

# STONEHENGE PROTECTED ENVIRONMENT

## Management Plan

2023 – 2028



**Prepared by:** Tankwa Tented Camp (PTY) Ltd, with assistance from South African National Parks (SANParks), Wilderness Foundation Africa (WFA-SA), WWF South Africa (WWF) and the Leslie Hill Succulent Karoo Trust (LHSKT).

**Citation:** Stonehenge Protected Environment (SPE), 2023. Management Plan, Version 1, Northern Cape Province, South Africa

## STATUS

The Stonehenge Protected Environment has been declared under Section 28 Protected Environment, under the National Environmental Management: Protected Areas Act (No. 57 of 2003).

**Declaration date:**

YYYY – MM – DD

**Government gazette notice:**

Gazette reference nr.

---

---

## AUTHORIZATION

This management plan is hereby internally accepted and authorised as required for managing the Stonehenge Protected Environment (SPE) in terms of Sections 39 and 41 of the National Environmental Management: Protected Areas Act No 57 of 2003 (NEM:PAA).

Supported by: South African National Parks

Recommended and adopted by:

Name and Title	Signature and Date
<p><b>Management Authority</b></p> <p>TANKWA TENTED CAMP PROPRIETARY LIMITED (REGISTRATION NUMBER: 2013/068673/07) BY VIRTUE OF A RESOLUTION HEREIN REPRESENTED BY JEAN-PIERRE DE VILLIERS (730729 5100 087)</p>	<p>Signature: _____</p> <p>Date: _____</p>
<p><b>South African National Parks</b></p> <p><i>Name of signatory</i></p> <p>_____</p> <p><i>Title of signatory</i></p> <p>_____</p>	<p>Signature: _____</p> <p>Date: _____</p>

Approved by:

Name and Title	Signature and Date
<p><b>Department Forest Fisheries and the Environment</b></p> <p><i>Name of signatory</i></p> <p>_____</p> <p><i>Title of signatory</i></p> <p>_____</p>	<p>Signature: _____</p> <p>Date: _____</p>

Review Date: October 2028

# Table of Contents

STATUS .....	II
AUTHORIZATION .....	III
LIST OF FIGURES .....	VII
LIST OF TABLES .....	VIII
ABBREVIATIONS .....	VIII
1. BACKGROUND .....	1
1.1. Purpose of this document.....	1
1.2. Structure of the management plan.....	1
1.3. Adaptive management.....	1
1.4 Introduction to Stonehenge Protected Environment .....	2
2. STRATEGIC MANAGEMENT FRAMEWORK.....	6
2.1 Purpose of Stonehenge Protected Environment .....	6
2.2 Vision .....	7
2.3 Management Focus Areas, Challenges and Opportunities .....	7
3. DESCRIPTION OF THE STONEHENGE PROTECTED ENVIRONMENT .....	8
3.1 Legislative basis for the management of Stonehenge Protected Environment .....	8
3.1.1 Proclamation status of the Stonehenge Protected Environment .....	9
3.2 History of Stonehenge Protected Environment and the Tankwa region .....	9
3.3 Biophysical context of Stonehenge Protected Environment .....	10
3.3.1 Climate and weather .....	10
3.3.2 Topography, geology, land types and soils .....	11
3.3.3 Hydrology.....	17
3.3.4 Vegetation .....	19
3.3.4.1 SKv5 Tanqua Karoo .....	21
3.3.4.2 AZi7 Tanqua Wash Riviere .....	25
3.3.5 Mammals .....	26
3.3.6 Avifauna .....	27
3.4 Cultural heritage context of Stonehenge Protected Environment.....	29
3.5 Socio economic context of Stonehenge Protected Environment.....	32
4. IMPORTANT BIODIVERSITY OF THE STONEHENGE PROTECTED ENVIRONMENT .....	32
4.1 Protected Area Expansion Strategies and Implementation Plans .....	33
4.1.1 Critical Biodiversity Areas (CBA).....	33
4.2 Contributions to the conservation of biodiversity patterns .....	35
4.3 Contributions to the conservation of biodiversity processes .....	35

4.4	Contributions to the conservation of ecosystem goods and services .....	36
4.5	Species of special concern .....	36
4.6	Threats to biodiversity .....	36
4.6.1	Shale Mining .....	36
4.6.2	Alien invasive plants .....	36
4.6.3	Wash Riviere transformation .....	36
4.6.4	Irresponsible tourism .....	37
5.	LEGAL AND ADMINISTRATIVE FRAMEWORK .....	39
5.1	Legal and Policy Framework .....	39
5.1.1	National Environmental Management: Protected Areas Act, No. 57 of 2003 .....	39
5.1.2	National Environmental Management: Biodiversity Act, No. 10 of 2004 .....	39
5.1.3	National Environmental Management Act: EIA Regulations, GNR. 543 of 2010 .....	39
5.1.4	National Veld and Forest Fire Act, No. 101 of 1998 .....	39
5.1.5	Conservation of Agricultural Resources Act, No. 43 of 1983 .....	39
5.1.6	Protected Area Management Agreement for the Stonehenge Protected Environment, 2020 .....	40
5.2	Administrative Framework .....	40
6.	PROTECTED AREA POLICIES AND OPERATIONAL MANAGEMENT FRAMEWORK .....	40
6.1	Policy statements and guiding management principles .....	40
6.1.1	Veld condition management .....	40
6.1.2	Wildlife management .....	41
6.1.3	Alien invasive plant control .....	41
6.1.4	Soil erosion and landscape degradation .....	41
6.1.5	Problem Animal Control .....	41
6.1.6	Fire Management .....	41
6.1.7	Monitoring and Research .....	42
6.1.8	Access Control .....	42
6.1.9	Sustainable Tourism .....	42
6.1.10	Waste Management .....	42
6.1.11	Financial and Human Resources .....	42
6.1.12	Fencing and infrastructure .....	42
6.1.13	Natural resource use .....	43
6.1.14	Cultural Heritage .....	43
6.2	Management objectives .....	43
6.2.1	Alien invasive plant control .....	43

6.2.2 Soil erosion and landscape degradation control .....	46
6.2.3 Access control .....	49
6.2.4 Waste management .....	49
6.2.5 Infrastructure management .....	50
6.2.6 Monitoring .....	50
7. DEVELOPMENT FRAMEWORK .....	52
7.1 Zonation plan .....	52
7.2 Development plan .....	52
8. RESTRICTED ACTIVITIES .....	56
8.1 Restriction of development and other activities in the Conservation Zone .....	56
8.2 Restriction of development and other activities in the Low Impact Zone .....	56
8.3 Restriction of development and other activities in the High Impact Zone .....	57
9. MANAGEMENT PLAN IMPLEMENTATION, REVIEW AND ANNUAL PLAN OF OPERATIONS .....	58
9.1 Annual Plan of Operations .....	58
9.2 Management plan review and annual audit.....	58
REFERENCES.....	59
APPENDIXES.....	61
APPENDIX A. List of statutes to which the Stonehenge PE is subject to. ....	61
APPENDIX B. Archived ‘The Cape Argus’ article about developments and farming in the Tanqua region .....	64
APPENDIX C. Provisional mammal species list for the Tankwa Karoo including Stonehenge Protected Environment (Fitzpatrick Institute of African Ornithology, 2021. Mammal MAP Virtual Museum).....	65
APPENDIX D. South African Bird Atlas Project (SABAP) species list for pentads covering the Stonehenge PE .....	67
APPENDIX E. Mammal species list for Tankwa Karoo National Park from the Fitzpatrick Institute of African Ornithology Virtual Museum .....	72
APPENDIX F. Plant species list for the Stonehenge Protected Environment .....	73
APPENDIX G. Stonehenge Protected Environment Proclamation Notice .....	75

## LIST OF FIGURES

<b>Figure 1. 1</b> The adaptive management cycle .....	2
<b>Figure 1.2.</b> Snapshot of the area surrounding Stonehenge Protected Environment (Tankwa-Karoo & Roggeveld Escarpment, 2018, Slingsby Maps). .....	3
<b>Figure 1.3</b> Locality map for the Stonehenge Protected Environment .....	5
<b>Figure 3. 1</b> .....	11
<b>Figure 3. 2</b> Climate diagram of Tanqua Wash Riviere (AZi7) vegetation unit (Mucina et. al., 2006) ..	11
<b>Figure 3. 3</b> Stonehenge PE Land types map .....	13
<b>Figure 3. 4</b> Map indicating the geological groups for Stonehenge Protected Environment and surrounding area. ....	14
<b>Figure 3. 5</b> Geological section from Agterkop near Gannaga pass in the north eastern section of the TKNP through to Geosite 2 near Elandsvlei farm in the corridor. (TKNP geological fold out map, Council for Geoscience) .....	15
<b>Figure 3. 6</b> Map indicating different soil types occurring on SPE and surrounding area. ....	16
<b>Figure 3. 7</b> Map indicating the hydrology of the Stonehenge Protected Environment .....	18
<b>Figure 3. 8</b> The Tanqua Karoo vegetation type of the Bo-Stompiesfontein undulating plains .....	19
<b>Figure 3.9</b> The Tanqua Karoo vegetation type of the Central Tanqua bottomland plains.....	20
<b>Figure 3.10</b> The Tanqua Wash Riviere vegetation type on silt in the large floodplains .....	20
<b>Figure 3. 11</b> Vegetation map of the Stonehenge Protected Environment .....	22
<b>Figure3.12</b> Landscape unit map of the Stonehenge Protected Environment as extrapolated according to Van der Merwe et al. (2015).....	23
<b>Figure 3.13</b> The Tanqua Karoo vegetation type of the Central Tanqua bottomland plains .....	24
<b>Figure 3.14</b> The Tanqua Karoo vegetation type of the Tanqua bottomland pans.....	25
<b>Figure 3.15</b> Aerial image indicating stark transition between Tanqua Karoo and Tanqua Wash Riviere vegetation types.....	26
<b>Figure 3. 16</b> Stonehenge PE South African Bird Atlas Project pentads.....	28
<b>Figure 3. 17</b> Unifacial points collected on neighbouring f. Displaying a range of morphologies and Stone Age technologies; raw materials: a–c) hornfels; d–e) dolerite; f–i) silcrete; j & k) chert found at Tweefontein (Hallinan & Shaw, 2020).....	30
<b>Figure 3.18</b> Sections of petrified wood (Agathoxylon genus) collected on Stonehenge Protected Environment .....	31
<b>Figure 4. 1</b> Critical Biodiversity Areas Map for Stonehenge Protected Environmen .....	34
<b>Figure 4. 2</b> Impacts of shale mining neighbouring property. ....	37
<b>Figure 6. 1</b> Stonehenge PE Alien and Invasive Plant distribution and management unit map .....	45
<b>Figure 6. 2</b> Stonehenge PE degradation map .....	48
<b>Figure 7. 1</b> Stonehenge PE zonation plan.....	55

## LIST OF TABLES

<b>Table 2. 1</b> Management focus areas, challenges and opportunities for the Stonehenge Protected Environment .....	7
<b>Table 3. 1</b> Land types for Stonehenge Protected Environment (Figure 3.4) .....	12
<b>Table 3. 2</b> Hantam Local municipality at a glance (Hantam IDP, 2021) .....	32
<b>Table 4. 1</b> CBA contribution figures for Stonehenge PE .....	33
<b>Table 4. 2</b> SPE contributions to national conservation targets per vegetation type .....	35
<b>Table 4.3</b> SPE Ecosystem types, conservation and protection status.....	35
<b>Table 7. 1</b> Zone description and management objectives.....	54

## ABBREVIATIONS

<b>APO</b>	Annual Plan of Operation
<b>AIP</b>	Alien and Invasive Plants
<b>CARA</b>	Conservation of Agricultural Resources Act
<b>CBA</b>	Critical Biodiversity Area
<b>CITES</b>	Convention on International Trade in Endangered Species of Wild Fauna and Flora
<b>CMA</b>	Catchment Management Authority
<b>CR</b>	Critically Endangered
<b>CREW</b>	Custodians of Rare and Endangered Wildflowers
<b>DFFE</b>	Department of Forestry, Fisheries and Environment
<b>DAELR</b>	Northern Cape Department: Agriculture, Environmental Affairs, Land Reform and Rural Development (The Department)
<b>DWA</b>	National Department of Water Affairs
<b>EIA</b>	Environmental Impact Assessment
<b>EMF</b>	Environmental Management Framework
<b>EMP</b>	Environmental Management Plan
<b>EN</b>	Endangered
<b>ESA</b>	Ecological Support Area
<b>FEPA</b>	Freshwater Ecosystem Priority Area
<b>FPA</b>	Fire Protection Association
<b>GIS</b>	Geographical Information System
<b>IDP</b>	Integrated Development Plan (Municipal)
<b>IUCN</b>	International Union for the Conservation of Nature
<b>LC</b>	Least Concern
<b>LHSTK</b>	Leslie Hill Succulent Karoo Trust
<b>LT</b>	Least Threatened
<b>MA</b>	Management Authority
<b>MAP</b>	Mean Annual Precipitation
<b>MCA</b>	Mountain Catchment Area
<b>MEC</b>	Member of the Executive Council



<b>METT</b>	Management Effectiveness Tracking Tool
<b>MOA</b>	Memorandum of Agreement
<b>MOU</b>	Memorandum of Understanding
<b>NBA</b>	National Biodiversity Assessment
<b>NEM:BA</b>	National Environmental Management: Biodiversity Act
<b>NEM:PAA</b>	National Environmental Management: Protected Areas Act
<b>NEMA</b>	National Environmental Management Act
<b>NFEPA</b>	National Freshwater Ecosystem Priority Area
<b>NGO</b>	Non Governmental Organisation
<b>NPAES</b>	National Protected Area Expansion Strategy
<b>NCPAES</b>	Northern Cape Protected Area Expansion Strategy
<b>NR</b>	Nature Reserve
<b>NSBA</b>	National Spatial Biodiversity Assessment
<b>NWA</b>	National Water Act
<b>ODRS</b>	Olifants Doring River System
<b>ONA</b>	Other Natural Area
<b>PA</b>	Protected Area
<b>PE</b>	Protected Environment
<b>SAHRA</b>	South African Heritage Resources Agency
<b>SANBI</b>	South African National Biodiversity Institute
<b>SANParks</b>	South African National Parks
<b>SDF</b>	Spatial Development Framework
<b>SKEP</b>	Succulent Karoo Ecosystem Programme
<b>SMP</b>	Strategic Management Plan
<b>SDF</b>	Spatial Development Framework (Municipal)
<b>SMME</b>	Small, Micro and Medium Enterprises
<b>SMP</b>	Strategic Management Plan
<b>SPE</b>	Stonehenge Protected Environment
<b>TKNP</b>	Tankwa Karoo National Park
<b>TKWC</b>	Tankwa Karoo to Cederberg Wilderness Corridor (the 'Corridor')
<b>VU</b>	Vulnerable
<b>WFA</b>	Wilderness Foundation Africa
<b>WWF-SA</b>	World Wide Fund for Nature South Africa

# 1. BACKGROUND

## 1.1. Purpose of this document

Management plans for biodiversity stewardship sites are strategic documents that provide the framework for the development and operation of biodiversity stewardship sites. These documents inform management at all levels, from the landowner through to South African National Parks (SANParks) support staff. The purpose of the management plan is to:

- Provide the primary strategic tool for management of Stonehenge Protected Environment (SPE), informing the need for specific programmes and operational procedures.
- Provide for capacity building, future thinking and continuity of management.
- Enable the landowner to develop and manage the Stonehenge Protected Environment in such a way that the purpose for which it has been established are fulfilled.

## 1.2. Structure of the management plan

Section 1.	Background and introduction to the Stonehenge Protected Environment (SPE) management plan.
Section 2.	Strategic management framework for the SPE.
Section 3.	Description of the Stonehenge Protected Environment – Legislative basis, history and biophysical context, cultural and socio-economic context.
Section 4.	Important biodiversity of the Stonehenge Protected Environment.
Section 5.	Legal and administrative framework.
Section 6.	Protected area policy and operational framework which sets out the management objectives and targets for the Stonehenge Protected Environment.
Section 7.	Development framework which sets out the zonation plan and development plan for the Protected Environment.
Section 8.	Restricted activities listed for the Stonehenge Protected Environment.
Section 9.	Five-year costing plan which estimates the cost linked to the various key performance areas.
Section 10.	Management plan implementation, review, and annual plan of operations

## 1.3. Adaptive management

Adaptive management (Figure 1.1) is a structured, iterative process in which decisions are made using the best available information, with the aim of obtaining better information through monitoring of performance. Decision making is therefore aimed at achieving the best outcome based on current understanding, whilst accruing the information needed to improve future management. Adaptive management can lead to revision of a part or, if necessary, the whole management plan.

Adaptive management enables landowners and managers to learn through experience; take account of, and respond to, changing factors that affect the Protected Area; develop or refine management processes; adopt best practice and innovation; and demonstrate that management is appropriate and effective.



Figure 1. 1 The adaptive management cycle

## 1.4 Introduction to Stonehenge Protected Environment

Stonehenge Protected Environment (SPE) (figure 1.2) is situated within the Namaqua District and Hantam Local Municipalities of the Northern Cape Province of South Africa. The R355 gravel road between Ceres and Calvinia is the closest major road. A minor public road (OP802 in Figure 1.2) extends from the R355 through the SPE into the Tankwa Karoo National Park (TKNP).



Figure 1.2. Snapshot of the area surrounding Stonehenge Protected Environment (Tankwa-Karoo & Roggeveld Escarpment, 2018, Slingsby Maps).

On a cadastral scale, the property is situated within the Tankwa Karoo National Park’s Land Inclusion Plan (SPE borders the TKNP for 17km) and also identified for the proposed *Tankwa Karoo to Cederberg Wilderness Corridor* (TKWC). The creation of this ecological corridor has long been an ambition in the conservation community that connects the Cederberg Wilderness Area (towards the west) with the Tankwa Karoo National Park (further east) and in so doing, creating a mega interprovincial protected area of approximately 240 000 hectares.

The SPE is also situated within the Succulent Karoo biome which is globally recognised as a biodiversity hotspot and one of only two arid biodiversity hotspots on the planet. The biodiversity importance of the SPE pivots on the fact that it contains two National Freshwater Ecosystem Priority Area (NFEP) rivers and is an essential link in creating the TKWC. The NFEP rivers drain into the Olifants Doring River System (ODRS) and provide a natural ecological corridor connecting the TKNP and CWA. These are significant ecological features especially considering the extreme arid environment.

Stonehenge Protected Environment is a single farm portion covering a total area of 3161.5238 hectares:

- STONEHENGE, REMAINDER OF FARM 1105, 3161.5238HA, CALVINIA

The landowner decided to formally protect the property through the declaration of the Stonehenge Protected Environment as they mainly wanted to ensure that the property is conserved for future generations through sound management practices and also providing a platform for authentic nature, cultural-and heritage based experiences.

The concept and opportunity to form part of the Tankwa Karoo to Cederberg Wilderness Corridor (TKWC) was introduced to the landowner by Wilderness Foundation Africa (WFA) and SANParks. After willingness to form part of the Corridor was established the property was assessed and presented to the SANParks Land Inclusion Committee. This committee approved the property to be

eligible for the declaration as protected area and furnished the property with potential Protected Environment status.

SANParks has committed to fulfil the role of the conservation authority responsible for supporting the declared protected areas by annually visiting and evaluating the management of the protected areas established in the Corridor. The legal declaration of the Protected Environments in the Corridor have been processed through SANParks and the National Minister responsible for the Environment.

The notice of proclamation for Stonehenge Protected Environment appeared in the **National/Provincial** Government Gazette on (date)\_\_\_\_\_.

Through its proclamation, Stonehenge Protected Environment is subject to the provisions of the Protected Areas Act. The act requires that the management authority (MA) of a protected area must, within 12 months of the assignment of the management authority, submit a management plan for the protected area to the Member of the Executive Council (MEC) or National Minister responsible for the environment, for approval. This document is the management plan for Stonehenge Protected Environment.



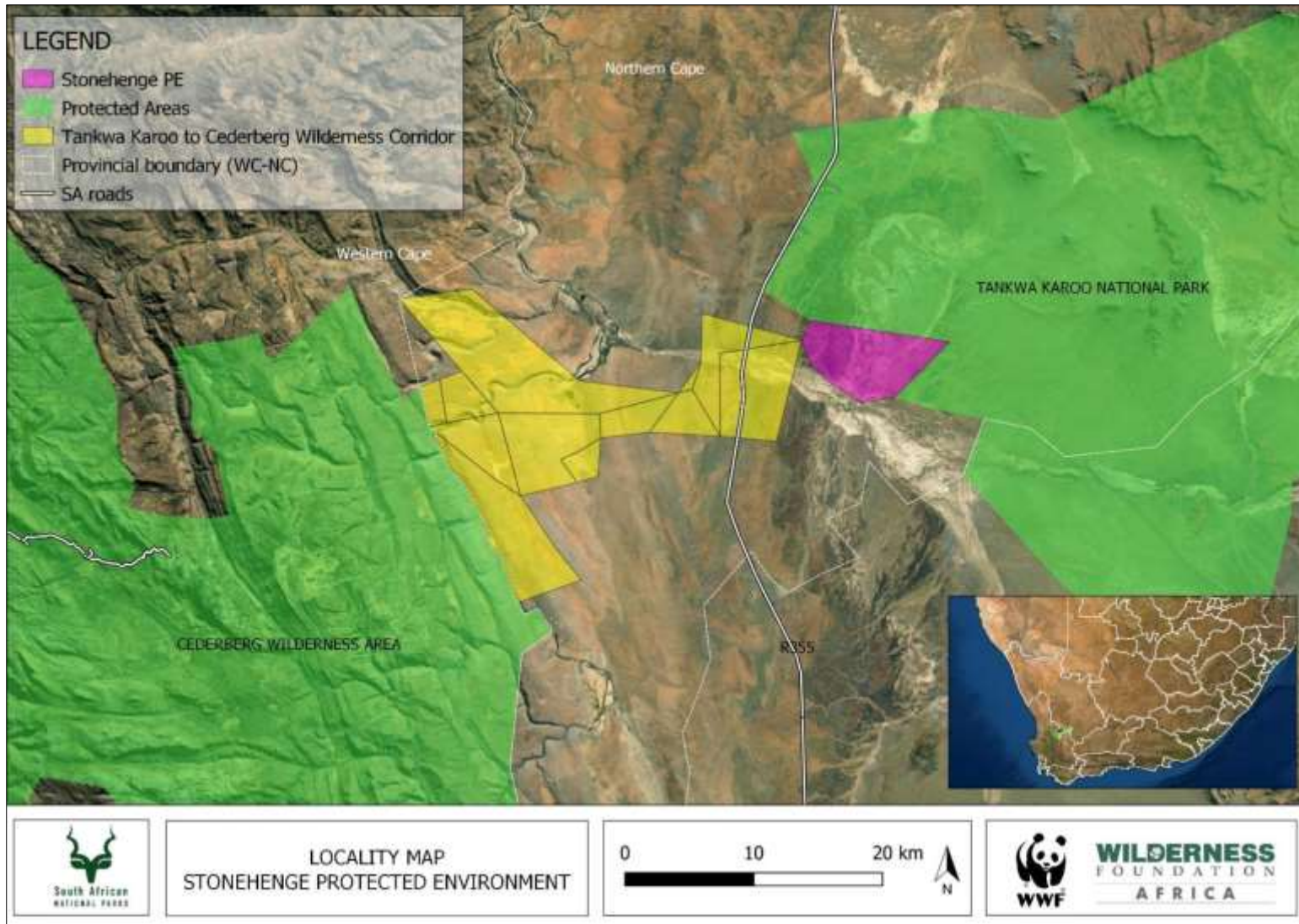


Figure 1.3 Locality map for the Stonehenge Protected Environment

## 2. STRATEGIC MANAGEMENT FRAMEWORK

### 2.1 Purpose of Stonehenge Protected Environment

The purpose of the Protected Environment is the foundation on which all future actions are based and is in line with the key ecological attributes of the Protected Environment and the overall management philosophy of the management authority. According to Section 17 of the National Environmental Management: Protected Areas Act (NEM: PAA), the purpose of declaring a Protected Areas is:

- 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.**

In light of the above, Stonehenge Protected Environment strives to contribute to the above NEM: PAA section 17 listed purposes, **marked in bold**, through formal declaration as a Protected Environment and forming part of the Tankwa Karoo to Cederberg Wilderness Corridor (TKCWC). The Corridor's objectives also include improving sustainable land use practices and facilitating the conservation of natural landscape scale patterns and processes.

---

*\*The terms 'natural resource use' and 'sustainable land use' in this document generally refers to grazing/ veld utilisation and low impact eco-tourism activities.*

## 2.2 Vision

The vision statement below describes the desired long term, overarching envisaged outcome of the Stonehenge Protected Environment:

*“A Protected Environment striving to improve ecological functioning, promote sustainable land use within the Tankwa Karoo to Cederberg Wilderness Corridor and create environmental awareness of the landscape among visitors to the area.”*

## 2.3 Management Focus Areas, Challenges and Opportunities

A summary of the management focus areas, challenges and opportunities, addressed in the management plan, are emphasised in the table below.

**Table 2. 1** Management focus areas, challenges and opportunities for the Stonehenge Protected Environment

Management Focus Areas	Challenges and Opportunities
Alien invasive plant management	<p>In terms of the Conservation of Agricultural Resources Act No. 43 of 1983, the management of invasive alien plant species is a legal requirement on any private property. <i>Prosopis glandulosa</i> is the most common Alien Invasive Plants (AIPs) species on the SPE and largely restricted to the Tankwa River washes and its tributaries.</p> <p>Although infestations occur at low densities, an adequate strategic alien clearing plan is required to identify and manage alien plants on the property.</p> <p>Demarcation of <i>Prosopis</i> trees found inside the high impact zones will be accommodated and phased out with indigenous species over time.</p>
Soil erosion and landscape degradation management	<p>Historic agricultural land use has especially impacted the ecological condition of especially the riparian areas of the SPE. Flood irrigation and associated earth works, is the main cause for degradation in the river washes on the property. The cost associated with rehabilitating these riparian areas is generally considered unfeasible, but management of the SPE would welcome rehabilitation initiatives if the opportunity arises and encourage rehabilitation trials and monitoring of such.</p>
Access control	<p>Proper access control to and through the SPE is an essential part of protecting the SPE. The main road through the SPE links the R355 with the Tankwa Karoo National Park and poses a threat to the biodiversity and ecosystem function. Off road vehicles often abandon the demarcated roads to drive into the veld leaving long lasting tracks and sometimes permanent damage to the veld.</p> <p>Appropriate signage and environmental awareness efforts can be directed towards educating road users and visitors to the SPE.</p>
Waste management	<p>Tourism facilities on the SPE generate a reasonable amount of waste and needs to be properly managed. A waste management strategy for the SPE is required. Recycling and ‘up cycling’ initiatives need to be incorporated in the strategy.</p>



Infrastructure management	Infrastructure on the SPE (i.e. existing roads, boreholes and perimeter fences) need to be maintained as per legislation and agreement with neighbouring landowners. Redundant infrastructure such as internal fences and unused roads need to be considered for removal and closure where possible. This can also be seen as part of the landscape degradation rehabilitation objective. Tourism facilities in the high impact zones also require adequate maintenance as deterioration might have a negative impact on biodiversity (i.e. sewage systems)
Monitoring	Current capacity for environmental monitoring activities is limited. Partners in the landscape and institutions such as SANParks and CREW/SANBI can be engaged to assist in this regard. Long term monitoring of rehabilitation activities (i.e. AIP clearing and other land degradation rehabilitation activities) needs to be considered and encouraged when resources and such opportunities arises. The management authority can start with basic data collection, including record keeping of rainfall and game numbers.
Cultural Heritage Management	As the TKWC is largely undiscovered from an archaeological perspective, there are opportunities to partner with organisations such as the Eastern Cederberg Rock Art Group (eCRAG), SANParks and archaeological researchers working in the area. This will likely lead to new discoveries of the Middle Stone Age hunter-gatherers era and also more recent history. It will contribute to the preservation of the cultural heritage assets of the PE and also for the rest of the Corridor.

### 3. DESCRIPTION OF THE STONEHENGE PROTECTED ENVIRONMENT

#### 3.1 Legislative basis for the management of Stonehenge Protected Environment

There is a large body of legislation that is relevant to the management of Stonehenge Protected Environment, but the primary legislation guiding the management of protected areas, is the National Environmental Management: Protected Areas Act (No.57 of 2003) (Hereafter referred to as the Act).

The Act establishes the legal basis for the creation and administration of protected areas in South Africa, as its objectives include provisions “for the protection and conservation of ecologically viable areas representative of South Africa’s biological diversity and its natural landscapes”. The Act sets out the mechanisms for the declaration of protected areas and the requirements for their management.

SANParks and the Northern Cape Department: Agriculture, Environmental Affairs, Land Reform and Rural Development (DAELR/ ‘the Department’) are the conservation authorities responsible for Protected Area expansion in the Northern Cape. These two entities’ Biodiversity Stewardship Programmes facilitate the establishment and management of protected areas on private land in the province.

For the Tankwa Karoo to Cederberg Wilderness Corridor (TKCWC), SANParks is the Biodiversity Stewardship implementing agent and conservation authority responsible for evaluating the management of Stewardship sites in the corridor.

A detailed list of relevant legislation is provided in Appendix A. Landowners should familiarize themselves with the purpose and contents of the statutes and their subsequent amendments and regulations.

### 3.1.1 Proclamation status of the Stonehenge Protected Environment

Stonehenge Protected Environment is proclaimed under Section 28 (1) of the National Environmental Management: Protected Areas Act (Act 57 of 2003). See Appendix G for copy of the Stonehenge Protected Environment Proclamation Notice.

## 3.2 History of Stonehenge Protected Environment and the Tankwa region.

Historically, and presently to a certain extent, extensive livestock farming is the primary land-use type in the Tankwa Karoo region. Sheep making up the largest proportion of livestock with some goats and cattle. Eco-tourism and the purchase of lifestyle properties have become popular economic alternatives to farming in recent years.

Along the rivers of the Tankwa Karoo, early pioneer farmers cultivated crops by flood irrigation. Since the flow of these rivers, such as the Tankwa River in the Stonehenge Protected Environment, is highly unpredictable most of these flood irrigated lands now lay abandoned with many alien and pioneer species slowly encroaching these brackish riparian zones and river washes.

A farming practice somewhat unique to the larger Namaqualand district is the transhumance or 'trekboer' system. The 'trekboer' grazing system refers to when farmers move their livestock between the higher altitude, wetter Roggeveldberge areas and the lower lying drier Tankwa Karoo areas further westwards. If sufficient winter rain was received in the Tankwa Karoo, farmers usually move their livestock to these areas. The following summer thunderstorms occurring further eastwards are relied upon for fodder during summer. It is during these summer months that livestock is relocated back to the Roggeveld where there is available fodder in the form of natural veld as well as additional feed reserves produced on the cultivated fields. This is on average a six month cycle between the Tankwa Karoo and Roggeveld (Van Der Merwe, 2010). It is believed that game species such as springbok, gemsbok and eland followed the same migration patterns between these winter and summer rainfall areas during these periods and in the past.

Livestock was mainly moved by foot along a 'trekpad' (trek road) with many of these routes being hundreds of years old. An example of such a 'trekpad' is the 'Ouberg Pass' (Van Der Merwe, 2010).

Before the current owner purchased the property in 2004, the Stonehenge property was used for livestock farming. The landowner then decided that livestock farming will no longer continue on the property and available grazing will only be utilised by game species occurring on or moving through the property. As an alternative to the conventional land use for the area, the landowner initiated various tourism based events on the property. Activities and tourist facilities on the property include and art route, accommodation units, restaurant, bar, motorcross track, hiking trails, camp sites and

also hosts large annual events. The 'Afrika Burn' event was hosted on the property since its inception in 2007. The organisers of this event is planning to host the 'Afrika Burn' event elsewhere in the Tankwa region in future. Smaller events will still be hosted on the property in high impact areas zoned for such events.

The property was initially registered under the ownership of 'Great Karoo Safaris CC', but was later transferred to Tankwa Tented Camp PTY (LTD) which was created in 2013.

The origin of the property name 'Stonehenge' could not be confirmed, but could potentially be attributed to the 'stony' landscape formed by the shale plateau on the property, or related to the Middle Stone Age archaeological artefacts found in the region. Landmark names on the property include 'Luiperdskop', 'Oskop' and 'Spitskop' which are hills on Stonehenge PE marking out boundary beacons for the property.

The Stonehenge PE is located close to Elandsvlei farm which was situated on a busy postal route and even had its own Post Office depot at Elandsvlei Farm. Due to the water richness of the area through the Doring, Tra-Tra and Tankwa Rivers the area flourished economically and socially during the 1950-1970's. Due to the rise in agricultural input costs and changing climatic factors, agriculture became less feasible in the area. Remnants of buildings at Elandsvlei are telling of these previous prosperous times.

A Cape Argus article dated 13 October 1923 (Appendix B) mentions a then proposed railway connection between Calvinia and Cape Town. The proposed railway line was to transect the Tweefontein/Elandsvlei farms, but never realised.

### 3.3 Biophysical context of Stonehenge Protected Environment

#### 3.3.1 Climate and weather

The Stonehenge Protected Environment is situated in a winter-rainfall regime with most rainfall between May and August, while December and January are generally precipitation free. The region has high spatial variability of rainfall, with some areas referred to as rain shadows experiencing as little as 40mm average rainfall per year. Weather stations in the Tankwa Karoo region recorded a Mean Annual Precipitation (MAP) that varies from a low of 72mm (measured at the SPE neighbouring farm Elandsvlei farm weather station over a 41 year period before 2006), to a high of 112mm (measured at Reenen over a 79 year period before 2006) (Mucina et. al., 2006).

The Elandsvlei farm which also forms part of the TKCWC recorded a mean maximum temperature of 36.4°C in February with an extreme maximum of 45.9°C in February 1995. The coldest month is July with a mean minimum temperature of 5.8°C. The extreme minimum temperature recorded was -1.3°C in July 1981. Rainfall in the Roggeveld ranges from 300 – 500mm per annum, while the Tanqua Karoo receives between 50 and 300mm per annum (Van der Merwe, 2010).

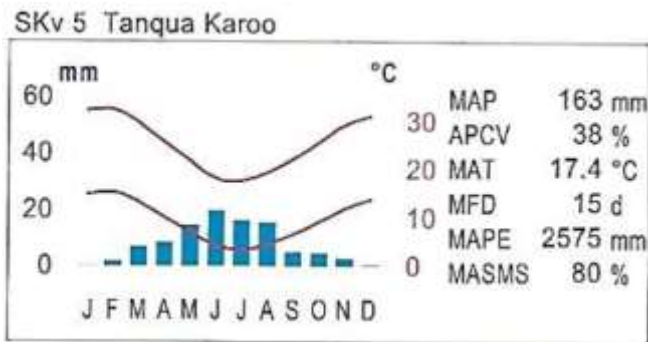


Figure 3. 1 Climate diagram of Tanqua Karoo (SKv5) vegetation unit (Mucina et. al., 2006)

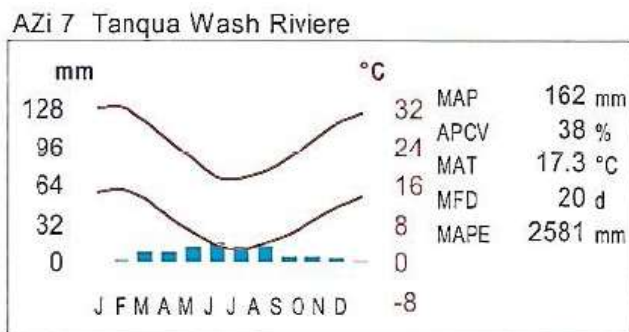


Figure 3. 2 Climate diagram of Tanqua Wash Riviere (AZi7) vegetation unit (Mucina et. al., 2006)

[MAP = Mean Annual Precipitation; APCV = Annual Precipitation Coefficient of Variance; MAT = Mean Annual Temperature; MFD = Mean Frost Days; MAPE = Mean Annual Potential Evaporation; MASMS = Mean Annual Soil Moisture Stress (% of days when evaporative demand was more than double the soil moisture supply.)]

### 3.3.2 Topography, geology, land types and soils

The Stonehenge Protected Environment (SPE) is situated in the transition zone between the Karoo and Cape Supergroups. The Dwyka Group is represented by tillite, arenite, mudstone and shale on SPE. The Ecca Group is present in the Whitehill and Prince Albert formations on the property with shale being the dominant rock. (Figure 3.4)

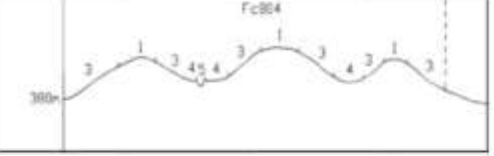
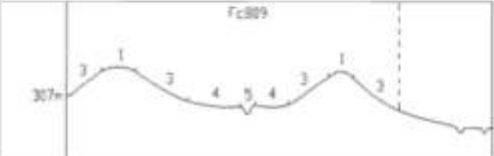
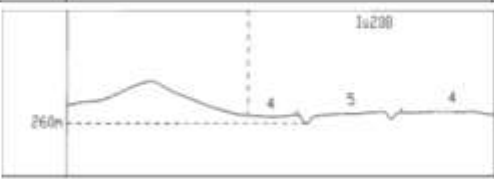
Refer to the geological section illustrating the geological formations from ‘Agterkop’ near Gannaga pass in the TKNP to ‘Geosite 2’ towards Elandsvlei farm in the TKWC, in figure 3.5. It is clear from the sectional diagram that the oldest ‘Dwyka’ group, forms a large section of the corridor and the western section of the TKNP. The Ecca Group occupies most of the central area of the Tankwa Karoo National Park and the Beaufort Group (youngest group) caps the Roggeveldberge along the eastern escarpment (TKNP Geology Booklet, 2014). Igneous rock intrusions of dolerite occur throughout the region and are easily recognised as very hard, dark grey to nearly black rocks on the surface (Van Der Merwe, 2010).

Four \*land types (Figure 3.3) are differentiated for the Stonehenge Protected Environment. Edaphic interfaces between these land types are potentially indicative of relatively high plant species diversity. High micro habitat and species diversity is often associated with high diversity land types (Bezuidenhout, personal communication, 2019)

Two dominant soil types have been described for the SPE. Descriptions for these soil types can be referred to in figure 3.6 below.

*\*Land type: classification of areas showing a clear degree of uniformity with respect to terrain form, soil pattern and climate.*

**Table 3. 1** Land types for Stonehenge Protected Environment (Figure 3.4)

Land type & Geological description	Terrain form sketch
<b>Fc287:</b> Shale and siltstone of the Tierberg, Prince Albert and Whitehill Formations; Eccca Group with dolerite intrusions.	(no terrain form sketch available).
<b>Fc804:</b> Shale and siltstone of the Prince Albert and Whitehill Formations; Eccca Group with dolerite.	
<b>Fc809:</b> Shale and siltstone of the Prince Albert and Whitehill Formations; Eccca Group.	
<b>Ia208:</b> Alluvium with tillite, diamictite and subsidiary shale of the Dwyka Group and also shale and siltstone of the Eccca Group.	

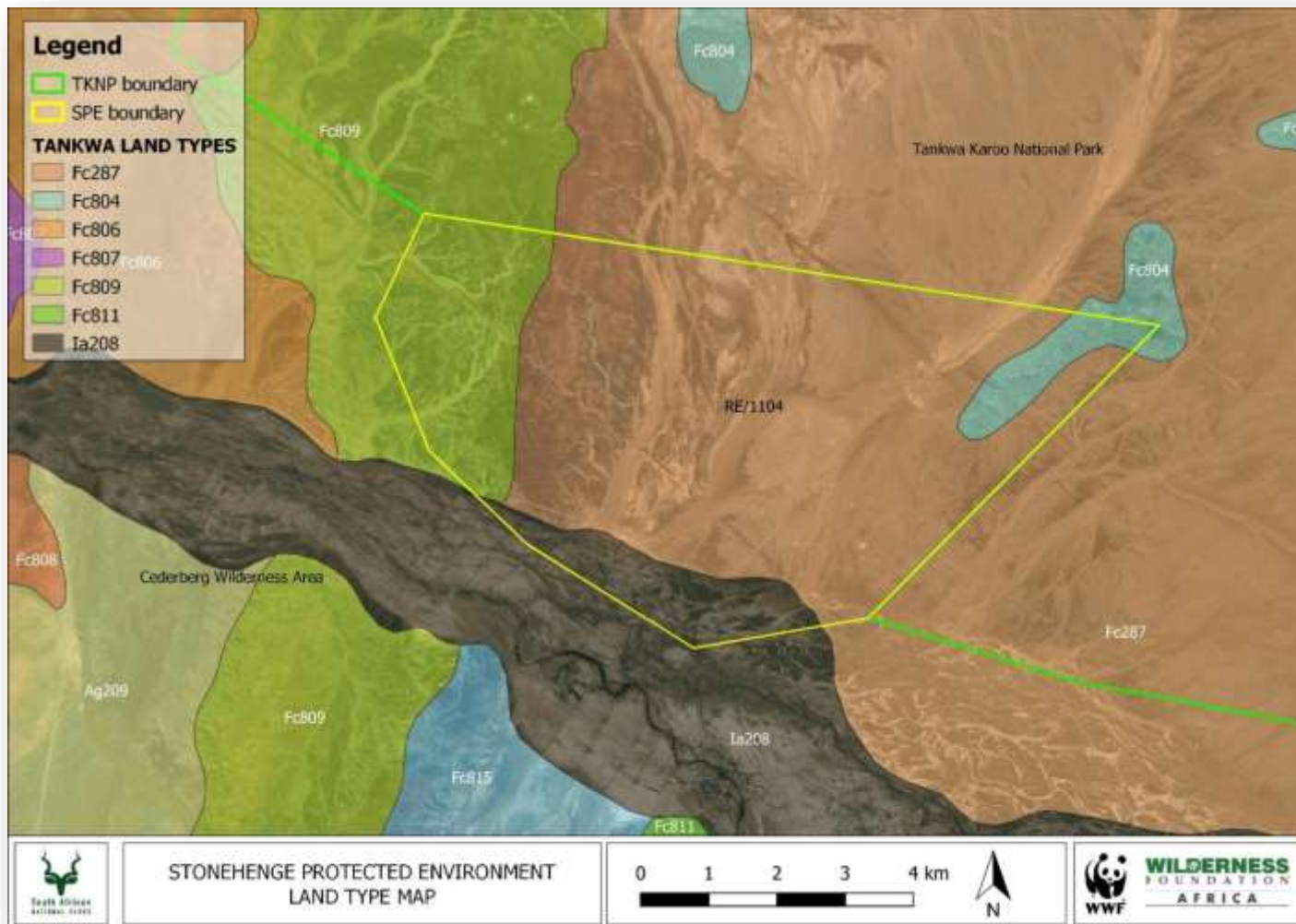


Figure 3. 3 Stonehenge PE Land types map



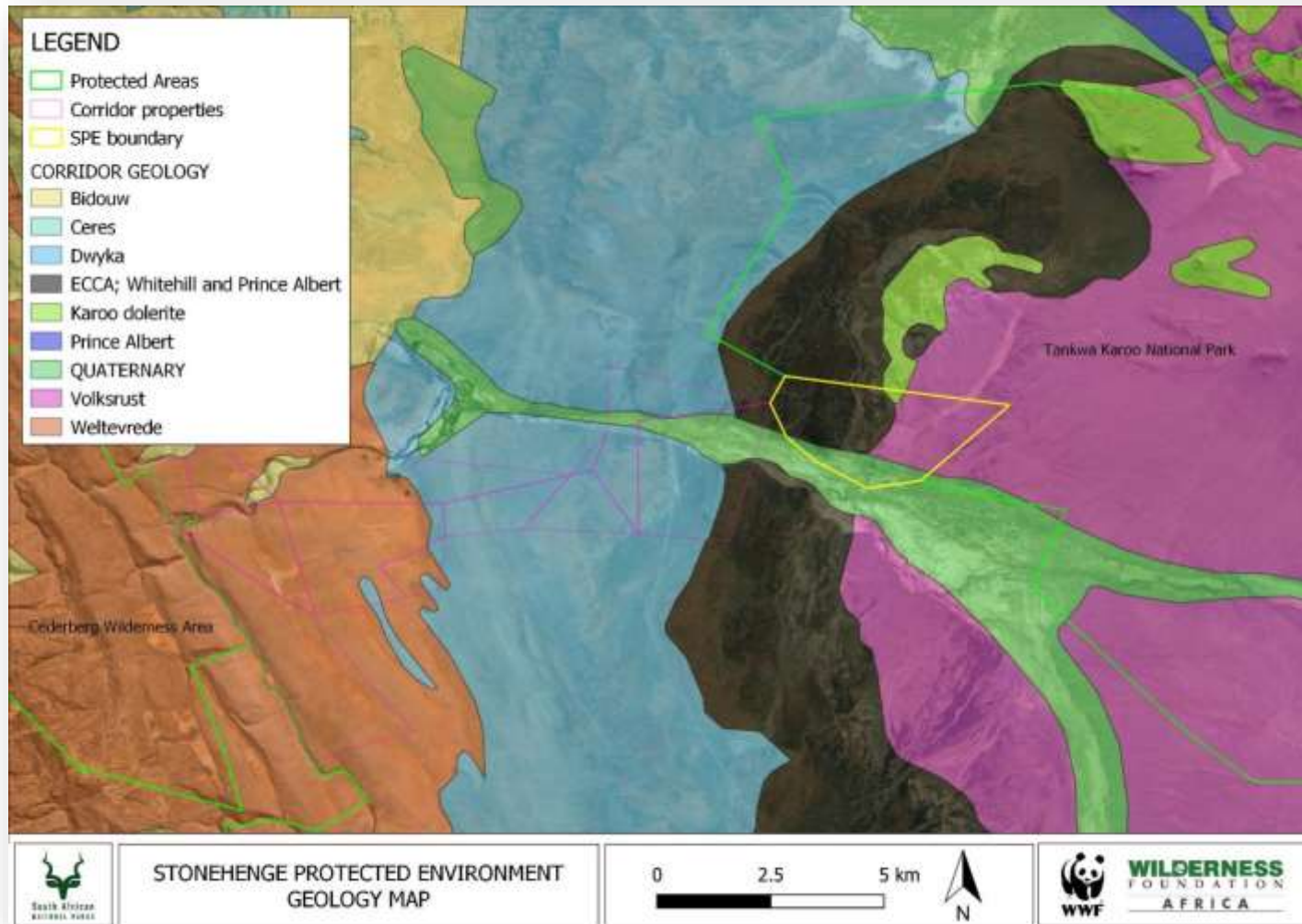


Figure 3. 4 Map indicating the geological groups for Stonehenge Protected Environment and surrounding area.

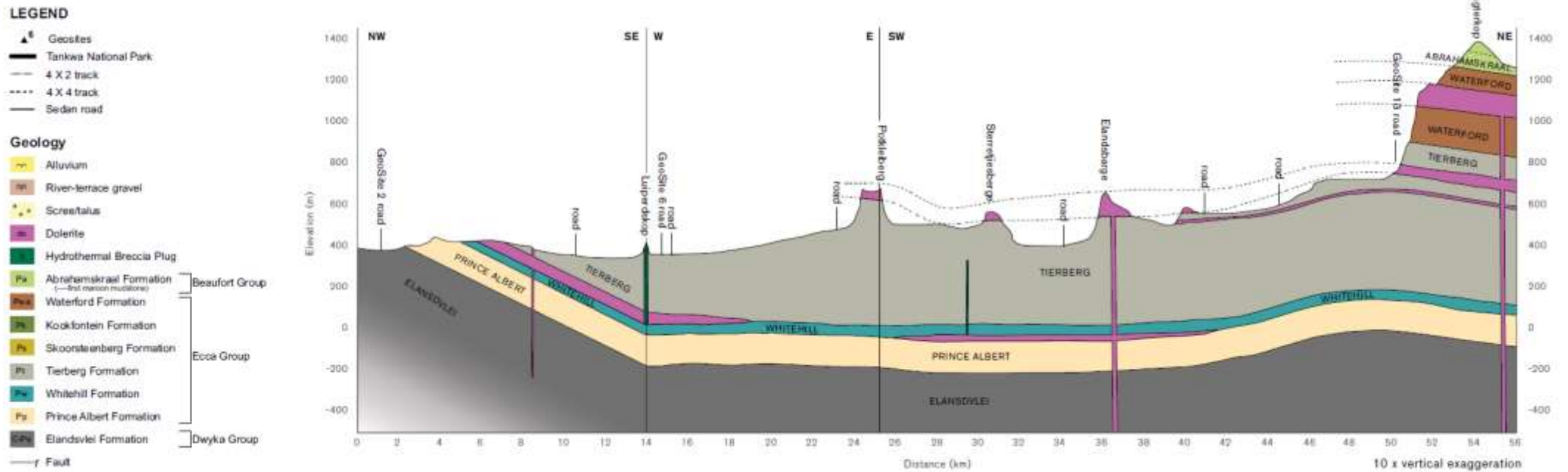


Figure 3. 5 Geological section from Agterkop near Gannaga pass in the north eastern section of the TKNP through to Geosite 2 near Elandsvlei farm in the corridor. (TKNP geological fold out map, Council for Geoscience)



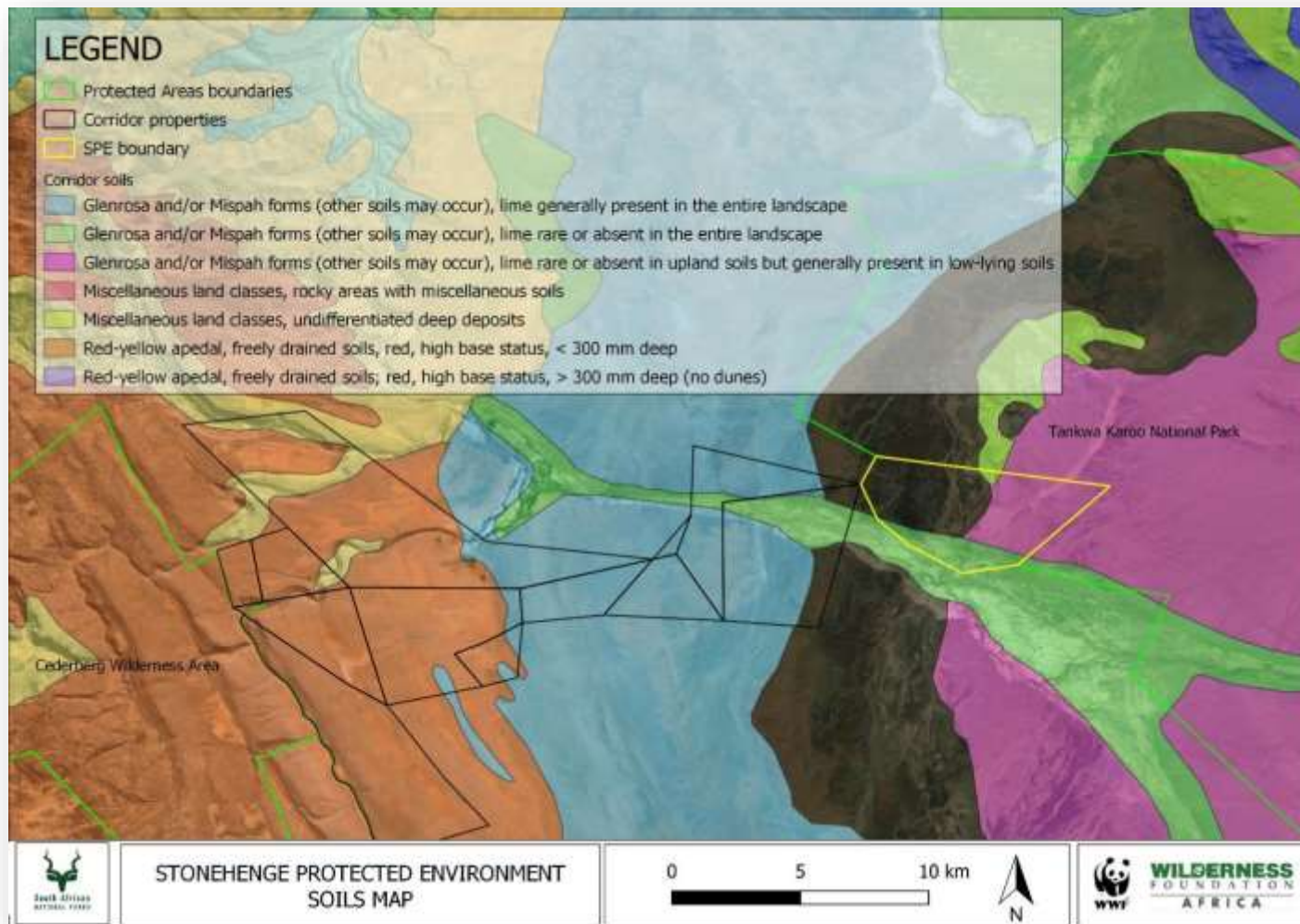


Figure 3. 6 Map indicating different soil types occurring on SPE and surrounding area.

### 3.3.3 Hydrology

The Stonehenge Protected Environment includes two Quaternary catchments delineated in the National Freshwater Ecological Priority Areas (NFEPA) database (Figure 3.7). This database categorises quaternary catchments into priority category codes 1 to 4 and include the following for SPE:

- Fish support area or fish corridor (FEPA code 2)
- Upstream management area (FEPA code 4)

Water provision on the SPE include three functional boreholes. Surface water is only present in the Tankwa River after heavy winter rains further along the Tankwa River catchment and also for short periods after cloud breaks, especially during summer months.

Water is currently extracted for wildlife and domestic purposes only. No large-scale extraction for irrigation fields or for the growing crops is being implemented. Borehole levels should be monitored closely.

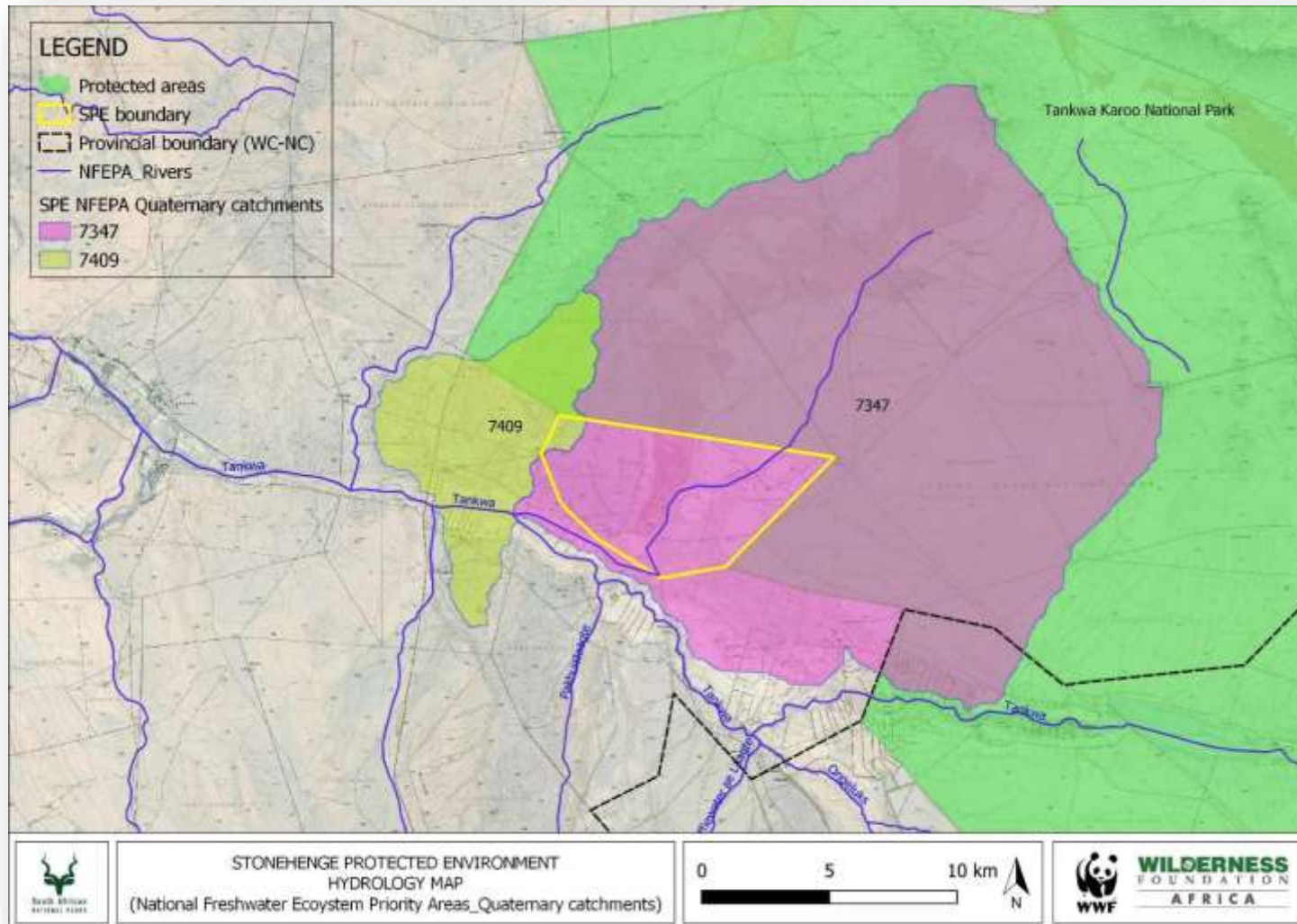


Figure 3. 7 Map indicating the hydrology of the Stonehenge Protected Environment.



### 3.3.4 Vegetation

The Stonehenge Protected Environment is situated in the Tanqua basin forming part of the Rainshadow Valley Karoo Bioregion, which is one of six bioregions of the Succulent Karoo (Rutherford *et al.*, 2006). This very unpredictable low (below 100 mm per annum), mostly winter rainfall area with hot very dry summers and cold dry winters has a flat to slightly undulating landscape with some ridges. The loam soil, covered with a surface layer of shale, tillite or dolerite is light brown, brown to almost black gravel and stones or desert paving, overlays shale. Two vegetation types are found in this Protected Environment: 1) the Tanqua Karoo vegetation type (Mucina *et al.*, 2006) with very sparse to no vegetation cover (Figures 3.8 & 3.9) the Tanqua Wash Riviere vegetation type (Mucina *et al.*, 2006) of the dry riverbed of the Tanqua drainage system, with a good vegetation cover of scattered trees and shrubs (Figure 3.10). The vegetation types according to Mucina *et al.* (2006) will be described in more detail according to the landscape units as extrapolated from Van der Merwe *et al.* (2015)

A preliminary plant species list can be viewed in Appendix F.



**Figure 3. 8** The Tanqua Karoo vegetation type of the Bo-Stompiesfontein undulating plains, with almost no vegetation cover, found on claystone desert paving in the flat landscape of the Prince Albert Formation in the western section of the Stonehenge Protected Environment. (Photo Annelise le Roux)



**Figure 3.9** The Tanqua Karoo vegetation type of the Central Tanqua bottomland plains with almost no vegetation cover, found on shale desert paving of the Tierberg Formation on the eastern section of the Stonehenge Protected Environment near Luiperdskop. (Photo Annelise le Roux)



**Figure 3.10** The Tanqua Wash Riviere vegetation type on silt in the large floodplains of the Tanqua River with mesquite tree (*Prosopis velutina*) and ganna shrub (*Salsola* sp.). (Photo D'Reull de Beer)

According to the South African National Biodiversity Institute Vegetation Map (2006-2018) the Tanqua Karoo and Tanqua Wash Riviere vegetation types are found in the Stonehenge Protected Environment (Figure 3.11). Van der Merwe et al. (2015) described the vegetation of the Tanqua Karoo National Park in more detail according to landscape units and, since the vegetation of the Stonehenge Protected Environment is the same as the western part of the National Park, the vegetation here will be described according to these landscape units (Figure 3.12).

#### 3.3.4.1 SKv5 Tanqua Karoo

This vegetation type consists of perennial dwarf shrublands, all of which are very low in cover. Sub units of this type are delineated according to landscape units as described by Van der Merwe et al., 2015 (Figure 3.12). In general, the same species are found in all 4 landscapes of the Tanqua Karoo vegetation type but the percentage of cover may differ.

##### *3.3.4.1.1 Sub unit 1: Bo-Stompiesfontein undulating plains (Figures 3.8 & 3.12)*

This is a predominantly flat to slightly undulating landscape (Rubin, 1998; Van der Merwe et al., 2015) and is comprised of claystone, tillite, diamictite and subsidiary shale with some dolerite intrusions. In the western section of the Stonehenge Protected Environment most of this unit has a layer of grey-black to shiny-black desert paving gravel. This unit contains large denuded areas that may be particularly sensitive to physical disturbance (Van der Merwe et al., 2015).

Vegetation cover is very low (<5%) and consist of dwarf shrubs. After good rains, grasses can cover up to 10–20% of sandy areas. The palatable grasses, langbeenboesmangras (*Stipagrostis ciliata*) and kortbeenboesmangras (*Stipagrostis obtusa*), will be grazed off almost immediately. Another noteworthy grass species is the unpalatable steekgras (*Cladoraphis spinosa*) which is present at times and also closely associated with reddish sandy patches. Annuals are generally absent or have a low cover of less than 5%. Dwarf shrubs that are, or might be found here, include bobbejaankos (*Augea capensis*), vleisbos or donkiebos (*Mesembryanthemum noctiflorum*), geelbos or kraalbos (*Galenia africana*), slangbesseie or kriedoring (*Lycium* sp.), geelvingertjies (*Malephora crassa*), doringvygie (*Ruschia intricata*), ganna (*Salsola* sp.), kleinskaapbossie (*Osteospermum sinuata*) and kleinskilpadbos (*Tetraena chrysopteron*).

##### *3.3.4.1.2 Sub unit 2: Grasberg undulating hills (Figures 3.12)*

This landscape unit is situated in the central part of the Stonehenge Protected Environment (Figure 3.12) and includes dolerite plateaus with slightly undulating topography and low shale mounds protruding through the dolerite, limestone outcrops and shales. The soil-rock complex is dominated by rocks or rock paving. Limestone outcrops are found in localised areas below the dolerite plateaus. Brackish alluvial soils are also found in this unit, with vegetation differing according to the salinity of these soils (Rubin, 1998; Van der Merwe et al., 2015).

The dwarfshrub cover is higher (up to 30%), whereas the grass component is absent, and annual cover is very low. Species to this landscape unit are vleisbos or donkiebos (*Mesembryanthemum noctiflorum*), geelvingertjies (*Malephora crassa*), doringvygie (*Ruschia intricata*), ganna (*Salsola* sp.), kleinskaapbossie (*Osteospermum sinuata*) and kleinskilpadbos (*Tetraena chrysopteron*).



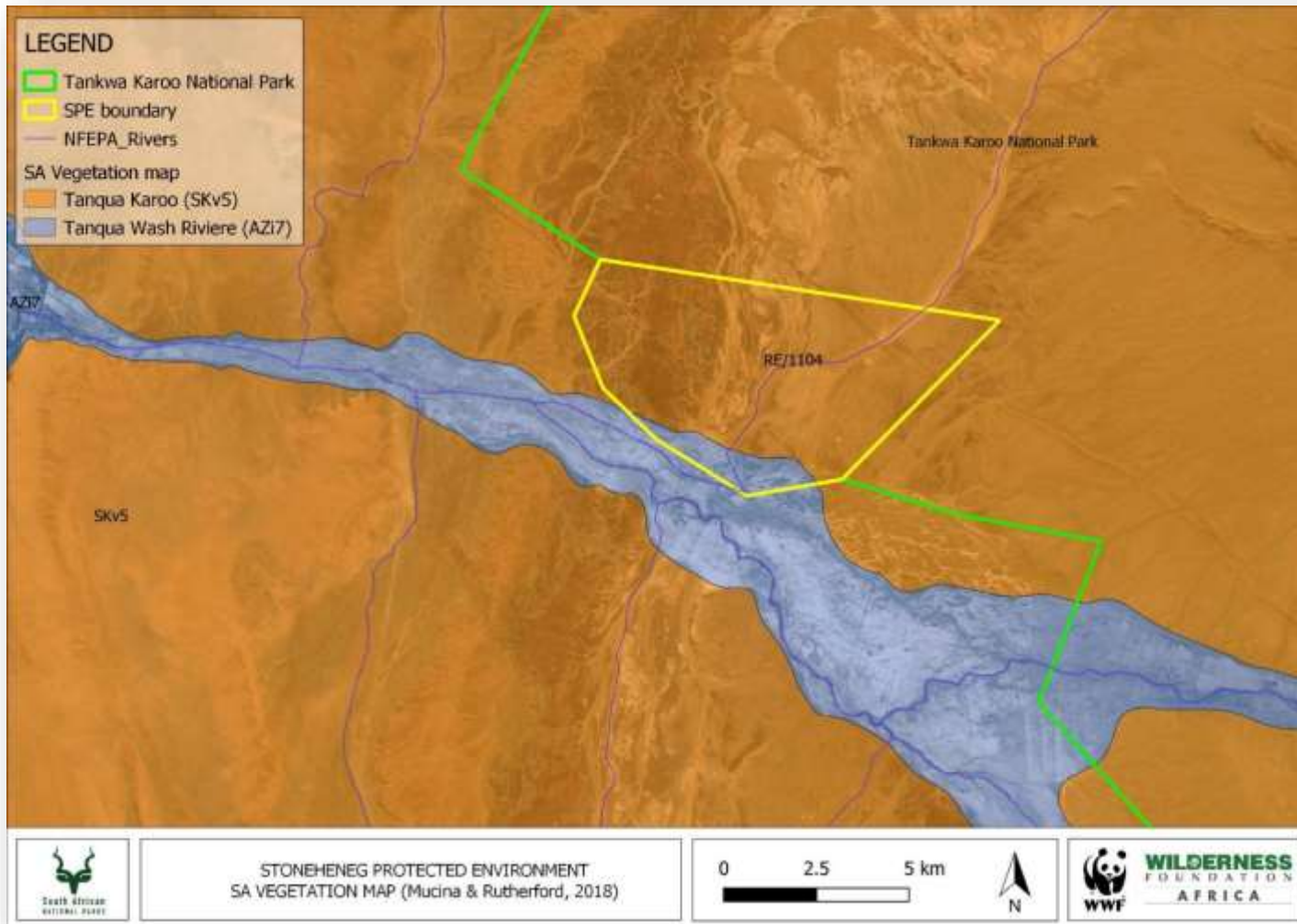


Figure 3. 11 Vegetation map of the Stonehenge Protected Environment (South African National Biodiversity Institute Vegetation Map, 2006-2018).

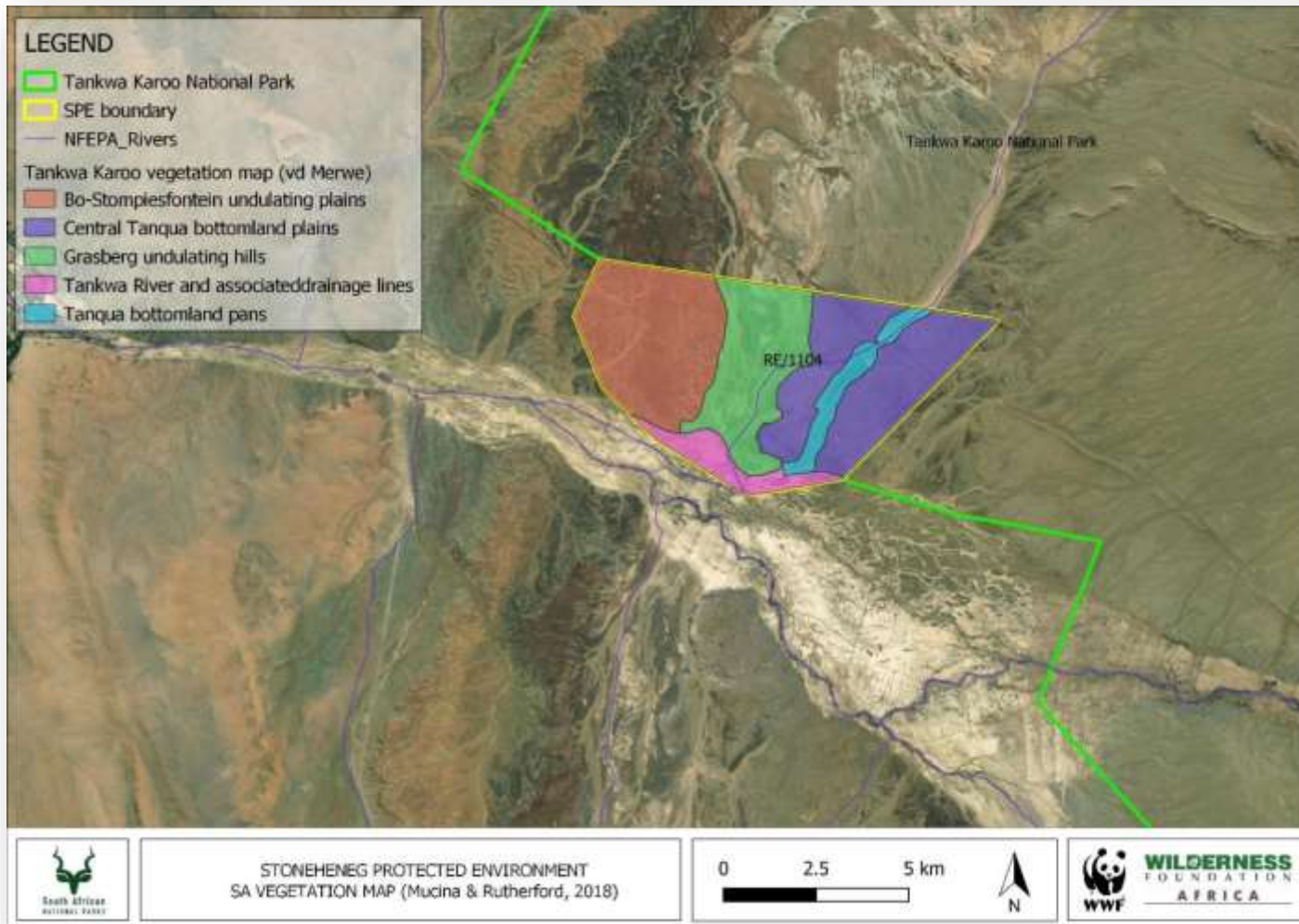


Figure 3.12 Landscape unit map of the Stonehenge Protected Environment as extrapolated according to Van der Merwe et al. (2015).



#### 3.3.4.1.3 Sub unit 3: Central Tanqua bottomland plains (Figures 3.9, 3.12 & 3.13)

The Central Tanqua bottomland plains unit is found in the eastern section of the Stonehenge Protected Environment and varies from flat to slightly concave plains of shale with dolerite intrusions. The sandy plains and isolated ridges generally have no rock cover, or have high cover in localised ridge patches, with a 60 to 90% cover of gravel and small stones. The sandy soils vary in colour from light brown to brown to red brown (Rubin, 1998; Van der Merwe et al., 2015).

Vegetation canopy cover is low and the soil surface is generally flat and covered with shale, gravel and/or sand. Dwarfshrub cover is less than 20% with bobbejaankos (*Augea capensis*), vleisbos or donkiebos (*Mesembryanthemum noctiflorum*), haarslaai (*Mesembryanthemum vaginatum*), geelbos or kraalbos (*Galenia africana*), slangbesseie or kriedoring (*Lycium* sp.), geelvingertjies (*Malephora crassa*), doringvygie (*Ruschia intricata*), ganna (*Salsola* sp.), kleinskaapbossie (*Osteospermum sinuata*) and kleinskilpadbos (*Tetraena chrysopteron*). Grass cover ranges is less than 10% with palatable grasses, langbeenboesmangras (*Stipagrostis ciliata*) and kortbeenboesmangras (*Stipagrostis obtusa*), which are grazed down almost immediately after good rains. Annuals are generally absent or have less than 5% cover.



**Figure 3.13** The Tanqua Karoo vegetation type of the Central Tanqua bottomland plains, with slightly higher vegetation cover, found on shale desert paving of the Tierberg Formation with haarslaai (*Mesembryanthemum vaginatum*) near Luiperdskop. (Photo Ben-Jon Dreyer)

#### 3.3.4.1.4 Sub unit 4: Tanqua bottomland pans (Figures 3.12 & 14)

This landscape unit of shale and siltstone with alluvium and some dolerite intrusions cuts through the Central Tanqua bottomland plains. The soils are high in silt, often with more silt than clay (Rubin, 1998; Van der Merwe *et al.*, 2015). The flat, alluvial floors are generally denuded of vegetation during the dry season, but after good rain, these floors are rapidly covered by succulent forbs.

Plant species such as vleisbos or donkiebos (*Mesembryanthemum noctiflorum*), geelvingertjies (*Malephora crassa*), doringvygie (*Ruschia intricata*), and kleinskaapbossie (*Osteospermum sinuata*) are found here. Wind driven sand, exposed due to vegetation degradation, frequently accumulates producing elevated shrub clumps (mostly ganna (*Salsola* sp.) with steekgras (*Cladoraphis spinosa*) present around the sandy edges of the alluvial floors (Rubin, 1998; Van der Merwe *et al.*, 2015).



**Figure 3.14** The Tanqua Karoo vegetation type of the Tanqua bottomland pans at the northern boundary of the Stonehenge Protected Environment on alluvium floors of silt and clay on shale and siltstone. (Photo Ben-Jon Dreyer)

#### 3.3.4.2 AZi7 Tanqua Wash Riviere

This vegetation type (South African National Biodiversity Institute Vegetation Map, 2006-2018) is found in the usually dry Tankwa River and associated with the drainage lines landscape unit of Van der Merwe *et al.* (2015) (Figures 3.10, 3.11 & 3.12). Figure 3.15 indicates the stark transition between the Tanqua Karoo and Tanqua Wash Riviere vegetation types.

The Tankwa is a river and major drainage line traversing the Tanqua Karoo basin. Recent alluvium silt and sand is derived from mudstone, siltstone, sandstone and shale. Dolerite intrusions are also found in this landscape unit.

Trees such as Karoo-doring (*Vachellia karroo*) and the more dominant mesquite (*Prosopis velutina*) as well as shrubs like kriedoring (*Lycium* sp.) and dwarfshrubs like ganna (*Salsola* sp.) and kraalbos of geelbos (*Galenia africana*) are found in this river wash (Figures 3.10). The grass volstruisdoring (*Cladoraphis spinosa*) is also found here.

There are numerous, historical, derelict, flood-irrigated agricultural lands which exploited the more water favourable conditions along the drainage system that are found in the wash. These are still present although not used for agricultural purposes anymore. Rehabilitation of these disturbances are generally considered unfeasible and cost intensive should it be considered for certain areas.



**Figure 3.15** Aerial image indicating stark transition between Tanqua Karoo and Tanqua Wash Riviere vegetation types on Stonehenge Protected Environment (Photo: Ben-Jon Dreyer)

### 3.3.5 Mammals

The Namaqualand district and the Succulent Karoo as a whole, hosts a variety of mammal species. Small mammals, especially, often play an important role in most arid and semi-arid environments (Van Deventer & Nel, 2006).

There are about 75 mammal species recorded for the Succulent Karoo biome (CEPF, 2021) and 44 mammal species recorded for the Tankwa Karoo National Park (Appendix E). Apart from some of the reintroduced large mammals in the Park, it can be expected that most of the mammals recorded for the park occur on, or occasionally move through the Stonehenge PE.

Although a comprehensive inventory for the fauna of SPE has not yet been completed, species lists can be obtained for specific areas from the FitzPatrick Institute of African Ornithology's, Virtual Museum. See Appendix C for the mammal list recorded for 'Tankwa conservation area' referred to in the Virtual museum's database.

### 3.3.6 Avifauna

The Tankwa Karoo National Park is renowned for good Karoo birding. 187 bird species have been documented for the Park to date.

The 'South African Bird Atlas Project' (SABAP) includes a coverage map made up of geographical "pentads". These pentads are 5-minute by 5-minute coordinate grids which are overlain across Southern Africa and contain records of bird species which have previously been identified in a specific pentad.

Stonehenge PE overlaps with four of these pentads, namely 3215\_1940, 3215\_1945, 3220\_1940 and 3220\_1945 (see figure 3.16). 55 different bird species have been recorded through the SABAP for the SPE. The bird species list can be referred to in Appendix D.



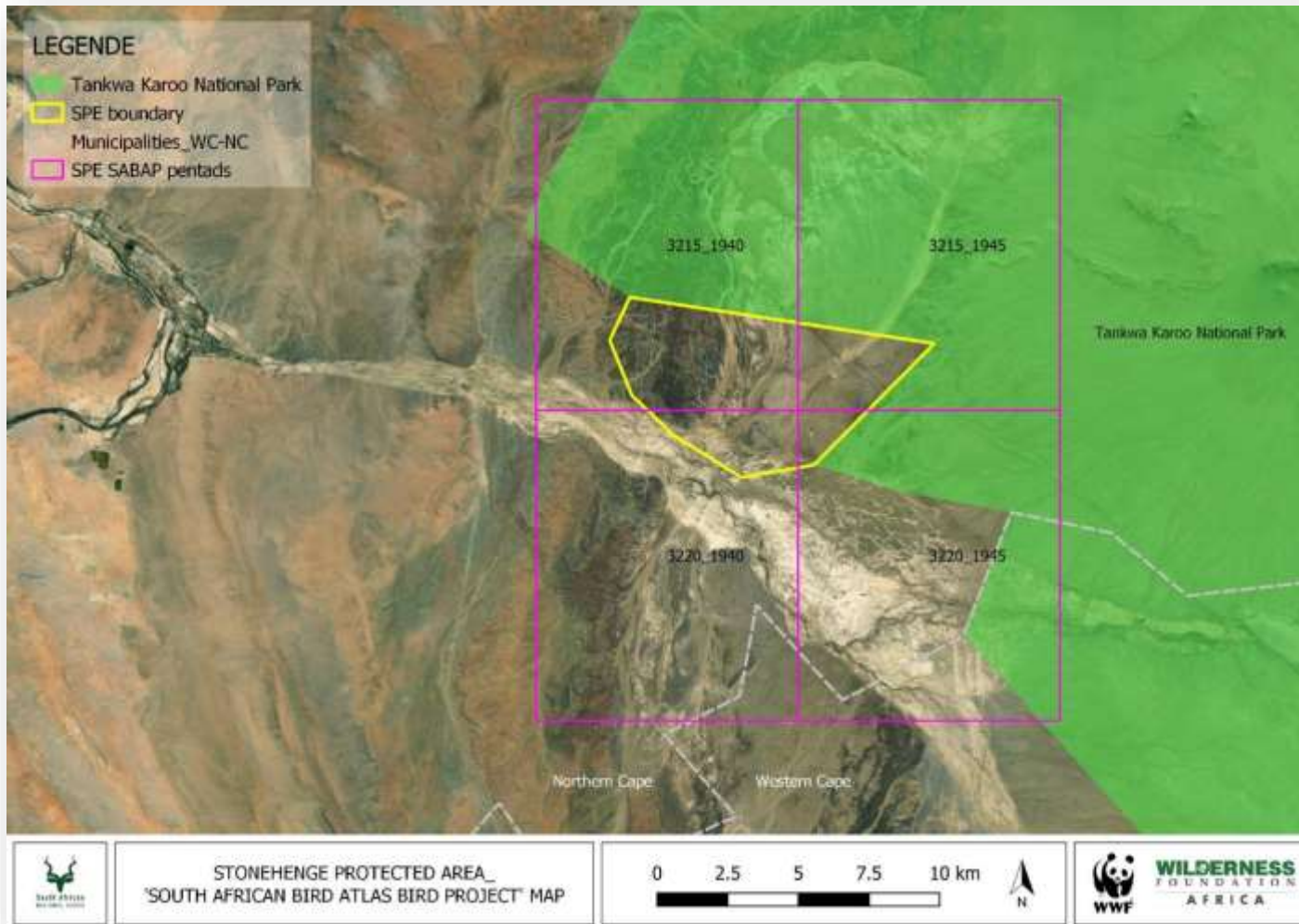


Figure 3. 16 Stonehenge PE South African Bird Atlas Project pentads

## 3.4 Cultural heritage context of Stonehenge Protected Environment

Recent archaeological research in the Tankwa Karoo to Cederberg Wilderness Corridor (TKWC/ the Corridor) has resulted in several peer reviewed journal articles published about the Middle Stone Age hunter-gatherers in this area. These studies have led to significant archaeological discoveries in the Tankwa Karoo including in the Corridor. Much of the research thus far focussed on the 'Twefontein' site, which borders the Stonehenge PE inside the Corridor. This site is now considered to be the largest Middle Stone Age \*unifacial point (Figure 3.17) assemblage in the Northern and Western Cape for both open air and rock shelter sites. These discoveries are important for understanding Middle Stone Age adaptations to an arid, marginal environment. (Antiquity, 2015.)

A survey centred on a 30km long linear transect of the Tankwa River resulted in recording over 7000 artefacts at 45 different localities (Hallinan & Shaw, 2015), emphasizing the archaeological significance of the area..

Emily Hallinan published her PhD thesis '*Variation and modernity in Middle Stone Age landscape use in the Western and Northern Cape, South Africa*' which included work done on the 'Twefontein' site: (<https://www.repository.cam.ac.uk/handle/1810/292442>).

Herewith the abstract of the study:

*"New research in the arid Tankwa Karoo region of the South African interior has revealed a rich surface artefact record including a novel method of point production, recognised as Nubian Levallois technology in Late Pleistocene North Africa, Arabia and the Levant. We analysed 121 Nubian cores and associated points from the surface site Twefontein against the strict criteria which are used to define Nubian technology elsewhere. We propose that the occurrence of this distinctive technology at numerous localities in the Tankwa Karoo region reflects an environment-specific adaptation in line with technological regionalisation seen more widely in \*\*MIS 3. The arid setting of these assemblages in the Tankwa Karoo compares with the desert context of Nubian technology globally, consistent with convergent evolution in our case. The South African evidence contributes an alternative perspective on Nubian technology removed from the 'dispersal' or 'diffusion' scenarios of the debate surrounding its origin and spread within and out of Africa."*

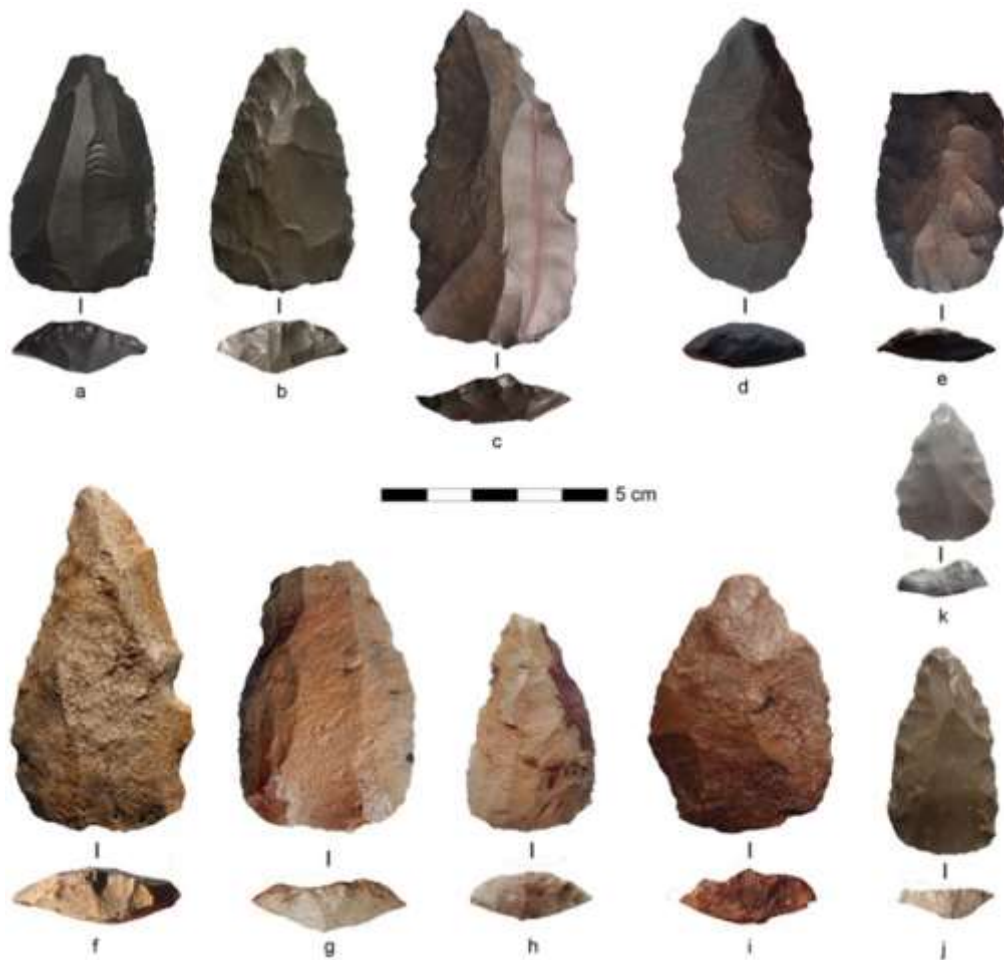
Along with Matthew Shaw, Emily Hallinan also published '*Nubian Levallois reduction strategies in the Tankwa Karoo, South Africa*' (<https://journals.plos.org/plosone/article/authors?id=10.1371/journal.pone.0241068>). A popular article on their 'Twefontein' work can be found at <http://www.antiquity.ac.uk/projgall/hallinan344>.

These reports contain in depth information related to the archaeological significance of the Tankwa Karoo area and the Corridor.

---

\* *unifacial* = single bevel of a stone formed as the working edge; *Bifacial* = both sides of stone sharpened as working edges

\*\*MIS 3: *Marine Isotope Stage 3. (MIS 2-4 is called the Last Glacial Period, Wisconsinan glaciation in North America, Weichselian glaciation in Europe)*



**Figure 3.171** Unifacial points collected on neighbouring f. Displaying a range of morphologies and Stone Age technologies; raw materials: a–c) hornfels; d–e) dolerite; f–i) silcrete; j & k) chert found at Tweefontein (Hallinan & Shaw, 2020).

Petrified wood (Figure 3.18) collected on Stonehenge Protected Environment, has provisionally been identified by Marion Bamford (paleobotanist at WITS University) as being from the genus *\*Agathoxylon* from the Ecca or Beauford groups. *Agathoxylon* is an extinct species of conifer-like wood that belonged to the Glossopteris group

Nomadic pastoralism first brought sheep into the succulent Karoo about 2000 years ago, and cattle some 1500 years later. The European pastoralist ('trekboere'/ transhumance farmers) who moved northwards from the Cape Peninsula in the 18<sup>th</sup> century were nomadic, moving with their flocks to suitable grazing. Sheep farmers moved into the Tankwa and Roggeveld areas in the mid-eighteenth century. In the 19<sup>th</sup> century the Succulent Karoo became the first biome used for settled European pastoralism. (Tankwa Karoo National Park Management Plan, 2014)

---

\* *Agathoxylon* is a form genus of Araucarian family fossil wood, including massive tree trunks. Although identified from the late Palaeozoic to the end of the Mesozoic, *Agathoxylon* is common from the Carboniferous to Triassic periods.

Names of places in the TKCWC that can be traced back to the original Khoi people who utilised the area:

- 'Tanqua River': Refer to the San. 'Sanqua' and 'Sonqua' is also used.
- 'Tra-Tra River': Densely vegetated / bushy (Referring to the river and mountains (Khoisan place names, 2005, unpublished)



**Figure 3.18** Sections of petrified wood (*Agathoxylon* genus) collected on Stonehenge Protected Environment (Collected and photographed by Andrée Bonthuys)



### 3.5 Socio economic context of Stonehenge Protected Environment

The Stonehenge Protected Environment (SPE) is located in the Namaqua District Municipality and Hantam Local Municipality. Based on 2019 statistics the local government (R364m) subsector is the largest economic contributor with agriculture (R249m) in the form of livestock farming coming in second (Hantam IDP, 2021). Tourism has become an increasingly significant contributor to the local economy in recent years.

Table 3. 2 Hantam Local municipality at a glance (Hantam IDP, 2021)

Total municipal area (km <sup>2</sup> )		Demographics (in 2019)					
		Population	20 860	Households	6 196	Average household size	3.5
Education in 2016 (Northern Cape)		Poverty: Proportion of households (in 2011)					
Learner-School Ratio	509: was 501 in 2014	With no income			6.8%		
Educator-School Ratio	15.9: also 15.9 in 2014	Earning less than R4800 per annum			9.3%		
Access to basic services by households in 2019 as a percentage (percentage change since 2011 in brackets)							
Piped water inside dwelling	58.8% (-1.6%)	Flush toilet connected to sewerage	75.7% (41.7%)	Electricity for lighting	76.4% (0.1%)	Refuse removal	73.1% (1.5%)
Economy (2010 —2017)				Labour in 2017			
Average GDP growth (%)		8.9%		Unemployment rate		10.2%: was 9.6% in 2016	
Largest economic subsectors by contribution to municipal GVA in 2019 (R millions current prices in brackets)							
General government (R364m)		Agriculture (R249m)		Transport, storage and communication (R224m)		Wholesale and retail trade, catering and accommodation (R191m)	
Safety and security – actual number of crimes in 2019 in Hantam Municipality (Namaqua district in brackets)							
Serious crimes	Driving under the influence	Drug-related crime		Murders		Sexual offences	
732: was 993 in 2018 (4678: was 4766 in 2018)	17: was 16 in 2018 (67: was 79 in 2018)	141: was 335 in 2018 (651: was 1085 in 2018)		4: was 5 in 2018 (22: was 21 in 2018)		21: was 19 in 2018 (144: was 132 in 2018)	

The Biodiversity Sector Plan (2008) for the Namaqua District Municipality, states that conservation contributes significantly towards the socio-economic wellbeing of the district. The proclamation of protected areas such as that of the Stonehenge PE is important as these areas provide a platform for conservation, but also economic opportunities such as ecotourism and sustainable resource use.

## 4. IMPORTANT BIODIVERSITY OF THE STONEHENGE PROTECTED ENVIRONMENT

The contributions and importance of the Stonehenge PE with respect to conservation planning strategies, biodiversity patterns and processes are described in this section.

Main reasons for declaring the Stonehenge Protected Environment (SPE):

- The Property is included in the Tankwa Karoo National Park’s expansion footprint and a primary focus area in the National Protected Areas Expansion Strategy;
- The Property borders the Tankwa Karoo National Park for 17km, is 3161ha in size and is therefore strategically significant in establishing the Tankwa Karoo to Cederberg Wilderness Corridor;

- SPE contributes to conservation targets of two vegetation units in need of supplementary protection. (Contributions: Tanqua Wash Riviere 0.63% and Tanqua Karoo 2.19%);
- Stonehenge is a tier 2 Critical Biodiversity Area (see 4.1.1);
- The Tanqua River forms the southern section of SPE and is a National Fresh Water Ecosystem Priority Area. Securing the Property will improve ecological connectivity as the Tankwa river is an important natural migration corridor between the Roggeveld and Cederberg areas; and
- Ecological management between the Tankwa Karoo National Park and SPE will improve through broader landscape conservation initiatives such as a consolidated alien and invasive plant clearing strategy.

## 4.1 Protected Area Expansion Strategies and Implementation Plans

The National Protected Areas Expansion Strategy (NPAES) (DEA, 2016) has collated information related to the expansion of each province’s protected area estate. The strategy includes a framework for the expansion of protected areas in the country and it identifies priority protected areas expansion zones and recommends mechanisms for achieving these expansion targets.

Broadly incorporated into the NPAES, South African National Parks also has an expansion strategy in place for the Tankwa Karoo National Park. This strategy is in the form of a land inclusion plan and recommends various mechanisms to secure properties. SPE is a priority expansion property in the SANParks land inclusion plan.

### 4.1.1 Critical Biodiversity Areas (CBA)

The Northern Cape Critical Biodiversity Areas (CBA) Map is the product of a systematic biodiversity planning assessment that delineates Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) which require safeguarding to ensure the continued existence and functioning of species and ecosystems. This includes the delivery of ecosystem services across terrestrial and freshwater systems. These spatial priorities are also used to inform sustainable development and land use in the Northern Cape Province.

The SPE is CBA2 area (Figure 4.1 and Table 4.1)

**Table 4. 1** CBA contribution figures for Stonehenge PE

<b>CBA type</b>	<b>ha</b>	<b>% of property</b>
<b>CBA1</b>	0.0000	0.00%
<b>CBA2</b>	3161.5238	100.00%
<b>ESA</b>	0.0000	0.00%
<b>other natural areas</b>	0.0000	0.00%
<b>Total area</b>	3161.5238	100.00%

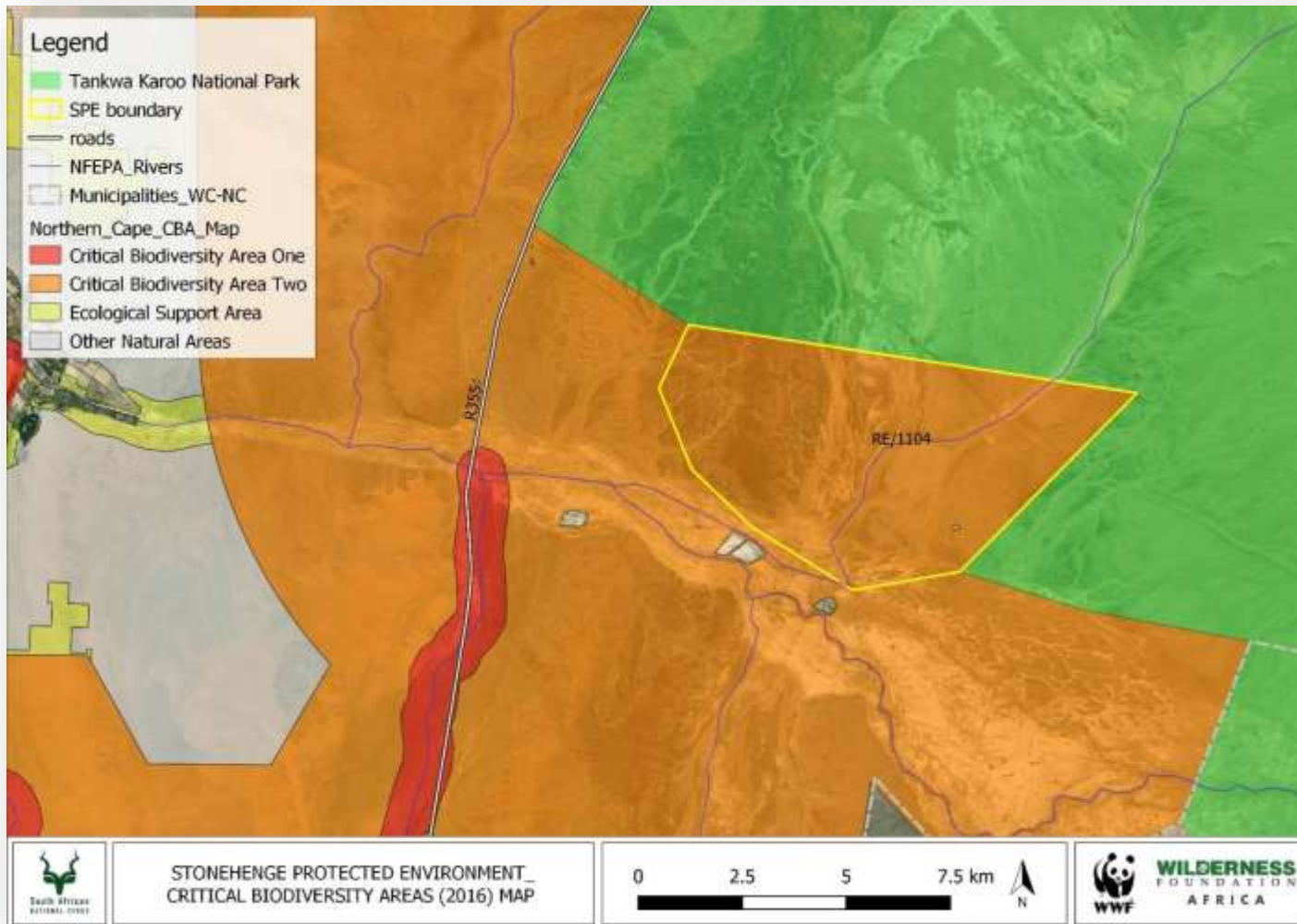


Figure 4. 1 Critical Biodiversity Areas Map for Stonehenge Protected Environment

## 4.2 Contributions to the conservation of biodiversity patterns

The Stonehenge PE contributes to protecting two poorly protected vegetation types which is listed as a 'least concern' red list ecosystem.

**Table 4. 2** SPE contributions to national conservation targets per vegetation type

Ecosystem	ha contribution	National target ha	cons. % contribution
AZi7 -Tanqua Wash Riviere	254.030832	40448.42959	0.63%
SKv5- Tanqua Karoo	2907.492968	132716.7433	2.19%
	3161.5238		

**Table 4.3** SPE Ecosystem types, conservation and protection status

Ecosystem	Conservation status	Protection status
AZi7 -Tanqua Wash Riviere	Least concerned	Moderately Protected
SKv5- Tanqua Karoo	Least concerned	Moderately Protected

## 4.3 Contributions to the conservation of biodiversity processes

Stonehenge PE is located on the eastern edge of the proposed Tankwa Karoo to Cederberg Wilderness Corridor (TKCWC). The property does not contribute significantly to upland-lowland linkages within its cadastral scale borders, but is an anchor property in connecting the Corridor to the Tankwa Karoo National Park.

Stonehenge PE is also located in the 'Rainshadow Valley Karoo Bioregion' with Tanqua Karoo (SKv5) as the dominant vegetation type locked in between the Cederberg and Roggeveld escarpments. As a result of the scarcity of natural surface water sources, riparian zones (dry river beds in the case of the TKCWC) are often used as natural movement and migration corridors in this landscape, the TKCWC properties were selected primarily as they are located along the Tankwa/Doring/Tra-Tra River system.

The Stonehenge PE contributes to the conservation of the confluence of four NFEPA rivers at Elandsvlei which forms part of the Oliphant's-Doring River System. SPE is therefore key in terms of ecological connectivity for the mega interprovincial protected area.

## 4.4 Contributions to the conservation of ecosystem goods and services

The Stonehenge PE contributes to the conservation of ecosystem services by:

- *Water security:* As discussed in 4.3, Stonehenge Protected Environment is an anchor property in connecting the Corridor and especially the riparian zones of five NFEPA rivers which confluence near the Elandsvley property close by. Even though the Tankwa Karoo region qualifies as a semi-desert and rivers are primarily seasonal, the conservation of Stonehenge PE contributes to improved catchment management and the provision of ground water (surface water to a lesser extent) for properties downstream.
- *Ecological connectivity:* Consolidation of the 17km wedged boundary between the Park and SPE is a significant contribution. Removing the 17km fence along this boundary with the Park will contribute to improved ecological connectivity between the Park and the Corridor and also shorten the fence line significantly. (The legalities and feasibility of the removal of the fence line still need to be established.)
- *Socio economic (Tourism):* Ecosystem services on SPE include ecotourism and hospitality based activities which have been a significant contributor to job creation in the region for more than a decade. Due to the Tankwa Karoo's desert and wilderness like landscape and relatively close proximity to Cape Town, eco-tourism has become increasingly popular in the region. This has resulted in the Tankwa Karoo becoming a well-established tourist destination. Protecting the Stonehenge PE, the Corridor and broader Tankwa Karoo landscape will therefore contribute to tourism and increase the associated socio economic benefits.

## 4.5 Species of special concern

No species of special concern have yet been recorded for Stonehenge PE.

## 4.6 Threats to biodiversity

### 4.6.1 Shale Mining

Historically, small scale shale mining occurred on the shale ridge on neighbouring properties (Figure 4.2). The impact of shale mining is irreparable and future shale extraction should be avoided for the SPE.

### 4.6.2 Alien invasive plants

Alien and invasive plants are less of a threat to the Tankwa Karoo vegetation type. *Prosopis* species have invaded in this vegetation type, but can be relatively easily managed at low cost. The Tankwa Wash Riviere vegetation type and associated areas are infested by *Prosopis glandulosa* at greater densities and will require more resources and systematic approach to be managed.

### 4.6.3 Wash Riviere transformation

The transformation of large portions of the Tankwa river bed/ 'washes' can be observed along this river. Historically farmers cultivated lucerne and planted other grazing in the Tankwa River by means



of flood irrigation. This was done by manipulating water flow in the river bed through the construction of earth berms and terraces (Figure 6.2).

This planted grazing practice is now less common in the corridor due to diminishing surface and ground water resources, but is still considered a significant threat for the area. Rehabilitation of these transformed areas can be considered, but would require considerable resources to do so. Further transformation of the river washes should be avoided at all cost.

#### 4.6.4 Irresponsible tourism

The Tankwa Karoo attracts many 4x4 and motor cycle enthusiasts. Off road driving with these vehicles leave scars in the landscape that will last many decades (Figure 4.3). This is a major threat to the SPE and rest of the Corridor which could be mitigated through educating visitors of the sensitive nature of the landscape. Non-intrusive signage and other awareness initiatives can be considered. 4x4 best practice guidelines can be rolled out to visitors to the area.

As enduro motorcycle events are one of the hosted activities on the SPE, there should be firm guidelines set out by the Management Authority and rolled out to participants.



Figure 4. 2 Impacts of shale mining neighbouring property.



**Figure 4.3** Impacts of irresponsible tourism. Scars left behind on the SPE by drivers of off road vehicles.

## 5. LEGAL AND ADMINISTRATIVE FRAMEWORK

### 5.1 Legal and Policy Framework

#### 5.1.1 National Environmental Management: Protected Areas Act, No. 57 of 2003

The National Environmental Management: Protected Areas Act, No. 57 of 2003, aims to provide a representative network of protected areas on state, private and communal land, and to promote the sustainable utilisation of protected areas.

The Act encourages local community participation in the management of protected areas and balances the relationship between the environment, biodiversity, human settlement and economic development. The Act establishes the platform for biodiversity stewardship by creating a legal framework for cooperation between the state and landowners for the declaration and management of protected areas.

#### 5.1.2 National Environmental Management: Biodiversity Act, No. 10 of 2004

The National Environmental Management: Biodiversity Act, No. 10 of 2004, provides planning instruments for various aspects of biodiversity conservation. The planning tools provided for in the act are aimed at assisting provincial authorities and conservation agencies in identifying biodiversity priorities and addressing threats. The identified tools include the National Biodiversity Framework, bioregional plans, biodiversity management plans, the listing of threatened and protected species or ecosystems, and the control and enforcement of species and organisms posing a potential threat to biodiversity.

Section 76(1) of the Biodiversity Act states that the management authority of a protected area must incorporate into the management plan an invasive species control and eradication strategy.

#### 5.1.3 National Environmental Management Act: EIA Regulations, GNR. 543 of 2010

The National Environmental Management Act EIA Regulations of 2010 lists activities that cannot proceed without prior environmental authorisation. Dependent on the nature of the activities, and on which listing notice applies, authorisation may require either a Basic Assessment process or a Scoping and Environmental Impact Reporting process. It is important to note that the existence of a biodiversity stewardship agreement does not negate the requirement for environmental authorisation should the landowner or any other party wish to pursue a listed activity.

#### 5.1.4 National Veld and Forest Fire Act, No. 101 of 1998

In terms of the National Veld and Forest Fire Act, No. 101 of 1998, landowners may form fire protection associations for the purpose of predicting, preventing, managing and extinguishing veld fires.

#### 5.1.5 Conservation of Agricultural Resources Act, No. 43 of 1983

The Conservation of Agricultural Resources Act, No. 43 of 1983 is an act of the National Department of Agriculture and makes provision for the conservation of the natural agricultural resources of South Africa. The aim of the act is to ensure landowners maintain the production potential of land, combat

and prevent soil erosion, prevent the weakening or destruction of water sources, protect the indigenous vegetation and combat weeds and invader plants.

### 5.1.6 Protected Area Management Agreement for the Stonehenge Protected Environment, 2020

The Protected Area Management Agreement for the Stonehenge Protected Environment is an agreement between the landowners and South African National Parks governing the management of the Protected Environment. The agreement is the foundation for the current management plan and outlines the agreed upon management objectives for the Protected Environment.

## 5.2 Administrative Framework

The owner of the property, Tankwa Tented Camp (PTY) LTD, herein represented by Jean Pierre de Villiers by way of a written resolution signed by all company directors, has been appointed as the Management Authority of the Stonehenge Protected Environment. This appointment was made as per the declaration documents signed between South African National Parks and the Tankwa Tented Camp (PTY) LTD.

The South African National Parks is the national conservation body responsible for facilitating the proclamation of the SPE through the Department of Forestry, Fisheries and Environment (DFFE) as a Protected Environment under Section 28(1) of the National Environmental Management: Protected Areas Act (Act 57 of 2003).

Management decisions can be made through liaison between the Management Authority and SANParks, however the Management Authority will ultimately remain responsible for final decisions made and the overall management of the Protected Environment, while SANParks will be responsible for maintaining the SPE by conducting annual audits and supporting the landowners with technical advice.

## 6. PROTECTED AREA POLICIES AND OPERATIONAL MANAGEMENT FRAMEWORK

### 6.1 Policy statements and guiding management principles

#### 6.1.1 Veld condition management

Grazing by game and general veld management will be managed in line with the, *The Tankwa Karoo to Cederberg Wilderness Corridor Ecological Management Guidelines (2021)*, document. These guidelines were specifically developed with landowners, Department Agriculture, SANParks, SAEON, DAELR, WWF-SA, CapeNature, University of Cape Town and WFA to inform and promote sustainable land use on Protected Areas within the Tankwa Karoo to Cederberg Wilderness Corridor.

### 6.1.2 Wildlife management

The Stonehenge Protected Environment aims to promote the conservation of indigenous wildlife through the implementation of effective game management, while contributing towards the rehabilitation of plant growth and overall ecosystem functioning of the property.

Historically most large game species would have migrated through the area without staying in one place for too long, with the vegetation responding accordingly. For this reason, high numbers of confined game could easily result in permanent damage to the cover and condition of vegetation. While there are currently not high numbers of game on the SPE, it is important that these resident populations are monitored in terms of numbers and their consequent impact on vegetation. Game management could possibly take on a “corridor” wide approach in the future with the long-term aim of improving connectivity between the TKNP and the remainder of the TKCWC properties.

### 6.1.3 Alien invasive plant control

Invasive alien plant species which occur in the Stonehenge Protected Environment will be treated according to the categories and directives listed in the National Environmental Management: Biodiversity Act (No. 10 of 2004), through implementation of a strategic clearing plan. This plan will prioritise species according to objectives, with effective management techniques and monitoring guidelines. The plan will also allow, as applicable, for the management authority to exclude individual plants/trees, from clearing operations. This includes species such as *Prosopis glandulosa* which are often utilised for shade around the main rest camp and campsites. The MA will however still have the responsibility of demarcating such individuals/groups of plants, and ensuring systems are in place to control their spread as required by NEMBA. Naturally occurring indigenous trees will also be planted in areas where shade is required as part of a succession plan to replace shade providing AIP's.

### 6.1.4 Soil erosion and landscape degradation

There are limited signs of soil erosion present on the SPE. This is mainly due to the relatively flat topography across the property, coupled with low rainfall and rocky soils. Most degradation on the SPE is linked to redundant structures in riparian areas which were used during past flood irrigation practices and unauthorized off-road driving by visitors and other vehicles passing through.

Although the Management Authority aims to re-establish key ecological patterns and processes while limiting the extent of further degradation, the feasibility and effectiveness of any rehabilitation interventions should first be established, especially since such activities will be labour intensive and costly. Specialists in this field should thus be contracted to investigate a possible rehabilitation strategy while input from SANParks Scientific Services will also be obtained as degradation similar to that found in the SPE has previously been addressed in the Tankwa Karoo National Park.

### 6.1.5 Problem Animal Control

Problem animal control will be considered where deemed absolutely necessary and conducted in accordance with the regulations set out in section 63 of the Northern Cape Nature Conservation Act (Act No. 9 of 2009) and in consultation with SANParks.

### 6.1.6 Fire Management

Although the Stonehenge Protected Environment is not situated within a fire prone or driven ecosystem, the Management Authority will still endeavour to comply with legislative requirements pertaining to fires as well as join the nearest local Fire Protection Association (FPA) if there is an active FPA functioning in the area.



### 6.1.7 Monitoring and Research

The Management Authority encourages and supports monitoring and research projects within the Stonehenge Protected Environment, specifically those relevant to informing management actions and decisions as part of an adaptive management strategy.

### 6.1.8 Access Control

The Management Authority will control access to the Stonehenge Protected Environment. SANParks will be granted access upon request, by giving reasonable notice, to fulfil their obligations in terms of monitoring and auditing as set out in the SPE Management Agreement and this Management Plan. The public road which runs through the SPE is a limiting factor in enforcing access control, however since this road also provides passage to the TKNP through its western entrance gate (Oudebaaskraal), there is opportunity for the SPE and TKNP work together in terms of handling permits for access to the Park. Such opportunities will be discussed between the MA and SANParks management.

### 6.1.9 Sustainable Tourism

The SPE has several tourism ventures already being implemented by the Management Authority as part of services offered by the company, Tankwa Tented Camp. These tourism offerings cover a wide range of activities, including walks, mountain biking, self-catering accommodation, art exhibitions and the hosting of large events. Tourism and hospitality serve as the main source of revenue for the company (Tankwa Tented Camp) and will also provide financial support and security towards the management of the property as a Protected Environment. It is however essential that these activities are implemented and established in a sustainable manner which do not compromise the values or threaten the biodiversity and ecological functioning of the SPE.

### 6.1.10 Waste Management

The Management Authority is committed to safe and efficient waste management, to reduce and recycle waste produced and to ensure compliance with all requirements relating to waste management. Best practice waste management activities will be promoted and undertaken in a sustainable manner following the waste management hierarchy of: reducing the amount of waste generated, reuse and recycle and where feasible and dispose of remaining waste in the correct manner.

### 6.1.11 Financial and Human Resources

The necessary management interventions will be funded by the Management Authority. Where possible and justifiable for the organization, SANParks will aim to support the Management Authority with certain management activities, for example alien vegetation clearing as part of their DFFE funded Biodiversity and Social Projects.

The Management Authority furthermore employs and manages staff which can assist with the implementation of general management activities as listed in this management plan.

### 6.1.12 Fencing and infrastructure

Perimeter fences will be maintained and patrolled by the Management Authority in corporation with neighbouring landowners, including SANParks. Unnecessary and redundant internal camp fences will be removed where possible. Other infrastructure essential to the functioning of the SPE, such as water provision infrastructure, will be maintained and installed as required.

### 6.1.13 Natural resource use

The sustainable use of natural resources on the SPE by the landowners is permitted, for example grazing by game and use of wood from cut down AIP's, provided it does not have a negative or detrimental impact on indigenous species and ecological functioning.

### 6.1.14 Cultural Heritage

While the SPE was mainly declared to protect the unique ecological components present on the property, there are also numerous paleontological, archaeological and cultural features in the landscape which need to be discovered, examined and adequately managed. Partnerships with specialists in these fields are necessary to assist with the identification and recording of these important heritage assets to ensure their integrity is conserved and maintained and to allow for further research and knowledge sharing.

## 6.2 Management objectives

### 6.2.1 Alien invasive plant control

***To manage Alien Invasive Plants (AIP) on the property and re-establish natural biodiversity patterns and key processes that support the long-term persistence of biodiversity.***

*Prosopis glandulosa* is the primary alien invasive plant found across the SPE, however annual species might occur after flooding events in dry water courses which have not yet been recorded. The density of *P. glandulosa* infestations varies across the property and is closely linked to the different vegetation units. The Tankwa Wash Riviere (AZi7) vegetation type, which includes three NFEPA Rivers such as the Tankwa River and floodplains, is more susceptible to alien invasive plant infestations, thus densities tend to be higher. While the Tanqua Karoo (SKv5) vegetation unit also contains numerous smaller drainage lines, *P. glandulosa* is mainly restricted to sparsely scattered individuals. The mapping of management units and AIP distribution was done taking the above into account.

Management units with very low infestation densities (<1%) in the SKv5 vegetation unit will be prioritised for cost effective treatment and management purposes. After completion of initial "sweeping" treatments, follow-up treatments can be scheduled on a biennial basis. An \*upstream – downstream approach will be followed in management units with higher densities which fall within the AZi7 vegetation unit.

The following management strategies will be implemented for the treatment of *P. glandulosa* on SPE:

**Early detection / eradication:** Where *P. glandulosa* mostly occurs at low densities outside of the main NFEPA ephemeral rivers and drainage lines, an eradication control strategy should be successful. However, strict monitoring should take place on completed work to ensure follow-up operations are implemented timeously and effectively, especially on coppicing individuals. First follow-up operations should ideally occur within six months of initial treatment where after the interval between treatments can be extended to 12 months, subject to monitoring findings.

**Containment and Control:** There are certain individual *P. glandulosa* specimens which the Management Authority would like to temporarily retain as they serve the purpose of providing shade. These individuals will be identified and demarcated/mapped and are mostly restricted to the main rest camp (Tankwa Tented Camp) and other tourism facilities (High impact zones). Control and replacement measures should be put in place including the collection and burning of seed pods, and

a long-term replacement strategy through the planting of indigenous trees. The feasibility of establishing a nursery for the propagation of *Vachellia karroo* (soetdoring), an indigenous tree which grows naturally in the area, will be investigated by the MA to possibly assist in this regard.

Due to the extent of infestation and associated costs it will not be possible for the MA to adequately implement effective clearing operations their own. The MA will thus seek assistance through the SANParks Biodiversity and Social Projects (BSP), Working for Water Programme while also investigating the possibility of introducing a biocontrol agent, specifically targeting high density infestations in riparian areas.

A combination of the following methods will be used to control AIP's:

- Mechanical (chainsaw/lopping & pruning)
- Chemical (herbicide)
- Manual (hand pulling)
- Biocontrol

Planned management activities include:

- Identify, quantify, and map the extent of all invasive alien plant species on the SPE.
- Use data to draft a Strategic Clearing Plan (SCP). The SCP should include species densities, control methods and follow-up schedules.
- Research adequate biocontrol agents for the control of *P. glandulosa* and its variants, including any legal requirements before release.
- Consult with SANParks regarding the inclusion of the SPE in the Strategic Alien Clearing Lower-Level Plan of the TKNP as part of the Biodiversity and Social Projects (BSP), Working for Water Programme.
- Implement activities as set out in the SCP, including scheduled follow-up treatments.
- Monitor treatment effectiveness as well as for new infestations.
- Clear scattered, less dense areas first before addressing the higher density AIP infested areas i.e. dry river beds.

---

*\*Upstream – downstream alien and invasive plant (AIP) clearing approach: firstly, clear and manage AIPs in upstream areas. Downstream areas to follow after upstream areas are under control and resources are available to clear and manage downstream areas.*

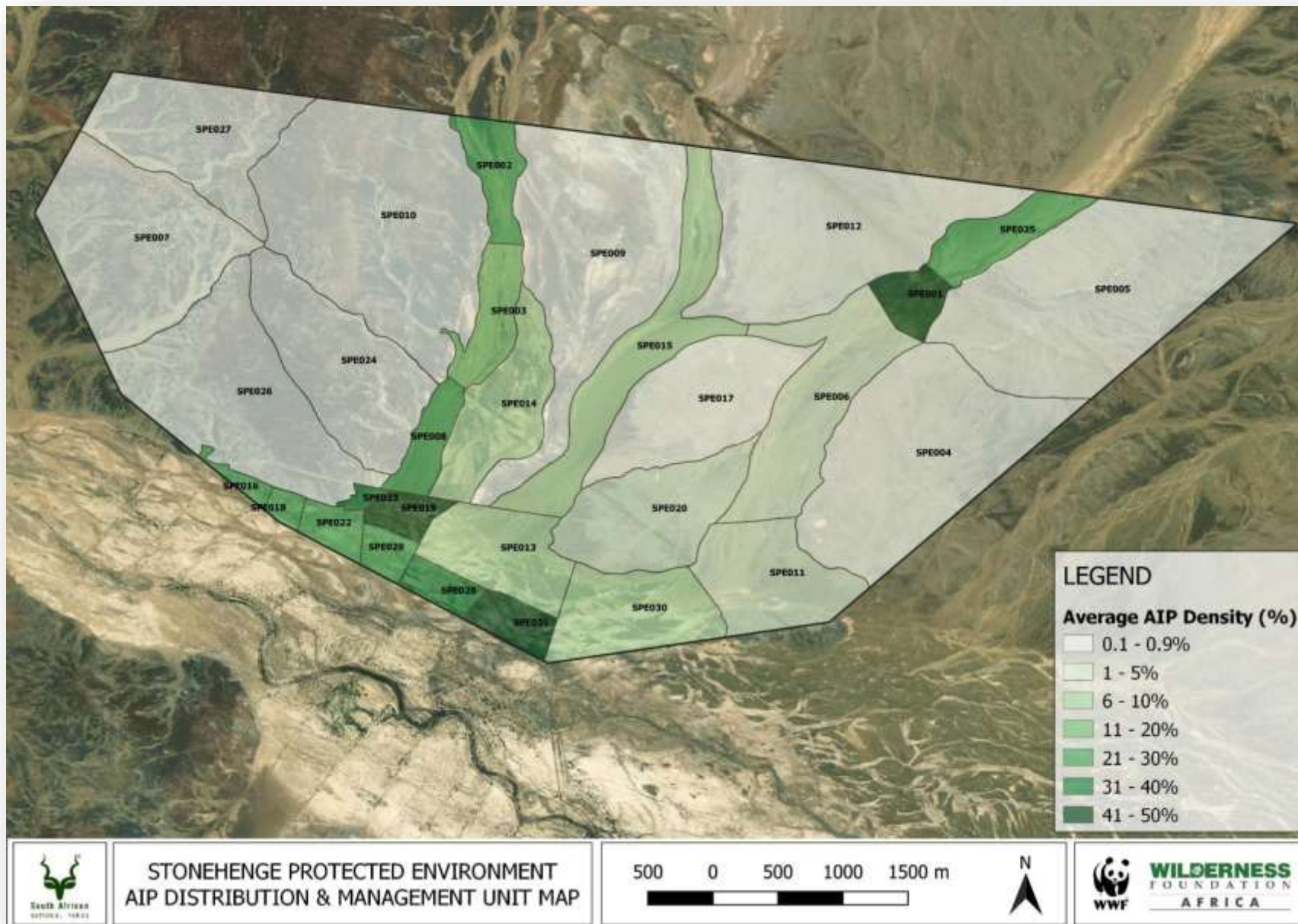


Figure 6. 1 Stonehenge PE Alien and Invasive Plant distribution and management unit map.

## 6.2.2 Soil erosion and landscape degradation control

***To identify areas across the reserve showing signs of degradation, and implement suitable and effective control measures where required, to improve overall ecosystem function.***

As noted in section 6.4 above, there are limited signs of soil erosion present on the SPE due to a flat topography, low rainfall and soil structures which are generally not erosion prone. The two main causes of degradation on the property namely roads, internal fencing and flood irrigation infrastructure, are discussed below.

### Roads:

In certain areas, poorly constructed roads along hill sides have resulted in increased water run-off forming shallow rills and gullies. These rills and gullies are restricted to the roads and tracks themselves and should be easily treated through small scale interventions such as rock packs and earth berms. Off road driving by visitors with four-wheel drive vehicles and motorbikes has resulted in the scarring of a sensitive landscape with the aesthetic impact thereof most notable.

Planned management activities include:

- Construction of earth berms across roads showing signs of increased water run-off leading to small rills and gullies. Berms should be constructed and spaced in such a way that they mitigate water flow velocity, while at the same time ensuring that redirected water does not result in new erosion systems.
- Placement of 'rock packs' to facilitate the filling of shallow rills and gullies in and along affected roads.
- Closure of excess roads (unnecessary for management and tourism purposes), particularly those showing signs of erosion and / or poorly constructed.
- Placement of no entry signs to limit and prevent unauthorised entry, and off road driving by visiting guests. This should ideally be coupled with the drafting of applicable rules for visitors to the SPE.

### Internal fencing:

Limited internal fences remain standing on the property and run predominantly in and along the Tankwa River. For this reason, their removal should be seen as a priority as riparian sections are frequented by game species and could hinder their movement.

Recommended rehabilitation activities include:

- Remove approximately 3000 m of internal, stock proof fencing.
- All material to be removed and be disposed of / stored in an area designated for such purposes.

### Flood irrigation infrastructure:

Past flood irrigation practices have resulted in the degradation of the Tanqua Wash Riviere (AZi7) vegetation type, and riparian systems on the property as a whole, with the Tankwa River itself impacted most severely. Through the construction of dam walls, earth banks and furrows to manipulate water flow, water was dammed up across the floodplains of riparian areas. These practices resulted in increased root-zone salinity, soil sodicity, nutrient leaching and siltation while the natural flow of the ephemeral rivers has also been altered. This degradation of soil quality has in turn impacted



the biodiversity levels in the riparian systems with large bare/capped patches of clayey soils, monotonous stands of *Salsola spp.*, and alien invasive plant infestations (*Prosopis spp.*).

Most earth banks have already broken through as a result of past rainfall and flooding events as well as lack of maintenance. Even though these structures are not entirely restricting water flow anymore in the main drainage channels, it still results in redirecting and channelling the natural flow. Complete removal could assist in the “flushing” of the riparian systems during large rainfall events and flooding, thus counteracting the effects of sedimentation, salinization and sodification.

Possible rehabilitation activities could include:

- Removal (sloping / flattening) of earth banks historically used for flood irrigation through manual labour.
- Removal of concrete structures associated with water furrows. Rubble should however be removed after demolition.
- The dam wall situated in the ephemeral riverbed entering from the northeastern section of the SPE can either be broken down and flattened completely, or opened up further where water has already broken through to be less restrictive to water flow. In this case the use of machinery, if available, might prove more cost effective due to the size of the dam wall.
- Small scale rehabilitation interventions in “demarcated” plots. Such activities could include the reestablishment of indigenous shrub species through ponding, ripping and seeding. The success of such activities should then be monitored to measure effectiveness before large scale implementation takes place.

It is however not clear whether the treatment/removal of these structures will have any significant impact on the health and flow of riparian systems. It is thus recommended that a specialist be consulted to survey the property to determine the validity and potential effectiveness of the rehabilitation recommendations above. Similar interventions previously implemented in the neighbouring Tankwa Karoo National Park should also be evaluated to determine the success thereof before resources are committed to active rehabilitation interventions in these areas.

The following interim management activities will be implemented:

- Establish the extent of land degradation across the SPE by identifying and mapping eroded / degraded areas.
- Consult with SANParks Scientific Services to establish the effectiveness of rehabilitation interventions on similar degraded areas in the TKNP.
- Seek input from specialists regarding potential rehabilitation mechanisms.
- Placement of no entry signs to limit and prevent unauthorised entry, and off road driving by visiting guests.
- Breakdown and removal of redundant internal fences.

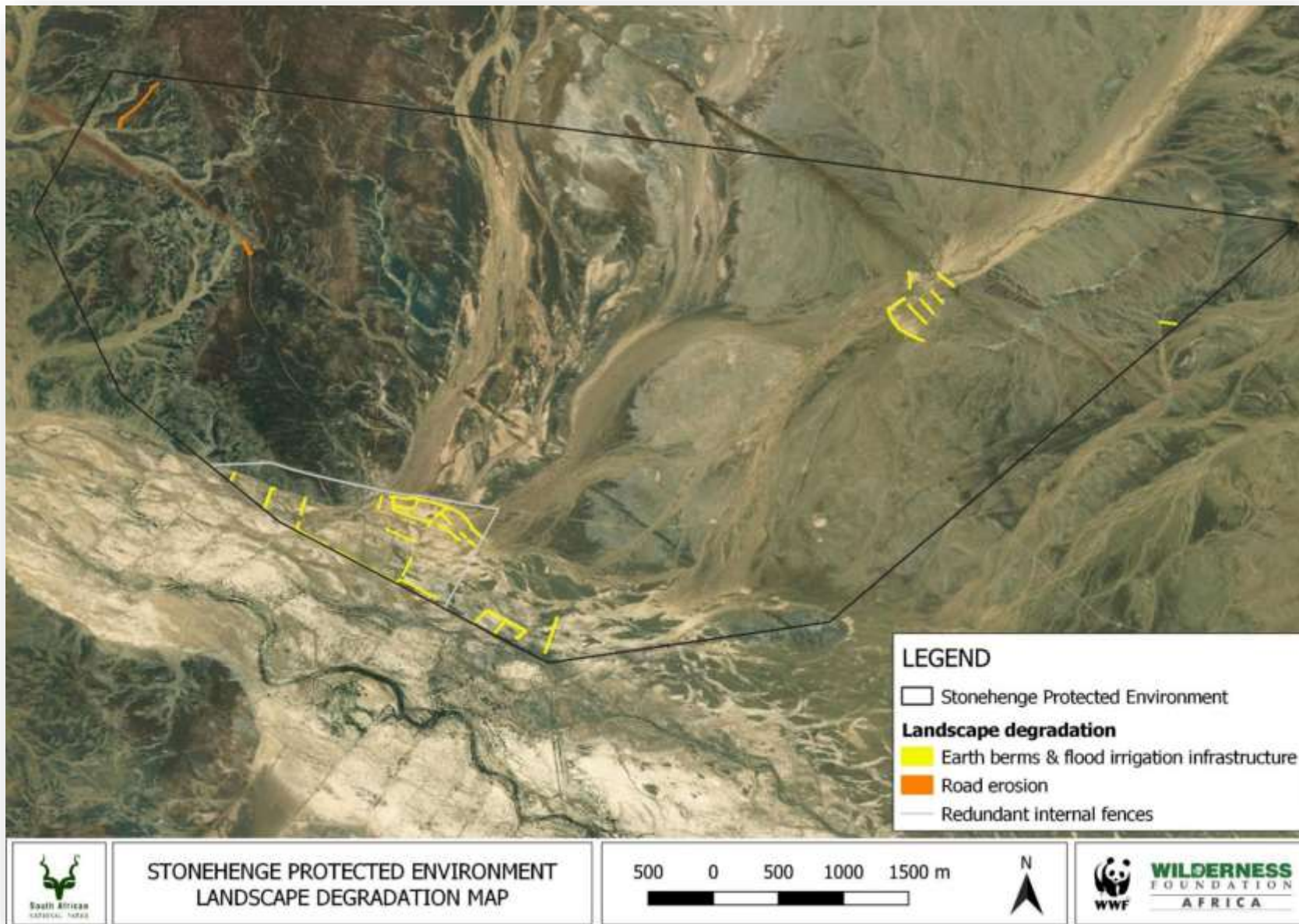


Figure 6. 2 Stonehenge PE degradation map

### 6.2.3 Access control

***To ensure that access to and on the Stonehenge Protected Environment is suitably and effectively managed to mitigate impacts on its biodiversity and unique ecosystems.***

An access control strategy is required in order to ensure the safety and integrity of biodiversity resources on the SPE. The strategy will place emphasis on managing access control in order to prevent any illegal and un-authorized activities from taking place on the SPE while also managing the movement of guests and visitors.

Access management rules will be enhanced through the strategic placement of signage, lockable gates where applicable and demarcation of management and recreational roads. This should ideally be coupled with the drafting of applicable rules which are communicated to visitors to manage the aforementioned. Border fences will be maintained to restrict both animal and human movement over the properties boundaries. The public road which runs through the SPE makes it difficult to control the movement of all vehicles passing through the property as it also serves as an access route to the Park and other farms. The opportunity however exists for the SPE and TKNP to work together in terms of the SPE handling permits for access of visitors to the Park (Oudebaaskraal section). The feasibility of such an opportunity will be discussed between the MA of the SPE and SANParks management.

The following activities will be implemented as part of an access control strategy:

- Maintain boundary fences to control human and animal movement onto the SPE.
- Printing and placement of signage (e.g. no entry signs) to manage access (including unauthorised access) on the SPE and prevent off-road driving.
- Draft a simple set of rules regulations to inform and guide visitors to the SPE regarding access and movement. These should be issued / communicated to visitors upon arrival.
- Liaise with the management of TKNP regarding access management. This could include the possibility of issuing access permits and receiving conservation fees on behalf of SANParks.

### 6.2.4 Waste management

***To promote and undertake sustainable waste management practises, reducing pollution and its impacts on the environment.***

Waste management not only reduces the impacts of waste and pollution on the environment, but also promotes sustainable environmental practises and ethos. This is in line with the vision of the SPE and as such the MA is committed to implementing a waste management strategy which aims to not only implement best practice waste management and reduce the overall amount of waste generated, but also to identify feasible activities to re-use and recycle.

While this could be difficult to implement, especially due to the remoteness of the SPE and lack of nearby facilities which are able to recycle waste material other than glass and tin, there are numerous opportunities for improved waste management. Some of the activities the MA investigate for implementation includes:

- Identifying areas where waste generated, especially through hospitality and tourism activities, can be reduced.
- Recycling materials such as glass and tin. These materials can be transported to the nearest recycling facility in Ceres. Plastics will also be recycled if there are nearby facilities that do so.

- Placement of marked recycling bins throughout the main rest camp and other tourism facilities.
- Inform visiting guests about the SPEs waste management policy and encourage them to make use of the recycling bins available.
- Investigate the feasibility of reusing certain waste materials. For example, starting a aluminium forging project to create useful items or souvenirs which can in turn be sold or given to guests.
- Composting of organic waste which can be used to fertilize soils for vegetable gardens or planted trees.
- Incinerating waste (non-hazardous) which cannot be re-used or recycled.
- Disposing of hazardous waste material in the correct manner.

The following management activities are planned in order to allow for the implementation of the above:

- Drafting of a waste management strategy to guide the processing and handling of waste products on the SPE.
- Identification and liaison with nearby facilities who are able and willing to accept waste for recycling.
- Implementation of activities as set out in the waste management strategy.

### 6.2.5 Infrastructure management

***Procurement and maintenance of equipment and infrastructure essential to ensuring productive and effective implementation of management activities on the Stonehenge Protected Environment.***

To ensure that the SPE is managed as effectively as possible, new and existing infrastructure needs to be maintained and in some instances developed. In order to address the infrastructure needs of the SPE, certain guidelines need to be adhered to. Suitable infrastructure must be provided to ensure the effective management and operation of the protected environment, while all infrastructure must be adequately maintained to avoid any damage to the environment and ensure the safety of staff and visitors to the site.

Planned management activities include:

- Patrol and maintain fences on a continuous basis in collaboration with neighbouring landowners.
- Maintain existing water infrastructure to ensure adequate water provision for wildlife and human consumption.
- General maintenance of buildings and campsite infrastructure as required to ensure continued functioning and compliance with relevant legislation.
- General maintenance of roads as required to limit and prevent negative impacts on the surrounding environment.

### 6.2.6 Monitoring

***To adapt, inform and evaluate the management strategy through monitoring and data collection activities.***

Monitoring and data collection is essential to the implementation of an adaptive management strategy. The aim of monitoring activities on the SPE is to gather and manage knowledge of the local ecology, measure the effectiveness of implemented management activities, inform veld management and measure the impact of tourism and recreational activities on the environment. Information gathered is used in informing biodiversity management decisions, and improving overall management of the Protected Environment. Opportunities also exist for area specific research programmes, which will contribute towards the perpetuation of species and ecological systems within the SPE.

The following monitoring activities will be implemented:

- Liaise with stakeholders and partners to assist with implementation of monitoring activities.
- Annual rainfall records.
- Record alien invasive plant control activities implemented as well as of new or emerging infestations.
- Record any rehabilitation or restoration work completed including annual fixed-point photographs to measure the effectiveness of such interventions.
- Completion of biennial vegetation assessments whereby overall veld condition and species composition is monitored and recorded and used to inform livestock management.
- Implementation of fixed-point photography in different vegetation/landscape units. One fixed point per site will be established with photographs taken on a biennial basis to measure changes in veld condition and cover.



## 7. DEVELOPMENT FRAMEWORK

### 7.1 Zonation plan

The aim of the SPE zonation plan (Figure 7.1) is to provide spatial guidelines which inform the various land use and management activities which can take place within the Protected Environment, while ensuring that these activities do not contradict each other or the values of the SPE. It is furthermore also a requirement of the National Environmental Management: Protected Areas Act (No. 57 of 2003), that the management plan for a Protected Area include a zonation plan which indicates which activities are allowed on the property.

The SPE has been divided into three use zones, namely:

- Conservation zone
- High impact zone
- Low impact zone

A detailed explanation of each zone with objectives, management guidelines and allowed activities is set out in table 7.1 below.

### 7.2 Development plan

No further development activities are planned for the Conservation zone. The High impact zone will possibly be utilized for the expansion of current, as well as development of new infrastructure for management and tourism purposes.

All standard environmental legislation will be complied with in the event of new developments.

Zone	ZONE DESCRIPTION	MANAGEMENT OBJECTIVES	ALLOWED ACTIVITIES
<b>CONSERVATION</b>	The Conservation Zone covers the largest extent of the property with the main goal of maintaining the area in as near natural state as possible with controlled visitor interaction and management interventions.	<ul style="list-style-type: none"> <li>a) Maintain area in as near natural state as possible, with limited interference of, and impact on, biological and ecological patterns and processes.</li> <li>b) Limit management activities, unless crucial for the functioning of ecological processes, or threats due to unnatural causes.</li> <li>c) Areas showing signs of degradation to be rehabilitated using low impact interventions.</li> <li>d) Limit the impact of external and neighbouring land use activities.</li> <li>e) Manage visitor access and impact thereof.</li> </ul>	<p><b>1) The following activities are allowed in the Conservation Zone:</b></p> <ul style="list-style-type: none"> <li>a) Low intensity grazing by indigenous game species in line with the <i>'Tankwa Karoo to Cederberg Wilderness Corridor Ecological Management Guidelines 2021'</i> (Wilderness Foundation Africa, 2021) document;</li> <li>b) Rehabilitation of previously degraded areas (landscape degradation &amp; invasive alien plant clearing);</li> <li>c) Development and maintenance of small scale, non-invasive infrastructures including water points for game and hiking trails; and</li> <li>d) Controlled non-motorized access by visitors on designated paths (e.g. hiking and mountain biking).</li> </ul> <p><b>2) No person may:</b></p> <ul style="list-style-type: none"> <li>a) Plough or transform virgin land without the required authorisation and prior consultation;</li> <li>b) Develop large-scale infrastructure without the required authorisation and prior consultation; and</li> <li>e) Undertake any activity that is not in line with the management philosophy and objectives of the Stonehenge Protected Environment (SPE). Activities implemented in this zone should be conservation, agriculture and/or ecotourism orientated.</li> </ul>
<b>HIGH IMPACT</b>	The High Impact Zone or <i>'High Intensity Leisure Zone'</i> includes most of the infrastructure required for the administration, maintenance and overall management of the SPE. Infrastructure for staff and sustainable tourism use is accommodated in this zone.	<ul style="list-style-type: none"> <li>a) Provision of infrastructure essential for the management and sustainable use of the SPE.</li> <li>b) To provide an allocated space for possible future developments and tourism activities.</li> <li>c) Maintain as much of the natural characteristics of the surrounding property as possible.</li> <li>a) Keep impact of development on ecological processes to the minimum.</li> </ul>	<p><b>1) The following activities are allowed in the High impact zone, if compliant with the relevant legal requirements and authorizations:</b></p> <ul style="list-style-type: none"> <li>a) Development and maintenance activities essential to meet the management objectives of the SPE;</li> <li>b) Staff, private and self-catering tourism accommodation units;</li> <li>c) Sustainable tourism activities that do not compromise or impact on the SPE's biodiversity and ecological functioning;</li> <li>d) Small-scale construction and development activities; and</li> <li>e) Any activity that is allowed in the Conservation Zone.</li> </ul>

	<p>Degraded / transformed areas that allow for the development of new infrastructure without affecting sensitive environments.</p> <p>Future infrastructure development.</p>		<p><b>2) No person may undertake any activity that is not in line with the management philosophy and objectives of the TPE. Activities implemented in this zone should be agriculture, conservation and/or ecotourism orientated.</b></p>
<b>LOW IMPACT</b>	<p>The Low Impact zone or '<i>Low Intensity Leisure Zone</i>' includes all the mapped roads across the SPE to be utilized for tourism and leisure purposes. These are the routes used for general access throughout the property as well as for any future motorized recreational- and ecotourism activities.</p> <p>This zone includes a buffer of 40 meters on either side of the roads, to manage impact of activities on the adjacent Conservation Zone.</p>	<p>b) To manage access on the property and the impact thereof.</p> <p>c) To manage the impact of infrastructure and usage activities on surrounding natural areas i.e. water run-off, soil erosion, trampling, off-road driving etc.</p> <p>d) To serve as buffer between low impact activities and the Conservation Zone.</p>	<p><b>1) The following activities are allowed in the Low Impact zone, if compliant with the relevant legal requirements and authorizations:</b></p> <ul style="list-style-type: none"> <li>a) Use by motorized vehicles for either management or recreational purposes;</li> <li>b) General maintenance of road infrastructure including small-scale gabion, culvert and berm construction to direct water flow and prevent soil loss;</li> <li>c) Selective utilization of rock and soil required to maintain roads and prevent erosion; and</li> <li>d) Any activity that is allowed in the Conservation Zone.</li> </ul> <p><b>2) No person may undertake any activity that is not in line with the management philosophy and objectives of the SPE. Activities implemented in this zone should be agriculture, conservation and/or ecotourism orientated.</b></p>

Table 7. 1 Zone description and management objectives.

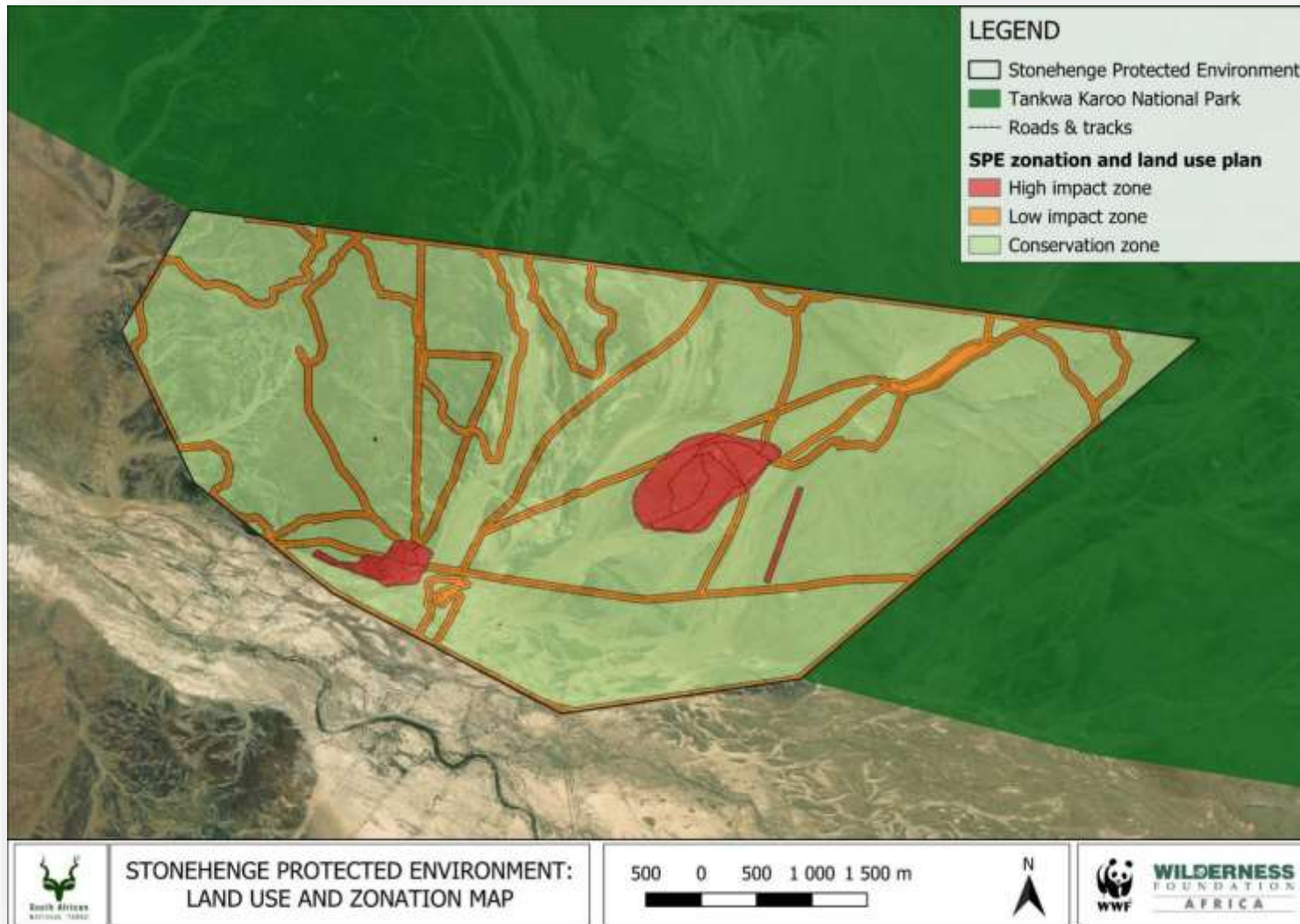


Figure 7. 1 Stonehenge PE zonation plan

## 8. RESTRICTED ACTIVITIES

A NEM:PAA Section 51 Notice has been drafted and gazetted as part of the declaration of the Tankwa Protected Environment. The purpose of a NEM:PAA Section 51 Notice is to restrict and regulate development and other activities that may be inappropriate or impede the purpose for which the Tankwa Protected Environment was declared.

Below follows the restrictions as contained in the Tankwa Protected Environment, NEM:PAA Section 51 Notice.

### 8.1 Restriction of development and other activities in the Conservation Zone

Insofar as development and other activities in the Conservation Zone are restricted, activities or developments conducted therein must be undertaken in line with the management plan and may not result in a transition away from conservation, agricultural and/or ecotourism land uses.

Development or activities within the Conservation Zone are, in accordance with **Table 7.1** and **Figure 7.1**, limited to:

- (a) Low intensity grazing by indigenous game species in line with the 'Tankwa Karoo to Cederberg Wilderness Corridor Ecological Management Guidelines 2021' (Wilderness Foundation Africa, 2021) document;
- (b) Rehabilitation of previously degraded areas (landscape degradation & invasive alien plant clearing);
- (c) Development and maintenance of small scale, non-invasive infrastructures including water points for game and hiking trails; and
- (d) Controlled non-motorized access by visitors on designated paths (e.g. hiking and mountain biking).

### 8.2 Restriction of development and other activities in the Low Impact Zone

Insofar as development and other activities in the Low Impact Zone are restricted, activities or developments conducted therein must be undertaken in line with the management plan and may not result in a transition away from agricultural and/or ecotourism land uses.

Developments or activities within the Low Impact Zone are, in accordance with **Table 7.1** and **Figure 7.1**, limited to:

- (a) Use by motorized vehicles for either management or recreational purposes;
- (b) General maintenance of road infrastructure including small-scale gabion, culvert and berm construction to direct water flow and prevent soil loss;
- (c) Selective utilization of rock and soil required to maintain roads and prevent erosion; and
- (d) Any activity that is allowed in the Conservation Zone.



### 8.3 Restriction of development and other activities in the High Impact Zone

Insofar as development and other activities in the High Impact Zone are restricted, activities or developments conducted therein must be undertaken in line with the management plan and may not result in a transition away from agricultural and/or ecotourism land uses.

Developments or activities within the High Impact Zone are, in accordance with **Table 7.1** and **Figure 7.1**, limited to:

- (a) Development and maintenance activities essential to meet the management objectives of the SPE;
- (b) Staff, private and self-catering tourism accommodation units;
- (c) Sustainable tourism activities that do not compromise or impact on the SPE's biodiversity and ecological functioning;
- (d) Small-scale construction and development activities; and
- (e) Any activity that is allowed in the Conservation Zone.

## 9. MANAGEMENT PLAN IMPLEMENTATION, REVIEW AND ANNUAL PLAN OF OPERATIONS

Monitoring and reporting assists with the evaluation of overall management of the Protected Environment. Depending on the outcomes, it can be used to directly adapt management strategies and activities to achieve the desired outcomes. During the annual review of the Annual Plan of Operation costing estimates per scheduled management action will be included, as applicable, to ensure adequate planning and provision for the implementation of said management actions.

### 9.1 Annual Plan of Operations

The Annual Plan of Operation (APO) forms an integral part of the Protected Area Management Plan. The APO gives life to the Operational Management Framework in the Strategic Management Plan by listing specific management actions. To facilitate effective review, each management action comprises the following components:

- a description of the management actions
- the Key Performance Indicator (KPI)
- the KPI target
- the person responsible for implementation
- the budget assigned to the activity
- the deadline for completion.

The APO for the Stonehenge Protected Environment will be captured in a separate document which is directly linked to the Management Plan and will be one of the main tools used to measure management effectiveness during annual audits and evaluations. Pending the findings of these audits and reviews, the Management Authority will draft a list of management activities to be included in the next year's APO with revised KPI targets, budgets, deadlines and responsible persons. SANParks will assist the Management Authority in terms of annual auditing and drafting of APO's.

### 9.2 Management plan review and annual audit

The purpose of undertaking an annual review of implementation of the Protected Area Management Plan will be to:

- Determine how effectively the management plan has been implemented.
- Assist in determining the focus for the Annual Plan of Operation and the setting of appropriate time frames and budgets.
- Enable effective adaptive management by identifying changes and modifying management interventions.

The annual audit will form the basis of the Management Plan review. This should include records of recommendations for update/changes to the annual revision of the management schedules as well as the five-year plan. The Annual Plan of Operation (APO) is in a similar format to the Annual Audit, allowing for a seamless transition of information from Audit to new APO.

## REFERENCES

- ANTIQUITY, 2015. A Review of world Archaeology. <http://www.antiquity.ac.uk/projgall/hallinan344> . Accessed on 30 February 2021)
- BALFOUR, D. 2021. Tankwa Karoo to Cederberg Wilderness Corridor, Ecological Management Guidelines. Wilderness Foundation Africa: Northern Cape Land Project. Port Elizabeth0
- BEZUIDENHOUT, H. 2019. Personal communication at Tankwa Karoo to Cederberg Wilderness Corridor planning session, 20 March 2019. Tankwa Karoo National Park
- BURGER, C. R. 1986. 'n Ondersoek na die oorsprong en die betekenis van plek- en plaasname in die landdrostdistrik Namakwaland. Department Afrikaanse Kultuurgeskiedenis. Stellenbosch University
- CRITICAL ECOSYSTEM PARTNERSHIP FUND. 2021 CEPF. [online] available at: <https://www.cepf.net/our-work/biodiversity-hotspots/succulent-karoo/species> [ Accessed 10 March 2021]
- DEPARTMENT OF ENVIRONMENTAL AFFAIRS (2016) NATIONAL PROTECTED AREAS EXPANSION STRATEGY FOR SOUTH AFRICA 2016. Department of Environmental Affairs, Pretoria, South Africa.
- ESLER, K.J., MILTON, S., DEAN, W.R.J. 2010. Karooveld Ekologie en Bestuur. Pretoria. South Africa.
- FITZPATRICK INSTITUTE OF AFRICAN ORNITHOLOGY (2019). MammalMAP Virtual Museum. Accessed at <http://vmus.adu.org.za/?vm=MammalMAP> on 20/02/2021. Accessed at <http://vmus.adu.org.za/?vm=MammalMAP> on 20/02/2021.
- HALLINAN, E. (2019). Variation and modernity in Middle Stone Age landscape use in the Western and Northern Cape, South Africa (Doctoral thesis). <https://doi.org/10.17863/CAM.39600>.
- HALLINAN, E & SHAW, M. 2015. A new Middle Stone Age industry in the Tankwa Karoo, Northern Cape Province, South Africa. Issue 344, Volume 89, April 2015. Antiquity.
- HANTAM LOCAL MUNICIPALITY. 2017. Hantam Integrated Development Plan 2017/2022. Calvinia.
- KHOISAN PLACE NAMES, 2005, Claus Riding. Unpublished report.
- MUCINA, L., JÜRGENS, N., LE ROUX, A., RUTHERFORD, M.C., SCHMIEDEL, U., ESLER, K.J., POWRIE, L.W., Desmet, P.G., Milton, S.J. 2006. Succulent Karoo Biome. In: Mucina, L., Rutherford, M.C. (Eds.), The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria, pp. 220–299.
- NAMAKWA BIODIVERSITY SECTOR PLAN. 2008. Northern Cape Province, Conservation International SA & Botanical Society of SA.
- NATIONAL BIODIVERSITY ASSESSMENT, 2018. South African National Biodiversity Institute.

- NORTHERN CAPE DEPARTMENT OF ENVIRONMENT NATURE CONSERVATION (2017). The Northern Cape Protected Area Expansion Strategy [draft] 2017. Kimberley.
- NORTHERN CAPE PROVINCIAL SPATIAL DEVELOPMENT FRAMEWORK. 2012. Department of Co-operative Governance, Human Settlements and Traditional Affairs.
- PETERSEN, H. 2015. In retrospect: How the vegetation of the Tanqua Karoo has changed over the last century. Department of Biological Sciences. University of Cape Town.
- RUBIN, FRANCINE. 1998. The physical environment and major plant communities of the Tankwa Karoon National Park. *Koedoe* (41(2): 61-94. Pretoria. ISSN 0075-6458.
- RUTHERFORD, M.C., MUCINA, L. POWRIE, L. 2006. Biomes and Bioregions of Southern Africa. In: Mucina, L., Rutherford, M.C. (Eds.), *The vegetation of South Africa, Lesotho and Swaziland*. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria, pp. 31-51.
- SOUTH AFRICAN NATIONAL BIODIVERSITY INSTITUTE (2006-2018). The Vegetation Map of South Africa, Lesotho and Swaziland, Mucina, L., Rutherford, M.C. and P.C.owrie, L.W. (Editors), Online <http://bgis.sanbi.org/SpatialDataset/Detail/18>, Version 2018.
- SOUTH AFRICAN BIRD ATLAS PROJECT. 2018. Sabap2. [Online] Available at: [http://sabap2.adu.org.za/pentad\\_info.php?pentad=2955\\_1740#menu\\_top](http://sabap2.adu.org.za/pentad_info.php?pentad=2955_1740#menu_top). [Accessed 10 January 2021]
- SOUTH AFRICAN NATIONAL BIODIVERSITY INSTITUTE (2006 - 2018). The Vegetation Map of South Africa, Lesotho and Swaziland, Mucina, L., Rutherford, M.C. and Powrie, L.W. (Editors), Online <http://bgis.sanbi.org/SpatialDataset/Detail/18>, Version 2018.
- SOUTH AFRICAN NATIONAL BIODIVERSITY INSTITUTE AND THE DEPARTMENT OF ENVIRONMENTAL AFFAIRS. 2010. National Protected Areas Expansion Strategy for South Africa; Priorities for expanding the protected area network for ecological sustainability and climate change adaptation. Published by the Government of South Africa, Pretoria, 2010. ISBN 978-1-919976-55-6.
- TANKWA KAROO NATIONAL PARK. 2014. Geology Booklet, ISBN 978-0-620-61712-3, SANParks.
- VAN DER MERWE, H., VAN ROOYEN, M.W., VAN ROOYEN, N. 2008. Vegetation of the Hantam–Tanqua–Roggeveld subregion, South Africa. Part 2: Succulent Karoo Biome related vegetation. *Koedoe* 50, 160–183.
- VAN DEVENTER, M. & J.A.J. NEL, 2006. Habitat, food, and Small mammal community structure in Namaqualand. *Koedoe* 49(1): 99 – 109, Pretoria. ISSN 0075-6458.

# APPENDIXES

## APPENDIX A. List of statutes to which the Stonehenge PE is subject to.

### **Biodiversity and Cultural Resource Management and Development:**

- Animals Protection Act [No. 71 of 1962]
- Atmospheric Pollution Prevention Act [No. 45 of 1965]
- Conservation of Agricultural Resources Act [No. 43 of 1983]
- Constitution of the Republic of South Africa [No. 108 of 1996]
- Criminal Procedures Act [1977]
- Environment Conservation Act [No. 73 of 1989]
- Forest Act [No. 122 of 1984]
- Hazardous Substances Act [No. 15 of 1973]
- National Environmental Management Act [No. 107 of 1998]
- National Environmental Management: Biodiversity Act [No. 10 of 2004]
- National Environmental Management: Protected Areas Act [No. 57 of 2003]
- National Forests Act [No. 84 of 1998]
- National Heritage Resources Act [No. 25 of 1999]
- National Water Act [No. 36 of 1998]
- National Water Amendment Act [No. 45 of 1999]
- National Veld and Forest Fire Act [No 101 of 1998]
- Nature Conservation Ordinance [No. 15 of 1974]

### **General Management:**

- Companies Act [No.71 of 2008]
- Promotion of Access to Information Act [No. 2 of 2000]
- Occupational Health and Safety Act [No. 85 of 1993]
- Development Facilitation Act [No. 67 of 1995]
- Disaster Management Act [No. 57 of 2002]
- Fire Brigade Services Act [No. 99 of 1987]
- Local Government: Municipal Systems Act [No. 32 of 2000]
- National Road Traffic Act [No. 93 of 1996]
- National Building Standards Act [No. 103 of 1977]
- Water Services Act [No. 108 of 1997]

### **Human Resource Management:**

- Basic Conditions of Employment Act [No. 75 of 1997]
- Broad-Based Black Economic Empowerment Act [No. 53 of 2003]
- Compensation for Occupational Injuries and Diseases Act [No. 130 of 1993]
- Employment Equity Act [No. 55 of 1998]
- Labour Relations Act [No. 66 of 1995]
- Occupational Health and Safety Act [No. 85 of 1993]
- Pension Funds Act [No. 24 of 1956]



- Skills Development Act [No. 97 of 1998]
- Skills Development Levies Act [No. 9 of 1999]
- Unemployment Insurance Act [No. 63 of 2001]

**A brief summary of the most applicable legislation:**

Protected Areas are proclaimed under section 23(1) of the National Environmental Protected Areas Act, 57 of 2003, (“the Protected Areas Act”).

- **Protected Areas Act (Act No. 57 of 2003)**

The [Minister/MEC] is empowered, under section 28 of the National Environmental Protected Areas Act, 57 of 2003, (“the Protected Areas Act”) to declare an area as a Protected Environment.

- **Biodiversity Act (Act No. 10 Of 2004)**

Objectives of Act

- a) within the framework of the National Environmental Management Act, to provide for —
  - i. the management and conservation of biological diversity within the Republic and of the components of such biological diversity;
  - ii. the use of indigenous biological resources in a sustainable manner; and
  - iii. the fair and equitable sharing among stakeholders of benefits arising from bio-prospecting involving indigenous biological resources;
- b) to give effect to ratified international agreements relating to biodiversity which are binding on the Republic;
- c) to provide for co-operative governance in biodiversity management and conservation; and
- d) to provide for a South African National Biodiversity Institute to assist in achieving the objectives of this Act.

- **National Veld and Forest Fire Act (Act No. 101 of 1998)**

Purpose

“The purpose of the Act is to prevent and combat veld, forest and mountain fires throughout the Republic.”

Firebreaks

In terms of section 12 and 14 every landowner must prepare and maintain a firebreak as determined in section 13. Failure to do so is an offence in terms of section 25(3), unless he has been exempted by the Minister in terms of section 15.

Fighting Preparedness

There is also a further duty on landowners to have equipment, protective clothing and trained personnel available in the eventuality that there may be fire on their property (section 17). Failure to meet this requirement is an offence in terms of section 25(4).

- **Conservation of Agricultural Resources Act, 1983 (No 43 of 1983)**

Purpose

CARA is an act of the National Department of Agriculture and makes provision for the conservation of the natural agricultural resources of South Africa through:

- i. Maintaining the production potential of land;
- ii. Combating and preventing erosion;
- iii. Preventing the weakening or destruction of water sources;
- iv. Protecting the vegetation; and
- v. Combating weeds and invader plants.

**Other Relevant Legislation:**

- Municipal Systems Act
- National Water Act, 1998 (No 36 of 1998)
- Constitution of the Republic of South Africa Act, 1996 (No 108 of 1996)
- Environment Conservation Act No 73 of 1989
- Forest Act No 122 of 1984
- National Environmental Management Act, 1998 (No 107 of 1998)
- National Heritage Resources Act, 1999 (No 25 of 1999)
- World Heritage Convention Act, 1999 (No 109 of 1999)
- Mountain Catchment Areas Act, 1970 (Act No. 63 of 1970)
- The administration of the Act has been assigned to the Board by virtue of Act 3 of 2000 as published in Provincial Gazette Extraordinary No. 5442 dated 24 March 2000
- Land Use Planning Ordinance 15/1985 (section 29)

There may be other legislation applicable to the Protected Environment and it is the landowner's/Management Authority's responsibility to identify and comply with applicable legislation.



# APPENDIX B. Archived 'The Cape Argus' article about developments and farming in the Tanqua region

THE CAPE ARGUS, SATURDAY, OCTOBER 13, 1923.

## IN THE NEGLECTED NORTH WEST.

### CALVINIA WANTS A RAIL SOUTHWARDS.

#### VISIT OF THE RAILWAY BOARD.

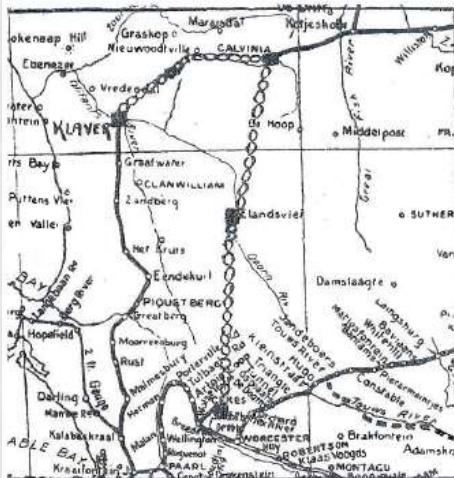
#### PROBLEMS OF TRANSPORT AND PRODUCTION.

(Special to The Argus.)

At some time past the people of Calvinia, supported by the Cape Town Chamber of Commerce, have been asking for more direct railway communication with Cape Town and the South.

In response to requests the Railway Board (Mr. J. Rissik and the Hon. T. Orr) visited these districts quite recently, and motored through from Ceres to Calvinia, and thence across to Vanrhynsdorp and the country around Klaver. The object of the visit was to obtain information as to the whole route. Taking advantage of an invitation from several interested in this matter, a representative of The Argus joined the party, and was thus enabled to gather the following notes on the districts visited.

#### FROM CERES TO CALVINIA AND KLAVER.



Sketch plan showing proposed rail extensions.

The customary placidity of the North-West of the Cape extends quite a size just recently. The occasion was a flying

plying a very wide area of excellent river soil lower down. Enthusiasts do not hesitate to count the irrigable area in hundreds of thousands of morgen. An additional advantageous feature is the fact that the Government controls a large proportion of this irrigable land so that possibilities of settlement are thrown into the scale.

As it is difficult to accept entirely the sanguine calculations of the enthusiasts—for even a Karoo river has its limitations in the shape of water supplies—the larger figures freely used to base calculations upon must be approached with reserve. So far as can be ascertained the whole proposition includes the construction of a dam or weir some sixty feet high in the position shown in illustrations herewith. The bulk of the irrigable area, unfortunately, is much lower down the river. Some 1,500 to 2,000 morgen lie within a couple of miles, while the greater proportion is some sixteen miles further on. As the suggested weir cannot do much in the shape of conservation for so large an area the prospect so far means a winter water supply which practically excludes most crops, except winter cereals—wheat, barley, oats, rye, and possibly winter legumes. The rough estimate of the cost of such works is given as upwards of £250,000.



Doorn River at Aaspoort. Point where visiting party inspected flow of stream.

including canals of a capacity to handle and distribute the flow. Unfortunately no really satisfactory site has been located for a large storage dam; but should such be found, the possibilities are simply enormous. The land is there awaiting the water; it is rich river soil which would be constantly and continuously renewed by

via Klaver. However, the Boer does not stay long to argue, but I visit the morning after it arrived rapidly in the three Nieuwoudville. To reach this the valley of the Hartam River be negotiated, which is both picturesque. The country is and steep in places, the soil and natural vegetation largely Karoo. Some of these should carry large numbers of stock in good seasons, but plants were heard of very rains for the past two years much was seen of the famed flocks of Calvinia.

The road shows a continuation following the course of the river passes several quite attractive farms with wide areas of wheat and other winter cereals. There is also in evidence, the great majority of the grain under grain. This continues good distance, when the count out ones more on to a wide hollow. Here the Hartam River the Zwart Doorn, each of the respectable streams in the district. In this large or hollow, it slides several thousands of much work of a sound char

the and van Rhynsdorp, to Kokenap and the Orange country, seeking information possible and practicable sites.

It originated in the desire of people of Calvinia and adjoining districts for a nearer direct way out to the south. Calvinia is served by the a from Hutchinson junction eastern main line through This is quite convenient the northern markets are But the people stoutly that their prospects are so the production of the sections so full of promise general interests of the whole could be served by giving one direct outlet to the quite naturally, of course Town, and thence to the markets.

When Hottentots Kloof is reached, one learns that the Government owns, or has control of, some 500 morgen of good ground which might be used for settlement purposes if only transport were available to market crops. The next feature of this route is the Karoo Fout. From here onwards the country opens out and Karoo conditions, with a gradually diminishing rainfall, are encountered.

One has not, however, left all the enterprise behind, for at a farm known as Ejen Bona, a great work is being carried on. As the soil and climate conditions are excellent and seasonal rains can be relied upon in the neighbourhood, a Cape Town syndicate has invested large sums in development. A huge dam is just about completed, designed to hold a thousand acre feet of water, and a large extent of rich soil is being laid down to fruit with the intention of marketing in the dried state. These include 500 of several varieties which show remarkable growth already; apricots, and vines for raisins, sultanas, etc. The plantings up to the present include 135,000 vines, 10,000 figs, and 3,500 apricots. Fair example as to what can be done.

From here onwards the whole country is on the semi-arid side and the soil and vegetation hard. Large stretches are shaly and barren, but there are also very wide deposits of deep river silt which, when the waters serve, are most fertile.

#### THE GOLD BOKKEVELD.

The semi-circular undulating plain mentioned above is bounded to the north by the heights of the Cold Bokkeveld, which are frequently snowed in the winter. This section is even more productive than the other, and the apples and pears grown here are estimated to be of the best quality in the Union, entirely owing to the climate and soil conditions. Rain is plentiful and seasonal, and the dreaded south-easter is unknown. Wheat of the best and barley of excellent malting quality rank high among its products, while for stock of all descriptions the conditions are most favourable. From here onwards the track proceeds through a charming country with the Gydow mountains in the foreground and the Cedarbergen in the distance.

When Hottentots Kloof is reached, one learns that the Government owns, or has control of, some 500 morgen of good ground which might be used for settlement purposes if only transport were available to market crops. The next feature of this route is the Karoo Fout. From here onwards the country opens out and Karoo conditions, with a gradually diminishing rainfall, are encountered.

#### AN ENCOURAGING ENTERPRISE.

One has not, however, left all the enterprise behind, for at a farm known as Ejen Bona, a great work is being carried on. As the soil and climate conditions are excellent and seasonal rains can be relied upon in the neighbourhood, a Cape Town syndicate has invested large sums in development. A huge dam is just about completed, designed to hold a thousand acre feet of water, and a large extent of rich soil is being laid down to fruit with the intention of marketing in the dried state. These include 500 of several varieties which show remarkable growth already; apricots, and vines for raisins, sultanas, etc. The plantings up to the present include 135,000 vines, 10,000 figs, and 3,500 apricots. Fair example as to what can be done.

#### THE DOORN RIVER COUNTRY.

From here onwards the whole country is on the semi-arid side and the soil and vegetation hard. Large stretches are shaly and barren, but there are also very wide deposits of deep river silt which, when the waters serve, are most fertile.

The Doorn River runs into the Oliphants River below the dam, and as the catchment area is very extensive large supplies of silty water are brought down when it is in flood. Wherever possible these floods are utilized and heavy crops of wheat and other cereals are procured. But the high cost of carriage to the rail is a terrible handicap, a rate of 6s. per bag for wagon transport being far from uncommon. In such circumstances it is not surprising that farmers are discouraged, though many of them assert freely that wheat can be grown at a profit in a fair season at 10s. per bag. With reasonable rates of transport wheat crops should make an enormous difference in the national bread bill.

#### IRRIGATION POSSIBILITIES.

The most prominent feature of this part of the country is the possibility of irrigation on a large scale. The Doorn River passes through a gully known as Aaspoort where a site has been provisionally selected upon which a dam could be erected capable of sup-

plies to be allowed to do this in a country which is constantly calling aloud for breadstuffs.

#### ELAND'S VLEI—SUB-TROPICAL FRUITS.

Still moving north another region is entered at Elands Vlei, a huge property held for generations by the Hough family. This group of farms covers something like 115,000 morgen—or, say, approximately 250,000 English acres. It lies in a wide open valley, and is served by the waters of the Doorn river. The conditions here



(1) Entrance to Aaspoort Gorge on Doorn River, looking up stream, and (2) looking down stream from weir site.

are so favourable that date palms are thriving in the garden at the homestead and fruit regularly, while fruit is practically unknown. Otherwise the soil conditions are similar to the surrounding country with perhaps a tendency to more friability in the river silt. The whole country remains much the same till leaving Calvinia, when, with a rise of altitude one experiences a sharp drop in the average temperatures. The most striking features are the developments, for every stream is conserved, fore or less, and full use is made of the waters, either by flood irrigation or canals. To the north the really vast activities on the Zak River are well-known, for much of the grain supplies of the Union is grown there.

#### THE KLAVER CALVINIA SECTION.

Passing on from Calvinia towards Klaver the Railway Board found another interesting section of country. The deputations to Calvinia fully explained the merits of both routes, the advantage of the Klaver connection mainly depending on the fact that the length to be constructed is considerably less than that to Ceres. This advantage is admitted, but compensation is claimed in favour of the Ceres connection in that the development possibilities are such as to give that route first claim. One asserts that when this line is completed the distance to Cape Town will be less than

tremendous crops. The winter cereals are most successful, and at the moment portions of the lands were being ploughed for meal as a summer crop. Only a portion this huge area has been brought in profit, but on such a property might practically speaking, should be impossible. All such development, however calls for capital and without ready means of transport it looks though much of this enterprise will brought to a halt.

To give some indication of the



(1) Entrance to Aaspoort Gorge on Doorn River, looking up stream, and (2) looking down stream from weir site.

and climate at this farm there is quite a thick stretch of well-grown nut thorn trees established on the banks. This cereals about a hundred morgen, and with it is a splash of canary grass (phalaris) bulbs in full flower. One feels inclined rub one's eyes and ask, "Can't such things be, in the arid north-west?"

From this point the Board passed through Nieuwoudville where I were entertained with similar star dropping down Van Ryn's Pass zig-zag descending sharply some 1 feet, the conditions change once in The soils are lighter and more as the temperatures are higher travelling is less pleasant. But here the possibilities of development are plain on every side right on Klaver, the present railroad of line through Malmesbury.

As to which route, if any, to preference of construction should given to connect Calvinia with south, is not easy to select, but one considers the really remarkable country on the Ceres side, the W and Cold Bokkeveld, with their soil and unique climate; the Karoo with all the possibilities of profit exploitation; and the Bokkeveld belt all this with its wealth of stock crops, this section has undoubtedly great claim to be considered.

APPENDIX C. Provisional mammal species list for the Tankwa Karoo including Stonehenge Protected Environment (Fitzpatrick Institute of African Ornithology, 2021. Mammal MAP Virtual Museum)

#	Species code	Family	Scientific name	Common name	Red list category	Last recorded
1	211990	Bovidae	<i>Alcelaphus buselaphus caama</i>	Red Hartebeest	Least Concern (2008)	2018-09-07
2	212190	Bovidae	<i>Antidorcas marsupialis</i>	Springbok	Least Concern (2016)	2018-09-07
3	216020	Bovidae	<i>Oryx gazella</i>	Gemsbok	Least Concern (2016)	2018-09-07
4	213320	Bovidae	<i>Raphicerus campestris</i>	Steenbok	Least Concern (2016)	2017-04-12
5	215700	Bovidae	<i>Sylvicapra grimmia</i>	Bush Duiker	Least Concern (2016)	2012-10-25
6	198600	Canidae	<i>Canis mesomelas</i>	Black-backed Jackal	Least Concern (2016)	2012-04-07
7	199080	Canidae	<i>Otocyon megalotis</i>	Bat-eared Fox	Least Concern (2016)	2018-09-07
8	199410	Canidae	<i>VuSPEs chama</i>	Cape Fox	Least Concern (2016)	1987-09-27
9	192070	Felidae	<i>Felis silvestris</i>	Wildcat	Least Concern (2016)	1991-04-24
10	196300	Herpestidae	<i>Herpestes pulverulentus</i>	Cape Grey Mongoose	Least Concern (2016)	2012-10-26
11	157560	Leporidae	<i>Lepus capensis</i>	Cape Hare	Least Concern	1987-09-27
12	106540	Macroscelididae	<i>Macroscelides proboscideus</i>	Short-eared Elephant Shrew	Least Concern (2016)	1987-09-27
13	217960	Muridae	<i>Aethomys granti</i>	Grant's Rock Mouse	Least Concern	1987-09-26
14	217970	Muridae	<i>Aethomys namaquensis</i>	Namaqua Rock Mouse	Least Concern	1997-11-26
15	144330	Muridae	<i>Desmodillus auricularis</i>	Cape Short-tailed Gerbil	Least Concern (2016)	1987-09-27
16	144580	Muridae	<i>Gerbilliscus paeba</i>	Paeba Hairy-footed Gerbil	Least Concern (2016)	1987-09-27
17	147990	Muridae	<i>Micaelamys granti</i>	Grant's Micaelamys	Least Concern (2016)	1987-09-26
18	151100	Muridae	<i>Otomys irroratus</i>	Southern African Vlei Rat (Fynbos type)	Least Concern (2016)	2005-07-23
19	151170	Muridae	<i>Otomys saundersiae</i>	Saunders' Vlei Rat	Least Concern	
20	218000	Muridae	<i>Otomys unisulcatus</i>	Karoo Bush Rat	Least Concern (2016)	1987-09-27
21	151210	Muridae	<i>Parotomys brantsii</i>	Brants's Whistling Rat	Least Concern (2016)	2012-04-09
22	150360	Muridae	<i>Rhabdomys pumilio</i>	Xeric Four-striped Grass Rat	Least Concern (2016)	1987-09-26
23	203170	Mustelidae	<i>Mellivora capensis</i>	Honey Badger	Least Concern (2016)	



24	205210	Mustelidae	<i>Poecilogale albinucha</i>	African Striped Weasel	Near Threatened (2016)	2012-10-25
25	136680	Nesomyidae	<i>Malacothrix typica</i>	Large-eared African Desert Mouse	Least Concern (2016)	1987-09-27
26	137030	Nesomyidae	<i>Petromyscus barbouri</i>	Barbour's Pygmy Rock Mouse	Least Concern (2016)	1987-10-10
27	176970	Nycteridae	<i>Nycteris thebaica</i>	Egyptian Slit-faced Bat	Least Concern (2016)	
28	107300	Procaviidae	<i>Procavia capensis</i>	Cape Rock Hyrax	Least Concern (2016)	2017-04-11
29	163350	Soricidae	<i>Myosorex varius</i>	Forest Shrew	Least Concern (2016)	1985-11-12
30	163010	Soricidae	<i>Suncus varilla</i>	Lesser Dwarf Shrew	Least Concern (2016)	1927-01-01
31	190500	Vespertilionidae	<i>Miniopterus schreibersii</i>	Schreibers's Long-fingered Bat	Near Threatened	2012-04-06
32	195120	Viverridae	<i>Genetta genetta</i>	Common Genet	Least Concern (2016)	1988-07-17
33	195300	Viverridae	<i>Genetta tigrina</i>	Cape Genet (Cape Large-spotted Genet)	Least Concern (2016)	1986-04-27



APPENDIX D. South African Bird Atlas Project (SABAP) species list for pentads covering the Stonehenge PE

SOUTH AFRICAN BIRD ATLAS PROJECT (EXTRACTED 26 AUGUST 2021)				
PENTAD 3220_1945				
Ref	Common_group	Common_species	Genus	Species
722		Bokmakierie	<i>Telophorus</i>	<i>zeylonus</i>
674	Batis	Pirit	<i>Batis</i>	<i>pririt</i>
404	Bee-eater	European	<i>Merops</i>	<i>apiaster</i>
808	Bishop	Southern Red	<i>Euplectes</i>	<i>orix</i>
873	Bunting	Cape	<i>Emberiza</i>	<i>capensis</i>
218	Bustard	Ludwig's	<i>Neotis</i>	<i>ludwigii</i>
154	Buzzard	Common	<i>Buteo</i>	<i>buteo</i>
861	Canary	Black-headed	<i>Serinus</i>	<i>alario</i>
865	Canary	White-throated	<i>Crithagra</i>	<i>albogularis</i>
866	Canary	Yellow	<i>Crithagra</i>	<i>flaviventris</i>
570	Chat	Familiar	<i>Oenanthe</i>	<i>familiaris</i>
566	Chat	Karoo	<i>Emarginata</i>	<i>schlegelii</i>
571	Chat	Tractrac	<i>Emarginata</i>	<i>tractrac</i>
638	Cisticola	Grey-backed	<i>Cisticola</i>	<i>subruficapilla</i>
522	Crow	Pied	<i>Corvus</i>	<i>albus</i>
316	Dove	Cape Turtle	<i>Streptopelia</i>	<i>capicola</i>
317	Dove	Laughing	<i>Spilopelia</i>	<i>senegalensis</i>
318	Dove	Namaqua	<i>Oena</i>	<i>capensis</i>
146	Eagle	Black-chested Snake	<i>Circaetus</i>	<i>pectoralis</i>
139	Eagle	Booted	<i>Hieraaetus</i>	<i>pennatus</i>
368	Eagle-Owl	Spotted	<i>Bubo</i>	<i>africanus</i>
61	Egret	Western Cattle	<i>Bubulcus</i>	<i>ibis</i>
626	Eremomela	Karoo	<i>Eremomela</i>	<i>gregalis</i>
114	Falcon	Lanner	<i>Falco</i>	<i>biarmicus</i>
707	Fiscal	Southern	<i>Lanius</i>	<i>collaris</i>
678	Flycatcher	Fairy	<i>Stenostira</i>	<i>scita</i>
89	Goose	Egyptian	<i>Alopochen</i>	<i>aegyptiaca</i>
165	Goshawk	Pale Chanting	<i>Melierax</i>	<i>canorus</i>
171	Harrier-Hawk	African	<i>Polyboroides</i>	<i>typus</i>
418	Hoopoe	African	<i>Upupa</i>	<i>africana</i>
81	Ibis	African Sacred	<i>Threskiornis</i>	<i>aethiopicus</i>
84	Ibis	Hadada	<i>Bostrychia</i>	<i>hagedash</i>
122	Kestrel	Greater	<i>Falco</i>	<i>rupicoloides</i>
130	Kite	Black-winged	<i>Elanus</i>	<i>caeruleus</i>
220	Korhaan	Karoo	<i>Eupodotis</i>	<i>vigorsii</i>
245	Lapwing	Blacksmith	<i>Vanellus</i>	<i>armatus</i>
461	Lark	Karoo	<i>Calendulauda</i>	<i>albescens</i>
463	Lark	Large-billed	<i>Galerida</i>	<i>magnirostris</i>

488	Lark	Red-capped	<i>Calandrella</i>	<i>cinerea</i>
506	Martin	Rock	<i>Ptyonoprogne</i>	<i>fuligula</i>
392	Mousebird	Red-faced	<i>Urocolius</i>	<i>indicus</i>
372	Nightjar	Rufous-cheeked	<i>Caprimulgus</i>	<i>rufigena</i>
1	Ostrich	Common	<i>Struthio</i>	<i>camelus</i>
359	Owl	Western Barn	<i>Tyto</i>	<i>alba</i>
311	Pigeon	Speckled	<i>Columba</i>	<i>guinea</i>
692	Pipit	African	<i>Anthus</i>	<i>cinnamomeus</i>
237	Plover	Kittlitz's	<i>Charadrius</i>	<i>pecuarius</i>
238	Plover	Three-banded	<i>Charadrius</i>	<i>tricoloris</i>
4139	Prinia	Karoo	<i>Prinia</i>	<i>maculosa</i>
307	Sandgrouse	Namaqua	<i>Pterocles</i>	<i>namaqua</i>
583	Scrub Robin	Karoo	<i>Cercotrichas</i>	<i>coryphoeus</i>
90	Shelduck	South African	<i>Tadorna</i>	<i>cana</i>
786	Sparrow	Cape	<i>Passer</i>	<i>melanurus</i>
784	Sparrow	House	<i>Passer</i>	<i>domesticus</i>
485	Sparrow-Lark	Grey-backed	<i>Eremopterix</i>	<i>verticalis</i>
746	Starling	Pied	<i>Lamprotornis</i>	<i>bicolor</i>
751	Sunbird	Malachite	<i>Nectarinia</i>	<i>famosa</i>
760	Sunbird	Southern Double-collared	<i>Cinnyris</i>	<i>chalybeus</i>
493	Swallow	Barn	<i>Hirundo</i>	<i>rustica</i>
498	Swallow	Pearl-breasted	<i>Hirundo</i>	<i>dimidiata</i>
386	Swift	Alpine	<i>Tachymarptis</i>	<i>melba</i>
383	Swift	White-rumped	<i>Apus</i>	<i>caffer</i>
686	Wagtail	Cape	<i>Motacilla</i>	<i>capensis</i>
658	Warbler	Chestnut-vented	<i>Curruca</i>	<i>subcoerulea</i>
659	Warbler	Layard's	<i>Curruca</i>	<i>layardi</i>
619	Warbler	Rufous-eared	<i>Malcorus</i>	<i>pectoralis</i>
843	Waxbill	Common	<i>Estrilda</i>	<i>astrild</i>
803	Weaver	Southern Masked	<i>Ploceus</i>	<i>velatus</i>
568	Wheatear	Capped	<i>Oenanthe</i>	<i>pileata</i>

**PENTAD 3215\_1940**

Ref	Common_group	Common_species	Genus	Species
722		Bokmakierie	<i>Telophorus</i>	<i>zeylonus</i>
871	Bunting	Lark-like	<i>Emberiza</i>	<i>impetuani</i>
865	Canary	White-throated	<i>Crithagra</i>	<i>albogularis</i>
572	Chat	Sickle-winged	<i>Emarginata</i>	<i>sinuata</i>
638	Cisticola	Grey-backed	<i>Cisticola</i>	<i>subruficapilla</i>
316	Dove	Cape Turtle	<i>Streptopelia</i>	<i>capicola</i>
600	Eremomela	Yellow-bellied	<i>Eremomela</i>	<i>icteropygialis</i>
114	Falcon	Lanner	<i>Falco</i>	<i>biarmicus</i>
707	Fiscal	Southern	<i>Lanius</i>	<i>collaris</i>
89	Goose	Egyptian	<i>Alopochen</i>	<i>aegyptiaca</i>

165	Goshawk	Pale Chanting	<i>Melierax</i>	<i>canorus</i>
461	Lark	Karoo	<i>Calendulauda</i>	<i>albescens</i>
463	Lark	Large-billed	<i>Galerida</i>	<i>magnirostris</i>
474	Lark	Spike-heeled	<i>Chersomanes</i>	<i>albofasciata</i>
506	Martin	Rock	<i>Ptyonoprogne</i>	<i>fuligula</i>
4139	Prinia	Karoo	<i>Prinia</i>	<i>maculosa</i>
307	Sandgrouse	Namaqua	<i>Pterocles</i>	<i>namaqua</i>
583	Scrub Robin	Karoo	<i>Cercotrichas</i>	<i>coryphoeus</i>
786	Sparrow	Cape	<i>Passer</i>	<i>melanurus</i>
485	Sparrow-Lark	Grey-backed	<i>Eremopterix</i>	<i>verticalis</i>
495	Swallow	White-throated	<i>Hirundo</i>	<i>albigularis</i>
386	Swift	Alpine	<i>Tachymarptis</i>	<i>melba</i>
686	Wagtail	Cape	<i>Motacilla</i>	<i>capensis</i>
619	Warbler	Rufous-eared	<i>Malcorus</i>	<i>pectoralis</i>
843	Waxbill	Common	<i>Estrilda</i>	<i>astrild</i>
<b>PENTAD 3215_1945</b>				
<b>Ref</b>	<b>Common_group</b>	<b>Common_species</b>	<b>Genus</b>	<b>Species</b>
722		Bokmakierie	<i>Telophorus</i>	<i>zeylonus</i>
105		Secretarybird	<i>Sagittarius</i>	<i>serpentarius</i>
432	Barbet	Acacia Pied	<i>Tricholaema</i>	<i>leucomelas</i>
873	Bunting	Cape	<i>Emberiza</i>	<i>capensis</i>
871	Bunting	Lark-like	<i>Emberiza</i>	<i>impetuani</i>
218	Bustard	Ludwig's	<i>Neotis</i>	<i>ludwigii</i>
152	Buzzard	Jackal	<i>Buteo</i>	<i>rufofuscus</i>
861	Canary	Black-headed	<i>Serinus</i>	<i>alario</i>
865	Canary	White-throated	<i>Crithagra</i>	<i>albogularis</i>
866	Canary	Yellow	<i>Crithagra</i>	<i>flaviventris</i>
570	Chat	Familiar	<i>Oenanthe</i>	<i>familiaris</i>
566	Chat	Karoo	<i>Emarginata</i>	<i>schlegelii</i>
571	Chat	Tractrac	<i>Emarginata</i>	<i>tractrac</i>
638	Cisticola	Grey-backed	<i>Cisticola</i>	<i>subruficapilla</i>
316	Dove	Cape Turtle	<i>Streptopelia</i>	<i>capicola</i>
317	Dove	Laughing	<i>Spilopelia</i>	<i>senegalensis</i>
146	Eagle	Black-chested Snake	<i>Circaetus</i>	<i>pectoralis</i>
368	Eagle-Owl	Spotted	<i>Bubo</i>	<i>africanus</i>
626	Eremomela	Karoo	<i>Eremomela</i>	<i>gregalis</i>
707	Fiscal	Southern	<i>Lanius</i>	<i>collaris</i>
88	Goose	Spur-winged	<i>Plectropterus</i>	<i>gambensis</i>
165	Goshawk	Pale Chanting	<i>Melierax</i>	<i>canorus</i>
122	Kestrel	Greater	<i>Falco</i>	<i>rupicoloides</i>
461	Lark	Karoo	<i>Calendulauda</i>	<i>albescens</i>
463	Lark	Large-billed	<i>Galerida</i>	<i>magnirostris</i>
488	Lark	Red-capped	<i>Calandrella</i>	<i>cinerea</i>

474	Lark	Spike-heeled	<i>Chersomanes</i>	<i>albofasciata</i>
506	Martin	Rock	<i>Ptyonoprogne</i>	<i>fuligula</i>
391	Mousebird	White-backed	<i>Colius</i>	<i>colius</i>
1	Ostrich	Common	<i>Struthio</i>	<i>camelus</i>
311	Pigeon	Speckled	<i>Columba</i>	<i>guinea</i>
4139	Prinia	Karoo	<i>Prinia</i>	<i>maculosa</i>
307	Sandgrouse	Namaqua	<i>Pterocles</i>	<i>namaqua</i>
583	Scrub Robin	Karoo	<i>Cercotrichas</i>	<i>coryphoeus</i>
90	Shelduck	South African	<i>Tadorna</i>	<i>cana</i>
786	Sparrow	Cape	<i>Passer</i>	<i>melanurus</i>
486	Sparrow-Lark	Black-eared	<i>Eremopterix</i>	<i>australis</i>
485	Sparrow-Lark	Grey-backed	<i>Eremopterix</i>	<i>verticalis</i>
493	Swallow	Barn	<i>Hirundo</i>	<i>rustica</i>
386	Swift	Alpine	<i>Tachymarptis</i>	<i>melba</i>
619	Warbler	Rufous-eared	<i>Malcorus</i>	<i>pectoralis</i>
803	Weaver	Southern Masked	<i>Ploceus</i>	<i>velatus</i>
564	Wheatear	Mountain	<i>Myrmecocichla</i>	<i>monticola</i>
<b>PENTAD 3220_1940</b>				
<b>Ref</b>	<b>Common_group</b>	<b>Common_species</b>	<b>Genus</b>	<b>Species</b>
722		Bokmakierie	<i>Telophorus</i>	<i>zeylonus</i>
674	Batis	Pirit	<i>Batis</i>	<i>pririt</i>
404	Bee-eater	European	<i>Merops</i>	<i>apiaster</i>
871	Bunting	Lark-like	<i>Emberiza</i>	<i>impetuani</i>
865	Canary	White-throated	<i>Crithagra</i>	<i>albogularis</i>
866	Canary	Yellow	<i>Crithagra</i>	<i>flaviventris</i>
570	Chat	Familiar	<i>Oenanthe</i>	<i>familiaris</i>
566	Chat	Karoo	<i>Emarginata</i>	<i>schlegelii</i>
571	Chat	Tractrac	<i>Emarginata</i>	<i>tractrac</i>
278	Cursorer	Double-banded	<i>Rhinoptilus</i>	<i>africanus</i>
522	Crow	Pied	<i>Corvus</i>	<i>albus</i>
316	Dove	Cape Turtle	<i>Streptopelia</i>	<i>capicola</i>
317	Dove	Laughing	<i>Spilopelia</i>	<i>senegalensis</i>
626	Eremomela	Karoo	<i>Eremomela</i>	<i>gregalis</i>
600	Eremomela	Yellow-bellied	<i>Eremomela</i>	<i>icteropygialis</i>
707	Fiscal	Southern	<i>Lanius</i>	<i>collaris</i>
678	Flycatcher	Fairy	<i>Stenostira</i>	<i>scita</i>
88	Goose	Spur-winged	<i>Plectropterus</i>	<i>gambensis</i>
165	Goshawk	Pale Chanting	<i>Melierax</i>	<i>canorus</i>
288	Gull	Grey-headed	<i>Chroicocephalus</i>	<i>cirrocephalus</i>
123	Kestrel	Rock	<i>Falco</i>	<i>rupicolus</i>
130	Kite	Black-winged	<i>Elanus</i>	<i>caeruleus</i>
129	Kite	Yellow-billed	<i>Milvus</i>	<i>aegyptius</i>
461	Lark	Karoo	<i>Calendulauda</i>	<i>albescens</i>

463	Lark	Large-billed	<i>Galerida</i>	<i>magnirostris</i>
488	Lark	Red-capped	<i>Calandrella</i>	<i>cinerea</i>
474	Lark	Spike-heeled	<i>Chersomanes</i>	<i>albofasciata</i>
509	Martin	Brown-throated	<i>Riparia</i>	<i>paludicola</i>
506	Martin	Rock	<i>Ptyonoprogne</i>	<i>fuligula</i>
238	Plover	Three-banded	<i>Charadrius</i>	<i>tricoloris</i>
4139	Prinia	Karoo	<i>Prinia</i>	<i>maculosa</i>
524	Raven	White-necked	<i>Corvus</i>	<i>albicollis</i>
307	Sandgrouse	Namaqua	<i>Pterocles</i>	<i>namaqua</i>
583	Scrub Robin	Karoo	<i>Cercotrichas</i>	<i>coryphoeus</i>
786	Sparrow	Cape	<i>Passer</i>	<i>melanurus</i>
784	Sparrow	House	<i>Passer</i>	<i>domesticus</i>
380	Swift	African Black	<i>Apus</i>	<i>barbatus</i>
386	Swift	Alpine	<i>Tachymarptis</i>	<i>melba</i>
686	Wagtail	Cape	<i>Motacilla</i>	<i>capensis</i>
606	Warbler	African Reed	<i>Acrocephalus</i>	<i>baeticatus</i>
619	Warbler	Rufous-eared	<i>Malcorus</i>	<i>pectoralis</i>
843	Waxbill	Common	<i>Estrilda</i>	<i>astrild</i>
803	Weaver	Southern Masked	<i>Ploceus</i>	<i>velatus</i>



## APPENDIX E. Mammal species list for Tankwa Karoo National Park from the Fitzpatrick Institute of African Ornithology Virtual Museum

Nr.	Family	Genus and specie	Common name	Red list category
1	Bovidae	<i>Alcelaphus buselaphus caama</i>	Red Hartebeest	Least Concern (2008)
2	Bovidae	<i>Antidorcas marsupialis</i>	Springbok	Least Concern (2016)
3	Bovidae	<i>Oryx gazella</i>	Gemsbok	Least Concern (2016)
4	Bovidae	<i>Raphicerus campestris</i>	Steenbok	Least Concern (2016)
5	Bovidae	<i>Sylvicapra grimmia</i>	Bush Duiker	Least Concern (2016)
6	Canidae	<i>Canis mesomelas</i>	Black-backed Jackal	Least Concern (2016)
7	Canidae	<i>Otocyon megalotis</i>	Bat-eared Fox	Least Concern (2016)
8	Canidae	<i>VuSPeS chama</i>	Cape Fox	Least Concern (2016)
9	Felidae	<i>Felis silvestris</i>	Wildcat	Least Concern (2016)
10	Herpestidae	<i>Herpestes pulverulentus</i>	Cape Gray Mongoose	Least Concern (2016)
11	Leporidae	<i>Lepus capensis</i>	Cape Hare	Least Concern
12	Macroscelididae	<i>Macroscelides proboscideus</i>	Short-eared Elephant Shrew	Least Concern (2016)
13	Muridae	<i>Aethomys granti</i>	Grant's Rock Mouse	Least Concern
14	Muridae	<i>Aethomys namaquensis</i>	Namaqua Rock Mouse	Least Concern
15	Muridae	<i>Desmodillus auricularis</i>	Cape Short-tailed Gerbil	Least Concern (2016)
16	Muridae	<i>Gerbilliscus paeba</i>	Paeba Hairy-footed Gerbil	Least Concern (2016)
17	Muridae	<i>Micaelamys granti</i>	Grant's Micaelamys	Least Concern (2016)
18	Muridae	<i>Otomys irroratus</i>	Southern African Vlei Rat (Fynbos type)	Least Concern (2016)
19	Muridae	<i>Otomys saundersiae</i>	Saunders' Vlei Rat	Least Concern
20	Muridae	<i>Otomys unisulcatus</i>	Karoo Bush Rat	Least Concern (2016)
21	Muridae	<i>Parotomys brantsii</i>	Brants's Whistling Rat	Least Concern (2016)
22	Muridae	<i>Rhabdomys pumilio</i>	Xeric Four-striped Grass Rat	Least Concern (2016)
23	Mustelidae	<i>Ictonyx striatus</i>	Striped Polecat	Least Concern (2016)
24	Mustelidae	<i>Mellivora capensis</i>	Honey Badger	Least Concern (2016)
25	Mustelidae	<i>Poecilogale albinucha</i>	African Striped Weasel	Near Threatened (2016)
26	Nesomyidae	<i>Malacothrix typica</i>	Large-eared African Desert Mouse	Least Concern (2016)
27	Nesomyidae	<i>Petromyscus barbouri</i>	Barbour's Pygmy Rock Mouse	Least Concern (2016)
28	Nycteridae	<i>Nycteris thebaica</i>	Egyptian Slit-faced Bat	Least Concern (2016)
29	Procaviidae	<i>Procavia capensis</i>	Cape Rock Hyrax	Least Concern (2016)
30	Soricidae	<i>Myosorex varius</i>	Forest Shrew	Least Concern (2016)
31	Soricidae	<i>Suncus varilla</i>	Lesser Dwarf Shrew	Least Concern (2016)
32	Vespertilionidae	<i>Miniopterus schreibersii</i>	Schreibers's Long-fingered Bat	Near Threatened
33	Viverridae	<i>Genetta genetta</i>	Common Genet	Least Concern (2016)
34	Viverridae	<i>Genetta tigrina</i>	Cape Genet (Cape Large-spotted Genet)	Least Concern (2016)

## APPENDIX F. Plant species list for the Stonehenge Protected Environment

No of plant species recorded:		25		
Species of conservation concern recorded:		0		
Alien plant species recorded:		2		
STATUS	FAMILY	SPECIES	GROWTHFORM	COMMON NAMES
	AIZOACEAE	<i>Drosanthemum</i> sp	succulent-leaf dwarfshrub	
LC	AIZOACEAE	<i>Galenia africana</i>	dwarfshrub	geelbos/kraalbos
LC	AIZOACEAE	<i>Malephora crassa</i>	succulent-leaf dwarfshrub	geelvingertjies
LC	AIZOACEAE	<i>Mesembryanthemum nodiflorum</i>	succulent-leaf dwarfshrub	donkiebos, vleisbos
LC	AIZOACEAE	<i>Mesembryanthemum vaginatum</i>	succulent-leaf dwarfshrub	haarslaai
LC	APIACEAE	<i>Deverra denudata</i> subsp. <i>aphylla</i>	shrub	wildevinkel
DDD	APOCYNACEAE	<i>Hoodia gordonii</i>	stem succulent	ghaap
	ASPARAGACEAE	<i>Asparagus</i> sp	dwarfshrub	
LC	ASTERACEAE	<i>Osteospermum sinuata</i>	dwarfshrub	kleinskaapbossie
DDD	ASTERACEAE	<i>Othonna rhamnoides</i>	shrub	
Alien	CHENOPODIACEAE	<i>Atriplex nummularia</i>	shrub	oumansoutbos
	CHENOPODIACEAE	<i>Salsola</i> sp	shrub	ganna
Alien	FABACEAE	<i>Prosopis velutina</i>	tree	mesquite, muskietboom, Suidwes-doring
LC	HYACINTHACEAE	<i>Albuca consanguinea</i>	geophyte	
LC	HYACINTHACEAE	<i>Drimia physodes</i>	geophyte	
LC	IRIDACEAE	<i>Gethyllis villosa</i>	geophyte	harige koekoemaranka
LC	IRIDACEAE	<i>Lapeirousia plicata</i> subsp. <i>plicata</i>	geophyte	
LC	IRIDACEAE	<i>Moraea speciosa</i>	geophyte	
LC	PEDALIACEAE	<i>Rogeria longiflora</i>	herb	pietjelaapor, witblom

LC	POACEAE	<i>Stipagrostis ciliata</i> var. <i>capensis</i>	grass	langbeenboesmangras
LC	SCROPHULARIACEAE	<i>Aptosimum indivisum</i> cf	dwarfshrub	Karoo-viooltjie
	SOLANACEAE	<i>Lycium</i> sp.	shrub	kriedoring
LC	VERBENACEAE	<i>Chascanum pumilum</i>	dwarfshrub	
LC	ZYGOPHYLLACEAE	<i>Augea capensis</i>	succulent-leaf dwarfshrub	bobbejaankos, kinderpieletjies
LC	ZYGOPHYLLACEAE	<i>Tetraena chrysopteron</i>	dwarfshrub	kleinskilpadbos

## APPENDIX G. Stonehenge Protected Environment Proclamation Notice

(to be inserted when available)