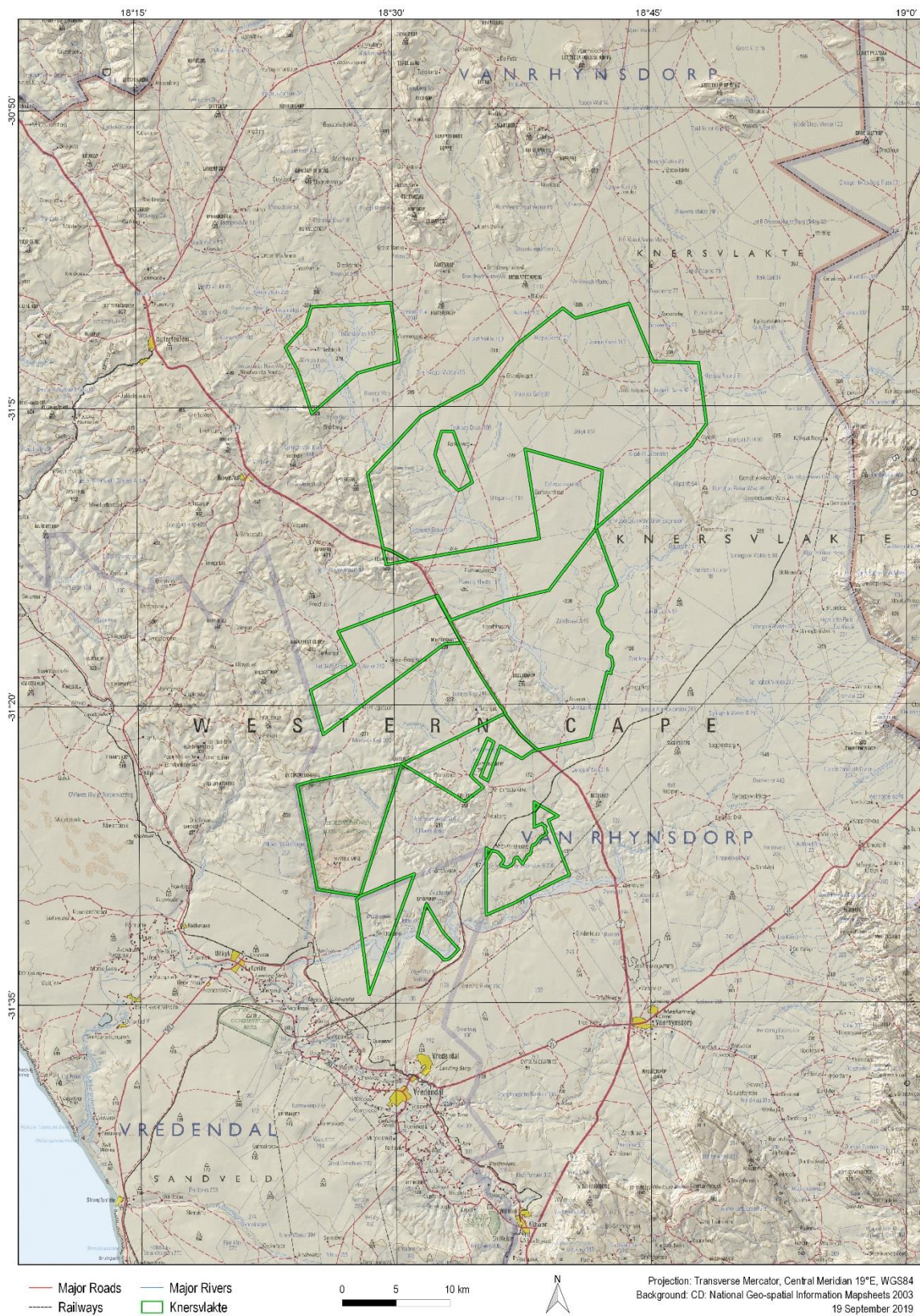
- Thackeray A.I., Deacon J., Hall S., Humphreys A.J.B., Morris A.G. & Malherbe V.C. (editor). 1990. The Early History of Southern Africa to A.D. 1500: Handbook for wall chart. College Tutorial Press, Cape Town. ISBN: 0798507306.
- Turner A.A. & De Villiers A.L. 2017. Chapter 7: Reptiles. In: Turner A.A., editor. Western Cape Province State of Biodiversity 2017. CapeNature Scientific Services, Stellenbosch. ISBN: 978-0-621-45962-3.
- Underhill L.G., Loftie-Eaton M. & Navarro R. 2018. Dragonflies and damselflies of the Western Cape - OdonataMAP report, August 2018. *Biodiversity Observations* 9.7: 1-21.
- Van Wilgen B.W., Reyers B., Le Maitre D.C., Richardson D.M. & Schonegevel L. 2008. A biome-scale assessment of the impact of invasive alien plants on ecosystem services in South Africa. *Journal of Environmental Management* 89: 336-349.
- Van Wyk A.E. & Smith G.F. 2001. Regions of Floristic Endemism in Southern Africa. A Review with Emphasis on Succulents. Umdaus Press, Hatfield. ISBN: 9781919766188.
- Veldtman A., Dippenaar-Schoeman A.S., Samways M.J., Veldtman R. & Du Plessis D. 2017. Chapter 10: Arthropods. In: Turner A.A., editor. Western Cape Province State of Biodiversity 2017. CapeNature Scientific Services, Stellenbosch. ISBN: 978-0-621-45962-3.
- West Coast District Municipality (WCDM). 2017. Integrated Development Plan 2017-21. West Coast District Municipality, Moorreesburg. <http://westcoastdm.co.za/wp-content/uploads/2017/04/WCDM-IDP-2017-2021-Final-Draft-as-approved-by-Council-1.pdf>. Accessed on 2019/02/21.
- Whitehead V.B. 1984. Distribution, biology and flower relationships of fidelid bees of southern Africa (Hymenoptera: Apoidea, Fideliidae). *African journal of Zoology* 19: 87-90.
- Yarnell R.W., Richmond-Coggan L., Bussière E., Williams K., Bissett C., Welch R. & Wiesel I. 2016. A conservation assessment of *Parahyaena brunnea*. In: Child M.F., Roxburgh L., Do Linh San E., Raimondo D. & Davies-Mostert H.T., editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

APPENDIX 1 Maps of the Knersvlakte Nature Reserve.

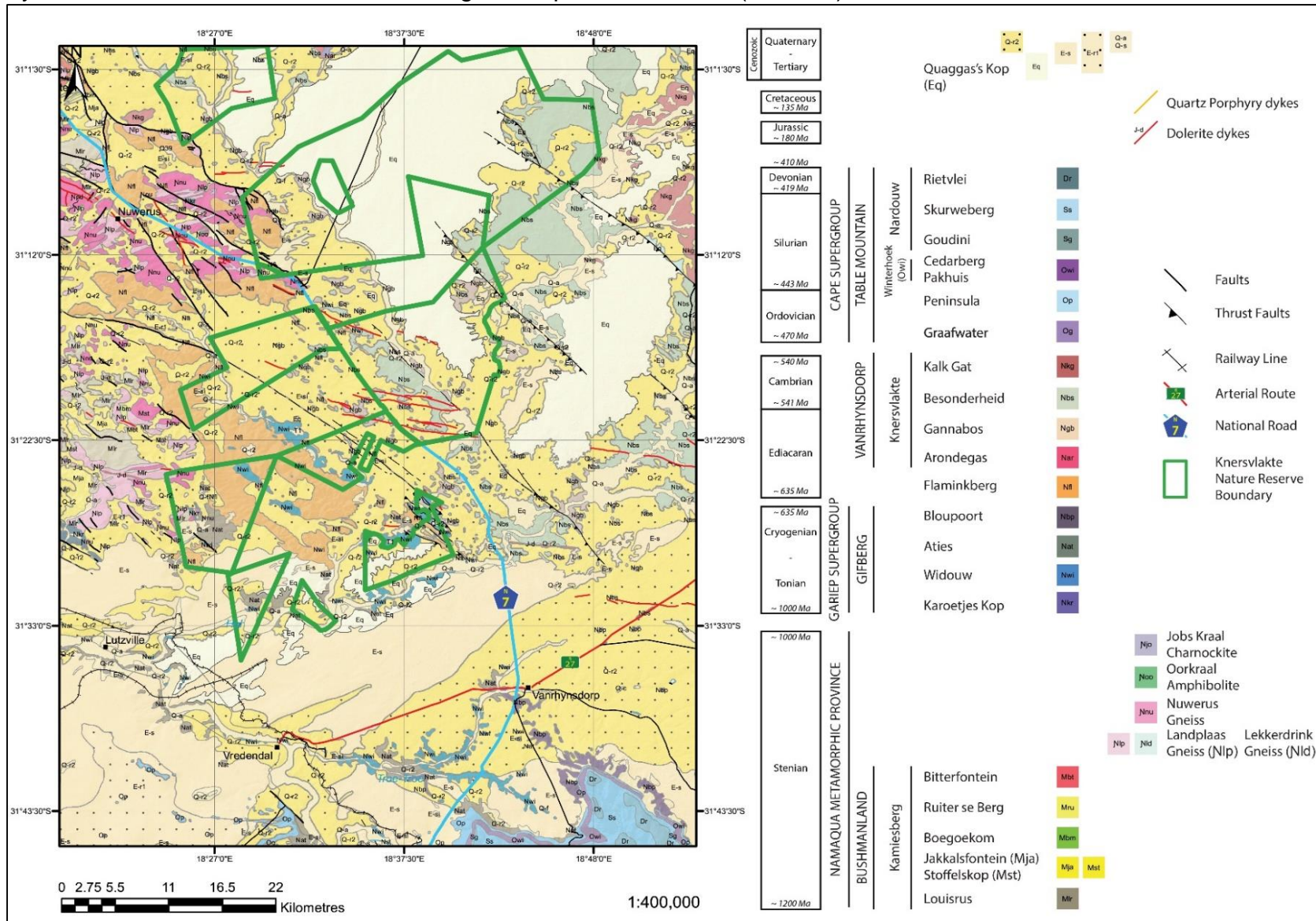
Map 1: Location and extent of the Knersvlakte Nature Reserve.



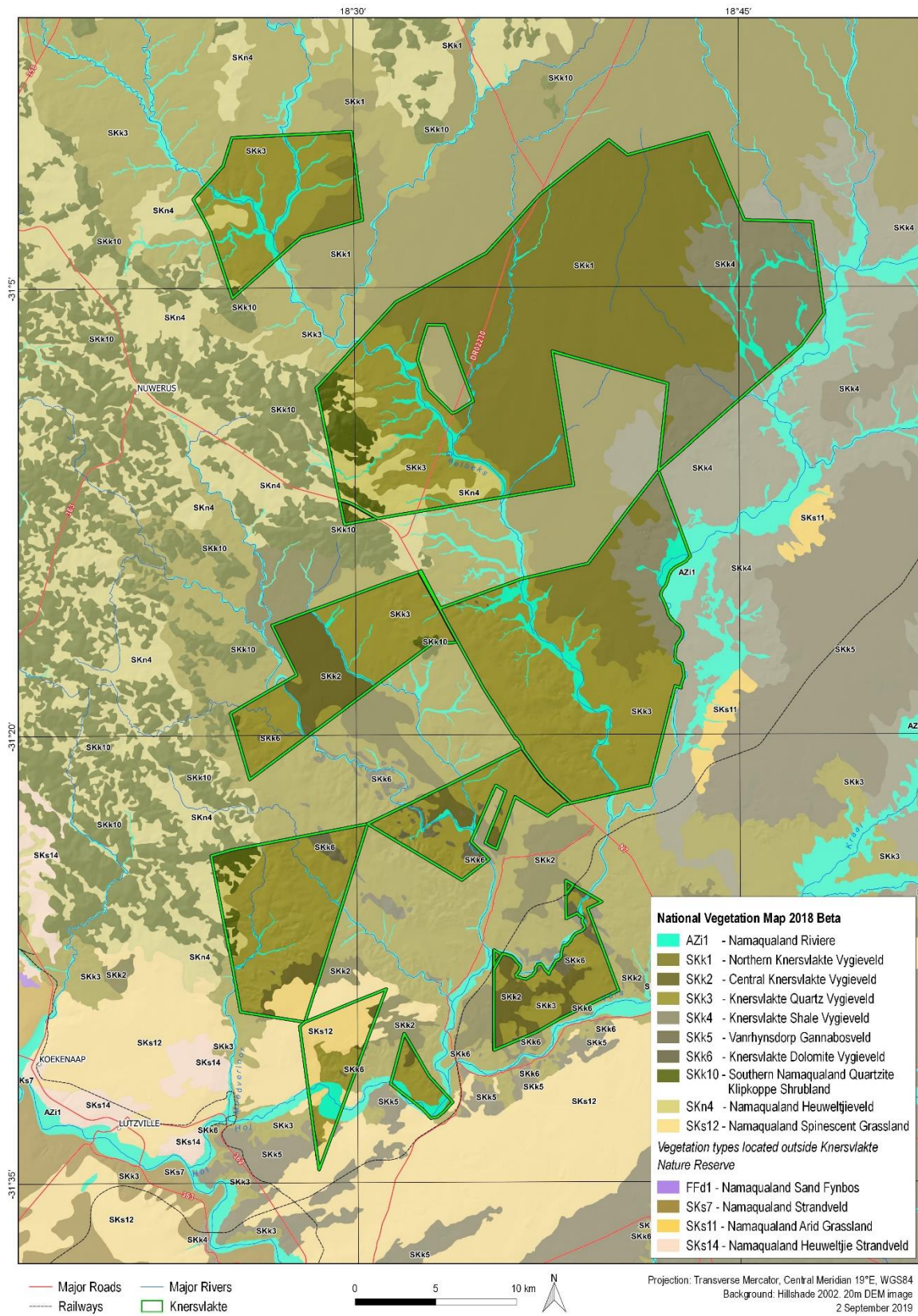
Map 2: Topography of the Knersvlakte Nature Reserve.



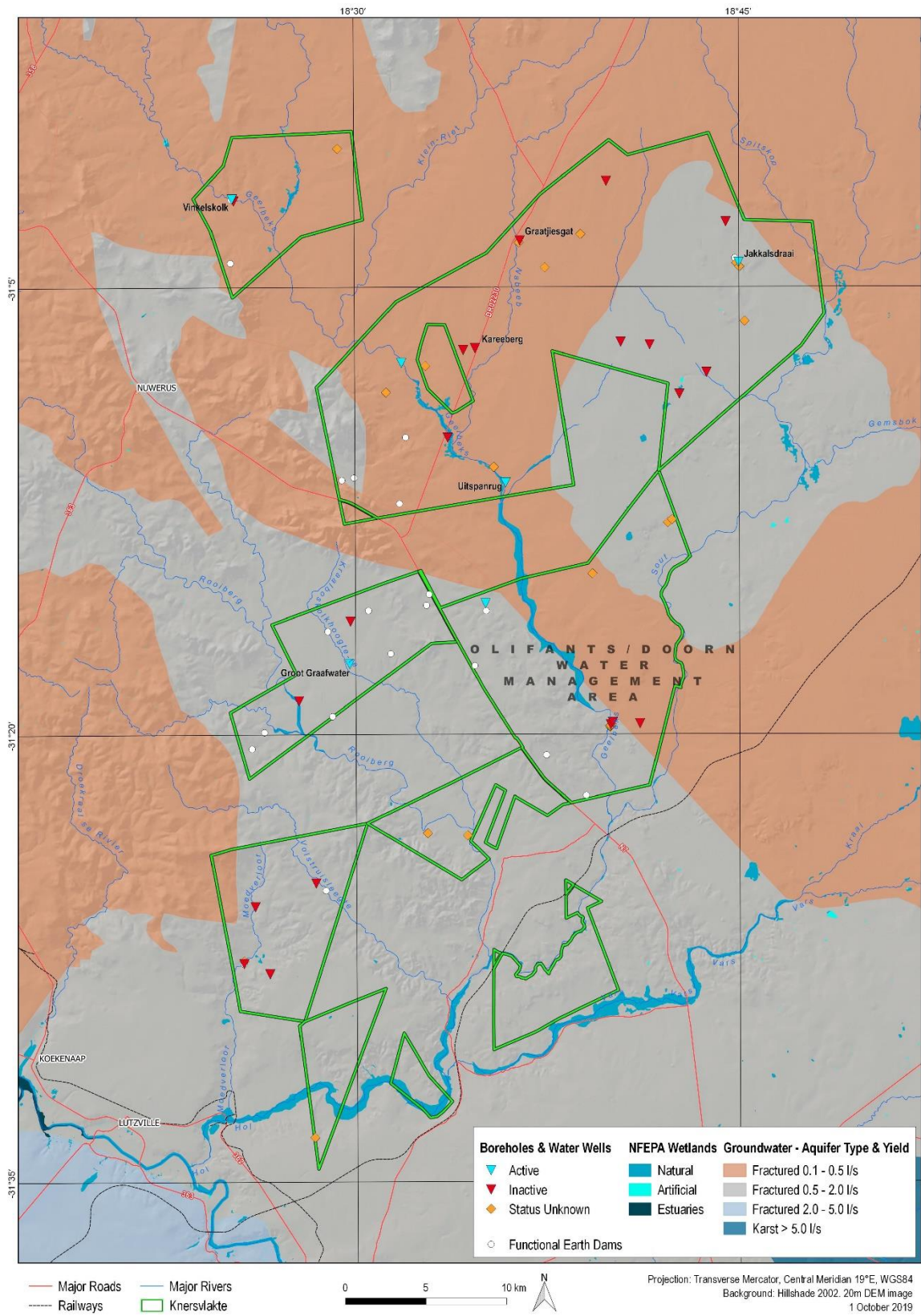
Map 3: Simplified geological map of the Knersvlakte region within the context of the Knersvlakte Nature Reserve. Map and data provided by: Council for Geoscience, 2001. Geological Map of Sheet 3118 (Calvinia).



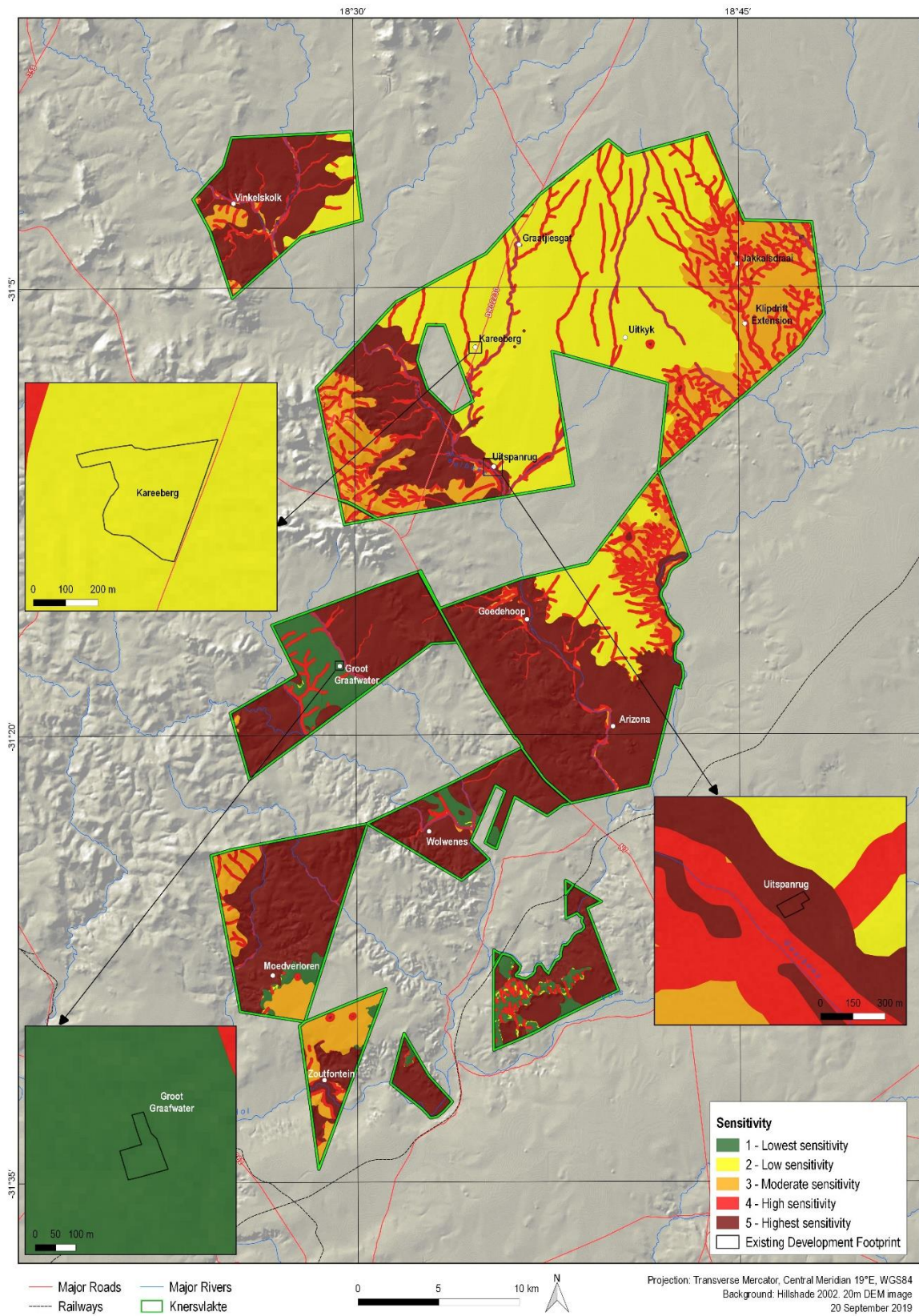
Map 4: Vegetation of the Knersvlakte Nature Reserve.



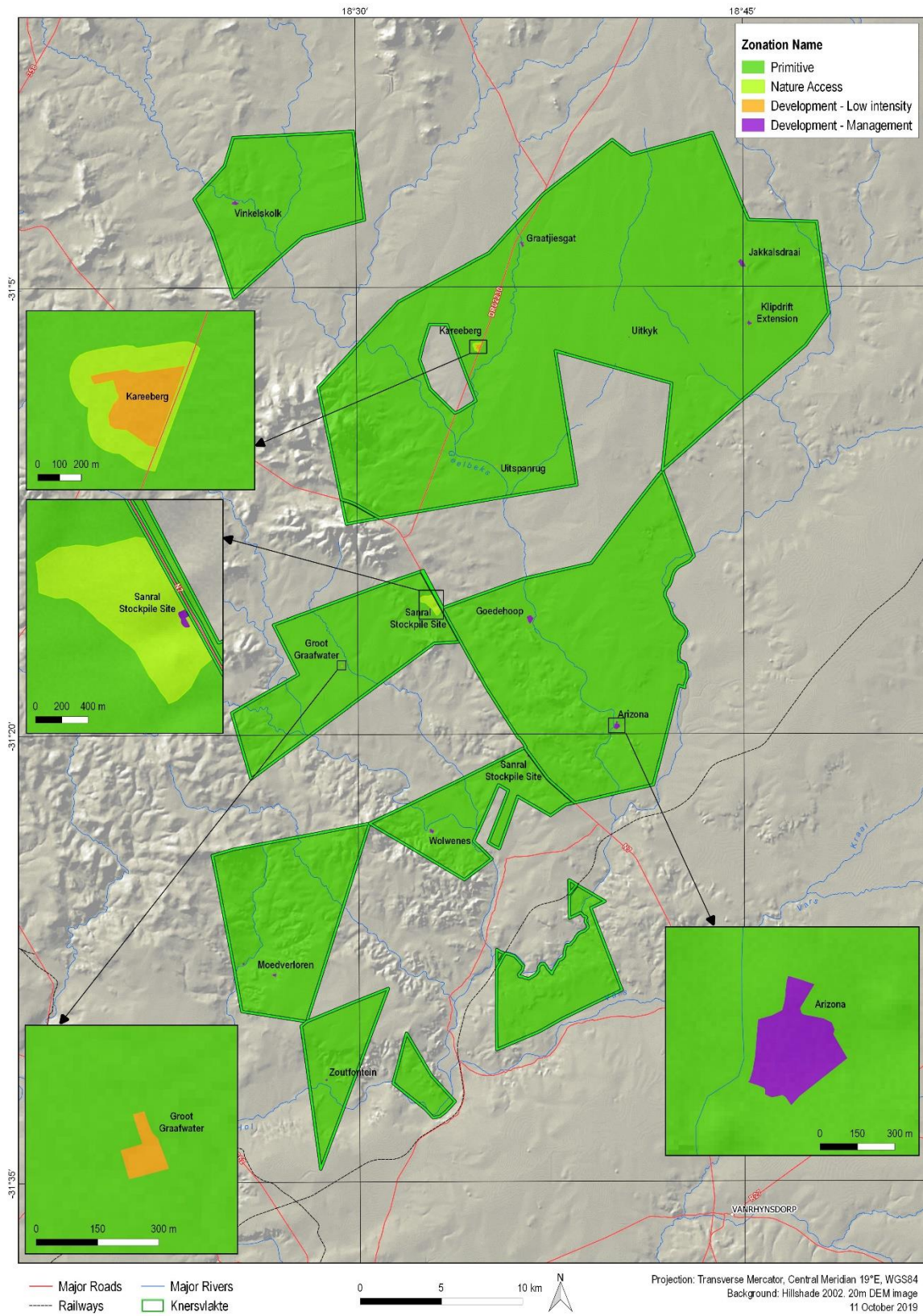
Map 5: Aquatic systems of the Knersvlakte Nature Reserve.



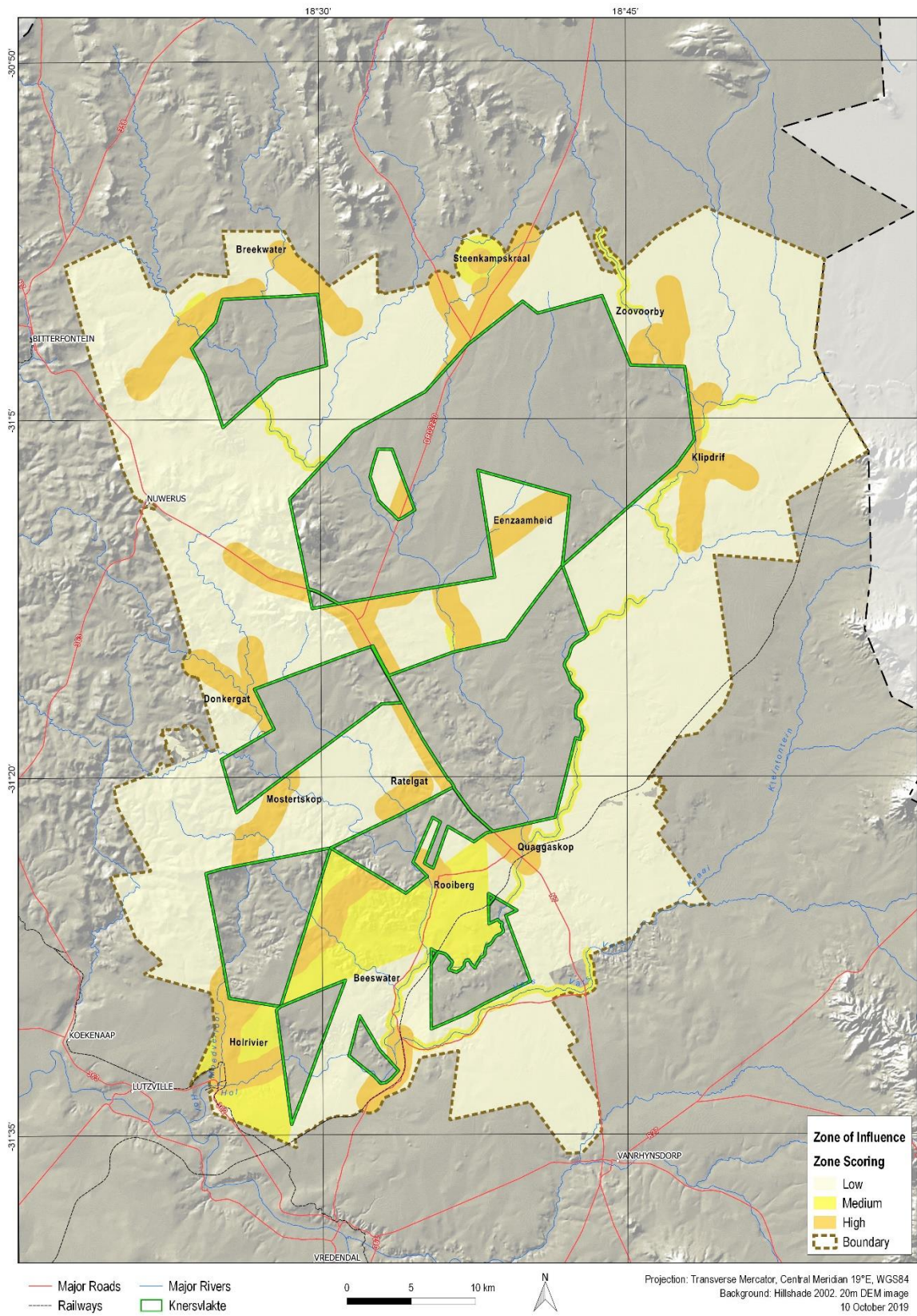
Map 6: Sensitivity of the Knersvlakte Nature Reserve.



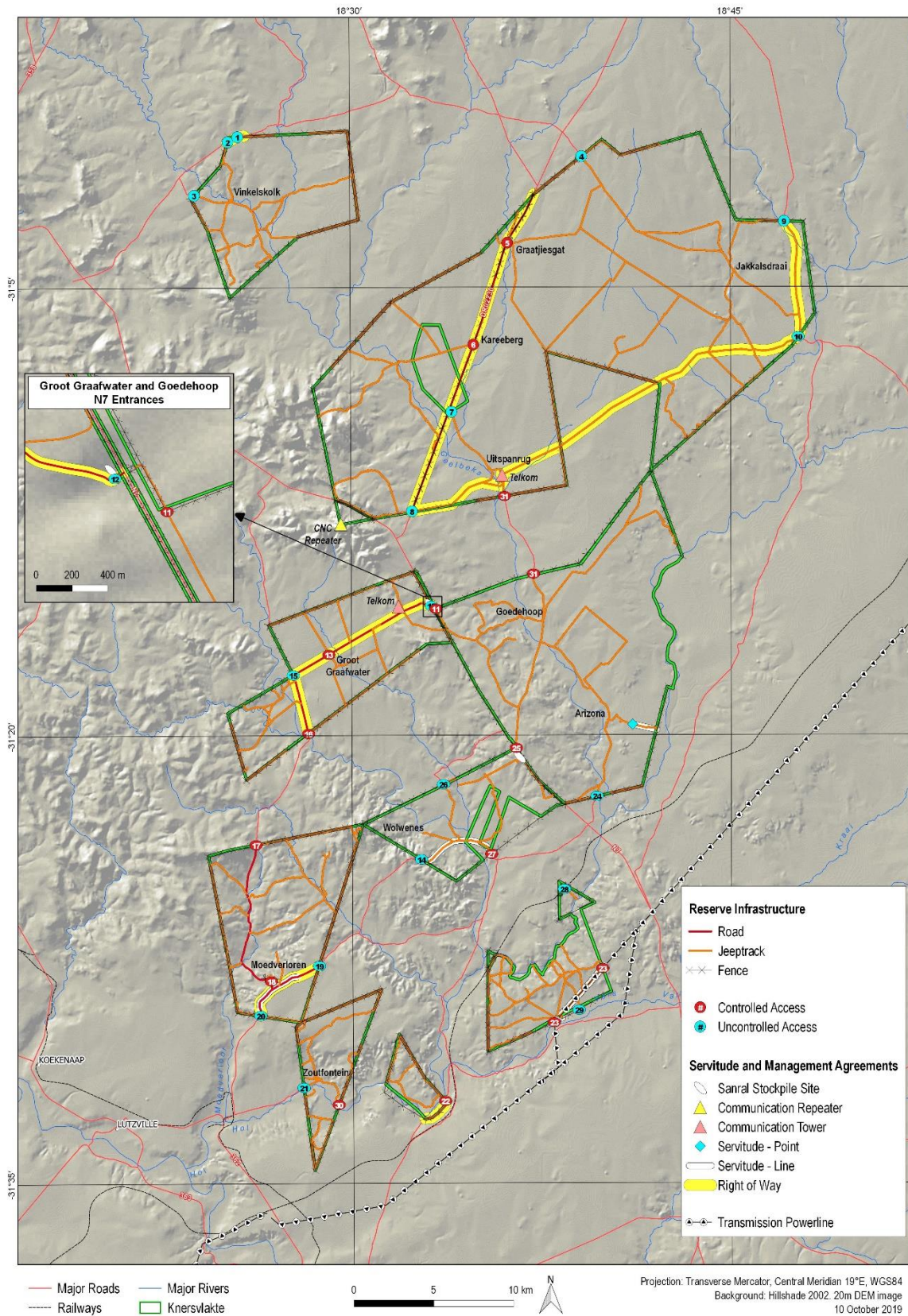
Map 7: Zonation of the Knersvlakte Nature Reserve.



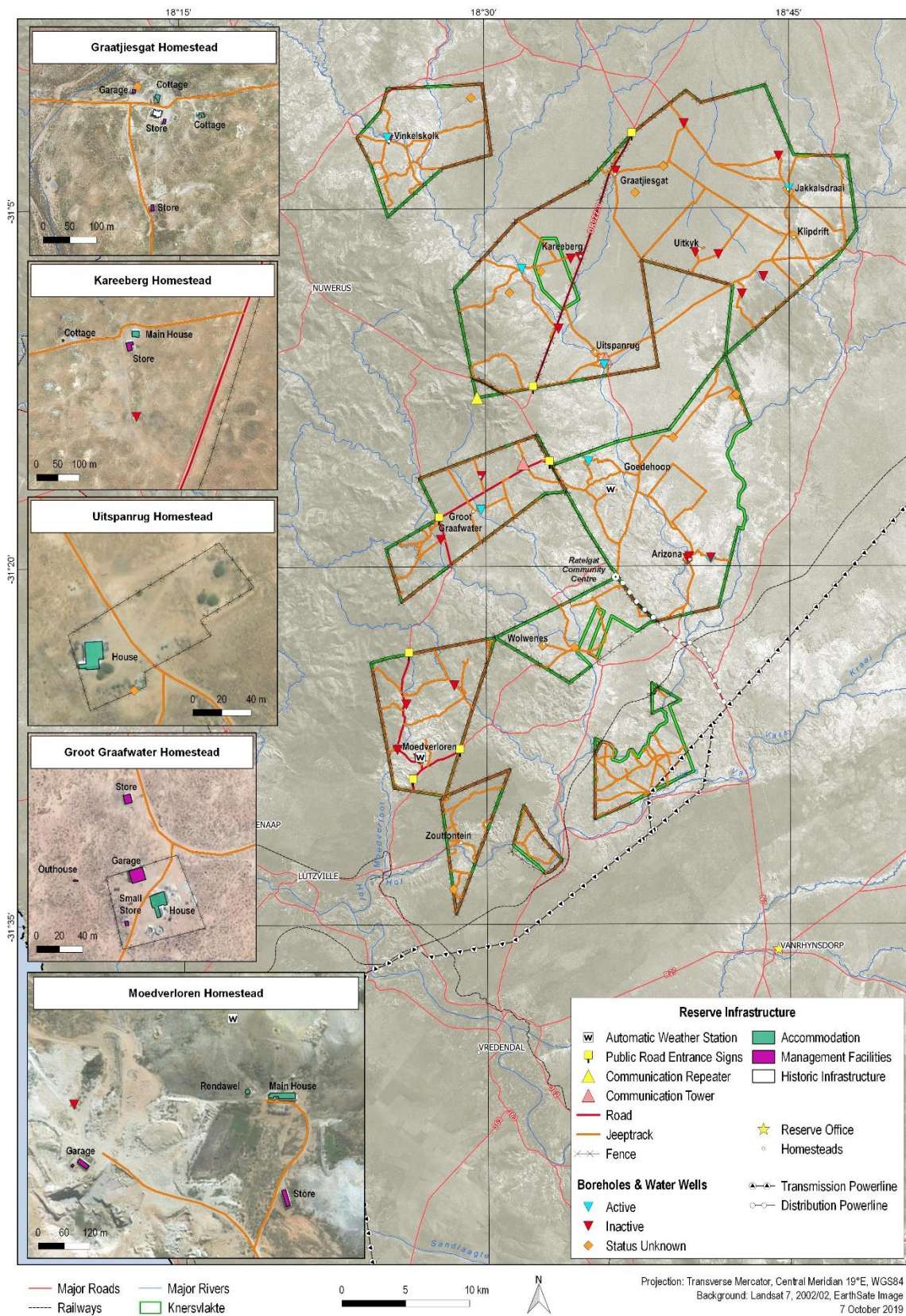
Map 8: Zone of influence around the Knersvlakte Nature Reserve.



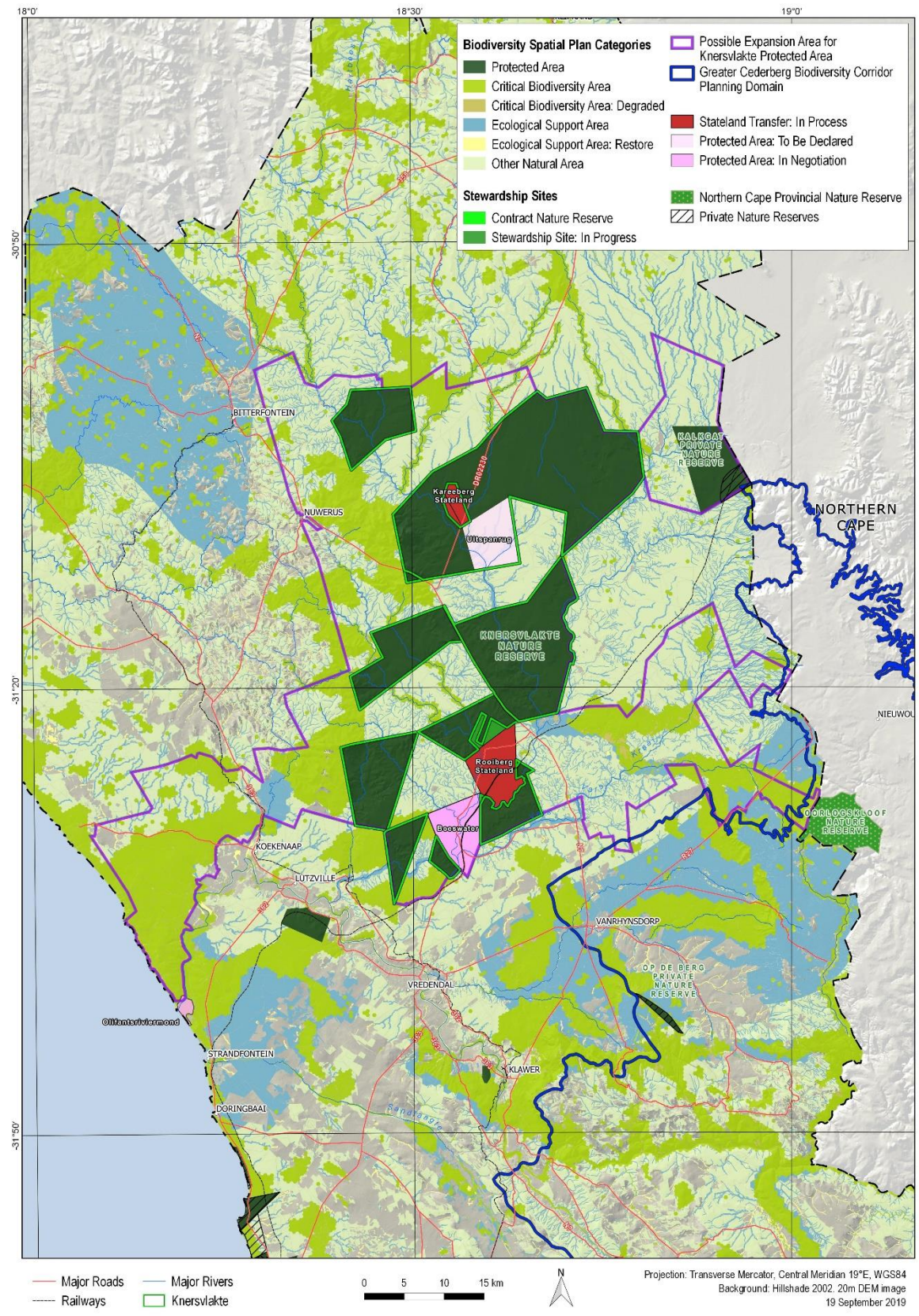
Map 9: Access and servitudes on the Knersvlakte Nature Reserve.



Map 10: Infrastructure on the Knersvlakte Nature Reserve.



Map 11: Expansion of the Knersvlakte Nature Reserve.



Map 12: Concept development plan for the Knersvlakte Nature Reserve.

