Appendix D: Specialist reports

Appendix D1: Services Investigation and Stormwater Management Report

HAYTERDALE AFRICAMPS

ROADS AND WET SERVICES REPORT:
PROPOSED PERMANENT TENTED CAMP:
FARM 406 HAYTERDALE, ZUURBERG ROAD, SUNDAYS RIVER VALLEY MUNICIPALITY NEAR ADDO IN THE, EASTERN CAPE

SYNOPSIS

This report deals with a preliminary engineering investigation regarding the bulk services and the preliminary investigation and design of the roads, stormwater, sewer, water and solid waste systems that will serve the mentioned permanent tented camp facility.

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HAYTERDALE AFRICAMPS

ROADS AND WET SERVICES REPORT:
PROPOSED PERMANENT TENTED CAMP:
FARM 406 HAYTERDALE, ZUURBERG ROAD IN THE SUNDAYS RIVER VALLEY MUNICIPALITY NEAR ADDO IN THE EASTERN CAPE

1. TERMS OF REFERENCE

In terms of our appointment by the Owner, Hayter Family Trust (Contact Person: Rob Hayter) of the Farm Hayterdale No. 406 dated 9 December 2019, we have prepared an engineering report regarding the preliminary investigation of the bulk services and preliminary investigation and design of access roads, stormwater, sewer and water and solid waste systems that will serve the mentioned permanent tented camp facility development.

2. SCOPE

The scope of this report deals with the collection of data on and adjacent to the relevant portion of the Farm Hayterdale No. 406 in the Sundays River Valley Municipality near Addo in the Eastern Cape and analysis of this data concerning an engineering opinion regarding the availability of bulk services, identification of restraints, further approvals and studies as well as the preliminary investigation and design of access roads, stormwater, sewer and water reticulation systems to serve the above-mentioned Hayterdale Africamps development.

In particular**, this report will focus** on the road access and wet services systems that have to serve the proposed 20 x permanent tented camp.

The above information is required for the water, foulsewer and solid waste systems and stormwater management plan that has to form part of the environmental report.

3. LOCATION

The location of the proposed tented camp development is as shown on the attached google map.

The new main entrance to the proposed permanent tented camp, Hayterdale Africamps is approximately 320m south-west of the existing entrance to the Farm Hayterdale off the existing R335 Zuurberg Road and approximately 7.4km north of the intersection of the R335 and R342 Roads.

4. DATA COLLECTION

4.1 Layout Planning and Survey details

The kml layout of the 20 x tented camp, Hayterdale Africamps has been obtained from the Owner, Hayter Family Trust (Contact Person: Rob Hayter) on 8 December 2019.

The 5m contours have been obtained electronically from Dr Belinda Clark of CEN IEM on 11 December 2019.

The identification of the roads which would be used by the visitors has been obtained electronically and as shown on site by the Owner, Rob Hayter.

4.2 Field records and observations

The Hayterdale Africamps will mainly be located on the western side of the existing vehicle track as shown on the google map.

The permanent tents will be situated between the 287m and 233m contours above Mean Sea Level (MSL). The land falls in general with steep gradients from west to east and with a mild gradient along the existing vehicle track.

The vegetation at and near the proposed tented development mainly consists of indigenous dense bush.

4.3 Engineering Geological report

A detailed engineering geological investigation has not been done.

However, an engineering geological investigation could be required on certain parts of the development as dictated by the appointed professional engineer prior to the detailed design stage.

Based on visual observations and secondary desk studies, a typical general soil profile could be described as follows.

The typical topsoil encountered at the tent sites can be described as sandy clayey silt with a relative high concentration of roots.

The topsoil is underlain by loose to moderately dense clayey silt or intact sandy clay.

The last-mentioned layer could also be underlain at places at shallow to moderate depths by intact or moderately fractured calcrete, sandstone and/or a sandy layer with pebbles and rounded stones.

5. LEVEL OF SERVICES

The level of services will be in accordance with the Guidelines for Human Settlement Planning and Design compiled under the patronage of the Department of Housing by CSIR Building and Construction Technology: (2000: Revision August 2003) and other acceptable design specifications.

6. ANALYSIS

6.1 Methodology

The methodology adopted in analyzing an effective design for the wet services system and main roads for the residential development under discussion, consists of the following:

* Establishing acceptable objectives for the proposed road and wet services systems.

* Determine appropriate design standards for the purpose of analysis and report.

* Applying these criteria to the expected post-development conditions to confirm findings and details regarding the proposed design and constructed works.

6.2 Acceptable objectives

- To provide flood control measures that prevent loss of life and significant damage to property from the run-off from major storms and keep excess run-off away from buildings and/or habitable units as far as practical possible.

- To provide reasonable access to buildings and/or habitable units, effective water supply, effective foulsewer and stormwater systems for the health, safety and convenience of the community and to protect property from damage by frequent storms.

- To provide economical facilities and find solutions to accommodate water demand, foulsewer effluent and stormwater run-off problems compatible with the physical and ecological environment and protect the natural environment in particular the sensitive areas against pollution.

- To implement procedures and practices that are consistent with the operating and maintenance standards of the accountable governing bodies and/or local authorities.

6.3 Appropriate design standards

A balance must be achieved between the objectives, optimal land use and economic viability of the development.

A compromise between the Guidelines for the provision of Engineering Services as published by the Department of Community Development 1983 (Blue Book), Guidelines for the Provision of Engineering Services and Amenities in Residential Townships Development issued by The South African Housing Advisory Council 1994 ("old" Red Book) and Guidelines for Human Settlement Planning and Design compiled under the patronage of the Department of Housing by CSIR Building and Construction Technology: (2000: Revision August 2003) ("new" Red Book).

The Guidelines for the Geometric design of Urban arterial roads (UTG1, 1986), TRH4 Specifications: Structural Design of Inter-urban and Rural road pavements **and** other accepted specifications as indicated, have generally been adopted as a basis for the design of the access roads to the restaurant and mentioned lodges.

In accordance with the recommendations from the Hydrological Research Unit (HRU) of the University of the Witwatersrand:
HRU report No. 1/72 – Design Flood Determination in S.A. and HRU report No. 2/78 – Additional information and improvements to Depth - Duration - Frequency diagram the so-called Rational Method has been used to determine the run-off for the relative small catchment areas where preliminary overland stormwater flows had to be determined near the proposed habitable areas.

DWAF (2001) White Paper on basic Household Sanitation. Department of Water Affairs & Forestry, September

Gazette No. 27187, Government Notice, DWAF, No. 399, 27 March 2004: Table B1: Effluent Treatment Standards

Xu, Y and Braune, E (1995). A guideline for groundwater protection for the community water supply and sanitation programme. Department of Water Affairs & Forestry, Pretoria.

7. INVESTIGATION AND PRELIMINARY DESIGN

7.1 Roads – Access

Due to logistical reasons, the preferred access to the **tented camp**, Hayterdale Africamps is approximately 265m south-west of the existing entrance to the Farm Hayterdale off the existing R335 Zuurberg Road and approximately 7.4km north of the intersection of the R335 and R342 Roads. Refer to the attached Hayterdale Africamps Layout: Google Image and the Traffic Impact Assessment (**TIA**) done by Engineering and Advice (Pty) Ltd dated January 2020.

The upgrading of security and traffic access control points (gates or booms) and intersections on and near the R335 Road, will have to be done in accordance with the approved TIA.

7.2 Roads and Parking - Structural

The structural design of the **main access roads** will have to be done in accordance with the TRH4 Specifications: Structural design of inter-urban and rural road pavements subject to the conditions as indicated in the geo-technical report.

The structural layer works of the main internal access road to the **tented camp** should be designed to accommodate the repetitive axle loads associated with post-development light vehicles and occasional heavier commercial vehicles.

In areas where the California Bearing Ratio (**CBR**) of the insitu material would be lower than 3% at 90% MOD AASHTO density (especially wet conditions), a selected subgrade layer of 250mm to 350mm crushed overburden material compacted to 95% MOD AASHTO density could be specified.

Subject to the applicable CBR values of the existing vehicle track, the preliminary structural layer works should consist of selected 150mm in-situ material compacted to 95% Modified American Association of State Highway Traffic Officials (**MOD AASHTO**) density and a 150mm subbase layer consisting of subbase quality or G5 material compacted to 95% MOD AASHTO density, (Classification in accordance with TRH 14: Guidelines for Road Construction Materials).

The subbase quality or G5 material will be obtained from the existing registered quarry on Farm No. 406 Hayterdale.

If preferred by the Developer, the layerworks at the proposed parking areas near the permanent tents can also be covered with a final gravel layer consisting of 19mm crushed stone or paving. The said gravel layer shall not be less than 60mm deep.

Subject to the total design repetitive axle loads that have to be accommodated, the paving should consist of 25mm sand on top of the road layerworks and 60mm or 80mm interlocking concrete paving blocks (30MPa crushing strength) complete with cement infill and sunken kerb edge restraints. The sunken kerb edge restraint shall be used to accommodate the sheet flow of stormwater as far as practical possible and not to interfere in general with the natural stormwater sheet flow.

7.3 Roads and Parking – Geometric Design

If required, the coordinated horizontal alignment of the existing intersections directly related to the proposed development will have to be amended and designed in accordance with the requirements as approved by the relevant authorities.

The preferred width of the main internal access roads to the tented camp should preferably be a minimum width of 3.4m with adequate by-pass areas and 5.5m wide near the entrance gates.

The vertical alignment of the roads (excluding existing 2-spoor tracks that would be used under controlled conditions by private 4 X 4 vehicles) will have to be done in accordance with the mentioned Guidelines as indicated earlier in this report.

As far as practical possible, all access roads and parking areas shall be modified **not to concentrate stormwater**. In case stormwater would be concentrated, effective erosion protection should be introduced to guide overland flow effectively to natural water courses.

Considering the topography of the sites, the roads and parking areas will have to be designed mainly to fall within the allowed minimum and maximum gradients (maximum stormwater flow velocities) to the natural lower-lying overland flow routes that would eventually drain to the natural watercourses.

Based on our experience and in accordance with the available topographical data for the site, maximum and minimum longitudinal vertical gradients on the roads should vary in general between 16% and 0,5% (absolute minimum 0,4%) respectively with a cross fall gradient of 2,0% to 2,5%.

7.4 Stormwater System

In general, an approach has to be adopted to accommodate a distributed and/or natural overland sheet flow as far as practical on and near the proposed permanent tent areas, parking areas and upgraded vehicle track access road.

In an attempt to address the post-development stormwater drainage in a responsible way including adherence to the accepted objectives, the following preliminary design proposals are recommended.

- Subject to the detailed design of earthworks, layerworks and stormwater systems, the upgraded tracks and parking areas shall be designed to follow the natural contours as far as practical possible subject to the accepted geometric design criteria as indicated earlier in this report.

- Distribute stormwater as far as practical possible to follow the natural contours and to be conveyed by the existing stormwater drainage system.

- Install non-rigid erosion protection consisting of a filter cloth lined Reno mattress structure where erosion could occur as the result of concentrated stormwater

- Construct and maintain earthen berms on the upgraded vehicle tracks to prevent the accumulation of stormwater on the road surface itself with particular reference to steeper longitudinal gradients or where the road or upgraded track lends itself to intercept the natural flow of stormwater.

- Design and install effective non-rigid erosion protection across the upgraded vehicle track where stormwater has to flow across the road or track in a concentrated way.

- Establish drought-resistant groundcover near the up- and downstream edges of the non-rigid erosion protection to limit the risk of erosion further.

- Grade and shape the final formation levels on and near the proposed parking and by-pass areas to prevent the build-up of stormwater.

7.5 Water Supply System

As confirmed with the Owner, Hayterdale Family Trust (Contact person: Rob Hayter) during December 2019, the water for food preparation and drinking purposes will be bottled water.

The water for washing and sanitation purposes will be obtained from the existing Hayterdale Borehole on the farm.

The yield testing of the said borehole was done by SRK Consulting as indicated in the e-mail dated 22 January 2020.

The safe abstraction rate of the afore-mentioned borehole according to the report of SRK Consulting (South Africa) Pty Ltd is 38 880l/day (38.8m³/day) for 12 hour pumping period per day or 51 840l/day (51.84m³/day for a 24 hour pumping period per day.

The Owner is **currently using the untreated borehole** water from the mentioned borehole for washing and sanitation purposes.

However, based on available test results of the analytical report done by Talbot Laboratories (Pty) Ltd dated 28 May 2019 regarding the quality of the borehole water, there is a high probability that the water will have to be treated for hardness.

It is recommended that the quality of the borehole water be tested and treated by a specialist in accordance with the legal standards as dictated by the Department of Water and Sanitation for irrigation, washing and sanitation purposes.

It is preferable to locate the treatment of the borehole water near the existing borehole.

The author does not consider himself as a water specialist. However, based on the limited available test results and information which we received from Sarel Bam, we comment as follows.

The water will be treated for hardness for washing purposes with an online purifier which will have little waste which will be contained in the on-line purifier.

Based on the outcome of the test results on the characteristics of the soil which will be irrigated and testing of all applicable components in the borehole water, there is a possibility that the borehole water could also be treated for the saline components. It is assumed that the waste from the reverse osmosis process will mainly consist of brine water.

The volume of the afore-mentioned brine water can vary from 1.5m³ up to 7m³ per day.

The brine water can be directed to an evaporation pond fitted with a sprayer-pump system to increase the evaporation rate of the salty water in the said pond. The evaporation pond shall have a 300mm clay layer combined with a plastic lining.

Subject to the recommendation of the water treatment specialist and all applicable approvals, most of the brine water could be re-used to suppress the dust on the Zuurberg gravel and other gravel roads inter alia. During and after rain storms the concentration of the precipitated salt content in the run-off from the gravel roads will be diluted drastically.

Based on our preliminary calculations, the evaporation pond should be 11m x 11m x 0.9m deep.

The treated borehole water will be pumped from the said treatment plant to the proposed water reservoir via a 50mm diameter HDPE PE100 pumping main. The class of the HDPE pumping main will vary from a PN16 to PN10.

During high season, the Annual Average Daily Demand (AADD) for the proposed permanent tented camp has been calculated to be 20 000l/day (20m³/day). Based on the mentioned report of SRK Consulting, the existing borehole can definitely accommodate an abstraction rate of

38m³/day at a recommended pump depth of 26m below the ground level which should be more than adequate for the development under discussion.

The water storage facility will be designed to ensure the necessary capacity of water required during instantaneous peak demand including fire conditions at the afore-mentioned entities.

The Owner indicated that he will construct a reservoir with an effective storage capacity of 163m³ at the 352m contour level next to the existing vehicle track. In accordance with our calculations the capacity of 163m³ is much higher than the required fire and domestic capacity. The disturbed footprint of the reservoir platform should not exceed 190m².

The reticulation which will serve the 20 x permanent tents will consist of a double looped 110mm diameter HDPE PE100 pipe. The class of the pipe will vary from a PN16 to a PN10 depending on the maximum residual pressure which can develop in the reticulation.

Most of the pipework has been routed along existing tracks where the trenching will mainly be done with a TLB machine which will be 700mm wide x 1000mm deep. However, where the pipe route will go through natural vegetation, the trenching can be done by hand which should be 400mm wide x 700mm deep on average.

Considering the top water level of the reservoir and the ground level at each permanent tent, associated friction losses under instantaneous peak demand including the required fire flow as calculated by us, the required residual pressure in the reticulation system at each entity will be sufficient under the gravity feed from the 163m³ reservoir.

7.6 Foulsewer System

There are various options to treat the foulsewer effluent which will be generated by the proposed permanent tents on the Hayterdale Africamps development.

Most of the lodges under the jurisdiction of the Sundays River Valley Municipality operate on a septic tank system.

Normally the **first option**, the septic tank foulsewer system would have been approved for rural residential units where the density of the development is relative low, the permeability of the insitu soil is adequate and the risk of pollution of a natural water course, surface water, dam and/or underground water source is considered to be low.

If the outcome of the afore-mentioned investigations would indicate that further treatment options have to be investigated, we comment as follows.

The **second preferred option** will be to treat the overflow of the septic tanks to acceptable irrigation standards.

The **third option** will be to separate the black water (toilet) and effluent generated by the kitchens (sink) from the grey water (shower, bath and wash hand basin).

Under this design approach, the overflow from the grey water septic tanks of the permanent tent will be allowed to drain via a proper designed subsoil drain into the insitu soil near each tent subject to the fact that the permeability of the insitu soil is adequate and the risk of pollution of a natural water course, surface water, dam and/or underground water source is considered to be low.

The overflow from the black water septic tanks will be subject to further treatment.

The **fourth option** will be to direct the black water and the kitchen effluent to conservancy tanks instead of septic tanks. The conservancy tanks will have to be emptied on a regular basis by a competent contractor and the said effluent be treated by a registered wastewater treatment plant.

However, considering the nuisance, financial and maintenance costs, the **fourth option is not preferable at this stage.**

<u>Septic tank system: Option 1</u>

The proposed combined septic tank system at each permanent tent will be installed **underground** near the parking areas which will serve the respective tents in order to have reasonable access regarding the maintenance of the septic tanks.

The afore-mentioned septic tank system will consist of a 2500l **watertight** PVC septic tank in serie with a 1500l PVC septic tank complete with **watertight pipework connections**.

The overflow pipe of the second septic tank will be connected with a **watertight joint to the 110mm diameter HDPE sewer reticulation** pipe which will convey the clearer effluent of the combined septic tank system to the buffer tank at the sewer treatment plant.

The mentioned 110mm diameter **HDPE pipe will be elevated** for a above the **stream** at the water course to make it easier regarding the effective maintenance of the pipe and to monitor leaks. The HDPE pipe portion across the water course will be jointless and will stretch over a horizontal distance of approximately 10m. The elevated pipe will be constructed approximately 2m high above the perennial stream. The elevated pipe will be supported by 150mm diameter gum poles which will be founded outside the stream at a spacing not exceeding 3m with suitable concrete foundations and 1m radius Reno mattress erosion protection around the poles. The pipe will be fixed to the pole with 3mm thick x 40mm wide galvanized steel fittings.

Further treatment: Option 2

The preferred Option 2 to treat the domestic effluent under post-development conditions is the Clearedge Sewage Treatment System or similar foulsewer treatment system as approved by Municipality.
The mentioned Clearedge sewage system has been installed inter alia at the following developments in South Africa:

Fuel Station and Convenience Store, Nanaga (2018) as approved by Sundays River Valley Municipality
Royalston Eco Estate, Port Elizabeth (2013) as approved by the Nelson Mandela Bay Municipality
Sardinia Bay Golf Estate, Port Elizabeth (2008) as approved by the Nelson Mandela Bay Municipality
Glen Eagles Estate, East London, 2007
Crossways Village, East London 2015
Lilyfontein School, East London, 2003
Samola Golf Estate, Western Cape, 2007
Caltex Garage Truck Stop, Komga, 2017
In layman's terms, the operation of the closed onsite Clearedge Sewage Treatment System can be summarized as follows (also refer to our enclosed Drawing No. RH/2020-01/FT/01):

The effluent overflow from the septic tanks at each tent is conveyed under gravity to the “communal” two-chamber septic tank (buffer tank) at the Clearedge package plant (sewage treatment plant) with a minimum 24-hour design load capacity.

Most of the suspended solids will be contained and be broken down by anaerobic and aerobic action in the first chamber of the “communal’ buffer tank. The clearer effluent overflow into the second chamber will be pumped to the bio-reactors.

The sewage effluent will move through the media where aerobic bacteria in a submerged fixed-film will break down the organic matter to more stable levels with the addition of air (higher concentration of dissolved oxygen) supply under pressure.

The treated overflow from the bioreactor(s) will be discharged to the clarifier(s) where the sludge will be settled out, drained and be returned to the first chamber of the “communal’ septic tank (buffer tank). The clear treated effluent from the top part in the clarifier will be conveyed to the chlorine contact tank to disinfect the clear treated effluent.

In order to keep the maintenance process as simple as possible, the Etatron DLX series (wall mounted) & DLXB series (foot mounted) solenoid dosing pumps with the electronic flow sensor and level probe, will not be recommended to control the dosage of Chlorine in the contact tank.

Instead of the solenoid driven dosing pump, an inline chlorinator as developed by Klorman or Clearedge will be used to supply chlorine under controlled conditions to the effluent in the contact tank.

The inline chlorinator consists of a spring-loaded cartridge filled with slow release chlorine tablets. The clear effluent will flow over the lower part of the spring loaded cartridge where the flow in the pipeline between the clarifier and the contact tank can be adjusted to control the contact area between the slow release chlorine pills and the effluent to release the correct dosage of chlorine to disinfect the effluent to the required standards.

In order to address the concern about the required levels of free chlorine residual in the final effluent, it is recommended that the applicable chlorine test in the final effluent from the contact tank should be done initially on a daily basis and to adjust the flow over the inline chlorinator accordingly if needed.

However, it is also recommended to design and construct an irrigation pond system at the foul sewer batch plant. The **irrigation** pond has to be designed and constructed to allow a minimum of 4 days retention time to make sure that the **final effluent to be free from any chlorine residual** that could occur under isolated overdosing conditions.

In case of extreme unforeseen package plant breakdowns or other risks, we recommend that the **irrigation pond** system should also be able to accommodate the inflow up to **15 days X ADWF** that can be re-circulated to the "communal" septic tank if needed to limit the risk of possible contamination of underground water sources.

The irrigation pond shall be constructed with a plastic lined base covered with a 300mm clay layer to avoid percolation to lower lying ground layers.

It is also recommended to supply the batch plant with a mobile independent diesel generator in case of power failures.

In order to make 99,9 % sure that fatty stuff and fine soil particles would not interfere with the effective working of the Clearedge Package Plant over the medium and long term, it has been recommended to install a 2 x PVC septic tanks in serie at each permanent tent. Depending on the occupancy rate and diet of the guests inter alia, the septic tanks could be emptied once every 3rd year. The afore-mentioned sewage can be discharged at the already upgraded Addo Wastewater Treatment Works as confirmed with the Rudi Herholdt: Manager: Infrastructure Planning and Development of the SRVM on 7 February 2020.

This precautionary measure will limit the risk of blockages in the media of the bioreactors and also bring down the required Chemical Oxygen Demand in the effluent that would be conveyed to the Clearedge package plant.

In order to monitor the effective working of the Clearedge package plant system in combination with the irrigation pond, it is recommended to have samples of the final treated water tested on a bi-weekly basis by the laboratory of the Nelson Mandela Bay Municipality: Port Elizabeth over the first 3 months.

The **treated water will be used to irrigate the 6 180m² grassed area as shown.** The irrigation pipeline will be a 50mm diameter PE100 PN6.

Depending on the occupancy rate and weather conditions, the maximum volume which could be available for irrigation, can be 15m³/day. That will give us a maximum irrigation rate of 2.4mm per day which is much less than the accepted average norm of 4mm per day.

It is realistic to assume that the monthly volume available for irrigation can vary between 90m³ up to 370m³ per month.

The irrigation pond has been designed to accommodate up to 15 days of the ADWF which can be generated by the 20 tents which should take care of most risks related to the storage of the treatment of the clearer effluent.

As confirmed with Rudi Herholdt: Manager: Infrastructure Planning and Development of the SRVM on 7 February 2020 and the Owner, Hayter Family Trust (Contact Person: Rob Hayter), the Owner can discharge the excess effluent which could generate in the irrigation pond over the said emergency period to the Addo Wastewater Treatment Works.

It is recommended to use sprayers for irrigation of the grassed area which will also enhance the aeration of the treated water.

During December 2019 the Owner, Rob Hayter indicated that he would prefer the **implementation of Option 1 combined with Option 2** on this development to ensure low risk regarding potential pollution and also use the treated water for irrigation of the said grassed area.

The **permanent tented camp** will be situated between the 289m and 234m contours above Mean Sea Level (MSL).

During high season, the design Average Dry Weather Flow (**ADWF**) of the 20 x permanent tents has been calculated to be 15.0kl/day.

The overflows from the mentioned septic tanks in serie at each tent will gravitate via a 110mm diameter HDPE Pe100 PN10 pipe to the “communal” buffer tank of the Clearedge Package Plant.

Based on our preliminary calculations, the effective capacity of the “communal” **buffer tank at the treatment plant** that would serve the 20 tents is 15.0kl. Practically it will be the equivalent of a 4m x 4m x 1.2m deep tank. The overflow from the buffer tank will be pumped to the treatment plant.

The treatment capacity of the Clearedge Package Plant that will serve this development has to be a mimimum of 15.0kl/day.

The approximate size of the irrigation pond to serve the package plant effluent from the 20 x permanent tents would be the equivalent of 45m X 5m X 1m deep considering the contours downstream of the treatment plant.

7.7 Solid Waste Disposal

The **domestic waste** that could be generated by the 20 x tented camp development has been calculated to be **6m³ per week** during full occupation.

The Owner, Hayter Family Trust will have to accept accountability for the effective management including the storage and collection of the solid waste from all the entities on site.

The solid waste from the will be collected and stored in containers in a **refuse area before collection** by a private licensed Contractor with a safe disposal certificate as dictated by the municipality.

The solid waste will be collected on a regular basis (weekly) from the communal refuse area and be disposed at the registered Sunland Waste Dump on the Remainder Farm 639 in the Administrative district of Uitenhage as confirmed with Rudi Herholdt: Manager: Infrastructure Planning and Development of the SRVM on 7 February 2020.

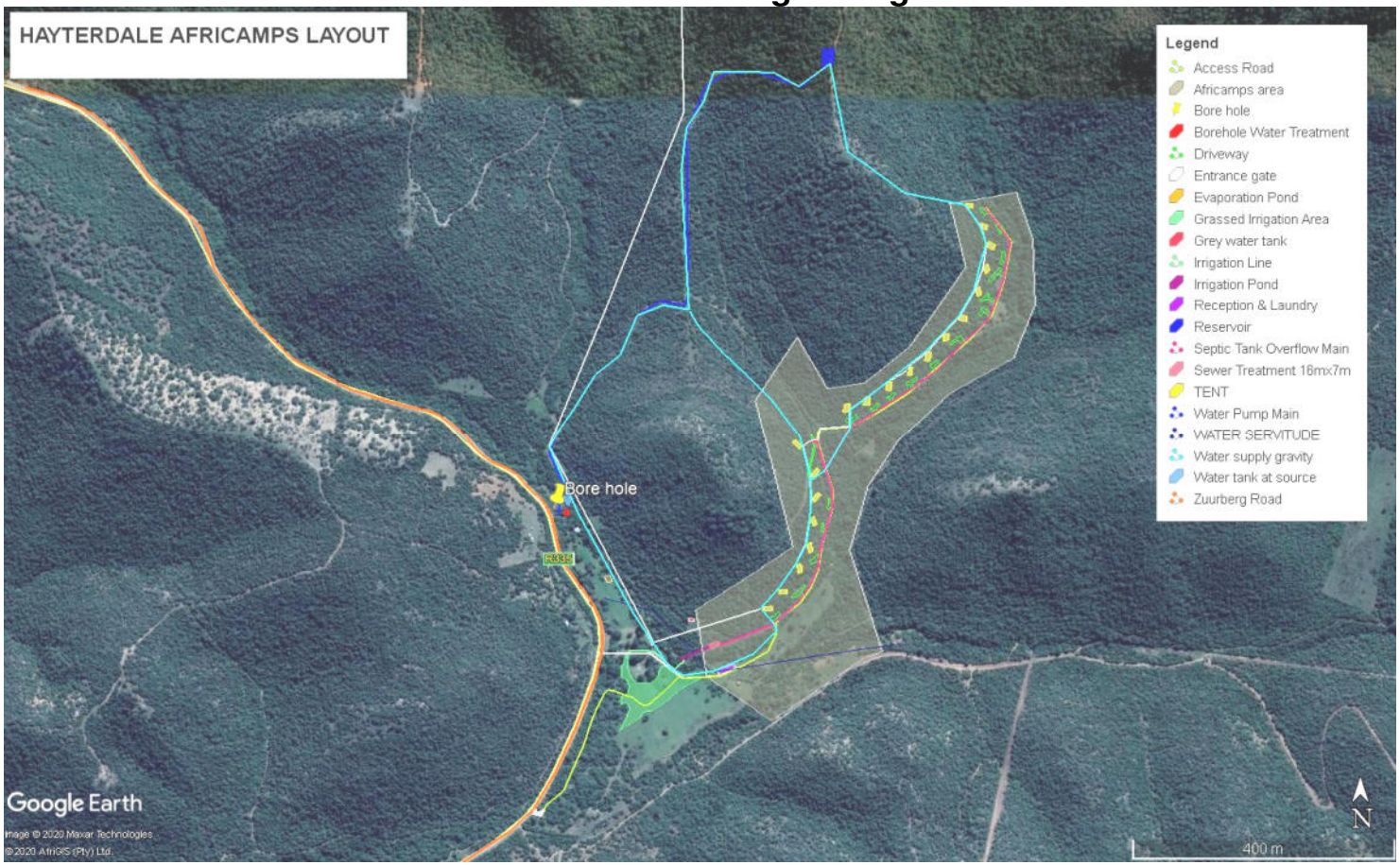
8. CONCLUSION

A cautious approach in the conceptual design of the roads and storm water, sewer, water and solid waste systems has been adopted.

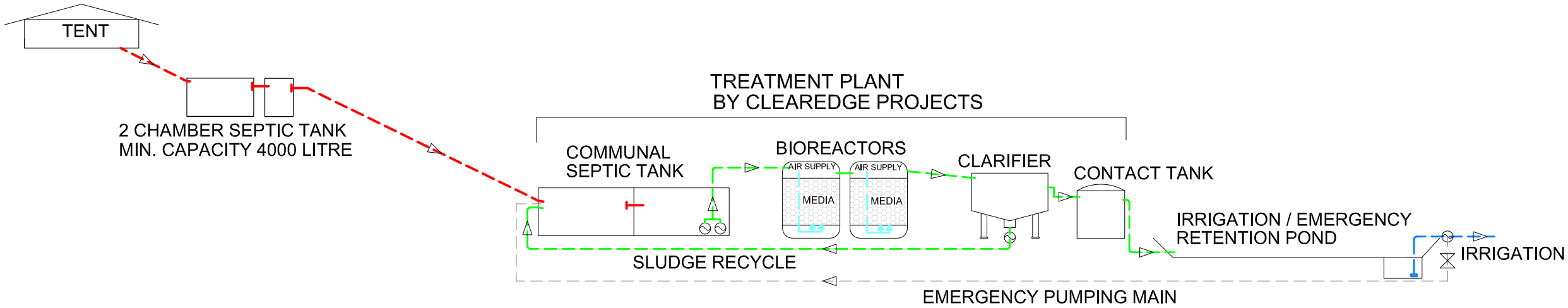
In strict adherence to the detailed design and execution of earthworks, roads, wet services and solid waste systems as indicated in this report, we are convinced that the proposed permanent tented development near Addo could be serviced effectively from a civil engineering perspective.

9.0 APPENDIX

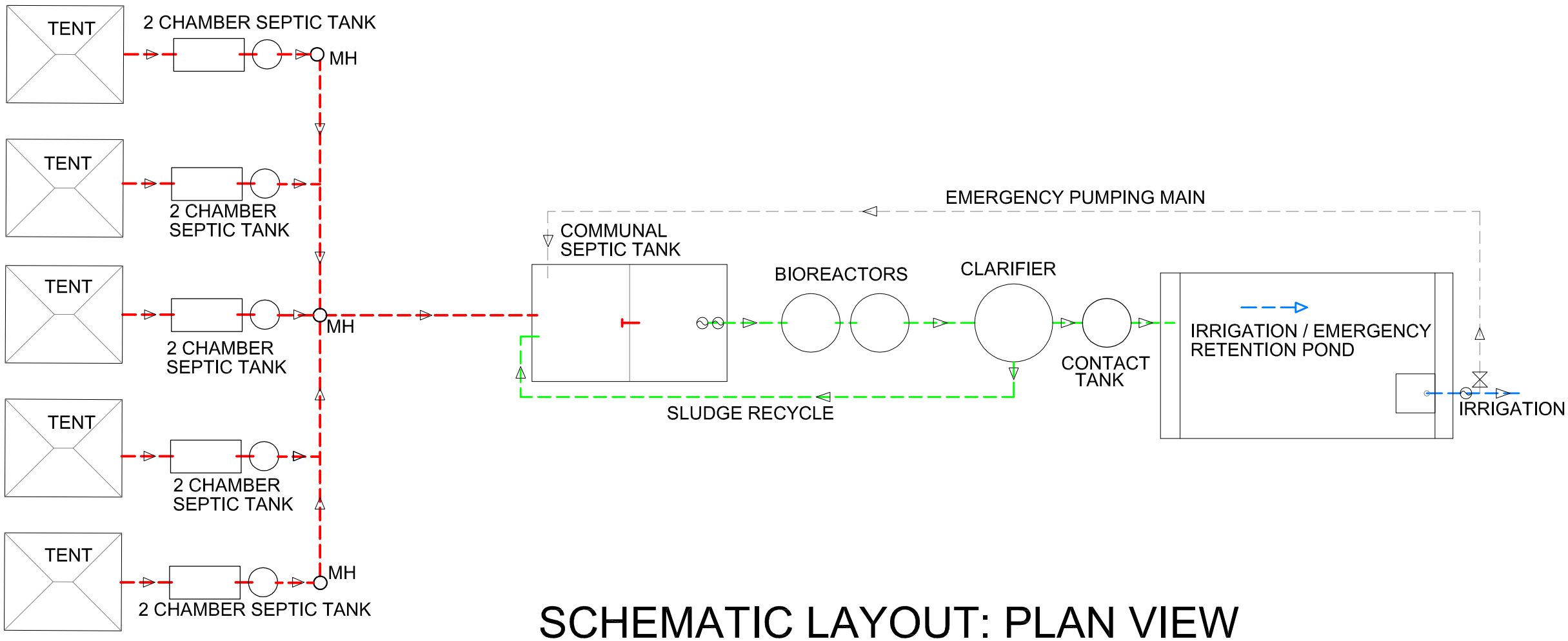
9.1 HAYTERDALE AFRICAMPS LAYOUT: Google Image



9.2 Typical Clearedge Sewer Treatment System



SCHEMATIC LAYOUT: ELEVATION VIEW



SCHEMATIC LAYOUT: PLAN VIEW

NO. / NR	DATE / DATUM	REVISION / WYSIGING

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HAYTERDALE
AFRICAMPS

Drawing/Tekening:

CLEAREDGE
FOULSEWER TREATMENT
SCHEMATIC LAYOUT

Scale/Skaal:	Date/Datum:	Drawn/Getaken:	Checked/Nagesien:
NTS	FEB 2020	RvS	

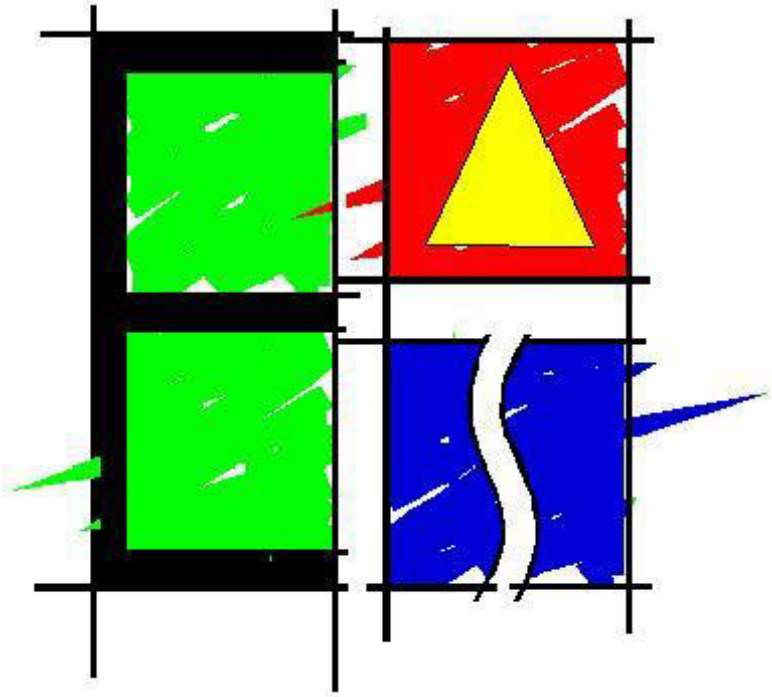
Drawing No./Tekening Nr.: RH/2020-01/FT/01

Rev/Wys:

Appendix D2: Traffic Impact Assessment

TRAFFIC IMPACT ASSESSMENT

FOR THE PROPOSED ESTABLISHMENT OF A TENTED CAMP RESORT FACILITY ON PORTION 0 OF FARM HAYTERDALE NO. 406, SUNDAYS RIVER VALLEY MUNICIPALITY



January 2020

Prepared for: **CEN Integrated Environmental Management Unit**

Prepared by: **Engineering Advice and Services (Pty) Ltd**
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DOCUMENT CONTROL SHEET

CLIENT REF: **CEN ENVIRONMENTAL MANAGEMENT UNIT**

PROJECT NAME: **PROPOSED ESTABLISHMENT OF A TENTED CAMP RESORT FACILITY ON PORTION 0 OF FARM HAYTERDALE NO. 406**

DOCUMENT TITLE: **TRAFFIC IMPACT ASSESSMENT**

DOCUMENT FILE REF: F:\1700-1799\1754\Reports\REP001 - TIA Hayterdale Tented Camp.docx

Version	**1**		
Compiled by	JK Charlton Candidate Eng Technologist (201580304)	January 2020	
Reviewed by	CGA Hastie Pr Tech. Eng (200070122)	January 2020	
Amendments made by			
Version			
Compiled by			
Reviewed by (Director)			
Amendments made by			
Version			
Compiled by			
Reviewed by (Director)			
Amendments made by			

DISTRIBUTION:
1) Original : Client (CEN IEM Unit – Ms Belinda Clark)
2) Copy : DoT EC – District Roads Engineer (Sarah Baartman)
3) Copy : Sundays River Valley Municipality
4) Copy :
5) Copy :
6) Copy : EAS File 1754

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1 INTRODUCTION

1.1 BACKGROUND

Engineering Advice & Services (Pty) Ltd was appointed by CEN Integrated Environmental Management Unit on during December 2019 to conduct a traffic impact assessment for development of a tented camp resort facility on portion 0 of farm Hayterdale No. 406 situated to the east of MR00450 (Zuurberg Road) in the Sundays River Valley Municipality.

1.2 METHODOLOGY

The approach followed in conducting the traffic impact assessment was in accordance with the guidelines contained in **TMH 16 Vol 1- South African Traffic Impact and Site Assessment Manual**[(1)].

Given the extent of the proposed development and in terms of the guidelines, the development is considered to be a small-sized development and this assessment will thus consider impact for the development horizon (assumed to be 2025).

The methodology used was as follows:

- The expected trips that will be generated by the development were determined.
- The suitability of the access point to the public road network was assessed.
- The impact on public roads that may be used by resort visitors was assessed in terms of operational safety taking into account road conditions and sight distances.
- By taking into account the major findings of the study, conclusions were made regarding the financial responsibilities of the affected parties for required road upgrading measures.

2 LAND USE RIGHTS, DEVELOPMENT AND ENVIRONS

2.1 LAND USE RIGHTS

The site which is currently zoned for Agricultural purposes measures approximately 254 ha and is located east of of MR00450 as indicated on **Figure 1**.

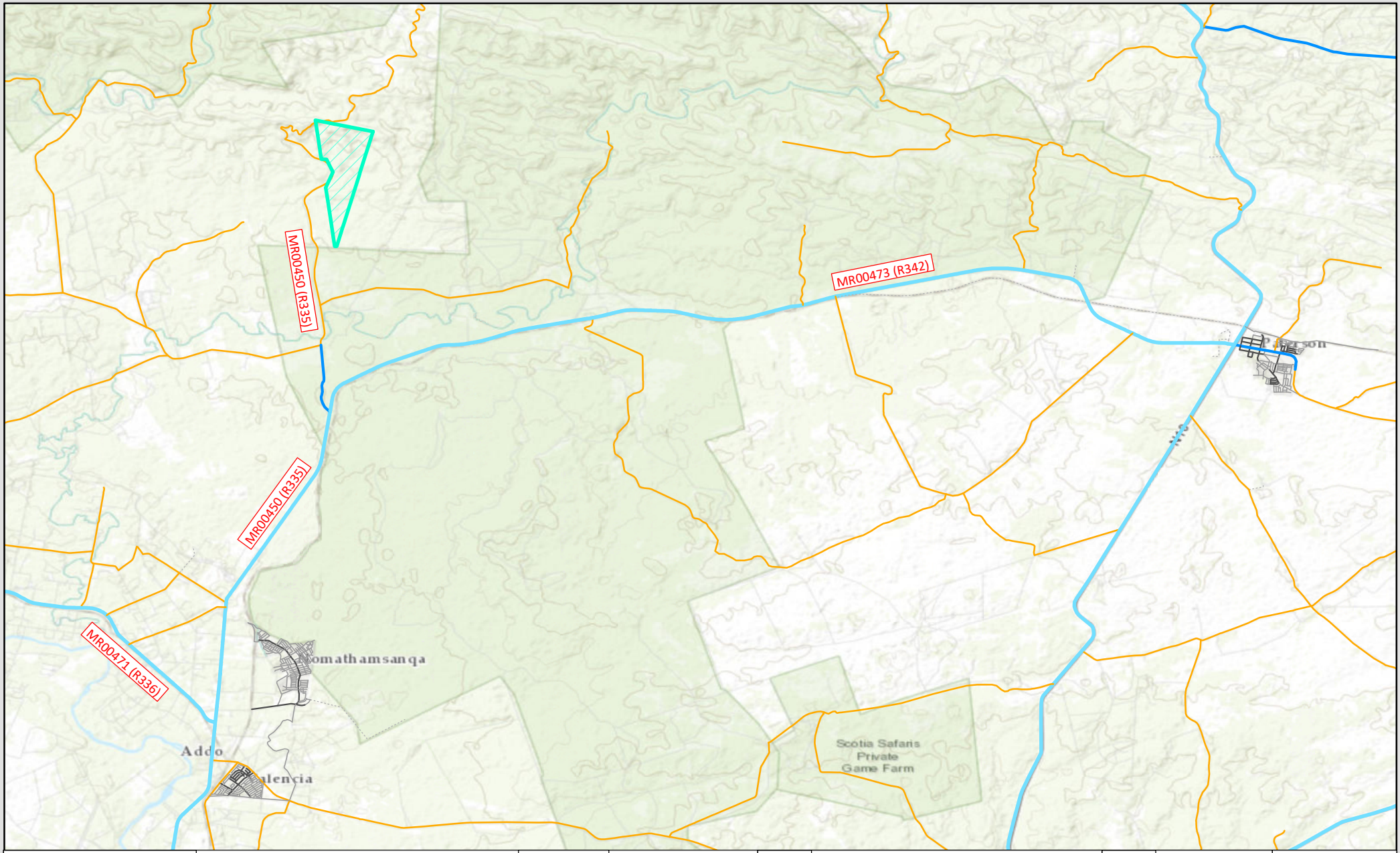
2.2 DEVELOPMENT OVERVIEW

It is proposed to develop twenty boutique camping (glamping) tents in two phases (12 in phase 1 and a further 8 depending on demand) on the property. A new access point is proposed approximately 300m south of the existing access point in order to maximise sight distances.

Each tent will accommodate a maximum of five persons.

In addition to the tents, a new roadway is proposed to accommodate the improved access location as well as services that will be dictated by the relevant specialist studies.

The property is currently used for walking and mountain biking trails and thus does attract some activity primarily on weekends and during holiday periods.



Engineering Advice and Services

Tel: (041) 581 2421

LEGEND

Site Boundary

Project Title:

Traffic Impact Statement for the Proposed Tented Camp on Farm 406, Hayterdale, Zuurberg Road, Sundays River Valley Municipality

Drawing No:

1754-P-001

0 0.3 0.6 1.2 1.8 2.4 3 Km

Scale 1:150 000

Drawing Title:

Figure 1: Locality Plan

Drawing Date:

February 2020

Prepared by : MS

Checked by : CH

3 DATA COLLECTION

3.1 HISTORICAL DAILY TRAFFIC VOLUMES

Traffic volume data was sourced from a 12-hour count conducted at the MR00450 / DR02006 junction approximately 5.4km south of the proposed development in January 2018 as part of the Eastern Cape Department of Transport's Rural Road Asset Management System (RRAMS) programme.

The traffic volume data is summarised on **Figure 2** below and attached as **Annexure A**.

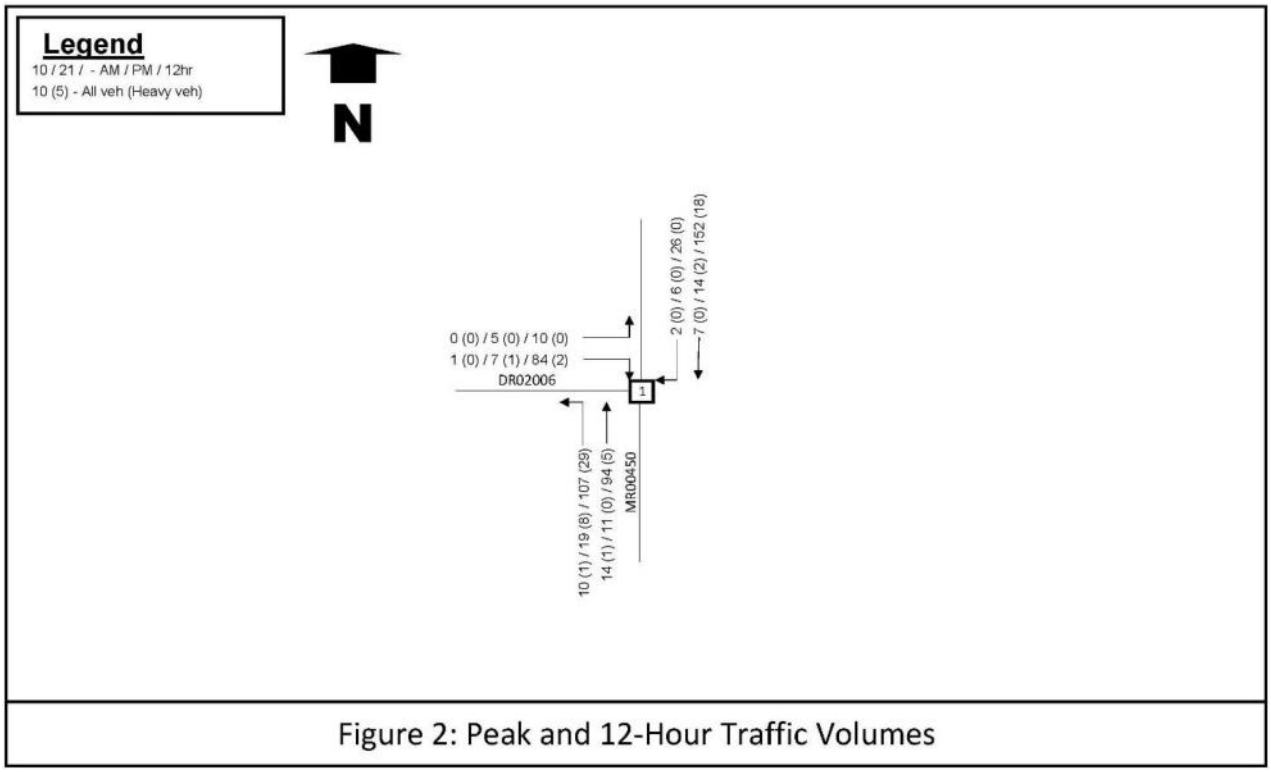


Figure 2: Peak and 12-Hour Traffic Volumes

The data, indicates that 12-hour volumes on MR 00450 between the site and DR02006 amount to282 vehicles. 23 and 36 vehicles were recorded during the AM and PM peak hours respectively.

The existing traffic volumes result in DR01976 falling into the high rural road category as indicated in **Table 1** below.

Table 1: Rural Road Categories by Traffic Volume

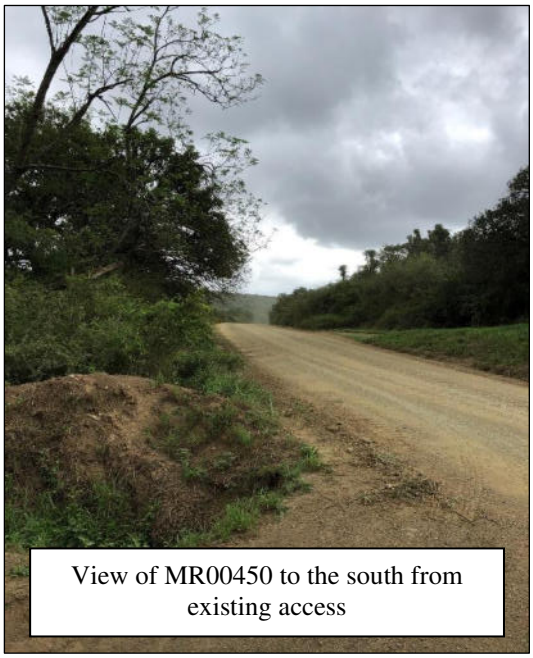
Daily traffic (v/d)	Category	Proposed road surface
0 – 50	Low	Gravel (75 mm)
50 – 180	Medium	Gravel (150 mm)
180 – 350	High	Gravel (150 mm)
Over 350		Surfaced

3.2 ROAD NETWORK

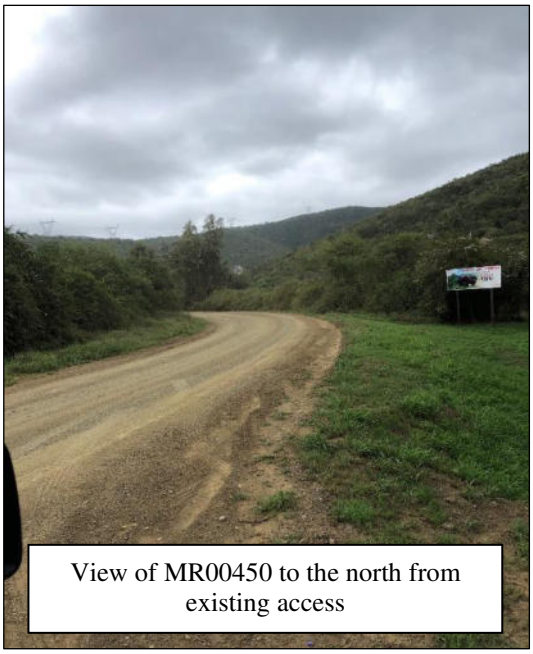
R335 (MR00450) is a gravel surfaced provincial main road which links Addo with Somerset East through the Zuurberg mountains. In the vicinity of the site, the road surface is approximately 7m wide and can be considered to be in a good condition. The posted speed limit is 60km/h.

DR02006 is a provincial gravel road that links MR00450 with Kirkwood to the west. The road is 7m wide and is in a fair to good condition.

The existing road network is indicated on **Figure 1.**



View of MR00450 to the south from existing access



View of MR00450 to the north from existing access

4 TRIP GENERATION AND DISTRIBUTION

The proposed development includes up to 20 tents.

Based on full development it is assumed that each tent will generate a maximum of 1 inbound or outbound trip during the AM or PM peak hours. This is assuming that each trip arrives or departs dring a single peak hour, which is unlikely to occur. In reality, visitors will arrive during the course of the day over a number of hours realising in the order of 3 to 4 trips per hour.

Notwithstanding, it is assumed that 100% of trips would arrive or depart during a single peak hour.

When adding these trips – 20 inbound during the AM peak hour and 20 outbound during the PM peak hour, it is clear that operation at the proposed access point is not of concern given that peak hour two-way volumes are in the order of 36 vehicles.

It is further assumed that given other tourist attarctions in the area and in order to be conservative, each tent could generate a further two trips per day in addition to the arriving and departing trips.

This worst-case scenario could realize 80 vehicle trips should all 20 tents be occupied simultaneously.

Given the location of the development it is further assumed that approximately 80% of trips would arrive from and depart to the south.

5 PROPOSED ACCESS ARRANGEMENTS

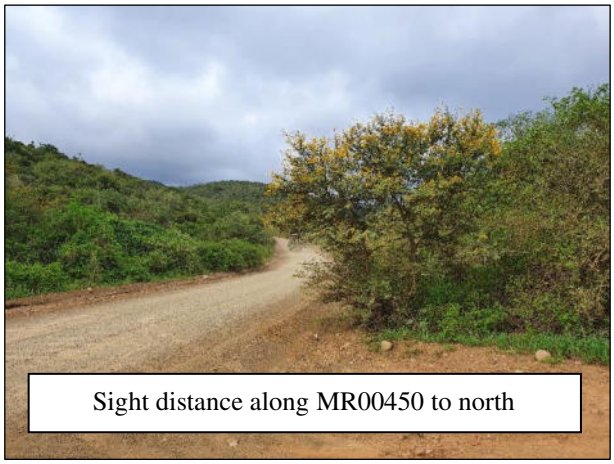
Although sight distance from the existing access to the south meets the necessary requirements, to the north it is limited – approximately 85m.

As such, it is proposed to create a new access to the tented camp approximately 300m south of the existing access point. Sight distances from this access point both to the north and the south meet the necessary requirements as specified in terms of **TRH 17: Geometric Design of Rural Roads** [(2)]. TRH17 recommends that a single unit and trailer vehicle entering a road with a design speed of 60kph turning left or right requires shoulder sight distance of 250m. The requirement for a passenger car is 145m.

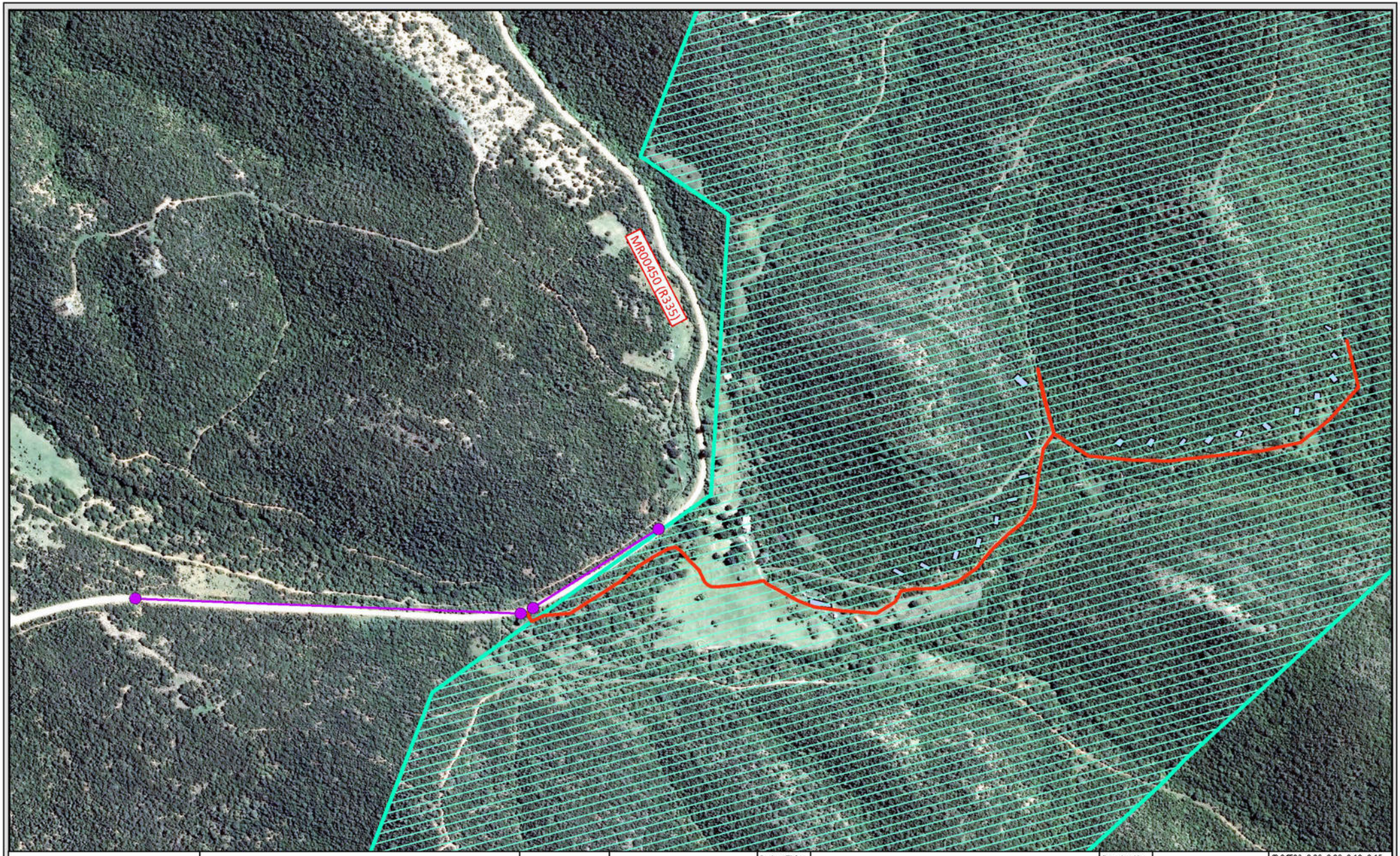
Shoulder sight distance (SSD) from the proposed access road along MR00450 to the south is in excess of 350m thus meeting the minimum requirement of 250m for both trucks and passenger cars. Sight distance to the north is approximately 220m, just less than the minimum requirement for trucks but more than the requirement for passenger cars, provided there is clearance of some vegetation at the access point (existing acacia thorn tree).

The proposed access location is indicated on **Figure 3** overleaf.

Sight distance along MR00450 to south



Sight distance along MR00450 to north



Engineering Advice and Services

Tel: (041) 581 2421

LEGEND

- Proposed Road
- Site Boundary
- Tent Locations

Project Title:

Traffic Impact Statement for the Proposed Tented Camp on Farm 406, Hayterdale, Zuurberg Road, Sundays River Valley Municipality

Drawing No:

1754-P-003

Drawing Title:

Figure 1: Proposed Access Arrangements

Drawing Date:

February 2020

0.00 0.03 0.06 0.09 0.12 0.15 Km

Scale 1:7 500

Prepared by : MS

Checked by : CH

6 POTENTIAL IMPACTS

6.1 IMPACTS

The following potential traffic related impacts relating to the proposed development have been identified. Note that the impacts will occur both in the short-term (i.e. during the construction phase) and medium- to long-term (as development is on-going) and once it is complete (operational phase).

- Road Capacity
  Trips generated by the proposed development will have minimal impact in terms of road capacity given the low daily volumes along MR00450 and at the affected access and low trips generated by the proposed development.

- Access
  Access to the development will be provided from MR00450 via a new access point positioned to ensure that potential road safety concerns are minimised.

- Road Condition
  Given low operational traffic volumes – comprising predominantly light motor vehicles - it is not anticipated that significant damage will be caused to the road network.

- Traffic Safety
  Safety issues may arise as a result of faster moving traffic on MR00450 encountering slower moving vehicles entering and exiting the development.

- Dust
  The quantity of dust generated by a vehicle depends on its shape, speed and the properties of the road surfacing material. While difficult to predict, an increase in traffic volumes will no doubt result in an increase in the generation of dust which may impact on the following:
  - Visibility, which will impact on safety particularly with regard to passing and following conditions;
  - Damage to vehicle moving parts; and
  - Acceleration of road damage due to loss of fine material as dust.

6.2 IMPACT ASSESSMENT

As described in **Chapters 4** and **5**, there is likely to be minimal impact on MR00450 as a result of additional traffic volume sassuming that the development is fully occupied at all times.

A general assessment has been undertaken of impacts on various factors, as provided in the tables below. Note that this assessment does not deal with issues relating to noise, emissions, job creation or environmental matters, as the author is not qualified to comment on these. If necessary, such key issues have been addressed in separate specialist assessments.

Table 2 overleaf indicates the impact rating system used for the study.

The assessment has been conducted for both the construction/development and operational phases of the development.

Table 2: Generic Table for rating of impacts

Nature of the Impact	This should include a description of the proposed impact to indicate if the impact is a direct, indirect or a cumulative impact.
Extent	Site specific, local, regional or national
Duration	Temporary, short term, medium term, long term or permanent
Intensity	High, medium or low
Probability	Improbable, probable, highly probable, definite
Reversibility	Reversible, Partially Reversible, Irreversible
Degree of Confidence	Low, medium or High
Status and Significance (without mitigation)	Low, medium or High indicating whether Positive (+), Negative (-) or Neutral (o)
Mitigation	Overview of mitigatory measures to mitigate potentially negative impacts or enhance potential positive impacts indicating how this mitigatory measure impacts on the significance of the impact
Status and Significance (after mitigation)	Low, medium or High indicating whether the status of the impact is Positive (+), Negative (-) or Neutral (o)

6.2.1 Construction Phase

Table 3: Impact Assessment: Additional traffic volumes

Description	Impact	Comment / Reason
Extent	Local	<2km radius from site
Duration	Short term	During construction period
Intensity	Low	Minimal impact on current road users
Probability	Definite	Development will generate construction vehicles delivering building supplies
Reversibility	Partially Reversible	By reducing construction period and keeping construction plant on the site during construction, impact of construction vehicles can be minimised
Degree of Confidence	High	
Status and Significance of impact (without mitigation)	Low (negative)	Construction volumes are low remaining on the site during construction.
Mitigation		None
Status and Significance of impact (with mitigation)	Low (negative)	Construction volumes are low.

Table 4: Impact Assessment: Traffic Safety Impact due to slow moving traffic

Description	Impact	Comment / Reason
Extent	Local	<2km radius from site – at access
Duration	Short term	Additional traffic generated by development during construction of tented camp .
Intensity	Low	Minimal impact on current road users
Probability	Probable	Construction traffic delivering materials – however volumes minimal.
Reversibility	Partially Reversible	Impact partially reversible if suitable temporary warning signage is erected.
Degree of Confidence	High	
Status and Significance of impact (without mitigation)	High (negative)	Accidents could mean loss of life.
Mitigation		Additional warning signage, compliance with Health and Safety requirements.
Status and Significance of impact (with mitigation)	Medium (negative)	Accidents could mean loss of life but mitigatory measures can minimise impact.

6.2.2 Operational Phase

Table 5: Impact Assessment: Road and Intersection capacity (additional traffic loading)

Description	Impact	Comment / Reason
Extent	Regional	5to 10km radius from site – at access and DR02006 / MR00450 junction
Duration	Long term	
Intensity	Low	Minimal daily traffic impact
Probability	Probable	Additioonal traffic will be generated.
Reversibility	Irreversible	Impact will continue to occur albeit low impact.
Degree of Confidence	High	Surveys of current daily traffic volumes conducted historically.
Status and Significance of impact (without mitigation)	Low (negative)	Traffic volumes generated are low.
Mitigation		None
Status and Significance of impact (with mitigation)	Low (negative)	Traffic volumes generated are low.

Table 6: Impact Assessment: Traffic Safety Impact due to additional traffic

Description	Impact	Comment / Reason
Extent	Regional	5to 10km radius from site – at access and DR02006 / MR00450 junction
Duration	Long term	Additional traffic generated by development – 2 to 3 interlink truck trips per day equating to 5 trips (2.5 in and 2.5 out) over 100 days each year
Intensity	Low	Minimal daily traffic impact
Probability	Probable	Potential for traffic safety to be compromised.
Reversibility	Ireversible	Impact will occur albeit low impact
Degree of Confidence	High	
Status and Significance of impact (without mitigation)	High (negative)	Accidents could mean loss of life.
Mitigation		Access located at safer position, existing access closed, additional warning signage erected.
Status and Significance of impact (with mitigation)	Medium (positive)	Accidents could mean loss of life but mitigatory measures can minimise impact.

Table 7: Impact Assessment: Deterioration of Public Road Network

Description	Impact	Comment / Reason
Extent	Regional	5 to 10km radius from site – at access and along MR00450
Duration	Long term	Maximum of 40 light vehicle trips per day
Intensity	Low	Minimal daily traffic impact relative to current volumes
Probability	Probable	Additional traffic using the road.
Reversibility	Partially Reversible	Road can be kept in good condition if maintained regularly.
Degree of Confidence	High	
Status and Significance of impact (without mitigation)	Medium (negative)	Possible damage to road surface
Mitigation		Ongoing road maintenance
Status and Significance of impact (with mitigation)	Low (negative)	Gravel loss can be negated should road be regularly maintained

Table 8: Impact Assessment: Generation of Dust

Description	Impact	Comment / Reason
Extent	Regional	5 to 10km radius from site – at access and along MR00450
Duration	Long term	Maximum of 40 light vehicle trips per day
Intensity	Low	Minimal daily traffic impact relative to current volumes
Probability	Definite	Additional trips will generate more dust
Reversibility	Reversible	By regular maintenance loss of dust can be reversed
Degree of Confidence	Medium	Subjective opinion - exact extent and impact can be assessed by detailed materials investigation
Status and Significance of impact (without mitigation)	Medium (negative)	Increased dust generation due to increased traffic volumes. Gravel roads may require increased maintenance measures.
Mitigation		Regular maintenance
Status and Significance of impact (with mitigation)	Medium (positive)	Dust generation can be negated should the road be regularly maintained.

7 PROPOSED MITIGATORY MEASURES

Measures to improve the safety of the existing road and to mitigate against the impact of the additional traffic volumes generated are listed below.

7.1 ROAD CONDITION MEASURES

As discussed in **Chapter 3.2** the gravel road network is in a fair to good condition. Based on the visual assessments conducted during the site inspection, it appears that maintenance has been regularly conducted on MR00450 on this road. It is therefore necessary for the responsible road authorities to continue conducting regular maintenance on the road.

Given the condition of the road, the addition of up to 40 light motor vehicles per will have a minimal impact on the condition of the road should regular maintenance be conducted.

7.2 TRAFFIC SAFETY MEASURES

Problems could occur at the proposed access point should advance warning signs not be in place on approaches.

The existing access point must be closed once the new access road has been constructed.

8 MANAGEMENT ACTIONS

The following management actions should be implemented in order to minimise the impact of the development on the infrastructural environment and road users:

- Warning traffic signs
  Appropriate warning traffic signs (in accordance with the South African Road Traffic Signs Manual [3]) should be erected to warn road users in advance of the existence of the proposed access point.

9 CONCLUSIONS

The following conclusions can be drawn from the study:

- Access to the proposed development can be provided directly from MR00450 as indicated on **Figure 3**;
- Regularly maintenance of MR00450 be conduced by the provincial Department of Transport;
- A maximum of 40 vehicle trips can be generated per day should the development be fully occupied;
- Relocating the existing access to a position 300m to the south will provide a safer environment to enter and exit the development.

10 RECOMMENDATIONS

In view of the findings of this study, it is recommended that:

- This TIA be approved by the Eastern Cape Department of Transport;
- Access to the proposed development be provided from MR00450 as indicated on **Figure 3** and the existing access be closed;
- Suitable signage warning motorists of the existence of the new access point be erected on the approaches to the proposed access point;
- Regular maintenance of MR00450 be conducted by the provincial Department of Transport.

11 REFERENCES

1. *Joubert, Sampson, et al*, **TMH 16 Volume 1- South African Traffic Impact and Site Assessment Manual**, COTO, September 2013.

2. NITRR, **TRH 17 -Geometric Design of Rural Roads,** CSRA, September 1984.

3. Department of Transport, **South African Road Traffic Signs Manual 3rd Edition**, May 2012

ANNEXURE A
Traffic Data

RRAMS INTERSECTION TRAFFIC COUNT OUTPUT

Station ID 837

Intersection MR00450 / DR02006

Local Municipality Sundays River Valley

District Municipality Sarah Baartman

Date: 2018-01-03

Enumerator: Andie Dike **Co-ord :** X 25,71868 Y -33,43779

Volumes per movement

Direction	NB				WB				SB				EB				TOTAL
Link ID	1011678								1011665				1011603				
Road Name	MR00450				-				MR00450				DR02006				
Movement	Left	Through	Right	**Total**	Left	Through	Right	**Total**	Left	Through	Right	**Total**	Left	Through	Right	**Total**	
M'ment ID	1	2	3		4	5	6		7	8	9		10	11	12		
12-hr																	
12-hr car	61	84	0	**145**	0	0	0	**0**	0	113	24	**137**	10	0	72	**82**	364
12-hr taxi	17	5	0	**22**	0	0	0	**0**	0	21	2	**23**	0	0	10	**10**	55
12-hr bus	10	2	0	**12**	0	0	0	**0**	0	12	0	**12**	0	0	2	**2**	26
12-hr HV	19	3	0	**22**	0	0	0	**0**	0	6	0	**6**	0	0	0	**0**	28
12-hr all veh	**107**	**94**	**0**	**201**	**0**	**0**	**0**	**0**	**0**	**152**	**26**	**178**	**10**	**0**	**84**	**94**	**473**
AM peak hr																	
AM peak car	7	13	0	**20**	0	0	0	**0**	0	7	2	**9**	0	0	1	**1**	30
AM peak taxi	2	0	0	**2**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	2
AM peak bus	0	1	0	**1**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	1
AM peak HV	1	0	0	**1**	0	0	0	**0**	0	0	0	**0**	0	0	0	**0**	1
AM peak all veh	**10**	**14**	**0**	**24**	**0**	**0**	**0**	**0**	**0**	**7**	**2**	**9**	**0**	**0**	**1**	**1**	**34**
OFF peak hr																	
OFF peak car	3	14	0	**17**	0	0	0	**0**	0	18	4	**22**	2	0	16	**18**	57
OFF peak HV	2	0	0	**2**	0	0	0	**0**	0	0	0	**0**	0	0	1	**1**	3
OFF peak bus	2	0	0	**2**	0	0	0	**0**	0	1	0	**1**	0	0	0	**0**	3
OFF peak taxi	1	1	0	**2**	0	0	0	**0**	0	1	0	**1**	0	0	0	**0**	3
OFF peak all veh	**8**	**15**	**0**	**23**	**0**	**0**	**0**	**0**	**0**	**20**	**4**	**24**	**2**	**0**	**17**	**19**	**66**
PM peak hr																	
PM peak car	8	11	0	**19**	0	0	0	**0**	0	12	6	**18**	5	0	2	**7**	44
PM peak taxi	3	0	0	**3**	0	0	0	**0**	0	0	0	**0**	0	0	4	**4**	7
PM peak bus	0	0	0	**0**	0	0	0	**0**	0	1	0	**1**	0	0	1	**1**	2
PM peak HV	8	0	0	**8**	0	0	0	**0**	0	1	0	**1**	0	0	0	**0**	9
PM peak all veh	**19**	**11**	**0**	**30**	**0**	**0**	**0**	**0**	**0**	**14**	**6**	**20**	**5**	**0**	**7**	**12**	**62**
ADT (24-hr)																	
24-hr car	66	90	0	**156**	0	0	0	**0**	0	122	26	**147**	11	0	77	**87**	390
24-hr taxi	18	5	0	**24**	0	0	0	**0**	0	23	2	**25**	0	0	11	**11**	59
24-hr bus	11	2	0	**13**	0	0	0	**0**	0	13	0	**13**	0	0	2	**2**	28
24-hr HV	20	3	0	**24**	0	0	0	**0**	0	6	0	**6**	0	0	0	**0**	30
24-hr all veh	**115**	**101**	**0**	**216**	**0**	**0**	**0**	**0**	**0**	**163**	**28**	**191**	**11**	**0**	**89**	**100**	**508**

Volumes per approach link (2-way)

	NB	WB	SB	EB
Link ID	1011678		1011665	1011603
ADT	469	0	303	243
% HV	12%	-	8%	14%

Appendix D3: Geohydrological Investigation

Ground Floor, Bay Suites
1a Humewood Road
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F: +27 (0) 41 509 4850
E: portelizabeth@srk.co.za
www.srk.co.za

18 February 2020
556443

CEN Integrated Environmental Management Unit
36 River Road
Walmer

Attention: Dr Mike Cohen

Dear Mike

Groundwater Investigation at the Proposed Tented Camp at Hayterdale Farm near Addo, Eastern Cape – Revision 1

1. Introduction

SRK Consulting South Africa (Pty) Ltd (SRK) was appointed by CEN IEM Unit (the Client) to conduct a groundwater investigation at the proposed tented camp at Hayterdale Farm near Addo.

SRK understands that the Client wishes to establish the recommended yield of an existing borehole; the potential impact that abstraction may have on the groundwater environment; as well as the potential impact of the proposed sanitation system on the groundwater environment.

2. Methodology

SRK proposed the following scope of work, which was accepted by the Client:

- A desktop investigation will be conducted where the geological and hydrogeological maps of the Site and surroundings will be studied. The National Groundwater Archive (NGA) of the Department of Water and Sanitation (DWS) will be searched for historical information on existing boreholes within a 1 km radius of the Site.
- A hydrocensus within a 1 km radius of the Site, gathering available information on existing boreholes (if any), including depth, water level, water use, position etc.
- Yield testing of an existing borehole will be conducted. The tests will be conducted in accordance with guideline documents of the DWS, and will comprise the following:
  - 4 x 1 hour stepped discharge rate testing, followed by 4 hrs recovery monitoring (or until the water level reached 95% or more recovery)
  - 24 hr constant discharge rate testing, followed by 24 hr recovery monitoring (or until the water level reached 95% or more recovery).

- All data gathered will be analysed and reported in a letter report, in accordance with the requirements from DWS. This will include:
  - The calculated recommended yield for the borehole;
  - The potential impact of abstraction from the borehole on the groundwater environment; and
  - The potential impact of the sanitation system on the groundwater environment.

The location of the Site and existing borehole is given in Figure 1 below.

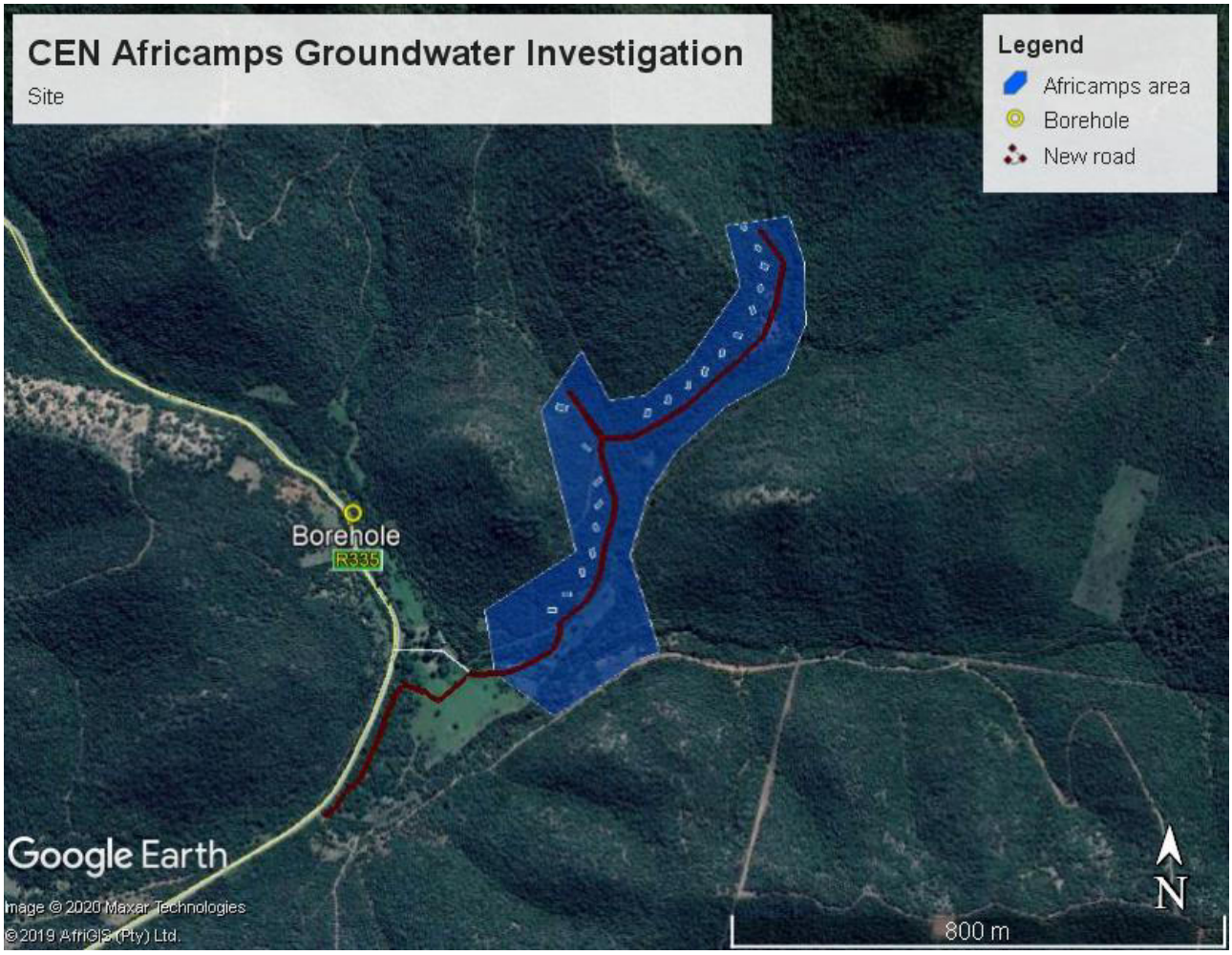

Figure 1: Site Location

3. Results

The study area comprises the proposed site for the resort facility, and an area of approximately 1 km radius around it.

3.1 Desktop Investigation

Geology

According to the publication "*The Geology of the Port Elizabeth Area*" by DK Toerien and RS Hill of the Geological Survey (1989), the geology of the study area comprises the Ecca, Suurberg and Uitenhage group rocks. No structures, like faults or folding, have been mapped for the study area. Refer to Figure 2 for the geology of the Site.

- The *Ecca Group* rocks (of which the formations are undifferentiated on the map) includes rhythmite, carbonaceous shale and dark, fine-grained lithofeldspathic sandstone.
- The Ecca Group is overlain by the *Suurberg Group* (of which the formations are mostly undifferentiated on the map, except for the Mimosa formation), which are volcanogenic rocks, comprising mostly breccia, tuff and basalt. The total thickness of the Suurberg Group does not exceed 250 m.

- The *Mimosa Formation of the Suurberg Group* comprises mainly basalt, with subordinate interbedded tuffs. Its maximum thickness recorded is 120 m. The basalt is often vesicular and amygdaloidal, and small occurrences of scoriaceous lava have been observed.
- The *Enon Formation of the Uitenhage Group* overlies the Suurberg Group and comprises a whitish grey to red-brown conglomerate with subordinate interbedded lenticular shale or sandstone. Its sandy matrix is iron-rich, often resulting in a thin orange veneer forming around the clasts.

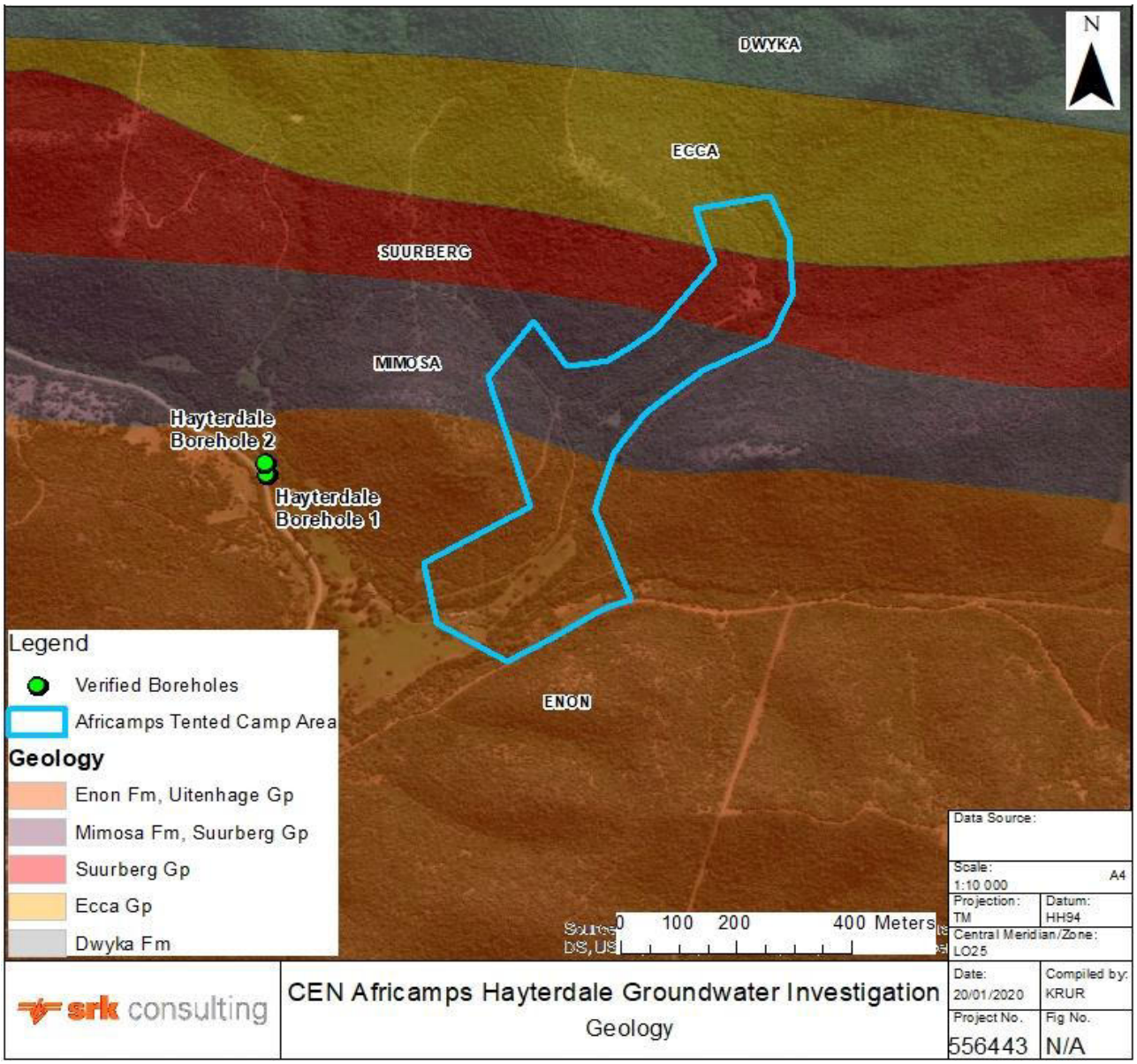

Figure 2: Geology

Hydrogeology

In accordance with the publication "*An Explanation of the 1 : 500 000 General Hydrogeological Map of Port Elizabeth 3324*" by the Department of Water Affairs and Forestry (1998), the following can be summarised regarding the hydrogeology of the above-mentioned rock groups:

- For the *Ecca Group*, a borehole yield analysis indicated that 41% of boreholes yield less than 2 L/s. Yields of more than 5 L/s can be obtained in fold, joint and fault structures where favourable recharge conditions exist. Groundwater quality in this group varies considerably, with conductivity ranging between 100 and 1200 mS/m. The water is often rich in sodium, magnesium, chloride, sulphate and fluoride.
- For the *Suurberg Group*, very few boreholes have been recorded. Yields seem to be limited and is generally less than 0.5 L/s. Groundwater quality appears to be brackish with conductivity measuring more than 300 mS/m.

- The *Uitenhage Group* is a dense mass of rock with low permeability, poor water quality and thus limited groundwater potential. Conductivity measures in excess of 300 mS/m, with sodium, magnesium and chloride often being above the desirable limits.

National Groundwater Archive

The National Groundwater Archive (NGA) was searched for information on existing boreholes within a 1 km radius of the Site. Five boreholes were identified, and available information is given in Table 1 below. The locations of the NGA boreholes are given in Figure 3.

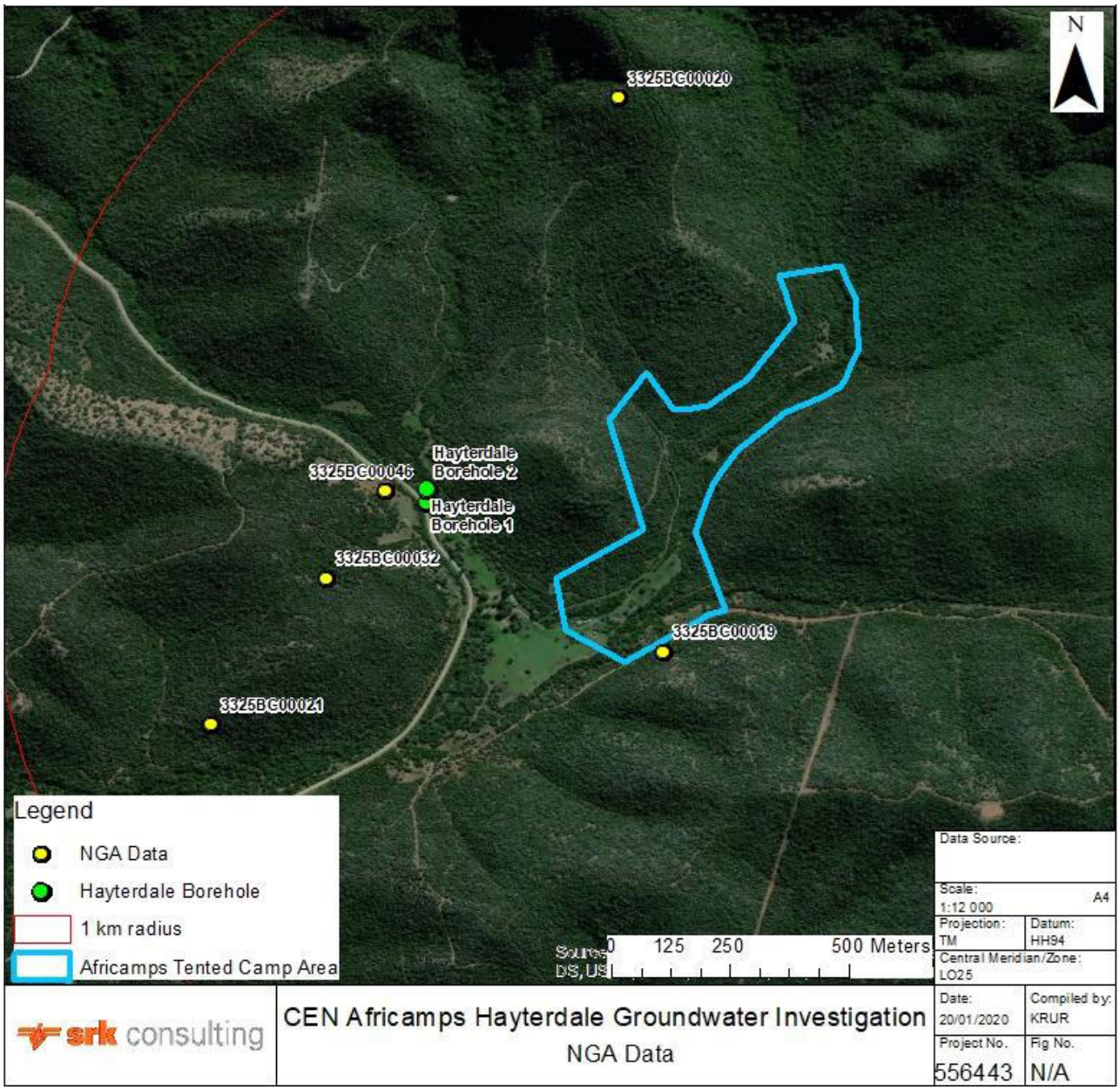

Figure 3: NGA Borehole Locations

Table 1: NGA Data

BHID	Latitude	Longitude	Water Level (mbgl)	Discharge Rate (L/s)	EC (mS/m)	pH	Depth (m)	Water Strike Depth (m)	Total Airlift Yield (L/s)
3325BC00021	-33.39406	25.71677	19	N/A	N/A	N/A	46	43	1.25
3325BC00019	-33.39267	25.72538	30	N/A	N/A	N/A	48	45	5
3325BC00032	-33.39128	25.71898	12.2	0.3	318	N/A	22.2	0.1	0.3
3325BC00046	-33.38961	25.72010	7.47	N/A	87.6 - 797	6.48 - 7.6	45	N/A	N/A
3325BC00020	-33.38213	25.72454	N/A	N/A	N/A	N/A	60	N/A	N/A

From the available data it is observed that water levels ranged between 7.47 and 30 metres below ground level (m bgl). Borehole depths ranged between 22.2 and 60 m bgl, and water was intersected between 0.1 and 45 m bg. Airlift yields ranged between 0.3 and 5 L/s. Conductivity of the groundwater ranged between 87.6 and 797 mS/m, which is fresh to saline (aesthetically).

Soils

According to the map "*Generalised Soil Patterns of South Africa – 2004*" by the Agricultural Research Council - Institute for Soil, Climate and Water, the Site is covered with sandy loam with an expected depth of 301 to 450 mm, which is considered shallow. The clay content of the soil is between 16 and 25 %; and its leaching status is calcareous. The soils are described as "soils with minimal development, usually shallow, on hard or weathering rock, with or without intermittent diverse soils. Lime generally present in part or most of the landscape".

Surface Water and Shallow Groundwater Drainage

The Site is undulating, with elevations ranging from 350 metres above mean sea level (m amsl) to 205 m amsl. Several drainages have been mapped for the Site, and the tented camp has been planned along one of these. The drainages do not seem to hold water, and will perhaps only do so for a short period of time during heavy rainfall events. From the camp, surface water and shallow groundwater will move in a south-western direction. Refer to Figure 4 for a map with contours, drainages and assumed surface and shallow groundwater flow directions.

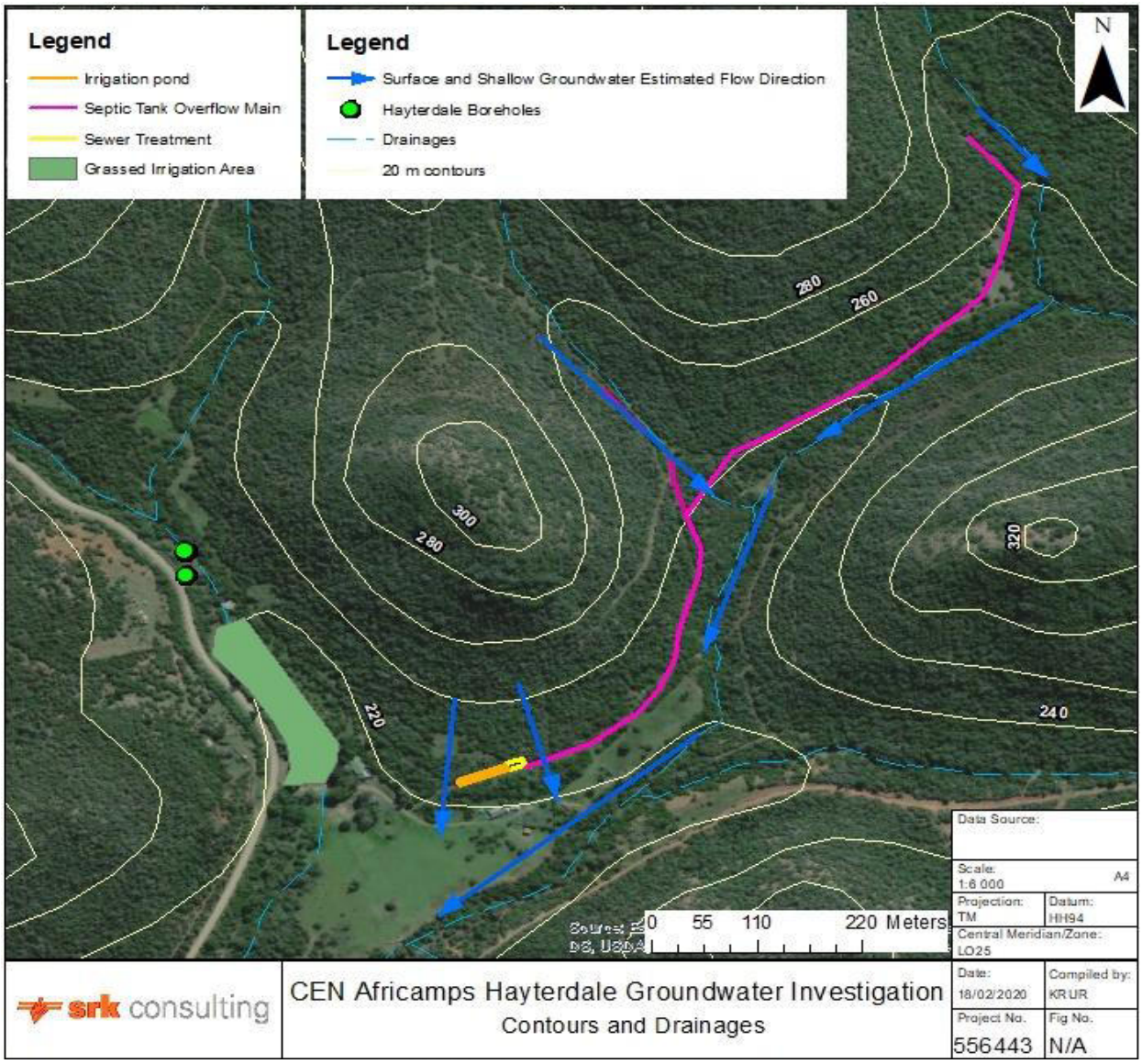

Figure 4: Drainages

Historical Data

During a previous investigation, geotechnical information was gathered from a borrow pit approximately 1.4 km to the northwest of Hayterdale Borehole 1. During the investigation, shallow weathered and fractured bedrock was encountered in four of the six test pits; and gravel was encountered in two of the pits, up to depths of 2.1 and 2.4 m bgl respectively.

3.2 Hydrocensus

A hydrocensus was conducted on 23 Jan 2020. Three boreholes were located during the hydrocensus, and their details are given in Table 2 below. The borehole locations are shown in Figure 5.

Table 2: Hydrocensus Information

BHID	Latitude	Longitude	Water Level (m bgl)	Depth (m bgl)	Comments
HD BH 1	-33.38989°	25.72097°	8.86	27	Borehole equipped (submersible pump), water “hard”. Staining and scaling visible in ablution facilities
HD BH 2	-33.39009°	25.72138°	N/A	N/A	Borehole equipped (windmill)
HD BH 3	-33.39114°	25.72129°	N/A	N/A	Borehole equipped (windmill)
HD BH 4	-33.38984°	25.72089°	8.98	33.4	Borehole not equipped, in pumphouse

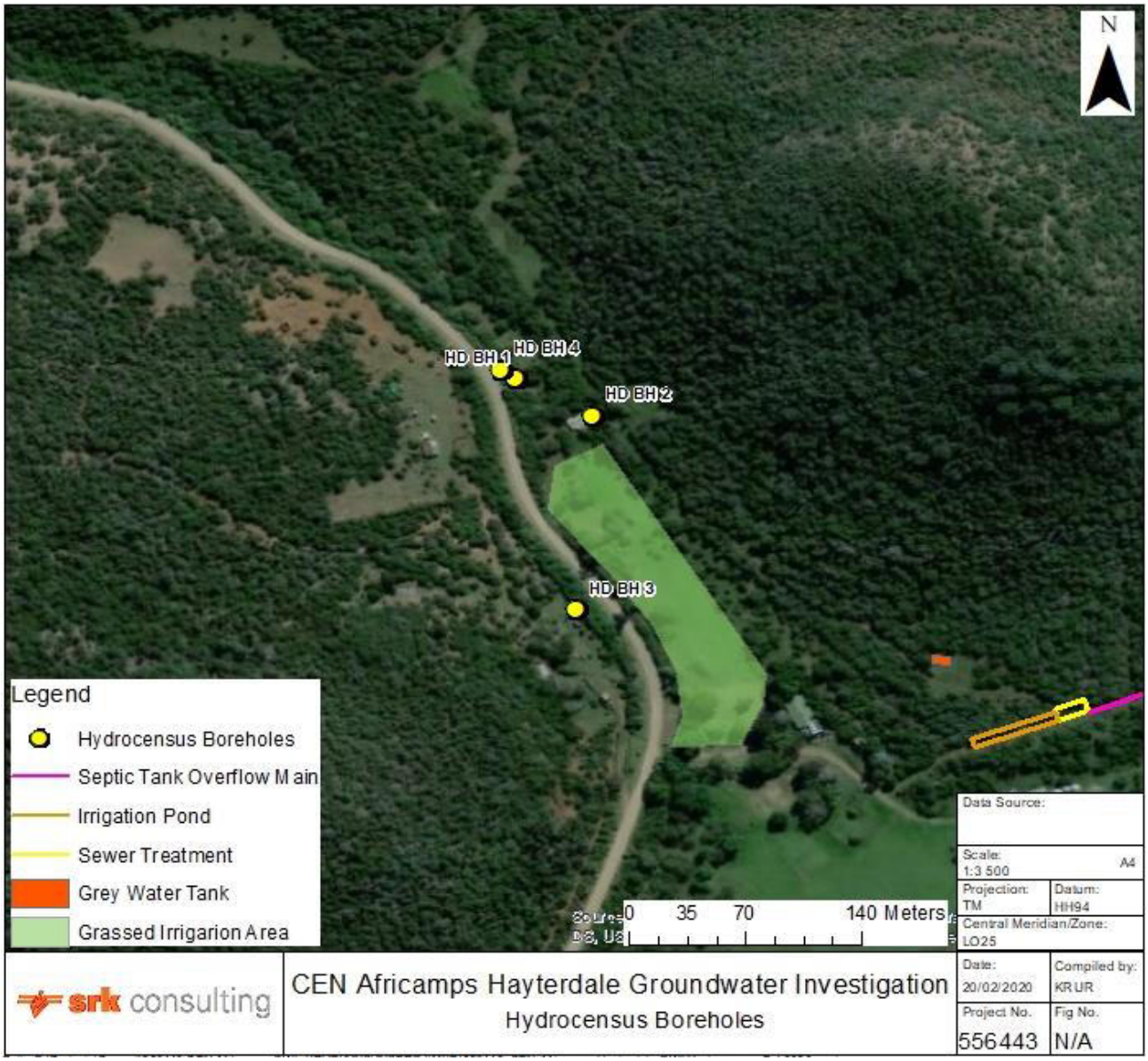

Figure 5: Hydrocensus Boreholes

3.3 Yield Testing

The borehole (referred to as “Hayterdale Borehole 1” in this report) is located at the coordinate -33.38989°, 25.72097°, and was yield tested by Spraymor Groundwater Services from 16 to 18 December 2019. The yield tests comprised the following tests:

- 4 x 1-hour step tests followed by recovery monitoring;
- A 24-hour constant discharge rate test (CDRT) followed by recovery monitoring.

During the CDRT, a water sample was taken from the borehole. Please note that the yields pumped during the yield tests are specifically used to stress the borehole for a short period of time, so that the character of the aquifer, with regards to water level drops and rises, can be recorded. The yields in the testing report should not be used as recommended yields.

The water level of another borehole (referred to as “Hayterdale Borehole 2” in this report), situated approximately 8 m to the north of the tested borehole, was monitored during pumping tests. The borehole was situated in a pumphouse but was not equipped. Monitoring of a nearby borehole is usually done to measure the influence that pumping the one borehole will have on the other. Before testing started, the water level of this borehole was 8.98 m bgl. During pumping, the water level in Borehole 2 dropped with 4.22 m, to 13.20 m bgl after 24 hours of pumping. The boreholes therefore influence each other significantly during pumping, and should not be used simultaneously.

The yield testing report is attached in Appendix A. Please note that the results in the yield testing report should not be used as actual yields for the borehole, since the borehole is stressed during the pumping test, specifically to measure the reaction of the aquifer to these conditions. This data is analysed and used to calculate a recommended yield that would enable the preservation of the aquifer.

3.4 Borehole Management Recommendations

A detailed analysis was performed on the yield testing data using Microsoft Excel based software called the FC-method (Flow Characteristic method). The following management recommendations are made (Table 3):

Table 3: Borehole Management Recommendations

Parameters	Data
Scientifically calculated abstraction rate for a 12 hour or less / day pumping period (therefore allowing the borehole to “rest” for 12 or more hours a day)	0.9 L/s (maximum 38 880 L/day)
Scientifically calculated abstraction rate for a 24 hour / day pumping period:	0.6 L/s (51 840 L/day)
✱ Static Water Level	8.86 m bgl
▲Expected Dynamic Water Level for 8 - 12 hour/day abstraction	9.5 m bgl
Expected Dynamic Water Level for 24 hour/day abstraction	4.4 m bgl
♣ Critical Water Level	15 m bgl
Recommended Pump Depth	26 m bgl
Notes: ✱ The static water level in a borehole is the groundwater level that is not influenced by abstraction. ▲The dynamic water level in a borehole is the steady level to which groundwater falls when it is being pumped ♣ The critical water level in a borehole is the groundwater level below which the water table should not be lowered during pumping.	

Please note that the pumping tests provide a glimpse of the nature of the aquifer during a specific time in space that the yield tests are conducted. However, the nature of the aquifer (recharge, recovery, water level etc.) can be determined much more accurately if the water level is monitored throughout the lifetime / use of the borehole. The borehole’s water levels and recharge will vary depending on the recharge of the aquifer from

rainfall, abstraction from other groundwater users nearby etc. Recharge of the aquifer may be local or may come from rainfall events many kilometres away.

Please note that the pump can be specified so that it yields any required volume, as long as the recommended rates given in Table 3 above are not exceeded. For instance, if 5 000 L is required per day, then a pump yielding of 0.2 L/s for 7 hrs a day can be installed to provide 5 000 L/day.

3.5 Groundwater Impact Assessment

From the above work, the following can be highlighted for the groundwater environment of the Site:

- According to literature, the geology of the site is not very favourable for groundwater development. However, a successful borehole has been drilled on the properly, and the NGA reported five boreholes of which three had airlift yields of 0.3, 1.25 and 5 L/s. Varying salinities (fresh to salty) have been recorded. Therefore, the groundwater within the area can be used, but may have to be treated depending on the water use.
- Boreholes are not drilled very deep, with the deepest recorded depth being 60 m bgl. According to the NGA, water was intersected between 0.1 and 45 m bgl.
- Soils appears to be shallow and bedrock can be intersected within 4.5 m bgl. Gravel and fractured bedrock was intersected in the top ~2.4 m at a borrow pit 1.4 km to the northwest of Hayterdale Borehole 1.
- Water levels in the two boreholes on Site was 8.86 and 8.98 m bgl. The NGA reported water levels ranging between 7.47 and 30 m bgl.
- “Hayterdale Borehole 1” will be used as a water source for the development. It is assumed that the other boreholes on the Site (HD BH 2 and HD BH 4) will not be used.
- During the hydrocensus, a neighbouring borehole was located (HD BH 3) and is situated approximately 30 m to the west of the planned irrigation area.

SRK understands that the planned sanitation system allows for closed septic tanks at each tent. From here the sewage will gravity feed into a Clearedge treatment system. After treatment, effluent will go to a tertiary wetland, emergency storage pond or irrigation dam. Treated effluent will be used to irrigate grassed areas in the area used for events.

3.5.1 Potential pollution sources:

Bearing in mind the source - pathway - receptor concept, the following can be concluded for the Site:

- Potential sources of contamination / potential impacts: It is understood that the systems will be designed in a way to reduce or eliminate the exposure of contaminants from the sewer system to the environment. However, this study will describe worst case scenarios, where the intended functioning of the system fails, and contaminants are exposed to the environment. Contaminants from the sanitation system could include:
  - Below the ground surface: damaged, leaking or overflowing septic tanks and sewer systems; and
  - On the ground surface: irrigations with effluent that have not been treated as intended and contains harmful pollutants.
- Potential pathways: Liquids from the sanitation system and / or rainwater, flowing through the soils, gravel, shallow fractured bedrock; and potential shallow groundwater.
- Potential receptors: Groundwater as a natural resource; and groundwater users (existing and future).

In terms of the Risk Based Corrective Action (RBCA[1]) approach, risk (that triggers the need for remediation) is considered to be present when a complete link exists between the source, pathway and receptor. SRK understands that the DWS considers all groundwater as a natural resource that must be protected, irrespective

[1] The principle of RBCA is applied when a source of contamination is proven and the need for remedial action must be calculated.

of the current water quality. No contamination or further contamination is allowed. Should contaminants from the sanitation system come into contact with the natural ground, it will likely[2] follow the following routes:

- Seeping through the permeable soil, gravel or fractured shallow bedrock and move towards the water table.
- Moving within the saturated zone (within the water table) towards areas of lower pressure.

3.5.2 Impact on Aquifer from Abstraction

A main potential impact that abstraction from the borehole may have on the groundwater environment is dewatering of the aquifer. There are various factors that could cause/contribute to dewatering, and these are:

- Over-abstraction of groundwater from the borehole (i.e. exceeding the recommended yields given in this report);
- Insufficient recharge to the aquifer (e.g. during extreme drought conditions); and
- Increased abstraction from other boreholes positioned in the same aquifer, e.g. additional groundwater users abstracting from the same aquifer.

Dewatering or over-abstracting of the aquifer may result in the following:

- Reduced volumes of water available for abstraction from the borehole; and
- Water quality changes in the aquifer, e.g. iron bacteria in the dewatered aquifer.

3.5.3 Conceptual Site Model

Refer to Figure 6 and Figure 7 for generalised conceptual site models (CSMs) of the perceived underground conditions and groundwater setting within the project area; and to Figure 8 for the location of the CSMs. The CSM reflects (amongst others) the Site, location of the potential contamination source, soils, the estimated water levels during various scenarios and the estimated flow directions of potential contaminants.

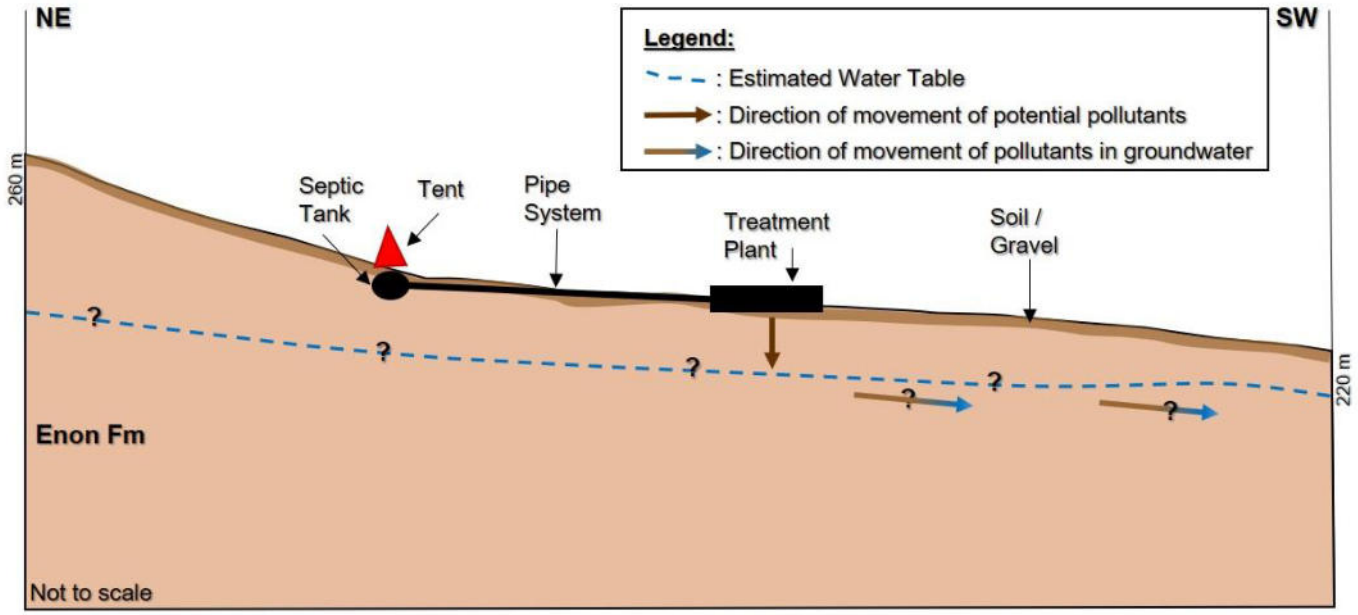

Figure 6: Generalised Conceptual Site Model – Northeast to Southwest

[2] The migration of a contaminant / contaminant plume is dependent on the volume of contaminant, concentration of the contaminant and hydraulic gradient. Small volumes of contaminant release can attenuate naturally, if favorable conditions exist.

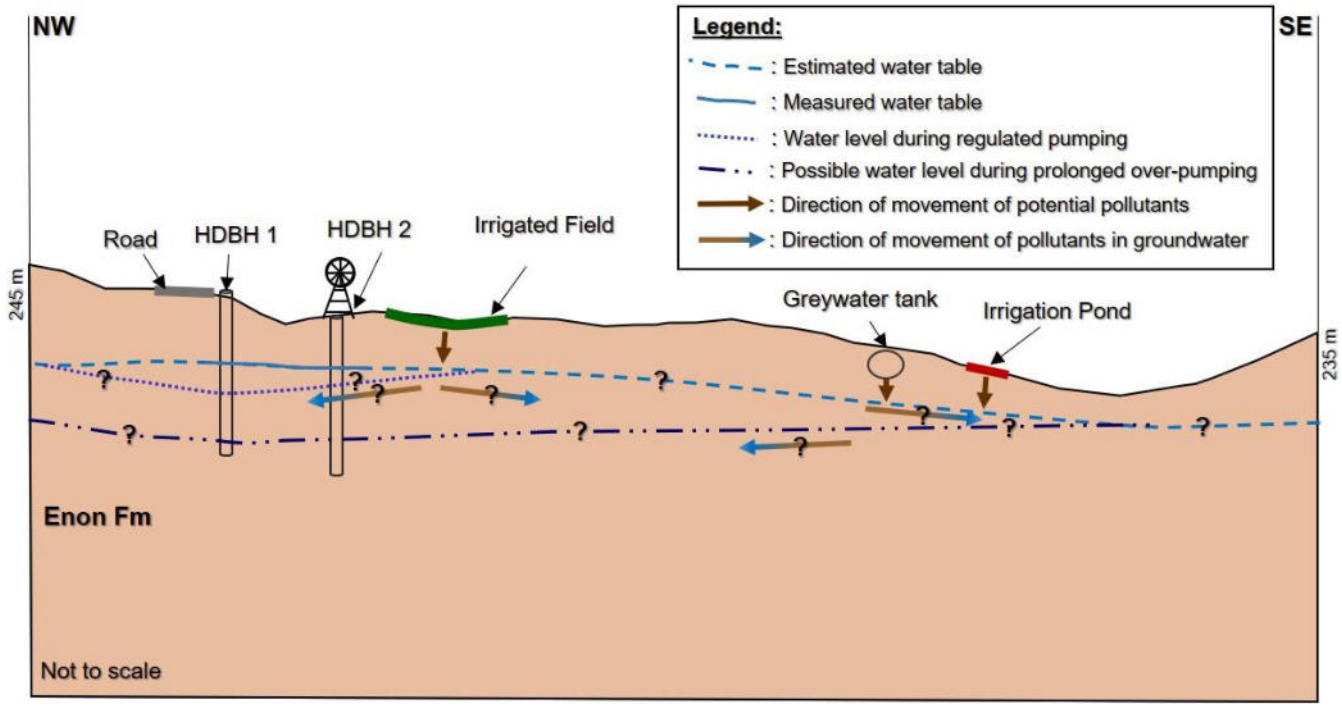

Figure 7: Generalised Conceptual Site Model – Northwest to Southeast

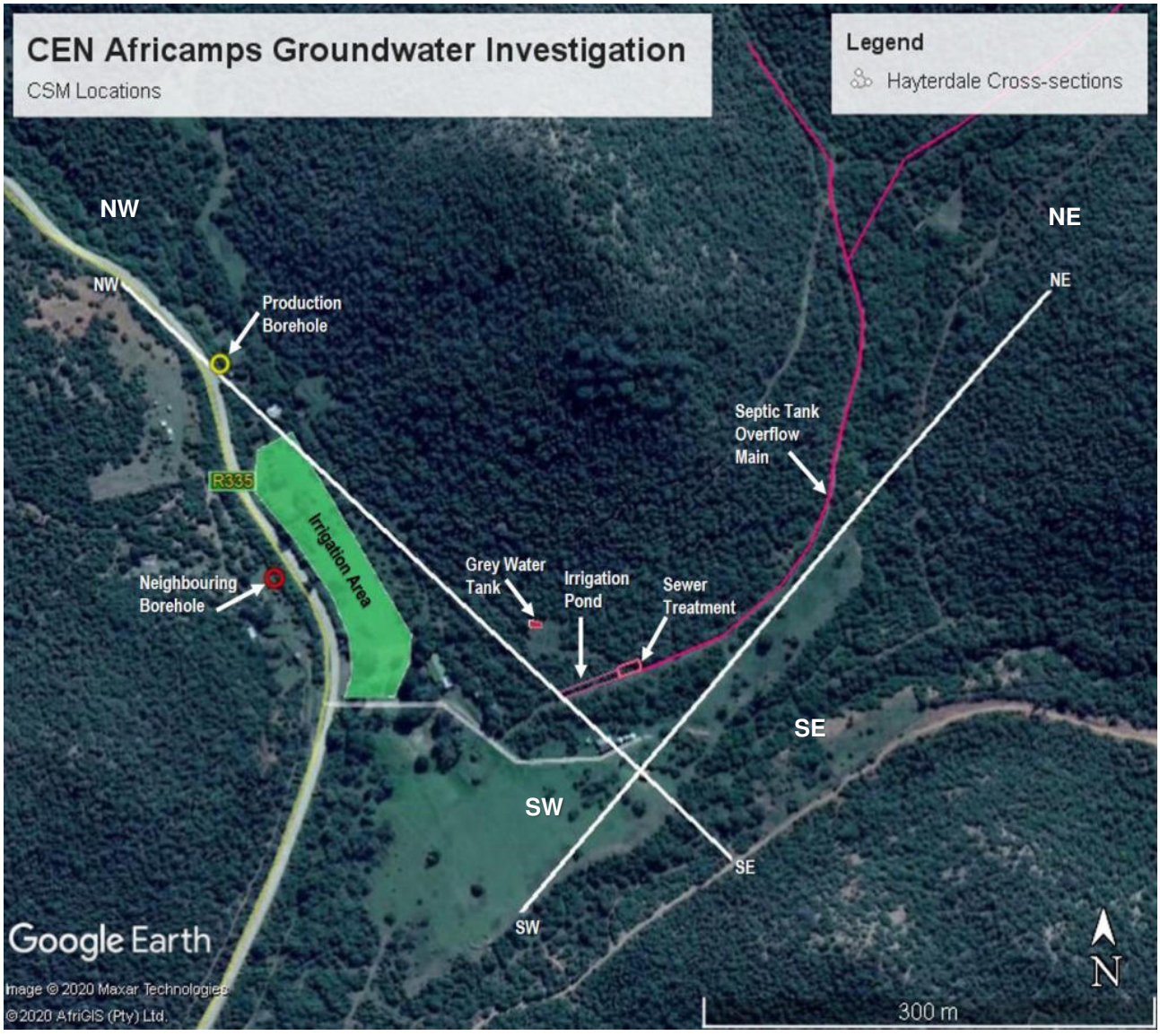

Figure 8: Location of Conceptual Site Model

The following data gaps are identified:

- Verified water level beneath potential pollution sources across the Site;
- Verified soil type beneath the Site;
- Contamination load;
- Rate of attenuation of contaminants and the distance over which this takes place (i.e. how far will contaminants travel before they will naturally attenuate); and
- Radius of the cone of depression of the water table during prolonged pumping of the borehole.

3.5.4 Evaluation of Aquifer

The Groundwater Protocol states risk levels to be based on three factors:

- The vulnerability of the aquifer;
- The contamination load from the particular sanitation system; and
- The strategic value or current and/or future use of water from the aquifer.

Aquifer Vulnerability

According to the Groundwater Protocol, the vulnerability of an aquifer is related to the distance that the contaminants must travel to reach the water table (vertically), and the ease with which it can flow through the soil and rock layers above the water table.

For the Site, the water level is known at certain areas (at the existing boreholes), and therefore these levels can be used to some extent, but in lower-lying areas in the drainages, the water level will likely be shallower than the measured ~8.9 m bgl However, it is possible that the water level may vary across the Site. It is assumed that the septic tanks and sewer system will be installed underground at a depth of maximum 3 m bgl. Therefore, the depth from the bottom of a potential pollution source to the water level is estimated to vary between 2 and 6 m bgl.

For a water table between 2 and 5 m bgl, the aquifer vulnerability is regarded to be high, with a high risk to contamination of the aquifer. According to the Groundwater Protocol, the aquifer will be vulnerable to many contaminants, except those that are highly absorbed, filtered and/or readily transformed.

According to the "*Generalised Soil Patterns of South Africa – 2004",* the soils of the area are likely no deeper than 450 mm, and with regards to attenuation of contaminants, is regarded to be thin. It is also likely that the sewerage system will be founded below this layer directly into gravel or bedrock.

Contamination Loads & Contamination Type/Concentrations

The contamination load of raw sewerage is regarded high, and decreases to some extent as treatment takes place. For a system where the contamination loads are high, it is best to prevent the contaminants of getting into contact with the environment. For contamination load risks that are minimal, there will be a low overall risk. For contamination load risks that are high, there will be a high overall risk. For the Site it is recommended that a closed sewerage system be developed that is closed off from the land surface, in order to prevent contaminants from getting into contact with the environment. This will reduce the contamination load risk to minimal (only present under upset or abnormal conditions e.g. a leak or spillage/overflow).

Where irrigation with treated effluent is planned, the treated effluent must be of such a standard that it does not release contaminants into the environment. Currently the rate of attenuation is unknown, as well as the contamination load of the treated effluent.

Strategic Value or Current / Future Use of Groundwater

There are boreholes in use within 30 m of the irrigation area, and within 330 m of the irrigation ponds. The aquifer is an important groundwater source, currently and in the future, and should be protected.

3.6 Potential Impacts: Sewerage System

Potential impacts for the development can be described under normal conditions (where the sewerage system function as intended) and upset conditions (where there is major failure and contaminants gets into contact with the environment).

3.6.1 Normal conditions

Sewerage System: With a "closed" system in place, the risk of contaminants reaching the groundwater is considered to be minimal. Such a system will be designed to isolate contaminants from the environment, therefore basically eliminating risk.

Irrigation with treated effluent: During irrigation, treated effluent will come into contact with, and will infiltrate the sandy soils. Here attenuation of contaminants will take place, but, depending on the extent that the effluent is treated, there may still be contaminants left in the treated effluent (e.g. bacteria). The volumes of treated effluent released onto the irrigation area will also play a role in the quantity and quality of water reaching the water table. Plants and soil will remove some contaminants to some extent, but currently the extent of attenuation is unknown. The production borehole (Hayterdale Borehole 1) and a neighbouring borehole (HD BH 3) is situated approximately 70 m to the northwest and 30 m to the west respectively, of the planned irrigated area. Therefore it is likely that these boreholes will draw in treated effluent (of unknown quality) when they are being pumped.

Mitigation:

Sewerage System: Should a "closed" waste water treatment system be used, then the risk to contamination of the groundwater is considered minimal for this area; and no mitigation measures should be applied. However, this is based on the assumption that the system will be maintained as intended and not overloaded.

Irrigation with treated effluent: The treated effluent should be of such a standard that attenuation of remaining contaminants can take place across the unsaturated zone. It is advised that the effluent is treated to the General limit values given in the Government Gazette, "*Revision of General Authorisation in terms of Section 39 of the National water Act, 1998 (Act 36 of 1998*)", 6 September 2013, Table 2.1: Wastewater limit values applicable to discharge of wastewater into a water resource (refer to Table 4 below for Table 2.1). Alternatively, monitoring boreholes should be installed around the irrigated area so that the water quality of groundwater around the area can be monitored. Should the quality be poor because of irrigation with treated effluent, then treatment can be increased or halted.

3.6.2 Upset / Abnormal Conditions

Under upset conditions, a scenario is imagined where:

- An "open" sewerage treatment system without liners is installed;
- The sewerage system is not maintained or is damaged to such an extent that contaminants from sewage gets into direct contact with the ground surface for an extended period of time; or
- Insufficiently treated effluent is used for irrigation.

For these scenarios, the contamination load will be high, and the potential for it to reach the water table is high. According to the Groundwater Protocol, the overall risk to the groundwater is then considered to be high. Under these conditions, the DWS will determine the extent to which remediation should take place.

Mitigation:

Sewerage system: Upgrading and fixing the system to a "closed" system where liners are installed and damages repaired so that the contaminants do not get into contact with the ground surface. Groundwater should then also be monitored to determine the extent to which groundwater has been affected.

Irrigation with treated effluent: Irrigation should seize until the effluent is treated to the General limit values given in the Government Gazette, "*Revision of General Authorisation in terms of Section 39 of the National water Act, 1998 (Act 36 of 1998*)", 6 September 2013, Table 2.1: "*Wastewater limit values applicable to*

discharge of wastewater into a water resource". Groundwater should then also be monitored to determine the extent to which groundwater has been affected.

Table 4: Table 2.1 from the "*Revision of General Authorisation in terms of Section 39 of the National water Act, 1998 (Act 36 of 1998*)",

TABLE 2.1: Wastewater limit values applicable to discharge of wastewater into a water resource

SUBSTANCE/PARAMETER	GENERAL LIMIT	SPECIAL LIMIT
Faecal Coliforms (per 100 ml)	1000	0
Chemical Oxygen Demand (mg/l)	75 (i)	30(i)
pH	5,5-9,5	5,5-7,5
Ammonia (ionised and un-ionised) as Nitrogen (mg/l)	6	2
Nitrate/Nitrite as Nitrogen (mg/l)	15	1,5
Chlorine as Free Chlorine (mg/l)	0,25	0
Suspended Solids (mg/l)	25	10
Electrical Conductivity (mS/m)	70 mS/m above intake to a maximum of 150 mS/m	50 mS/m above background receiving water, to a maximum of 100 mS/m
Ortho-Phosphate as phosphorous (mg/l)	10	1 (median) and 2,5 (maximum)
Fluoride (mg/l)	1	1
Soap, oil or grease (mg/l)	2,5	0
Dissolved Arsenic (mg/l)	0,02	0,01
Dissolved Cadm ium (mg/l)	0,005	0,001
Dissolved Chromium (VI) (mg/l)	0,05	0,02
Dissolved Copper (mg/l)	0,01	0,002
Dissolved Cyanide (mg/l)	0,02	0,01
Dissolved Iron (mg/l)	0,3	0,3
Dissolved Lead (mg/l)	0,01	0,006
Dissolved Manganese (mg/l)	0,1	0,1
Mercury and its compounds (mg/l)	0,005	0,001
Dissolved Selenium (mg/l)	0,02	0,02
Dissolved Zinc (mg/l)	0,1	0,04
Boron (mg/l)	1	0,5

3.7 Potential Impacts: Abstraction from the Borehole

A main potential impact that abstraction from borehole HD BH 1 may have on the groundwater environment is dewatering of the aquifer. There are various factors that could cause/contribute to dewatering:

1. Over-abstraction of groundwater from borehole HD BH 1;
2. Insufficient recharge to the aquifer (e.g. during extreme drought conditions); and
3. Increased abstraction from other boreholes positioned in the same aquifer, e.g. additional groundwater users abstracting from the same aquifer.

Dewatering or over-abstracting of the aquifer may result in the following:

1. Reduction in the available volumes from the borehole; and
2. Water quality changes in the aquifer, e.g. iron bacteria in the dewatered aquifer.

Another impact on the borehole and aquifer may be that poorly treated, or poorly attenuated irrigated effluent is drawn into the borehole during pumping. The borehole water quality may then be compromised. Since the rate of attenuation and level of treatment is currently not known, it is uncertain what the quality of the groundwater would be in the above-mentioned scenario.

3.7.1 Normal Conditions

Under normal conditions, it is envisaged that abstraction from the borehole takes place at the recommended yields, as given in section 3.4 of this report; that regular monitoring of the borehole's water level is carried out; and that no additional boreholes are sunk and abstracted from the same aquifer. It is also assumed that the quality of irrigated effluent will be such that it attenuates before it reaches the groundwater and is drawn into the boreholes.

Mitigation:

Under these conditions, there should be no significant impact on the aquifer. However, since the recharge to the aquifer may be unpredictable (droughts etc.), it is recommended that the water level of the borehole must be measured on a monthly basis. The water level measurements should be recorded and if it is observed that the water level is dropping over time, then adjustments to the abstraction rate can be made.

3.7.2 Upset / Abnormal Conditions

Under these conditions, a scenario is envisaged where the borehole is over-abstracted (thus pumping the borehole at a higher yield and for a longer period of time than recommended in this report); the recharge to the aquifer is inadequate; and/or another groundwater user is abstracting from the same aquifer.

During these circumstances, and when the water level is not being monitored, the water level in the borehole may be drawn down to pump intake, resulting in the pump running dry. The water level in the borehole may not recover to the original levels, because of over-abstraction and a lack of recharge. In an aquifer where the water level is reduced, and the geological formation is iron rich, aerobic bacteria may start to grow within the fractures of the rock formation, and may block or reduce the permeability of the aquifer. Ideally the water level should be kept as constant as possible during pumping, and should not be drawn down past the dynamic water level as mentioned in the SRK report.

Mitigation:

Should the above-mentioned conditions occur, then pumping from the borehole should seize. The water level should be monitored on a weekly basis to see whether it is recovering to the original static water level. This may take several months or years. Should the water level stabilise and recover, then pumping can start again at the recommended yield from the SRK report. Iron bacteria (if present) are dependent on oxygen for survival, and if saturated in water, they normally die off. However, the remains of the iron bacteria may continue to block the aquifer around the borehole, and may have to be removed manually or chemically.

A water level monitoring program should be implemented, as described in Scenario 1 above. Should it be noticed that the water level is lowering over time, then mitigation measures can be put in place to halt or reduce the effect of dewatering of the aquifer.

4. Conclusions and Recommendations

The following conclusions are made:

- The borehole yield is scientifically recommended at 0.9 L/s for a 12 hour *or less* pumping period. This can deliver 38 880 L/day (excluding treatment like reverse osmosis). Given the nature of the geological formation, and the undulating topography, the calculated borehole yield is higher than what is expected for this area. As we have no information on the borehole, e.g. depths of water strikes and strike yields, SRK recommends that the borehole is equipped with a pump that will satisfy the demand, if the demand is < 0.9 L/s, and not be equipped with a pump that can yield 0.9 L/s.

The following recommendations are made:

- The scientifically calculated yields, as given above, should not be exceeded, even if the borehole is to be pumped for a shorter period. The borehole can however be pumped at rates lower than 0.9 L/s.
- The sanitation system should not allow for pollutants to come into contact with the environment.

- Treated effluent should comply with the "*Wastewater limit values applicable to discharge of wastewater into a water resource*" as per the "*Revision of General Authorisation in terms of Section 39 of the National water Act, 1998 (Act 36 of 1998*) before irrigation takes place.
- The borehole's water level should be monitored on a monthly basis to ensure that it is not lowering over time. Should this be the case, then adjustments to the yield can be made. Water level meters or logger can be purchased to do this.

Yours faithfully,

SRK Consulting - Certified Electronic Signature
srk consulting
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Riona Kruger (Pr Sci Nat)
Principal Geoscientist

Gert Nel (Pr Sci Nat)
Principal Hydrogeologist & Partner

SRK Consulting (South Africa) (Pty) Ltd

Appendix A: Yield Testing Report

SPRAYMOR

GROUND WATER SERVICES

Project:	556443	Borehole No:	AFRICAMPS01	Date Started:	16/12/2019	33.39018 25.72158	Stepped Discharge Test and Recovery Testing
Water Level before test (m bgl):	8.86	Borehole Depth (m bgl):	27M	Test Pump Installation depth (m bgl):	26M		

DATUM ABOVE CASING .28M STEEL CASING 160MM

STEPPED DISCHARGE TEST & RECOVERY

DISCHARGE RATE 1			RPM		DISCHARGE RATE 2			RPM		DISCHARGE RATE 3			RPM	
DATE & TIME:			16/12/2019		DATE & TIME:					DATE & TIME:				
TIME (min)	WATER LEVEL (m)	YIELD (l/s)	TIME (min)	RECOVERY (m)	TIME (min)	WATER LEVEL (m)	YIELD (l/s)	TIME (min)	RECOVERY (m)	TIME (min)	WATER LEVEL	YIELD	TIME (min)	RECOVERY (m)
1	8.97		1		1	9.61		1		1	11.05		1	10.44
2	8.99		2		2	9.77		2		2	11.16		2	10.17
3	8.99		3		3	9.84		3		3	11.21		3	10.13
5	9.02	0.82	5		5	9.96	3.10	5		5	11.28		5	10.02
7	9.04		7		7	10.03		7		7	11.34	5.20	7	9.93
10	9.06		10		10	10.13		10		10	11.38		10	9.86
15	9.08		15		15	10.27		15		15	11.45		15	9.76
20	9.10		20		20	10.36		20		20	11.51		20	9.69
30	9.14		30		30	10.50		30		30	11.66		30	9.58
40	9.16		40		40	10.61		40		40	11.77		40	9.50
50	9.21		60		50	10.71		50		50	11.85		50	9.42
60	9.26		90		60	10.81		60		60	11.94		60	9.39
90								70		70			70	9.36
120								80		80			80	9.33
150								90		90			90	9.30
170								100					100	9.27
210								110					110	9.22
240								120					120	9.19
300								150					150	
Average Yield (l/s):					Average Yield (l/s):					Average Yield (l/s):			180	

DISCHARGE RATE 4			RPM		DISCHARGE RATE 5			RPM		DISCHARGE RATE 6			RPM	
DATE & TIME					DATE & TIME					DATE & TIME				
TIME (min)	WATER LEVEL (m)	YIELD (l/s)	TIME (min)	RECOVERY (m)	TIME (min)	WATER LEVEL (m)	YIELD (l/s)	TIME (min)	RECOVERY (m)	TIME (min)	WATER LEVEL (m)	YIELD (l/s)	TIME (min)	RECOVERY (m)
1			1		1			1		1			1	
2			2		2			2		2			2	
3			3		3			3		3			3	
5			5		5			5		5			5	
7			7		7			7		7			7	
10			10		10			10		10			10	
15			15		15			15		15			15	
20			20		20			20		20			20	
30			30		30			30		30			30	
40			40		40			40		40			40	
50			50		50			50		50			50	
60			60		60			60		60			60	
70			70					70					70	
80			80					80					80	
90			90					90					90	
			100					100					100	
			110					110					110	
			120					120					120	
			150					150					150	
			180					180					180	
			210					210					210	
			240					240					240	
			300					300						
			360					360						
			420											
Average Yield (l/s):					Average Yield (l/s):					Average Yield (l/s):			300	

SPRAYMOR
GROUND WATER SERVICES

Project:	556443	Borehole No:	AFRICAMPS 1	Date Started:	16/12/2019	CO ORDINATES: 33.39018 25.72158	Constant Discharge Rate Test & Recovery
Static Water Level (m bgl):	8.86	Borehole Depth (m bgl):	27M	Test Pump Installation Depth (m bgl):	26M		

CASING DIA: 160MM STEEL 151M HEAD EXISTING PUMP2.2KW

CONSTANT DISCHARGE TEST & RECOVERY

DISCHARGE BOREHOLE					OBSERVATION HOLE			OBSERVATION HOLE 1			OBSERVATION HOLE		
TEST STARTED					WATER LEVEL [mbcl]:			WATER LEVEL [mbcl]:	8.98		WATER LEVEL [mbcl]:		
DATE & TIME:	16/12/2019				DATUM ABOVE CASING			CASING HEIGHT [m]:	0.00		CASING HEIGHT [m]:		
TEST COMPLETED					CASING DIAMETER [m]:			CASING DIAMETER [m]:	160M		CASING DIAMETER [m]:		
DATE & TIME:					DISTANCE [m]:			DISTANCE [m]:	8M		DISTANCE [m]:		
Time [min]	Water Level [m]	Yield [l/s]	Time [min]	Recovery [m]	Time [min]	Water Level [m]	Recover [m]	Time [min]	Water Level [m]	Recovery [m]	Time [min]	Water Level [m]	Recovery [m]
1	9.07		1	13.56	1			1	9.13		1		
2	10.22		2	13.41	2			2			2		
3	10.34		3	13.34	3			3			3		
5	10.40		5	13.25	5			5		12.98	5		
7	10.47		7	13.16	7			7			7		
10	10.57		10	13.07	10			10	9.71		10		
15	10.68		15	12.96	15			15		12.73	15		
20	10.76		20	12.86	20			20			20		
30	10.88		30	12.71	30			30			30		
40	10.97		40	12.60	40			40			40		
60	11.10		60	12.45	60			60	10.42	12.27	60		
90	11.22		90	12.25	90			90			90		
120	11.35		120	12.11	120			120			120		
150	11.48		150	11.95	150			150	10.61	11.75	150		
180	11.55	4.50	180	11.83	180			180			180		
210	11.60		210	11.69	210			210			210		
240	11.64		240	11.59	240			240	10.83	11.45	240		
300	11.67		300	11.46	300			300			300		
360	11.72		360	11.30	360			360	11.02	11.13	360		
420	11.78		420	11.16	420			420			420		
480	11.89		480	11.07	480			480			480		
540	12.04		540	10.97	540			540	11.43	10.91	540		
600	12.13		600	10.89	600			600			600		
720	12.34		720	10.76	720			720			720		
840	12.55		840	10.61	840			840		10.45	840		
960	12.82		960	10.50	960			960	12.02		960		
1080	13.15		1080	10.41	10.41			1080			1080		
1200	13.40		1200	10.38	10.38			1200	12.75		1200		
1320	13.61		1320	10.35	10.35			1320			1320		
1440	13.84		1440	10.30	10.3			1440	13.20		1440		
1560			1560		1560			1560			1560		
1680			1680		1680			1680			1680		
1800			1800		1800			1800			1800		
1920			1920		1920			1920			1920		
2040			2040		2040			2040			2040		
2160			2160		2160			2160			2160		
2280			2280		2280			2280			2280		
2400			2400		2400			2400			2400		
2520			2520		2520			2520			2520		
2640			2640		2640			2640			2640		
2760			2760		2760			2760			2760		
2880			2880		2880			2880			2880		
									Depth: 33.39m				

Appendix D4: Vegetation Assessment

CEN INTEGRATED ENVIRONMENTAL MANAGEMENT UNIT

Environmental and Rural Development Specialist

Vegetation Assessment:

Proposed establishment of a tented camp resort facility – AfriCamps at Addo – with associated access and services in the Eastern Cape

December 2019

1. Introduction

CEN IEM Unit was appointed by the client, Hayterdale Trails (Pty) Ltd, to conduct a Vegetation Assessment on their property, Portion 0 of the Farm Hayterdale No. 406. The property is located north of the town of Addo, east of the R335 towards the Zuurberg area, in the Sundays River Valley Municipality in the Eastern Cape [approx. central GPS coordinates: 33° 23' 18.74" S, 25° 43' 31.03" E]. The client wishes to establish a tented camp resort facility (i.e. 20 separate canvas tents on a raised timber platform), under the AfriCamps Boutique Glamping brand, with associated offices, access roads, services and parking areas.

The property is approximately 254.2 ha in size and is zoned Agriculture, and is currently used for recreational purposes i.e. walking, trail running and mountain biking – as Hayterdale Trails. The property consists of natural areas i.e. dense Mesic Thicket vegetation in an undulating, mountainous landscape with river valleys. There is minimal development on the property in terms of buildings (i.e. one farmhouse with associated outbuildings and an open grassed area), fences, and gravel roads. Surrounding land uses include: natural areas, protected areas i.e. the Greater Addo Elephant National Park, other resort facilities, and agriculture.

Figure 1 is a Google Earth aerial image showing the proposed layout of tents, access roads and service infrastructure on the Farm Hayterdale.

1.1 Terms of reference

This assessment aims to –

- Review available publications for the study area and surrounds, and extract important information which needs to be considered when assessing the sensitivity of, and potential impacts on, on-site vegetation.
- Do a site survey to describe the biophysical composition and characteristics of the site, and identify important ecological attributes and / or sensitive areas.
- Identify Protected Plants and Trees and Species of Conservation Concern (SCC's), which may require permits prior to disturbance during development.

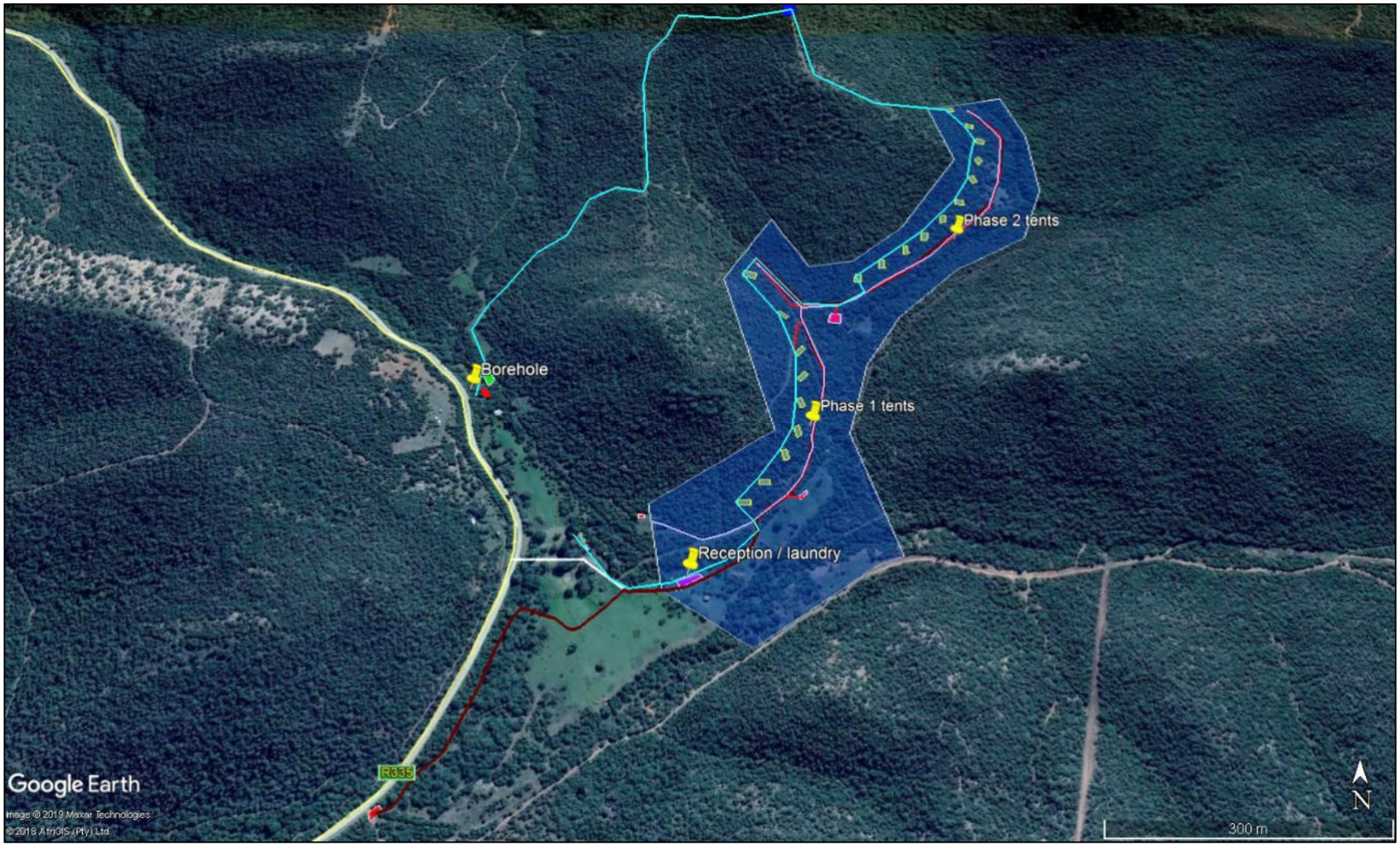

Figure 1. Google Earth © 2019 aerial image showing the proposed layout of the AfriCamps tented camp resort facility on the Farm Hayterdale [i.e. 20 rectangular platforms, outlined in yellow]; water lines [in light blue] and water tanks [in light green and dark blue]; sewage lines and septic tanks [in red]; grey water lines [in purple]; roads [in brown], and reception and laundry area [rectangle in purple].

2. Review of available literature

2.1 Biodiversity planning documents and guidelines

2.1.1 Mucina and Rutherford (2006) / National Vegetation Map (2012 beta2)

Mucina and Rutherford (2006) have mapped vegetation in the study area as **AT6 Sundays Thicket** (see **Figure 2**). AT6 Sundays Thicket falls within the Albany Thicket Bioregion [conservation status: Least threatened; protection status: Poorly protected; conservation target: 19%; Protected: 9% (+ 3%); Remaining habitat: 94.5%; Mucina and Rutherford, 2006].

Sundays Thicket is described as present on 'undulating plains and low mountains and foothills covered with tall, dense thicket, where trees, shrubs and succulents are common, with many spinescent species. The transition between lower and upper canopies is obscured by the presence of a wide variety of lianas. The local dominance of *Portulacaria afra* increases and the relative abundance of woody species present decreases with increasing aridity. There is considerable structural heterogeneity within this vegetation unit' (Mucina and Rutherford, 2006).

The following **Important Taxa** occur in AT6 Sundays Thicket vegetation (from Mucina and Rutherford, 2006) –

Important Taxa

Succulent trees: *Aloe africana* (d), *A. ferox*, *Euphorbia grandidens*. Small Trees: *Pappea capensis* (d), *Schotia afra* var. *afra* (d), *Acacia natalitia*, *Boscia albitrunca*, *Brachylaena ilicifolia*, *Cussonia spicata*, *Encephalartos lehmannii, Ptaeroxylon obliquum*, *Sideroxylon inerme*. Tall shrubs: *Euclea undulata* (d), *Olea europaea* subsp. *africana* (d), *Azima tetracantha*, *Cadaba aphylla*, *Carissa bispinosa* subsp. *bispinosa*, *Diospyros pallens*, *Ehretia rigida*, *Grewia occidentalis*, *G. robusta*, *Gymnosporia buxifolia*, *G. capitata*, *G. polyacantha*, *Maerua cafra*, *Mystroxylon aethiopicum*, *Nymania capensis*, *Putterlickia pyracantha*, *Rhus incisa*, *R. longispina*, *Scutia myrtina*. Low shrubs: *Pentzia globosa* (d), *Aptosimum elongatum*, *Asparagus burchellii*, *A. crassicladus*, *A. striatus*, *A. subulatus*, *Barleria obtusa*, *B. rigida*, *Blepharis capensis*, *Chascanum cuneifolium*, *Chrysocoma ciliata*, *Eriocephalus ericoides*, *Euryops algoensis*, *E. spathaceus, Felicia muricata*, *Garuleum latifolium*, *Hermannia althaeoides*, *Hibiscus aridus*, *Indigofera sessilifolia*, *Justicia orchioides*, *Lantana rugosa*, *Leucas capensis*, *Limeum aethiopicum*, *Lycium oxycarpum*, *Osteospermum imbricatum*, *Pteronia paniculata*, *Rhigozum obovatum*, *Rosenia humilis*, *Selago fruticosa*, *S. geniculata*, *Senecio linifolius*, *Solanum capense*, *S. tomentosum*. Succulent shrubs: *Crassula ovata* (d), *Euphorbia caerulescens* (d), *E. ledienii* (d), *Portulacaria afra* (d), *Adromischus cristatus* var. *cristatus*, *A. sphenophyllus*, *Cotyledon campanulata*, *C. orbiculata* var. *oblonga*, *Crassula capitella* subsp. *capitella*, *C. capitella* subsp. *thyrsiflora*, *C. cotyledonis*, *C. cultrata*, *C. mesembryanthoides* subsp. *hispida*, *C. rogersii*, *Delosperma echinatum*, *D. uniflorum*, *Euphorbia mauritanica*, *Exomis microphylla*, *Kalanchoe rotundifolia*, *Lampranthus productus*, *Mestoklema tuberosum*, *Orbea pulchella*, *Pachypodium succulentum*, *Pelargonium carnosum*, *Psilocaulon articulatum, Zygophyllum foetidum*. Semiparasitic shrub: *Osyris compressa*. Semiparasitic Epiphytic Shrubs: *Viscum crassulae*, *V. obscurum*, *V. rotundifolium.*

Woody succulent climbers: *Pelargonium peltatum* (d), *Crassula perforata*, *Cyphostemma quinatum*, *Sarcostemma viminale*. Woody climbers: *Asparagus asparagoides*, *A. multiflorus*, *A. racemosus*, *A. volubilis*, *Behnia reticulata*, *Capparis sepiaria* var. *citrifolia*, *Cissampelos capensis*, *Plumbago auriculata*, *Rhoiacarpos capensis*, *Rhoicissus digitata*. Herbaceous climbers: *Cynanchum ellipticum*, *Kedrostis capensis*. Graminoids: *Aristida adscensionis* (d), *A. congesta* (d), *Cynodon dactylon* (d), *C. incompletus* (d), *Eragrostis obtusa* (d), *Panicum maximum* (d), *Tragus berteronianus* (d), *Cenchrus ciliaris*, *Cyperus capensis*, *Digitaria argyrograpta*, *Ehrharta calycina*, *Enneapogon scoparius*, *Eragrostis curvula*, *Eustachys paspaloides*, *Heteropogon contortus*, *Panicum deustum*, *Sporobolus fimbriatus*, *Stipa dregeana*, *Themeda triandra*. Succulent herbs: *Senecio radicans* (d), *Crassula expansa*, *C. spathulata*, *Gasteria bicolor, Sansevieria aethiopica*. Geophytic herbs: *Bulbine frutescens* (d), *Drimia intricata* (d), *Sansevieria hyacinthoides* (d), *Cyanella lutea, Cyrtanthus loddigesianus*, *C. spiralis*, *Drimia anomala, Freesia corymbosa*, *Hypoxis argentea*, *Justicia cuneata* subsp. *cuneata*, *Moraea stricta*, *Oxalis smithiana*, *Spiloxene trifurcillata, Trachyandra affinis*, *Tritonia securigera*, *Tritonia strictifolia*, *Urginea altissima*. Herbs: *Abutilon sonneratianum*, *Aizoon glinoides*, *Arctotheca calendula*, *Chamaesyce inaequilatera*, *Commelina benghalensis*, *Cotula heterocarpa*, *Cyanotis speciosa*, *Cypselodontia eckloniana*, *Emex australis*, *Gazania krebsiana*, *Hibiscus pusillus*, *Hypoestes aristata*, *Indigastrum costatum* subsp. *macrum*, *Lepidium africanum*, *Lotononis glabra*, *Stachys aethiopica*.

Biogeographically Important Taxa ([S] Southern limit)

Succulent climber: *Ceropegia ampliata* var. *ampliata*[S]. Herbaceous climber: *Fockea sinuata*[S]. Epiphytic parasitic herb: *Cuscuta bifurcata*. Geophytic herb: *Pelargonium campestre.*

Endemic Taxa

Small tree: *Encephalartos horridus*. Succulent shrubs: *Aloe bowiea*, *A. gracilis*, *Bergeranthus addoensis*, *Glottiphyllum grandiflorum*, *Orthopterum coegana*, *Ruschia aristata*, *Trichodiadema rupicola*. Succulent climbers: *Aptenia haeckeliana*, *Ceropegia dubia*. Succulent herbs: *Haworthia arachnoidea* var. *xiphiophylla*, *H. aristata*, *Huernia longii* subsp. *longii*. Geophytic herbs: *Brachystelma cummingii*, *B. schoenlandianum*, *B. tabularium*, *Pelargonium ochroleucum*, *Strelitzia juncea*, *Tritonia dubia*. Herbs: *Arctotis hispidula*, *Argyrolobium crassifolium*, *Lessertia carnosa*, *Lotononis monophylla*, *Senecio scaposus* var. *addoensis*, *Wahlenbergia oocarpa.*

Figure 2. Mucina and Rutherford (2006) / National Vegetation Map (2012 beta 2) classification of vegetation types present in the study area i.e. AT6 Sundays Thicket [areas in green].

2.1.2 National Vegetation Map (2018)

In the newest, and most relevant, National Vegetation Map (NVM, 2018) classification of Albany Thicket Biome vegetation types, AT6 Sundays Thicket vegetation (Mucina and Rutherford, 2006) has been removed and replaced with the newly-described **AT50 Sundays Mesic Thicket** vegetation [for 80% of the previously-mapped AT6 Sundays Thicket vegetation area] (NVM (2018) new vegetation types described in Grobler *et al.*, 2018) – as mapped for the study area (see **Figure 3**).

AT50 Sundays Mesic Thicket is described as present on 'low foothills and mountain slopes and deeply incised valleys. Medium-sized to tall (3 to 5 m) thicket dominated by small trees and woody shrubs, with *Cussonia spicata* and *Euphorbia triangularis* emergent above the canopy. Some woody species are shared with AT51 Sundays Valley Thicket, but few spinescent or succulent species occur in this thicket unit and the tree component is better developed' (Grobler *et al.*, 2018).

The conservation target assigned to AT50 Sundays Mesic Thicket is 19%, it is described as *Well protected*, and the area of Sundays Mesic Thicket calculated as being *Transformed* is 10.16% (Grobler *et al.*, 2018).

The following **Important Taxa** are listed for AT50 Sundays Mesic Thicket vegetation (from Grobler *et al.*, 2018) [d = dominant, e = South African endemic, e_t = possibly endemic to a vegetation type] –

Important Taxa

Small tree: *Olea europaea* subsp. *cuspidata* (d), *Apodytes dimidiata, Allophylus decipiens, Canthium spinosum, Crotalaria capensis, Cussonia spicata, Hippobromus pauciflorus* (d), *Maytenus undata, Ptaeroxylon obliquum, Pterocelastrus tricuspidatus* (e), *Schotia latifolia* (d), *Sideroxylon inerme, Vepris lanceolata*.

Succulent tree: *Euphorbia triangularis* (d), *Aloe pluridens* (e).

Tall shrub: *Flueggea verrucosa* (d), *Scutia myrtina* (d), *Brachylaena elliptica* (e), *Buddleja saligna, Carissa bispinosa, Dovyalis rhamnoides, Grewia occidentalis, Lauridia tetragona, Rhoiacarpos capensis* (e), *Scolopia zeyheri, Searsia lucida* (e).

Herb: *Acalypha ecklonii* (e), *Asplenium cordatum, Asplenium rutifolium, Hypoestes forskaolii* (d), *Plectranthus verticillatus* (d), *Plumbago auriculata* (d).

Succulent herb: *Crassula cordata* (e), *Crassula orbicularis* (e), *Crassula pellucida* subsp. *marginalis* (e).

Geophytic herb: *Albuca bracteata, Bonatea speciosa, Chasmanthe aethiopica* (e), *Chlorophytum comosum*.

Graminoid: *Ehrharta erecta* (d), *Panicum deustum* (d), *Panicum maximum*.

Herbaceous climber: *Rhoicissus digitata, Rhoicissus tomentosa, Senecio angulatus* (e), *Senecio deltoideus*.

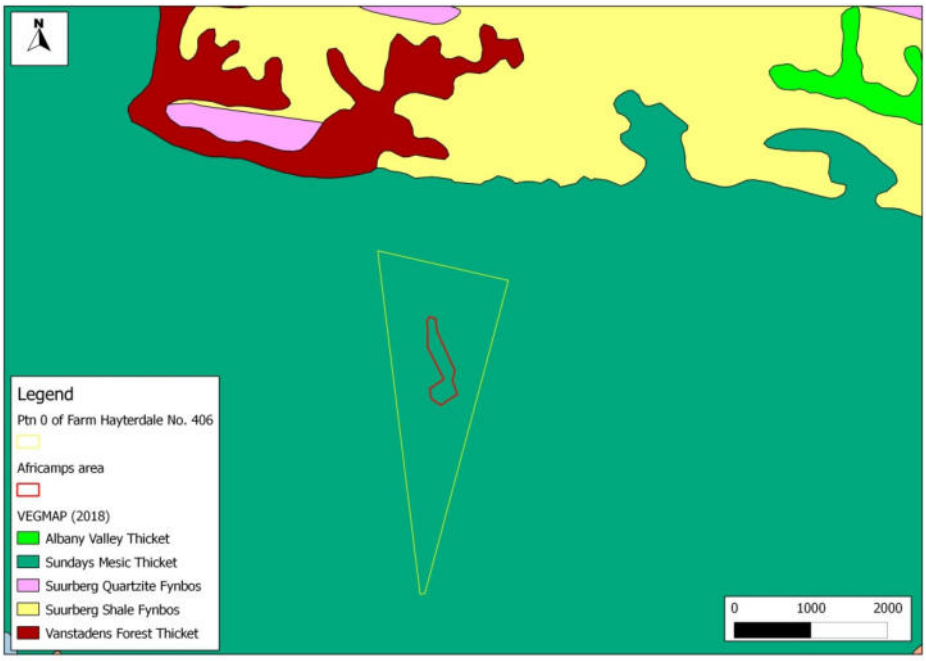

Figure 3. National Vegetation Map (2018) classification of vegetation types present in the study area [outlined in red] i.e. AT50 Sundays Mesic Thicket vegetation [areas in dark green].

2.1.3 National List of Threatened Ecosystems (2011)

The study area is not classified as falling within a threatened ecosystem (National Biodiversity Assessment – National List of Threatened Ecosystems, 2011).

2.1.4 Eastern Cape Biodiversity Conservation Plan (2007)

The Eastern Cape Biodiversity Conservation Plan (2007) indicates that the study area falls within a **Terrestrial Critical Biodiversity Area 1** [CBA_saveg T3, CBA_marx T1, CBA_corr1 Corridor1, CBA_CBA1; see **Figure 4**]. Terrestrial CBA 1 areas are included within *Biodiversity Land Management Class 1: Natural landscapes*. The recommended land use objectives for BLMC 1 areas are to 'maintain biodiversity in as natural state as possible...manage for no biodiversity loss' (Berliner *et al*., 2007).

The study area does not fall within a within a Freshwater Aquatic CBA.

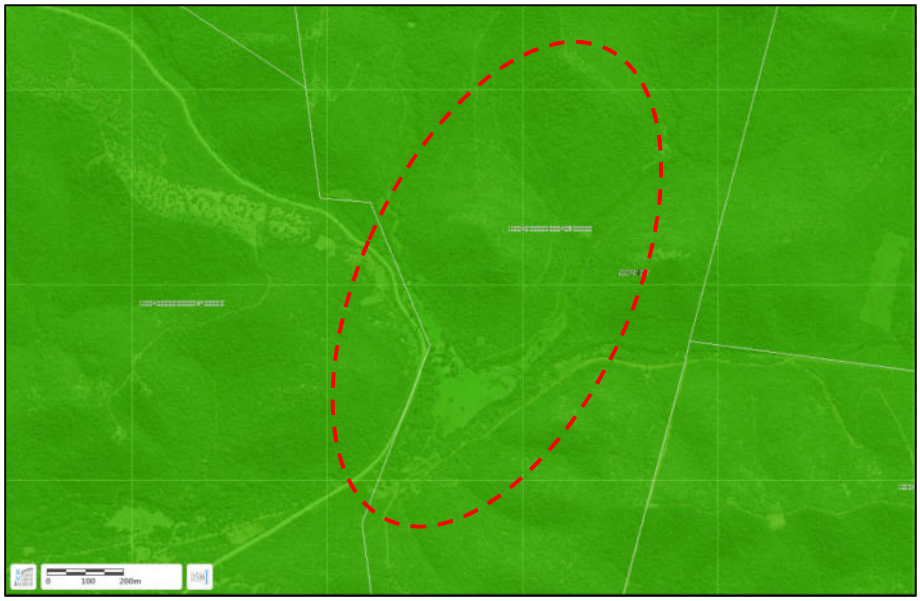

Figure 4. The study area falls within a Terrestrial CBA 1 [areas in green] (ECBCP, 2007).

2.1.5 National Freshwater Ecosystem Priority Areas project (2011)

The study area does not fall within a National Freshwater Ecosystem Priority Area (NFEPA, 2011). The study area is located in quaternary catchment N40D (EST_nbsap 74; ECBCP, 2007), in the Sundays Sub-Water Management Area, in the larger Fish to Tsitsikamma Water Management Area.

2.1.6 Addo Biodiversity Sector Plan (2012)

The study area is classed as a **Critical Biodiversity Area**[1] in the Addo Biodiversity Sector Plan for the Sundays River Valley Municipality (Vromans *et al.*, 2012; see **Figure 5**). Land cover in the study area is classed as *Natural*.

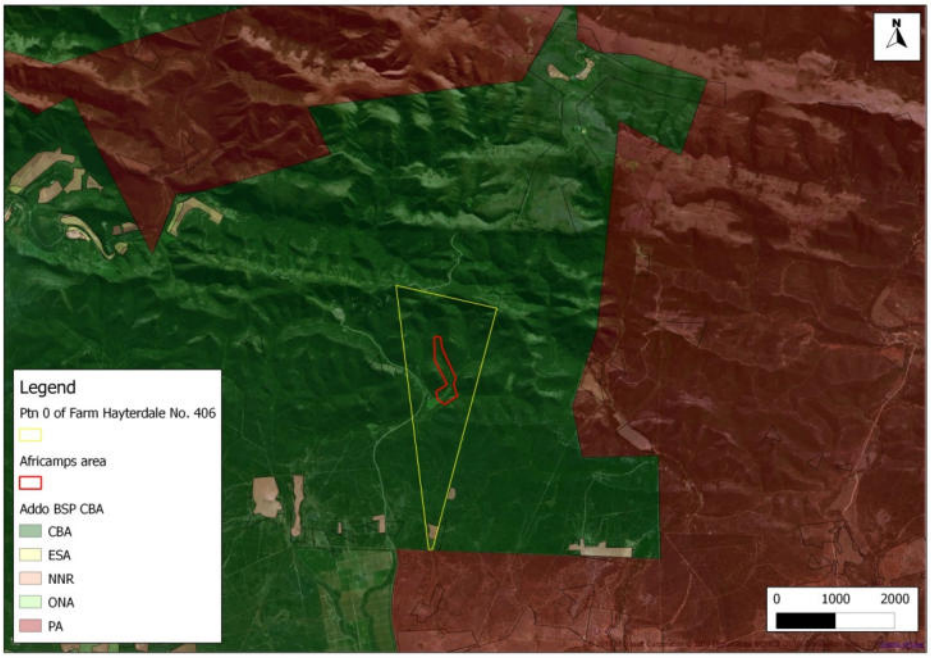

Figure 5. The study area falls within a Critical Biodiversity Area [areas in dark green] (Addo BSP, 2012).

2.2 Summary of available literature

Available biodiversity planning documents indicate that the study area includes:

- A Least Threatened vegetation type i.e. AT6 Sundays Thicket (Mucina and Rutherford, 2006; National Vegetation Map, 2012 beta2), which is not listed as a threatened ecosystem (National Biodiversity Assessment – National List of Threatened Ecosystems, 2011).
- A Well protected vegetation type i.e. AT50 Sundays Mesic Thicket (National Vegetation Map, 2018).
- A Terrestrial Critical Biodiversity Area 1 (ECBCP, 2007).
- A Critical Biodiversity Area and a Natural area (Addo Biodiversity Sector Plan, 2012).

[1] Critical Biodiversity Areas (CBA) are terrestrial (land) and aquatic (water) areas which must be safeguarded in their natural or near-natural state as they are critical for conserving biodiversity and maintaining ecosystem functioning. These areas include: (a) natural areas identified as requiring safeguarding in order to meet national biodiversity thresholds; (b) areas required to ensure the continued existence and functioning of species and ecosystems, including the delivery of ecosystem services; and / or (c) important locations for biodiversity features or rare species. It should be noted that some CBA are degraded but are still required for achieving the thresholds (targets) (Vromans *et al.*, 2012).

3. Site description

3.1 Assessment methodology

Members of CEN IEM Unit visited the study area on 29 October, 14 November and 17 December 2019. The different areas assessed during the site survey(s) were visited on foot. Observations on site characteristics e.g. steepness of slope, and vegetation e.g. degree of plant cover, dominant plants etc.; GPS coordinates of important environmental features, and a list of plant species present, were recorded.

Figures 6 to 8, below, are zoomed-in aerial images of the proposed new entrance and access road; the Phase 1 tent platform site area assessed i.e. Sites 1 to 12 described in **Tables 2 to 4** (from south to north – originally twelve sites, now reduced to nine for the same area), and the Phase 2 tent platform site area i.e. Sites 1 to 11 described in **Tables 5 and 6** (from north to south) – respectively.

Figure 6. Zoomed-in aerial image of the proposed new entrance area [at red rectangle] and access road [route in maroon].

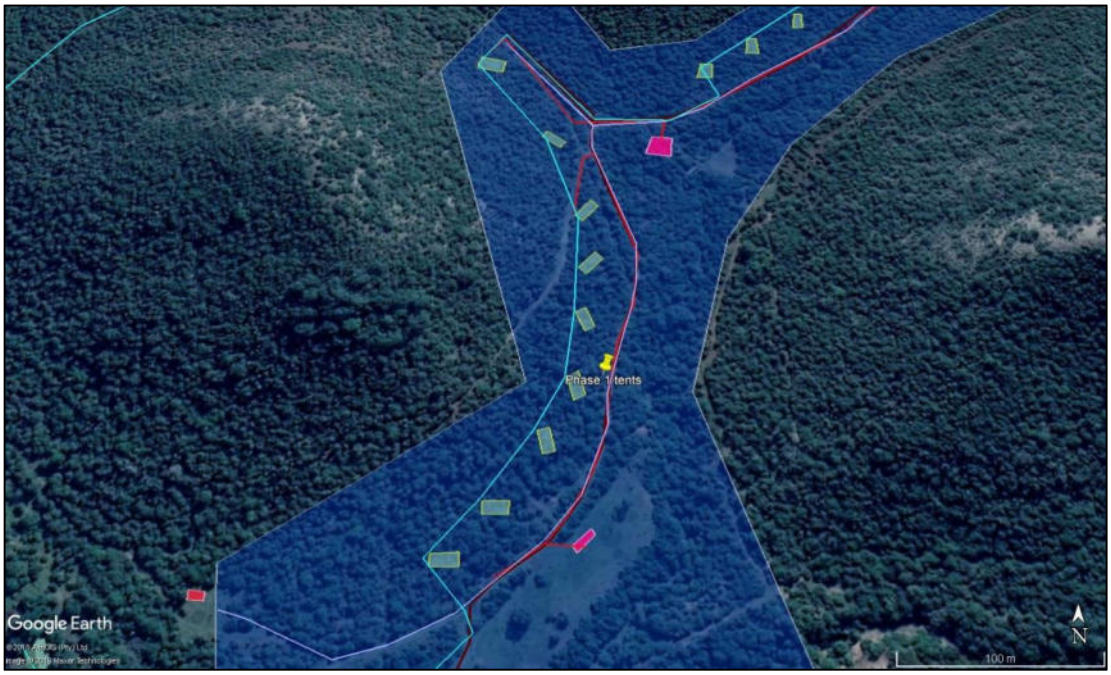

Figure 7. Phase 1 tent platform site area, to the south of Phase 2. Tent sites are located on the north-east, east and south-east facing slopes of a more or less round hill.

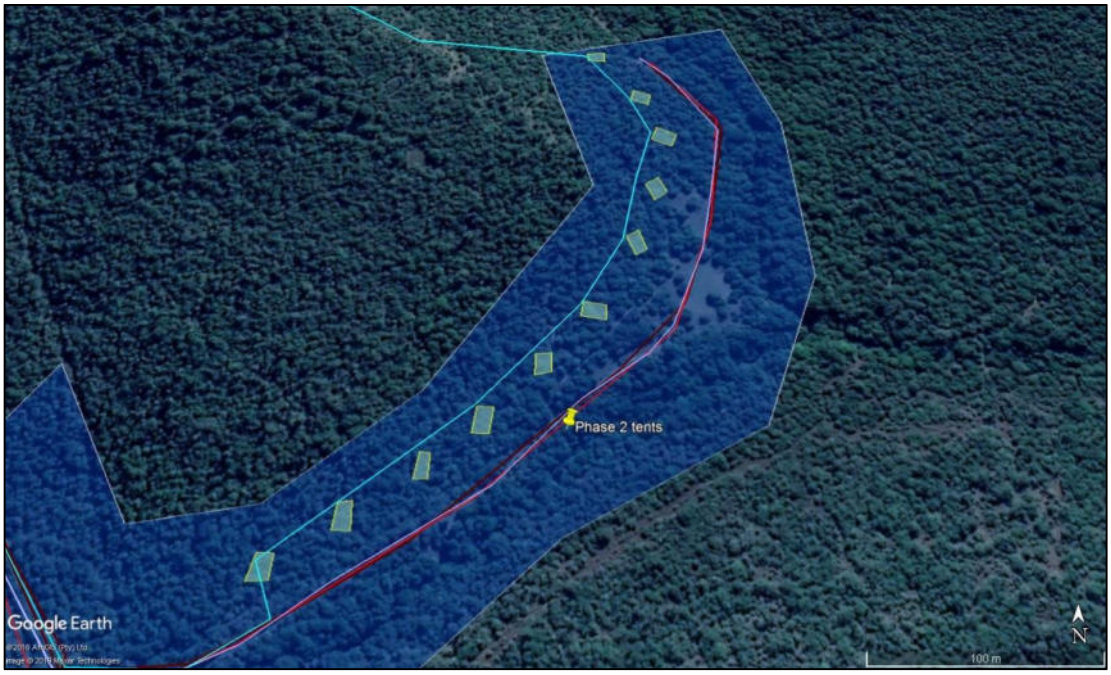

Figure 8. Phase 2 tent platform site area, to the north of Phase 1. Tent sites are located on the east, south-east and south-facing slopes of the next hill (to the north-east). All tent sites overlook the river valley.

3.2 Vegetation description

Notes and observations made, of on-site characteristics and vegetation present, at the 1) proposed new entrance area and access road, and the 2) 23 individual tent platform sites assessed in the Phase 1 and 2 areas – are given in **Tables 2 to 6**, below.

Access road and entrance area

The gravel road, becoming a single-track path, of the proposed access road area consists predominantly of a path of bare soil, flanked by low-growing *Cyndon dactylon* (Couch Grass), and grasses and shrubs characteristic of the Thicket 'edge' i.e. *Panicum* spp., *Hypoestes forskaolii*, *Croton rivularis*, and *Plumbago auriculata*. The tall, dense Thicket vegetation flanking the single-track path in the southern to central portions of the proposed access road route is dominated by *Azima tetracantha*, *Plumbago auriculata*, *Gymnosporia* spp., *Searsia* spp., *Lycium ferocissimum*, and *Scutia myrtina*. There are also tall *Schotia latifolia* (Forest Boer-bean) and *Calodendrum capense* (Cape Chestnut) trees present along the path near the proposed new entrance area, which will not be removed. The northern 'exit' of the gravel road to the open, grassed area in front of the farmstead is flanked by tall *Vachellia karroo* (Sweet Thorn) and *Jacaranda mimosifolia* (Jacaranda) trees, some of which will need to be removed and trimmed.

The proposed new entrance area, at the existing fence with access gate at the R335 road, consists predominantly of a bare, cleared area, with resprouting *Azima tetracantha* and *Senecio pterophorus*, flanked by dense trees and shrubs i.e. *Vachellia karroo*, *Azima tetracantha*, *Plumbago auriculata*, *Searsia rehmanniana*, *Buddleja saligna*, and *Grewia occidentalis*.

A total of 42 species were recorded along the proposed access road route and entrance area.

Tent platform sites

The overall dominant tree and shrub species present at the 23 tent platform sites assessed, include: *Azima tetracantha*, *Plumbago auriculata*, *Searsia rehmanniana*, *S. longispina*, *Gymnosporia buxifolia*, *G. capitata*, *Chaetacme aristata*, *Scutia myrtina*, *Carissa bispinosa*, and *Grewia occidentalis*. Other tree and shrub species present, included: *Euphorbia triangularis* (Tree or River Euphorbia), *Cussonia spicata* (Common Cabbage Tree), *Coddia rudis*, *Putterlickia pyracantha*, *Sideroxylon inerme* subsp. *inerme* (White Milkwood), *Brachylaena ilicifolia*, *Mystroxylon aethiopicum*, *Zanthoxylum capense*, *Hippobromus pauciflorus*, *Olea europaea* subsp. *africana* (African Olive), and *Ptaeroxylon obliquum*. Climbers present more or less consistently between sites included: *Asparagus setaceus*, *A. multiflorus*, *A. subulatus*, *A. asparagoides*, *Capparis sepiaria* var. *citrifolia*, *Rhoicissus digitata*, and *Cynanchum ellipticum*. Thicket understory and 'edge' species included: *Hypoestes forskaolii*, *Plumbago auriculata*, *Panicum* spp., *Croton rivularis*, *Cotyledon velutina*, and various ferns i.e. *Cheilanthes viridis*, *C. hirta*, and *Asplenium cordatum*.

The highest number of plant species recorded was at Tent site 1 in Phase 1 i.e. 35 species, and the lowest recorded was at Tent sites 9 and 12 in Phase 2, and Tent site 7 in Phase 1 i.e. 18 species. Tent site 1 in Phase 1 housed a high number of Thicket 'edge' and open patch-type

species i.e. *Asparagus* spp., *Pelargonium peltatum*, *Cotyledon velutina*, *Crassula tetragona* subsp. *acutifolia*, *Kalanchoe rotundifolia*, *Euryops spathaceus*, *Plectranthus madagascariensis*, *Hermannia althaeoides*, and *Felicia fascicularis*.

The average number of species recorded at the 23 proposed tent platform sites is 22 species per site. There was no marked 'turnover' of species from one tent site to the next, except between Tent sites 1 and 2 in Phase 1 i.e. 35 vs. 22 species recorded. Overall species richness and diversity of plant growth forms, or vegetation structure, between tent sites did not differ significantly (from an observational, rather than statistical perspective). No tent sites stood out as being particularly species-poor, or having particularly low vegetation cover. 'Open' patches are a natural occurrence in Thicket vegetation, particularly where large herbivores are present, and on steep, rocky slopes with shallow soil, which are vulnerable to soil erosion.

The only marked difference between tent sites was, perhaps, the localised / 'clumped' presence of one or more tall (some more than 5 m) *Euphorbia triangularis* trees, also associated with the presence of tall *Cussonia spicata* trees, 'emergent above the canopy', as described for AT50 Sundays Mesic Thicket by Grobler *et al.* (2018), covered in climbers, with 'open' patches present where Tree Euphorbias have fall over or died. This, in contrast with other tent sites, where there was a marked presence of dense, impenetrable woody spinescent trees and shrubs e.g. *Chaetacme arista* and *Gymnosporia* spp., with fewer or no 'open' patches, and very little growth in the understory with deep shade and gravelly soil.

Vegetation present in the general study area can be described as *AT50 Sundays Mesic Thicket* (Grobler *et al*., 2018; National Vegetation Map, 2018), *in a reasonably intact and undisturbed state* – despite the presence of a farmstead, mountain bike trails and gravel access roads. Vegetation in the study area is present on 'low foothills and mountain slopes', it is 'dominated by small trees and woody shrubs', in Thicket 'medium-sized to tall (3 to 5 m)', with '*Cussonia spicata* and *Euphorbia triangularis* emergent above the canopy', and a better developed tree, rather than succulent component, present (Grobler *et al*., 2018).

The overall plant species richness and diversity of Thicket vegetation recorded on site is reasonably high at 86 species in total [excluding three exotic plants recorded] – given its presence in a drought-stricken area, and across various habitats i.e. steep, exposed, gravelly slopes vs. flat valley bottoms at the farmstead. The dominant woody trees and shrubs present in the general study area are similar to dominants described for AT50 Sundays Mesic Thicket [see **Section 2.1.2**], though the species assemblages present at the proposed tent platform sites, and between tent platform sites, vary.

Vegetation present in the study area can be considered to be of *moderate conservation value* i.t.o. its representativity of AT50 Sundays Mesic Thicket. The conservation target set for AT50 Sundays Mesic Thicket is relatively low at 19%, and the vegetation type is described as *Well protected*. No significant reduction in the available habitat of AT50 Sundays Mesic Thicket, or its ability to persist in the landscape on the Farm Hayterdale is, therefore, anticipated once the AfriCamps at Addo tented camp resort facility is constructed and operational. The current land

use(s) of the property i.e. for *conservation* [the landowner's remaining surrounding property is natural open space] and *recreational activities* [i.e. mountain biking, trail running and walking] will not change upon completion of the AfriCamps resort.

Figure 9. Cleared, grassed area in front of the farmstead at the northern 'exit' of the proposed access road, which follows the path of an existing gravel road, becoming a single-track path to the proposed new entrance area.

Figure 10. Existing gravel road / single-track path in the northern portion of the proposed access road, surrounded by sparse shrubs and grasses and mature Sweet Thorn trees.

Figure 11. Gravel road / single-track path becomes more 'open' in the southern portion of the proposed access road, towards the proposed new entrance area. Low Couch Grass present along the path, with large Forest Boer-bean tree in background in photograph.

Figure 12. Proposed new entrance area at an existing fenced and gated gravel access road to the R335, in a cleared / maintained area at the southern end of the single-track path.

Figure 13. Amid Thicket vegetation at a proposed tent platform site in the Phase 1 area.

Figure 14. In a natural open patch amid Thicket vegetation, with predominantly bare soil and moss, at a proposed tent platform site in the Phase 1 area.

Figure 15. Open patch at the edge of a proposed tent platform site in the Phase 1 area, dominated by tall Tree Euphorbias.

Figure 16. Dense, impenetrable cover of Thicket trees and shrubs at a proposed tent platform site in the Phase 2 area.

Figure 17. Dense, impenetrable cover of Thicket trees with sparse understory growth and deep shade at a proposed tent platform site in the Phase 2 area.

3.2.1 Protected Plants and Species of Conservation Concern (SCC's)

The following legislation was consulted when annotating the list of plant species identified in the study area:

- National Environmental Management: Biodiversity Act (NEM:BA) 10 of 2004 – Alien and Invasive Species Lists (published July 2016);
- Red List of South African Plants (version 2017.1);
- National Forests Act No. 84 of 1998 – List of Protected Trees (published 23 December 2016);
- National Environmental Management: Biodiversity Act 10 of 2004 – Amendment of Critically Endangered, Endangered, Vulnerable and Protected Species List (14 December 2007);
- Eastern Province Nature Conservation Ordinance No. 19 of 1974;
- Eastern Cape Environmental Conservation Bill of 2003.

A total of 89 plant species were identified in the study area (see **Table 1**). Site notes recorded, and species identified in the different areas assessed during the site survey(s) are shown in **Tables 2 to 6**.

No Species of Conservation Concern (SCC's) i.e. species listed as threatened on the Red List of South African Plants (2017.1), were identified in the study area.

One protected tree listed under the National Forests Act 84 of 1998 (updated 23 December 2016), was identified in the study area i.e. *Sideroxylon inerme* subsp. *inerme* [White Milkwood].

Protected Plants identified in the study area i.e. listed under the Eastern Province Nature Conservation Ordinance No. 19 of 1974, and the Eastern Cape Environmental Conservation Bill of 2003, include: a number of trees and shrubs i.e. *Calodendrum capense*, *Olea europaea* subsp. *africana*, *Sideroxylon inerme* subsp. *inerme*, *Zanthoxylum capense*, *Clausena anisata*, *Ptaeroxylon obliquum*, *Buddleja saligna*, *Mystroxylon aethiopicum*, and *Carissa bispinosa*; a scrambling woody shrub i.e. *Lauridia tetragonia*, and climbers i.e. *Rhoicissus digitata*, *Pelargonium peltatum*, *Cynanchum ellipticum*, *Secamone filiformis*, *Sarcomstemma viminale*, and *Fockea edulis*.

- **Please note:** Protected plants and trees require permits from the relevant authorities i.e. DEDEAT and DAFF, prior to their disturbance (which includes the trimming of branches of protected trees), removal, and / or transplantation.

Three exotic and / or alien invasive plant species were identified in the study area i.e. *Jacaranda mimosifolia* [Jacaranda], *Opuntia ficus-indica* [Mission Prickly Pear], and *Solanum nigrum* [Black Nightshade]. One species i.e. *Opuntia ficus-indica* is listed as a Category 1b invader under the National Environmental Management: Biodiversity Act 10 of 2004 (NEM:BA) – Alien and Invasive Species Lists (published July 2016). This species was present along the proposed access road and tent platform sites in very low numbers.

3.2.2 Geology and soils

The general description for soils in the study area is 'soils with minimal development, usually shallow, on hard or weathering rock, with or without intermittent diverse soils. Lime generally present in part or most of the landscape' (gs_b LP2; BGIS, 2017).

Soils in this area are classed as an Associated of Classes 13 and 16: Undifferentiated shallow soils and land classes. A favourable property of this soil class is that it 'may receive water runoff' and is associated with water-intake areas. A limitation is that land use options are restricted where this soil class is present (soil_id S21; BGIS, 2017).

Table 1. Full annotated list of plant species identified on the Farm Hayterdale. Species in **GREEN** are Protected plants / Species of Conservation Concern. Species in **RED** are exotic and / or alien invasive plants.

Family	Species	Red List of South African Plants, 2017.1	EP Nature Conservation Ordinance No. 19 of 1974	EC Environmental Conservation Bill, 2003
ACANTHACEAE	Hypoestes forskaolii (Vahl) R.Br.	Least Concern (LC)		
ACHARIACEAE	Ceratiosicyos laevis (Thunb.) A.Meeuse	LC		
ANACARDIACEAE	Searsia longispina (Eckl. & Zeyh.) Moffett	LC		
ANACARDIACEAE	Searsia rehmanniana (Engl.) Moffett	LC		
APOCYNACEAE	Carissa bispinosa (L.) Desf. ex Brenan	LC		Schedule 5: Protected
APOCYNACEAE	Cynanchum ellipticum (Harv.) R.A.Dyer	LC		Schedule 5: Protected
APOCYNACEAE	Fockea edulis (Thunb.) K.Schum.	LC		Schedule 5: Protected
APOCYNACEAE	Sarcostemma viminale (L.) R.Br.	LC		Schedule 5: Protected
APOCYNACEAE	Secamone filiformis (L.f.) J.H.Ross	LC		Schedule 5: Protected
ARALIACEAE	Cussonia spicata Thunb.	LC		
ASPARAGACEAE	Asparagus asparagoides (L.) Druce	LC		
ASPARAGACEAE	Asparagus burchellii Baker	LC		
ASPARAGACEAE	Asparagus crassicladus Jessop	LC		
ASPARAGACEAE	Asparagus densiflorus (Kunth) Jessop	LC		
ASPARAGACEAE	Asparagus multiflorus Baker	LC		
ASPARAGACEAE	Asparagus setaceus (Kunth) Jessop	LC		
ASPARAGACEAE	Asparagus subulatus Thunb.	LC		
ASPLENIACEAE	Asplenium cordatum (Thunb.) Sw.	LC		
ASTERACEAE	Brachylaena ilicifolia (Lam.) E.Phillips & Schweick.	LC		
ASTERACEAE	Euryops spathaceus DC.	LC		
ASTERACEAE	Felicia fascicularis DC.	LC		
ASTERACEAE	Senecio deltoideus Less.	LC		
ASTERACEAE	Senecio pterophorus DC.	LC		
BIGNONIACEAE	Jacaranda mimosifolia D.Don	NE (Not evaluated / Exotic)		
BORAGINACEAE	Ehretia rigida (Thunb.) Druce subsp. rigida	LC		

Family	Species	Red List of South African Plants, 2017.1	EP Nature Conservation Ordinance No. 19 of 1974	EC Environmental Conservation Bill, 2003
BRASSICACEAE	Capparis sepiaria L. var. citrifolia (Lam.) Toelken	LC		
BRASSICACEAE	Lepidium africanum (Burm.f.) DC.	LC		
CACTACEAE	Opuntia ficus-indica (L.) Mill.	NE		
CELASTRACEAE	Gymnosporia buxifolia (L.) Szyszyl.	LC		
CELASTRACEAE	Gymnosporia capitata (E.Mey. ex Sond.) Loes.	LC		
CELASTRACEAE	Lauridia tetragona (L.f.) R.H.Archer	LC		Schedule 5: Protected
CELASTRACEAE	Mystroxylon aethiopicum (Thunb.) Loes.	LC		Schedule 5: Protected
CELASTRACEAE	Pleurostylia capensis (Turcz.) Loes.	LC		
CELASTRACEAE	Putterlickia pyracantha (L.) Szyszyl.	LC		
COMMELINACEAE	Commelina africana L.	LC		
CRASSULACEAE	Cotyledon velutina Hook.f.	LC		
CRASSULACEAE	Crassula tetragona L. subsp. acutifolia (Lam.) Toelken	LC		
CRASSULACEAE	Kalanchoe rotundifolia (Haw.) Haw.	LC		
CUCURBITACEAE	Kedrostis capensis (Sond.) A.Meeuse	LC		
EBENACEAE	Euclea undulata Thunb.	LC		
EUPHORBIACEAE	Acalypha glabrata Thunb. var. glabrata	LC		
EUPHORBIACEAE	Croton rivularis Müll.Arg.	LC		
EUPHORBIACEAE	Euphorbia mauritanica L.	LC		
EUPHORBIACEAE	Euphorbia triangularis Desf.	LC		
EUPHORBIACEAE	Clutia sp.			
EUPHORBIACEAE	Unidentified creeper (cf. Dalechampia capensis A.Spreng.)	LC		
FABACEAE	Schotia afra (L.) Thunb. var. afra	LC		
FABACEAE	Schotia latifolia Jacq.	LC		
FABACEAE	Vachellia karroo (Hayne) Banfi & Gallaso	LC		
GERANIACEAE	Pelargonium peltatum (L.) L'Hér.	LC		Schedule 5: Protected
IRIDACEAE	Iridaceae sp.		Schedule 4: Protected Flora	Schedule 5: Protected
LAMIACEAE	Plectranthus madagascariensis (Pers.) Benth. var. madagascariensis	LC		
LAMIACEAE	Stachys aethiopica L.	LC		

Family	Species	Red List of South African Plants, 2017.1	EP Nature Conservation Ordinance No. 19 of 1974	EC Environmental Conservation Bill, 2003
MALVACEAE	Abutilon sonneratianum (Cav.) Sweet	LC		
MALVACEAE	Grewia occidentalis L. var. occidentalis	LC		
MALVACEAE	Hermannia althaeoides Link	LC		
OLEACEAE	Jasminum angulare Vahl	LC		
OLEACEAE	Olea europaea L. subsp. africana (Mill.) P.S.Green	LC		Schedule 5: Protected
PLUMBAGINACEAE	Plumbago auriculata Lam.	LC		
POACEAE	Cynodon dactylon (L.) Pers.	LC		
POACEAE	Enneapogon scoparius Stapf	LC		
POACEAE	Eragrostis curvula (Schrad.) Nees	LC		
POACEAE	Eragrostis sp.	LC		
POACEAE	Panicum deustum Thunb.	LC		
POACEAE	Panicum maximum Jacq.	LC		
POACEAE	Stipa dregeana Steud.	LC		
POACEAE	Tenaxia disticha (Nees) N.P.Barker & H.P.Linder var. disticha	LC		
PTERIDACEAE	Cheilanthes hirta Sw.	LC		
PTERIDACEAE	Cheilanthes viridis (Forssk.) Sw.	LC		
RHAMNACEAE	Scutia myrtina (Burm.f.) Kurz	LC		
RUBIACEAE	Coddia rudis (E.Mey. ex Harv.) Verdc.	LC		
RUBIACEAE	Canthium inerme (L.f.) Kuntze	LC		
RUTACEAE	Calodendrum capense (L.f.) Thunb.	LC	Schedule 4: Protected Flora	Schedule 5: Protected
RUTACEAE	Clausena anisata (Willd.) Hook.f. ex Benth. var. anisata	LC	Schedule 4: Protected Flora	Schedule 5: Protected
RUTACEAE	Ptaeroxylon obliquum (Thunb.) Radlk.	LC	Schedule 4: Protected Flora	Schedule 5: Protected
RUTACEAE	Zanthoxylum capense (Thunb.) Harv.	LC	Schedule 4: Protected Flora	Schedule 5: Protected
SALVADORACEAE	Azima tetracantha Lam.	LC		
SANTALACEAE	Viscum rotundifolium L.f.	LC		
SAPINDACEAE	Allophylus decipiens (Sond.) Radlk.	LC		

Family	Species	Red List of South African Plants, 2017.1	EP Nature Conservation Ordinance No. 19 of 1974	EC Environmental Conservation Bill, 2003
SAPINDACEAE	Hippobromus pauciflorus (L.f.) Radlk.	LC		
SAPOTACEAE	Sideroxylon inerme L. subsp. inerme	LC		Schedule 5: Protected
SCROPHULARIACEAE	Buddleja saligna Willd.	LC		Schedule 5: Protected
SCROPHULARIACEAE	Selago sp.			
SCROPHULARIACEAE	Chaenostoma campanulatum Benth.	LC		
SOLANACEAE	Lycium ferocissimum Miers	LC		
SOLANACEAE	Solanum nigrum L.	NE		
ULMACEAE	Chaetacme aristata Planch.	LC		
VITACEAE	Rhoicissus digitata (L.f.) Gilg & M.Brandt	LC		Schedule 5: Protected
	Unidentified big cordiform-leaved climber			
	Total: 89			

Tables 2 to 6. Plant species identified in the different areas assessed during the site survey i.e. the proposed new access road, and the 23 proposed tent platform sites assessed i.e. 12 during the Phase 1 survey and 11 during the Phase 2 survey, including parking spaces.

Table 2.				
Access road	**Phase 1 - Tent site 1**	**Phase 1 - Tent site 2**	**Phase 1 - Tent site 3**	**Phase 1 - Tent site 4**
Notes: Dense cover of trees and shrubs present along existing gravel road / single-track path to proposed new entrance area. Dominants at proposed new entrance off R335 - Azima tetracantha, Plumbago auriculata, Searsia spp. Dominants along road leading to open, grassed area at farmstead - Gymnosporia spp., Azima tetracantha, Searsia spp., Scutia myrtina, Hypoestes forskaolii, Cynodon dactylon.	Good cover. Medium to tall shrubs. Sparse grass and forb layer. Dominants - Azima tetracantha, Capparis sepiaria, Searsia rehmanniana.	Moderate cover, more open area at upper section. Dominants - Azima tetracantha, Scutia myrtina, Capparis sepiaria, Grewia occidentalis, Searsia rehmanniana. Cussonia spicata outside footprint.	Good, solid cover of trees, sparse understory. Dominants - Searsia rehmanniana, Capparis sepiaria, Grewia occidentalis. Cussonia spicata seedling present.	Solid cover of trees, sparse understory. Dominants - Capparis sepiaria, Scutia myrtina. A few White Milkwood trees scattered across site. Large Tree Euphorbia present on site.
Abutilon sonneratianum (Cav.) Sweet	Asparagus asparagoides (L.) Druce	Asparagus multiflorus Baker	Asparagus asparagoides (L.) Druce	Allophylus decipiens (Sond.) Radlk.
Acalypha glabrata Thunb. var. glabrata	Asparagus burchellii Baker	Asplenium cordatum (Thunb.) Sw.	Asparagus burchellii Baker	Asparagus asparagoides (L.) Druce
Asparagus burchellii Baker	Asparagus multiflorus Baker	Azima tetracantha Lam.	Asparagus multiflorus Baker	Asparagus multiflorus Baker
Asparagus multiflorus Baker	Asparagus setaceus (Kunth) Jessop	Buddleja saligna Willd.	Asparagus setaceus (Kunth) Jessop	Asparagus setaceus (Kunth) Jessop
Asparagus setaceus (Kunth) Jessop	Asparagus subulatus Thunb.	Canthium inerme (L.f.) Kuntze	Asparagus subulatus Thunb.	Asparagus subulatus Thunb.
Azima tetracantha Lam.	Azima tetracantha Lam.	Capparis sepiaria L. var. citrifolia (Lam.) Toelken	Asplenium cordatum (Thunb.) Sw.	Azima tetracantha Lam.
Buddleja saligna Willd.	Buddleja saligna Willd.	Commelina africana L.	Azima tetracantha Lam.	Capparis sepiaria L. var. citrifolia (Lam.) Toelken
Calodendrum capense (L.f.) Thunb.	Canthium inerme (L.f.) Kuntze	Crassula tetragona L. subsp. acutifolia (Lam.) Toelken	Canthium inerme (L.f.) Kuntze	Carissa bispinosa (L.) Desf. ex Brenan
Capparis sepiaria L. var. citrifolia (Lam.) Toelken	Capparis sepiaria L. var. citrifolia (Lam.) Toelken	Cussonia spicata Thunb.	Capparis sepiaria L. var. citrifolia (Lam.) Toelken	Chaetacme aristata Planch.
Chaetacme aristata Planch.	Carissa bispinosa (L.) Desf. ex Brenan	Felicia fascicularis DC.	Carissa bispinosa (L.) Desf. ex Brenan	Coddia rudis (E.Mey. ex Harv.) Verdc.

Table 2.				
Access road	**Phase 1 - Tent site 1**	**Phase 1 - Tent site 2**	**Phase 1 - Tent site 3**	**Phase 1 - Tent site 4**
Coddia rudis (E.Mey. ex Harv.) Verdc.	Cheilanthes viridis (Forssk.) Sw.	Grass sp.	Croton rivularis Müll.Arg.	Croton rivularis Müll.Arg.
Cotyledon velutina Hook.f.	Coddia rudis (E.Mey. ex Harv.) Verdc.	Grewia occidentalis L. var. occidentalis	Cussonia spicata Thunb.	Euphorbia triangularis Desf.
Croton rivularis Müll.Arg.	Commelina africana L.	Gymnosporia capitata (E.Mey. ex Sond.) Loes.	Grewia occidentalis L. var. occidentalis	Grass sp.
Cynanchum ellipticum (Harv.) R.A.Dyer	Cotyledon velutina Hook.f.	Hypoestes forskaolii (Vahl) R.Br.	Gymnosporia capitata (E.Mey. ex Sond.) Loes.	Grewia occidentalis L. var. occidentalis
Cynodon dactylon (L.) Pers.	Crassula tetragona L. subsp. acutifolia (Lam.) Toelken	Panicum maximum Jacq.	Plumbago auriculata Lam.	Gymnosporia capitata (E.Mey. ex Sond.) Loes.
Ehretia rigida (Thunb.) Druce subsp. rigida	Croton rivularis Müll.Arg.	Plumbago auriculata Lam.	Rhoicissus digitata (L.f.) Gilg & M.Brandt	Hypoestes forskaolii (Vahl) R.Br.
Eragrostis curvula (Schrad.) Nees	Cynanchum ellipticum (Harv.) R.A.Dyer	Ptaeroxylon obliquum (Thunb.) Radlk.	Sarcostemma viminale (L.) R.Br.	Plumbago auriculata Lam.
Fockea edulis (Thunb.) K.Schum.	Euphorbia mauritanica L.	Rhoicissus digitata (L.f.) Gilg & M.Brandt	Scutia myrtina (Burm.f.) Kurz	Putterlickia pyracantha (L.) Szyszyl.
Grewia occidentalis L. var. occidentalis	Euryops spathaceus DC.	Sarcostemma viminale (L.) R.Br.	Searsia rehmanniana (Engl.) Moffett	Rhoicissus digitata (L.f.) Gilg & M.Brandt
Gymnosporia buxifolia (L.) Szyszyl.	Felicia fascicularis DC.	Scutia myrtina (Burm.f.) Kurz	Sarcostemma viminale (L.) R.Br.	
Gymnosporia capitata (E.Mey. ex Sond.) Loes.	Grewia occidentalis L. var. occidentalis	Searsia rehmanniana (Engl.) Moffett	Scutia myrtina (Burm.f.) Kurz	
Hermannia althaeoides Link	Gymnosporia buxifolia (L.) Szyszyl.	Secamone filiformis (L.f.) J.H.Ross	Searsia rehmanniana (Engl.) Moffett	
Hypoestes forskaolii (Vahl) R.Br.	Gymnosporia capitata (E.Mey. ex Sond.) Loes.			Sideroxylon inerme L. subsp. inerme
Iridaceae sp.	Hermannia althaeoides Link			
Jacaranda mimosifolia D.Don	Kalanchoe rotundifolia (Haw.) Haw.			
Kalanchoe rotundifolia (Haw.) Haw.	Panicum maximum Jacq.			
Lycium ferocissimum Miers	Pelargonium peltatum (L.) L'Hér.			
Opuntia ficus-indica (L.) Mill.	Plectranthus madagascariensis (Pers.) Benth. var. madagascariensis			
Panicum maximum Jacq.	Plumbago auriculata Lam.			
Plumbago auriculata Lam.	Putterlickia pyracantha (L.) Szyszyl.			

Table 2.				
Access road	**Phase 1 - Tent site 1**	**Phase 1 - Tent site 2**	**Phase 1 - Tent site 3**	**Phase 1 - Tent site 4**
Rhoicissus digitata (L.f.) Gilg & M.Brandt	Rhoicissus digitata (L.f.) Gilg & M.Brandt			
Schotia latifolia Jacq.	Schotia afra (L.) Thunb. var. afra			
Scutia myrtina (Burm.f.) Kurz	Scutia myrtina (Burm.f.) Kurz			
Searsia longispina (Eckl. & Zeyh.) Moffett	Searsia rehmanniana (Engl.) Moffett			
Searsia rehmanniana (Engl.) Moffett	Vachellia karroo (Hayne) Banfi & Gallaso			
Selago sp.				
Senecio pterophorus DC.				
Solanum nigrum L.				
Stachys aethiopica L.				
Stipa dregeana Steud.				
Tenaxia disticha (Nees) N.P.Barker & H.P.Linder var. disticha				
Vachellia karroo (Hayne) Banfi & Gallaso				
Total: 42	**35**	**22**	**19**	**23**

Table 3.				
Phase 1 - Tent site 5	**Phase 1 - Tent site 6**	**Phase 1 - Tent site 7**	**Phase 1 - Tent site 8**	**Phase 1 - Tent site 9**
Notes: Fallen Tree Euphorbia present. Site relatively open i.t.o. tree cover. Dominants - Searsia rehmanniana, Euphorbia triangularis. Ptaeroxylon obliquum mature tree and seedlings present.	Denser cover with tall trees, open understory. Dominants - Chaetacme aristata.	Dense tree cover with upper and understory layers present. Dominants - Scutia myrtina, Searsia rehmanniana.	Dense tree cover. Dominants - Rhoicissus digitata, Capparis sepiaria, Scutia myrtina, Searsia rehmanniana. One Tree Euphorbia present in centre of site.	Dense tree cover. Dominants Scutia myrtina, Rhoicissus digitata.
Asparagus setaceus (Kunth) Jessop	Abutilon sonneratianum (Cav.) Sweet	Allophylus decipiens (Sond.) Radlk.	Asparagus asparagoides (L.) Druce	Allophylus decipiens (Sond.) Radlk.
Asplenium cordatum (Thunb.) Sw.	Allophylus decipiens (Sond.) Radlk.	Asparagus setaceus (Kunth) Jessop	Asparagus multiflorus Baker	Asparagus setaceus (Kunth) Jessop
Azima tetracantha Lam.	Asparagus asparagoides (L.) Druce	Asparagus subulatus Thunb.	Asparagus setaceus (Kunth) Jessop	Asparagus subulatus Thunb.

Table 3.				
Phase 1 - Tent site 5	**Phase 1 - Tent site 6**	**Phase 1 - Tent site 7**	**Phase 1 - Tent site 8**	**Phase 1 - Tent site 9**
Buddleja saligna Willd.	Asparagus setaceus (Kunth) Jessop	Asplenium cordatum (Thunb.) Sw.	Azima tetracantha Lam.	Azima tetracantha Lam.
Capparis sepiaria L. var. citrifolia (Lam.) Toelken	Asplenium cordatum (Thunb.) Sw.	Azima tetracantha Lam.	Capparis sepiaria L. var. citrifolia (Lam.) Toelken	Capparis sepiaria L. var. citrifolia (Lam.) Toelken
Croton rivularis Müll.Arg.	Azima tetracantha Lam.	Canthium inerme (L.f.) Kuntze	Chaetacme aristata Planch.	Chaetacme aristata Planch.
Euphorbia triangularis Desf.	Capparis sepiaria L. var. citrifolia (Lam.) Toelken	Capparis sepiaria L. var. citrifolia (Lam.) Toelken	Croton rivularis Müll.Arg.	Coddia rudis (E.Mey. ex Harv.) Verdc.
Grass sp.	Carissa bispinosa (L.) Desf. ex Brenan	Carissa bispinosa (L.) Desf. ex Brenan	Ehretia rigida (Thunb.) Druce subsp. rigida	Euphorbia triangularis Desf.
Grewia occidentalis L. var. occidentalis	Chaetacme aristata Planch.	Chaetacme aristata Planch.	Euphorbia triangularis Desf.	Grewia occidentalis L. var. occidentalis
Gymnosporia capitata (E.Mey. ex Sond.) Loes.	Commelina africana L.	Cheilanthes hirta Sw.	Grewia occidentalis L. var. occidentalis	Gymnosporia buxifolia (L.) Szyszyl.
Hypoestes forskaolii (Vahl) R.Br.	Croton rivularis Müll.Arg.	Coddia rudis (E.Mey. ex Harv.) Verdc.	Gymnosporia buxifolia (L.) Szyszyl.	Hypoestes forskaolii (Vahl) R.Br.
Kedrostis capensis (Sond.) A.Meeuse	Ehretia rigida (Thunb.) Druce subsp. rigida	Croton rivularis Müll.Arg.	Gymnosporia capitata (E.Mey. ex Sond.) Loes.	Plumbago auriculata Lam.
Plectranthus madagascariensis (Pers.) Benth. var. madagascariensis	Euphorbia triangularis Desf.	Grewia occidentalis L. var. occidentalis	Hypoestes forskaolii (Vahl) R.Br.	Ptaeroxylon obliquum (Thunb.) Radlk.
Ptaeroxylon obliquum (Thunb.) Radlk.	Grewia occidentalis L. var. occidentalis	Gymnosporia capitata (E.Mey. ex Sond.) Loes.	Panicum maximum Jacq.	Putterlickia pyracantha (L.) Szyszyl.
Rhoicissus digitata (L.f.) Gilg & M.Brandt	Gymnosporia capitata (E.Mey. ex Sond.) Loes.	Hypoestes forskaolii (Vahl) R.Br.	Plumbago auriculata Lam.	Rhoicissus digitata (L.f.) Gilg & M.Brandt
Scutia myrtina (Burm.f.) Kurz	Hypoestes forskaolii (Vahl) R.Br.	Panicum maximum Jacq.	Ptaeroxylon obliquum (Thunb.) Radlk.	Scutia myrtina (Burm.f.) Kurz
Searsia rehmanniana (Engl.) Moffett	Mystroxylon aethiopicum (Thunb.) Loes.	Plumbago auriculata Lam.	Rhoicissus digitata (L.f.) Gilg & M.Brandt	Searsia rehmanniana (Engl.) Moffett
Stachys aethiopica L.	Panicum maximum Jacq.	Ptaeroxylon obliquum (Thunb.) Radlk.	Scutia myrtina (Burm.f.) Kurz	Viscum rotundifolium L.f.
Unidentified big cordiform-leaved climber	Plumbago auriculata Lam.	Putterlickia pyracantha (L.) Szyszyl.	Searsia rehmanniana (Engl.) Moffett	
	Ptaeroxylon obliquum (Thunb.) Radlk.	Rhoicissus digitata (L.f.) Gilg & M.Brandt		
	Putterlickia pyracantha (L.) Szyszyl.	Scutia myrtina (Burm.f.) Kurz		
	Searsia rehmanniana (Engl.) Moffett	Searsia rehmanniana (Engl.) Moffett		
	Unidentified big cordiform-leaved climber			
	Zanthoxylum capense (Thunb.) Harv.			

Table 3.				
Phase 1 - Tent site 5	**Phase 1 - Tent site 6**	**Phase 1 - Tent site 7**	**Phase 1 - Tent site 8**	**Phase 1 - Tent site 9**
Total: 19	**24**	**22**	**19**	**18**

Table 4.		
Phase 1 - Tent site 10	**Phase 1 - Tent site 11**	**Phase 1 - Tent site 12**
Notes: More open i.t.o. tree cover. Small to large Tree Euphorbias present.	Dense tree cover with sparse understory. Dominants - Capparis sepiaria, Carissa bispinosa, Searsia rehmanniana.	Dense tree cover.
Asparagus multiflorus Baker	Asparagus setaceus (Kunth) Jessop	Asparagus asparagoides (L.) Druce
Asparagus setaceus (Kunth) Jessop	Asparagus subulatus Thunb.	Asparagus multiflorus Baker
Azima tetracantha Lam.	Azima tetracantha Lam.	Asparagus setaceus (Kunth) Jessop
Capparis sepiaria L. var. citrifolia (Lam.) Toelken	Capparis sepiaria L. var. citrifolia (Lam.) Toelken	Azima tetracantha Lam.
Carissa bispinosa (L.) Desf. ex Brenan	Carissa bispinosa (L.) Desf. ex Brenan	Canthium inerme (L.f.) Kuntze
Ceratiosicyos laevis (Thunb.) A.Meeuse	Ceratiosicyos laevis (Thunb.) A.Meeuse	Capparis sepiaria L. var. citrifolia (Lam.) Toelken
Chaetacme aristata Planch.	Chaetacme aristata Planch.	Chaetacme aristata Planch.
Clausena anisata (Willd.) Hook.f. ex Benth. var. anisata	Croton rivularis Müll.Arg.	Croton rivularis Müll.Arg.
Croton rivularis Müll.Arg.	Euphorbia triangularis Desf.	Euphorbia triangularis Desf.
Euphorbia triangularis Desf.	Grass sp.	Gymnosporia buxifolia (L.) Szyszyl.
Grass sp.	Gymnosporia capitata (E.Mey. ex Sond.) Loes.	Gymnosporia capitata (E.Mey. ex Sond.) Loes.
Gymnosporia buxifolia (L.) Szyszyl.	Hypoestes forskaolii (Vahl) R.Br.	Hypoestes forskaolii (Vahl) R.Br.
Gymnosporia capitata (E.Mey. ex Sond.) Loes.	Panicum maximum Jacq.	Panicum maximum Jacq.
Hypoestes forskaolii (Vahl) R.Br.	Ptaeroxylon obliquum (Thunb.) Radlk.	Plumbago auriculata Lam.
Opuntia ficus-indica (L.) Mill.	Rhoicissus digitata (L.f.) Gilg & M.Brandt	Ptaeroxylon obliquum (Thunb.) Radlk.
Rhoicissus digitata (L.f.) Gilg & M.Brandt	Searsia longispina (Eckl. & Zeyh.) Moffett	Rhoicissus digitata (L.f.) Gilg & M.Brandt
Scutia myrtina (Burm.f.) Kurz	Searsia rehmanniana (Engl.) Moffett	Scutia myrtina (Burm.f.) Kurz
Searsia rehmanniana (Engl.) Moffett	Senecio deltoideus Less.	Searsia rehmanniana (Engl.) Moffett
Secamone filiformis (L.f.) J.H.Ross	Stipa dregeana Steud.	
Senecio deltoideus Less.	Zanthoxylum capense (Thunb.) Harv.	
Total: 20	**20**	**18**

Table 5.					
Phase 2 - Tent site 1	**Phase 2 - Tent site 2**	**Phase 2 - Tent site 3**	**Phase 2 - Tent site 4**	**Phase 2 - Tent site 5**	**Phase 2 - Tent site 6**
Notes: Slope very steep. Open-ish tree canopy with	Sparse tree cover with open understory. Dominants -	More open tree cover, approx. 50%. Grassy layer	Closed, dense tree cover. Closed understory. Dominants	Dense tree cover with sparse undergrowth in	Open tree canopy with low cover in both upper and

Table 5.					
Phase 2 - Tent site 1	**Phase 2 - Tent site 2**	**Phase 2 - Tent site 3**	**Phase 2 - Tent site 4**	**Phase 2 - Tent site 5**	**Phase 2 - Tent site 6**
moderate to good cover. Dominants - Chaetacme aristata, Hypoestes forskaolii, Scutia myrtina. Cussonia spicata trees present in area. Stressed Tree Euphorbia present. Allophylus decipiens seedlings present.	Plumbago auriculata, Azima tetracantha, Gymnosporia spp., Capparis sepiaria, Rhoicissus digitata. Schotia latifolia seedling present. Tree Euphorbia present.	present. Dominants - Azima tetracantha, Searsia rehmanniana, Scutia myrtina, Hypoestes forskaolii, Gymnosporia spp. Olea europaea subsp. africana sapling present.	- Scutia myrtina, Carissa bispinosa, Gymnosporia spp. Olea europaea subsp. africana tree present just outside footprint, but tree will be left intact. Zanthoxylum capense, Brachylaena ilicifolia and Eulcea undulata seedlings present.	upper section of footprint. Lower section open with grassy layer. Dominants - Searsia rehmanniana, Scutia myrtina. Parking area open, grassed, next to existing gravel road, with Azima tetracantha, Scutia myrtina.	lower sections. Mossy layer in upper section, sparse grass layer in lower section. Dominants - Azima tetracantha, Chaetacme aristata.
Abutilon sonneratianum (Cav.) Sweet	Abutilon sonneratianum (Cav.) Sweet	Abutilon sonneratianum (Cav.) Sweet	Abutilon sonneratianum (Cav.) Sweet	Allophylus decipiens (Sond.) Radlk.	Allophylus decipiens (Sond.) Radlk.
Allophylus decipiens (Sond.) Radlk.	Allophylus decipiens (Sond.) Radlk.	Allophylus decipiens (Sond.) Radlk.	Allophylus decipiens (Sond.) Radlk.	Asparagus setaceus (Kunth) Jessop	Asparagus multiflorus Baker
Asparagus setaceus (Kunth) Jessop	Asparagus asparagoides (L.) Druce	Asparagus asparagoides (L.) Druce	Asparagus multiflorus Baker	Azima tetracantha Lam.	Asparagus setaceus (Kunth) Jessop
Azima tetracantha Lam.	Asparagus burchellii Baker	Asparagus setaceus (Kunth) Jessop	Azima tetracantha Lam.	Brachylaena ilicifolia (Lam.) E.Phillips & Schweick.	Azima tetracantha Lam.
Brachylaena ilicifolia (Lam.) E.Phillips & Schweick.	Asparagus multiflorus Baker	Azima tetracantha Lam.	Brachylaena ilicifolia (Lam.) E.Phillips & Schweick.	Buddleja saligna Willd.	Capparis sepiaria L. var. citrifolia (Lam.) Toelken
Buddleja saligna Willd.	Asparagus setaceus (Kunth) Jessop	Brachylaena ilicifolia (Lam.) E.Phillips & Schweick.	Buddleja saligna Willd.	Capparis sepiaria L. var. citrifolia (Lam.) Toelken	Carissa bispinosa (L.) Desf. ex Brenan
Capparis sepiaria L. var. citrifolia (Lam.) Toelken	Asparagus subulatus Thunb.	Buddleja saligna Willd.	Capparis sepiaria L. var. citrifolia (Lam.) Toelken	Chaetacme aristata Planch.	Chaenostoma campanulatum Benth.
Chaetacme aristata Planch.	Asplenium cordatum (Thunb.) Sw.	Capparis sepiaria L. var. citrifolia (Lam.) Toelken	Carissa bispinosa (L.) Desf. ex Brenan	Cheilanthes viridis (Forssk.) Sw.	Chaetacme aristata Planch.
Croton rivularis Müll.Arg.	Azima tetracantha Lam.	Chaetacme aristata Planch.	Chaetacme aristata Planch.	Coddia rudis (E.Mey. ex Harv.) Verdc.	Cheilanthes viridis (Forssk.) Sw.
Cussonia spicata Thunb.	Buddleja saligna Willd.	Cheilanthes viridis (Forssk.) Sw.	Cheilanthes viridis (Forssk.) Sw.	Croton rivularis Müll.Arg.	Coddia rudis (E.Mey. ex Harv.) Verdc.
Ehretia rigida (Thunb.) Druce subsp. rigida	Capparis sepiaria L. var. citrifolia (Lam.) Toelken	Clausena anisata (Willd.) Hook.f. ex Benth. var. anisata	Clutia sp.	Cynanchum ellipticum (Harv.) R.A.Dyer	Cotyledon velutina Hook.f.
Euphorbia triangularis Desf.	Carissa bispinosa (L.) Desf. ex Brenan	Grewia occidentalis L. var. occidentalis	Coddia rudis (E.Mey. ex Harv.) Verdc.	Ehretia rigida (Thunb.) Druce subsp. rigida	Cynanchum ellipticum (Harv.) R.A.Dyer
Grass sp.	Cheilanthes hirta Sw.	Gymnosporia buxifolia (L.) Szyszyl.	Cynanchum ellipticum (Harv.) R.A.Dyer	Eragrostis sp.	Grass sp.
Grewia occidentalis L. var. occidentalis	Cheilanthes viridis (Forssk.) Sw.	Hypoestes forskaolii (Vahl) R.Br.	Euclea undulata Thunb.	Grewia occidentalis L. var. occidentalis	Gymnosporia buxifolia (L.) Szyszyl.
Gymnosporia buxifolia (L.) Szyszyl.	Commelina africana L.	Olea europaea L. subsp. africana (Mill.) P.S.Green	Grewia occidentalis L. var. occidentalis	Gymnosporia capitata (E.Mey. ex Sond.) Loes.	Hermannia althaeoides Link

Table 5.					
Phase 2 - Tent site 1	**Phase 2 - Tent site 2**	**Phase 2 - Tent site 3**	**Phase 2 - Tent site 4**	**Phase 2 - Tent site 5**	**Phase 2 - Tent site 6**
Hippobromus pauciflorus (L.f.) Radlk.	Croton rivularis Müll.Arg.	Opuntia ficus-indica (L.) Mill.	Gymnosporia buxifolia (L.) Szyszyl.	Hypoestes forskaolii (Vahl) R.Br.	Hypoestes forskaolii (Vahl) R.Br.
Hypoestes forskaolii (Vahl) R.Br.	Cynanchum ellipticum (Harv.) R.A.Dyer	Panicum deustum Thunb.	Hippobromus pauciflorus (L.f.) Radlk.	Mystroxylon aethiopicum (Thunb.) Loes.	Lepidium africanum (Burm.f.) DC.
Olea europaea L. subsp. africana (Mill.) P.S.Green	Euphorbia triangularis Desf.	Plumbago auriculata Lam.	Hypoestes forskaolii (Vahl) R.Br.	Plumbago auriculata Lam.	Panicum maximum Jacq.
Panicum deustum Thunb.	Grewia occidentalis L. var. occidentalis	Putterlickia pyracantha (L.) Szyszyl.	Jasminum angulare Vahl	Rhoicissus digitata (L.f.) Gilg & M.Brandt	Plumbago auriculata Lam.
Plumbago auriculata Lam.	Gymnosporia buxifolia (L.) Szyszyl.	Rhoicissus digitata (L.f.) Gilg & M.Brandt	Olea europaea L. subsp. africana (Mill.) P.S.Green	Scutia myrtina (Burm.f.) Kurz	Putterlickia pyracantha (L.) Szyszyl.
Putterlickia pyracantha (L.) Szyszyl.	Hypoestes forskaolii (Vahl) R.Br.	Scutia myrtina (Burm.f.) Kurz	Panicum maximum Jacq.	Searsia rehmanniana (Engl.) Moffett	Scutia myrtina (Burm.f.) Kurz
Rhoicissus digitata (L.f.) Gilg & M.Brandt	Lepidium africanum (Burm.f.) DC.	Searsia rehmanniana (Engl.) Moffett	Rhoicissus digitata (L.f.) Gilg & M.Brandt	Secamone filiformis (L.f.) J.H.Ross	Searsia rehmanniana (Engl.) Moffett
Scutia myrtina (Burm.f.) Kurz	Panicum maximum Jacq.	Tenaxia disticha (Nees) N.P.Barker & H.P.Linder var. disticha	Scutia myrtina (Burm.f.) Kurz	Senecio deltoideus Less.	Senecio deltoideus Less.
Searsia rehmanniana (Engl.) Moffett	Pleurostylia capensis (Turcz.) Loes.		Searsia longispina (Eckl. & Zeyh.) Moffett		Unidentified creeper (cf. Dalechampia capensis A.Spreng.)
Secamone filiformis (L.f.) J.H.Ross	Plumbago auriculata Lam.		Searsia rehmanniana (Engl.) Moffett		
Senecio deltoideus Less.	Rhoicissus digitata (L.f.) Gilg & M.Brandt		Zanthoxylum capense (Thunb.) Harv.		
	Schotia latifolia Jacq.				
	Scutia myrtina (Burm.f.) Kurz				
	Searsia rehmanniana (Engl.) Moffett				
	Senecio deltoideus Less.				
Total: 26	**30**	**23**	**26**	**23**	**24**

Table 6.				
Phase 2 - Tent site 7	**Phase 2 - Tent site 8**	**Phase 2 - Tent site 9**	**Phase 2 - Tent site 10**	**Phase 2 - Tent site 11**
Notes: Open canopy with shorter trees, approx. 50% cover. Grassy layer present. Dominants - Searsia spp., Grewia occidentalis.	Good, dense tree cover with open understory. Grassy and open area in upper section. Dominants - Gymnosporia	Good tree cover and understory layer present. Dominants - Panicum maximum, Hypoestes	Good tree cover and understory. Dominants - Azima tetracantha, Capparis sepiaria, Gymnosporia spp.,	Dense tree cover at tent footprint with sparse understory. Dominants - Scutia myrtina, Capparis

Table 6.				
Phase 2 - Tent site 7	**Phase 2 - Tent site 8**	**Phase 2 - Tent site 9**	**Phase 2 - Tent site 10**	**Phase 2 - Tent site 11**
	spp., Capparis sepiaria, Searsia rehmanniana, Scutia myrtina. White Milkwood tree present just outside footprint.	forskaolii, Azima tetracantha, Searsia rehmanniana, Grewia occidentalis, Scutia myrtina, Plumbago auriculata, Gymnosporia spp. Tall Tree Euphorbias present in the centre of footprint.Buddleja saligna sapling present. Parking area with good tree cover.	Chaetacme aristata. Cussonia spicata seedling present. Good tree cover at parking area i.e. Azima tetracantha, Capparis sepiaria, Grewia occidentalis, Gymnosporia spp.	sepiaria, Gymnosporia spp., Chaetacme aristata, Rhoicissus digitata. Dense tree cover at parking area.
Abutilon sonneratianum (Cav.) Sweet	Asparagus multiflorus Baker	Asparagus burchellii Baker	Asparagus burchellii Baker	Asparagus burchellii Baker
Asparagus multiflorus Baker	Asparagus setaceus (Kunth) Jessop	Asparagus subulatus Thunb.	Asparagus setaceus (Kunth) Jessop	Asparagus setaceus (Kunth) Jessop
Azima tetracantha Lam.	Azima tetracantha Lam.	Asplenium cordatum (Thunb.) Sw.	Azima tetracantha Lam.	Asplenium cordatum (Thunb.) Sw.
Buddleja saligna Willd.	Brachylaena ilicifolia (Lam.) E.Phillips & Schweick.	Azima tetracantha Lam.	Capparis sepiaria L. var. citrifolia (Lam.) Toelken	Azima tetracantha Lam.
Carissa bispinosa (L.) Desf. ex Brenan	Buddleja saligna Willd.	Buddleja saligna Willd.	Carissa bispinosa (L.) Desf. ex Brenan	Capparis sepiaria L. var. citrifolia (Lam.) Toelken
Chaetacme aristata Planch.	Capparis sepiaria L. var. citrifolia (Lam.) Toelken	Capparis sepiaria L. var. citrifolia (Lam.) Toelken	Chaetacme aristata Planch.	Chaetacme aristata Planch.
Cheilanthes viridis (Forssk.) Sw.	Carissa bispinosa (L.) Desf. ex Brenan	Carissa bispinosa (L.) Desf. ex Brenan	Cheilanthes hirta Sw.	Cheilanthes viridis (Forssk.) Sw.
Clutia sp.	Chaetacme aristata Planch.	Chaetacme aristata Planch.	Cussonia spicata Thunb.	Cussonia spicata Thunb.
Cynanchum ellipticum (Harv.) R.A.Dyer	Eragrostis sp.	Cheilanthes viridis (Forssk.) Sw.	Cynanchum ellipticum (Harv.) R.A.Dyer	Gymnosporia buxifolia (L.) Szyszyl.
Ehretia rigida (Thunb.) Druce subsp. rigida	Grewia occidentalis L. var. occidentalis	Euphorbia triangularis Desf.	Grewia occidentalis L. var. occidentalis	Hippobromus pauciflorus (L.f.) Radlk.
Grass sp.	Gymnosporia buxifolia (L.) Szyszyl.	Grewia occidentalis L. var. occidentalis	Gymnosporia buxifolia (L.) Szyszyl.	Hypoestes forskaolii (Vahl) R.Br.
Grewia occidentalis L. var. occidentalis	Hypoestes forskaolii (Vahl) R.Br.	Gymnosporia buxifolia (L.) Szyszyl.	Hippobromus pauciflorus (L.f.) Radlk.	Jasminum angulare Vahl
Hypoestes forskaolii (Vahl) R.Br.	Lauridia tetragona (L.f.) R.H.Archer	Hypoestes forskaolii (Vahl) R.Br.	Hypoestes forskaolii (Vahl) R.Br.	Mystroxylon aethiopicum (Thunb.) Loes.
Panicum maximum Jacq.	Panicum deustum Thunb.	Panicum maximum Jacq.	Panicum maximum Jacq.	Panicum maximum Jacq.
Plumbago auriculata Lam.	Plumbago auriculata Lam.	Plumbago auriculata Lam.	Plumbago auriculata Lam.	Plumbago auriculata Lam.
Searsia longispina (Eckl. & Zeyh.)	Rhoicissus digitata (L.f.) Gilg	Rhoicissus digitata (L.f.)	Rhoicissus digitata (L.f.)	Rhoicissus digitata (L.f.)

Table 6.				
Phase 2 - Tent site 7	**Phase 2 - Tent site 8**	**Phase 2 - Tent site 9**	**Phase 2 - Tent site 10**	**Phase 2 - Tent site 11**
Moffett	& M.Brandt	Gilg & M.Brandt	Gilg & M.Brandt	Gilg & M.Brandt
Searsia rehmanniana (Engl.) Moffett	Sarcostemma viminale (L.) R.Br.	Scutia myrtina (Burm.f.) Kurz	Scutia myrtina (Burm.f.) Kurz	Scutia myrtina (Burm.f.) Kurz
Tenaxia disticha (Nees) N.P.Barker & H.P.Linder var. disticha	Scutia myrtina (Burm.f.) Kurz	Searsia rehmanniana (Engl.) Moffett	Searsia rehmanniana (Engl.) Moffett	Searsia rehmanniana (Engl.) Moffett
	Searsia rehmanniana (Engl.) Moffett	Zanthoxylum capense (Thunb.) Harv.	Zanthoxylum capense (Thunb.) Harv.	Zanthoxylum capense (Thunb.) Harv.
	Sideroxylon inerme L. subsp. inerme			
Total: 18	**20**	**19**	**19**	**19**

4. Recommendations

Standard mitigation measures re. the **prevention of soil erosion** on steep, gravelly slopes must be applied when installing services i.e. water, grey water and sewage, and tent sites with associated access pathways and parking areas, during the construction and operational phases. Pathways and parking areas associated with tent sites should be gravelled and terraced to reduce soil erosion, and thereby reduce to the need for maintenance, particularly after high rainfall events. As the new entrance and access road area is reasonably flat in topography and flanked by a good cover of Thicket vegetation, soil erosion is not likely to be an issue. Vegetation cover, particularly that of talls shrubs and mature trees, should be maintained along the access road (as far as is practically possible) for aesthetic reasons, as well as maintenance of a green corridor and sound and dust 'screen' between the busier R335 road, and the AfriCamps resort area.

As the area includes Protected plants and Protected Trees, permits are required from the relevant authorities i.e. DEDEAT and DAFF, prior to their disturbance i.e. *commencement of site preparation and construction activities* (which includes the trimming of branches of protected trees), removal, and / or transplantation. Plant **'search and rescue'** should be conducted before construction starts, particularly at the proposed tent platform sites. Various succulent shrubs and trees, woody tree seedlings, and geophytes were noted in the study area, which can be propagated and / or removed and transplanted to bags. These plants can be used in rehabilitation efforts, particularly around tent platform sites where 'natural privacy screens' between tent sites are required, and in garden beds around renovated reception / administration buildings.

Recommendations regarding alternative an alternative layout plan:
Tree Euphorbias are damaged and consumed by animals e.g. Black Rhino (e.g. at Great Fish Reserve), Baboons and Porcupines. The environmental pressures i.t.o. recovery, on plants are higher during the dry season, when their soil moisture content is relatively higher vs. woody plants, increasing predation, but environmental conditions are less suited to plant growth and survival. Mature trees are also more vulnerable to mortality during the dry season, as their is a preference for the top parts of the plant for consumption (due to higher moisture and nitrogen content, and higher digestibility), and the preferred plant size for consumption i.e. 1 to 2 m high, become less available over time (rate of plant recruitment / replacement lower than consumption / mortality rate)[2].

[2] Heilmann *et al.* 2006. Will tree euphorbias (*Euphorbia tetragona* and *Euphorbia triangularis*) survive under the impact of black rhinoceros (*Bicornis diceros minor*) browsing in the Great Fish River Reserve, South Africa? Afr. J. Ecol., 44, 87–94

Though there aren't any Black Rhino on site, we can make a few assumptions about the likelihood of recovery of the mature stand of Tree Euphorbias. Recovery i.e. via reseeding, during the present drought conditions is unlikely - assuming no development takes place in stands of Tree Euphorbias. Trees are already falling over - presumably due to plant age / senescence, potentially damage by Baboons, drought, and the combined effects of drought and site topography (i.e. increased weathering on steeper slopes, with shallow roots more vulnerable due to drought stress). Moving tent sites to accommodate mature Tree Euphorbias is not deemed necessary. Tree Euphorbias are not mentioned as keystone species in Mesic Thicket, in the way that Spekboom, for example, is. Tree Euphorbias are consumed (by large herbivores and flowers and fruits by insects and birds) and likely serve as perches for birds and monkeys. Tree Euphorbias are also present in areas to be permanently conserved on the farm, and these trees may be in a better position i.t.o. site topography and microclimate, than trees at the proposed tent sites. Conserving the associated *Cussonia spicata* trees would prove more valuable, as they have thick underground stems that are difficult to remove, and will resprout when chopped down, or after extreme drought stress. New plants can also be propagated from stem cuttings of felled trees - trees that are browsed or felled during browsing do not resprout or 're-root' naturally - and replanted in areas to be rehabilitated / landscaped.

Euphorbia triangularis is not listed as a threatened plant (Red List - Least Concern). Plant parts also produce a milky latex, which is poisonous and may be hazardous to less well-informed guests.

A high diversity of dwarf succulent shrubs and forbs is characteristic of the understory of Albany Thicket vegetation, as well as lianas / scramblers recruiting into open space between trees. Where there is open space at tent sites i.e. Thicket with a clear Thicket edge and open patches, instead of solid trees across the site with no clear edge - species richness can be expected to be higher. Seedlings of woody Thicket trees and shrubs also do not recruit under Tree Euphorbias (due to competition for resources, also likely allelophathy), so areas where Tree Euphorbias have fallen over will have higher richness of scramblers and recruiting succulents, trees and shrubs over time. The succulent species present at Phase 1 Site 1 are represented elsewhere in Thicket vegetation on the farm, in areas that will be conserved. These species are not listed as threatened. By moving tent sites to naturally open patches in Thicket vegetation, the removal of biomass i.t.o. volume of trees and shrubs, is reduced (aiding soil conservation on slopes) - however, a higher number of species are likely to be impacted / removed in areas with open patches, a clear Thicket edge, as well as solid Thicket vegetation vs. solid Thicket trees and shrubs only. What you may gain in one area i.e. more biomass, you may lose in another i.e. reduced species. The placement of tent sites should, therefore, be done in a way that enables the most effective access i.t.o. size of parking area and length of access path, and position upslope in order to curb soil erosion - reducing the need for clearing - and allows for the conservation of mature woody trees and shrubs (which are slow-growing, especially during drought conditions, and more difficult to replace than succulent forbs, shrubs and trees, once tent sites are established).

In conclusion - the layout / placement of proposed tent sites on site can remain as is, and should not have a high significant negative impact on plant diversity and richness on site once sites are developed.

5. References

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Document printed December 2019.

Appendix D5: Agricultural Report

AGRICULTURAL COMPLIANCE CERTIFICATE

1. GAVIN NICHOLAS SCHAFER; soil scientist SACNASP registration No. 400081/03

See curriculum vitae attached.

2. I hereby declare that I work independently and am not affiliated in any way with the project developers

Signed..... Date 19/12/2019

3. Total development area is 5.71 ha
4. I find the project development acceptable and that there will be no disruption to any agricultural activities that exist.

SOIL SURVEY OF PORTION OF THE FARM HAYTERDALE No. 406 ADDO

for the establishment of a tented camp

G.N. Schafer
December 2019

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32 Saffron St. Tel : 042 293 0049
Jeffreys Bay terramap@net4all.co.za

1. SUMMARY

A soil survey of 5.71 ha was conducted on undeveloped land on a portion of the farm Hayterdale No. 406, Addo District, for the purpose of assessing and verifying that the proposed tented camp development falls into the medium- to low agricultural sensitivity class.

Much of the land in the project area is steep (over 20%) and vegetated with dense thicket. Soil pits were excavated along a track where the proposed tented camp is to be established. Only 5.71 ha of land was surveyed, where 1.41 ha was rated high potential for citrus, 3.88 ha as moderately high, and 0.42 ha as moderately low. The remaining 9.22 ha within the project area is not suitable for irrigation due to the steep slopes (exceeding 20%) and unsuitable soils. The suitability ratings and recommendations for citrus establishment on the different soil groups is provided in the soil map legends.

Mitigation for the construction of permanent tented campsites is discussed.

2. METHODS

Eleven soil pits were excavated using a backacter and the soil profiles described and classified using the South African Soil Classification (Soil Classification Working Group, 1991). The pits were located in the area where the tent erections are proposed. The pit description data were used to delineate like soil bodies. A soil map provides the spatial location of these soil bodies. The report incorporates data on the different soils and provides soil potential ratings for citrus. Appendix I provides the soil description data from the soil pits. Two maps were produced, one of the soil types and another of the potential for agricultural development.

3. SOILS

The published geology map (Toerien, 1986) shows several narrow bands of different rock types in the project area. These include the Enon formation (Enon Conglomerates) as well as shale, tuff and breccia. A band of basalt running through the project area has weathered to melanic soils. These strongly structured high clay soils are uncommon in the Eastern Cape, as is the occurrence of basalt. Some soft carbonate subsoils were identified on the upper slopes of the area.

The dominant soils range from strongly structured clay rich red soils (Shortlands form) to strongly structured, brown, clay rich soils (Valsrivier form). Soils are acid in most cases, but some alkaline subsoils and lower subsoils were found. The soils best suited to agricultural development are quite limited in extent making the establishment of orchards or even pastures impractical and not viable.

The soils vary considerably over short distances hence any specific soil unit e.g. Hu 1 may have more than one soil form.

Valsrivier form (Va 1 soil unit) was identified on the lower terrace and lower slopes. These soils have well developed blocky structure and high clay contents with restricted internal drainage and moderate to slow permeability. For these reasons they were downgraded to a moderate-high potential.

The Bonheim form soils (Bo 1) that were identified are most likely to have weathered from the basalt parent material. These soils have strongly structured clay rich topsoils which are unfavourable for root development and marginally suitable for most crops.

The Hutton and Shortlands form soils (Hu 1) on the lower slopes have high clay contents 40-60% in the topsoils and 60-70% clay in the subsoils. The Hutton soils are weakly structured while the Shortlands have a strong blocky structured top and sub-soil. They are freely drained and have a high water holding capacity (WHC).

3.1 Soil amelioration for agricultural development

All soils would be ripped to a depth of 1 m, and ridging carried out if citrus were to be planted. Fertilizer recommendations for the different soil units would only be available once the soil chemical analyses have been completed.

3.2 Soil Map & soil potential

The soil map shows the distribution of the soil types, and the legend (Table 1) provides soil data pertaining to these units.

Table 1. LEGEND TO SOIL MAP

SOIL UNIT	DOMINANT FORMS & FAMILY	OTHER FORMS	ERD cm	ARD cm	LIMITATIONS	CLAY % A	CLAY % B	STRUCT A	STRUCT B
Hu 1	Hutton 3200	Shortlands 3200	60-80	150	Strongly structured topsoil; Dense subsoil	40-60	60-70	sfb	wfb-sfb
Va 1	Valsrivier 1112		40	60	Stone and rock	20	35	sfb	sfb
Bo 1	Bonheim 1110	Steendal 1000	25-75	90-120	Dense lower subsoil; strongly structured top and subsoil	65	60-75	sfb	sfb

Explanation to codes in Table 1

SOIL FORM & FAMILY: refer to 'SOIL CLASSIFICATION, a taxonomic system for South Africa'.

ERD = effective rooting depth; ARD = ameliorated rooting depth; WHC = water holding capacity

STRUC = soil structure: a = apedal, m=massive DEGREE: w=weak, m=moderate, s=strong SIZE: f=fine, m=medium c=coarse; TYPE: b=blocky c=crumb

Table 2. SOIL POTENTIAL FOR CITRUS

SOIL UNIT	EXISTING POTENTIAL	AMELIORATED POTENTIAL	SOIL PREPARATION	AREA (ha)
Hu 1	Mod-High	High	Rip and ridge	1.41
Va 1	Mod	Mod-High	Rip and ridge	3.88
Bo 1	Mod-Low	Mod-low	Rip and ridge	0.42

4. SUITABILITY FOR AGRICULTURAL DEVELOPMENT

The project area falls into the medium to low risk sensitivity rating based on the initial site sensitivity screening.

The project area is not suitable for irrigated agricultural development for the following reasons.

1. Much of the land is steep – greater than 20%. This is labelled as S2 on the soil map. The area associated with a steeply incised watercourse was mapped as R1 and is also not suitable for agricultural development. A portion of the project area consists of infrastructure, labelled INF on the soil map.
2. The soils are variable over short distances
3. Many of the soils described have strongly developed blocky structure and high clay contents in both top- and subsoils which are not conducive to good internal drainage and water permeability. They are also hard setting when dry.
4. Only 5.71 ha were identified as suitable for agriculture or the establishment of orchards. This will not form a viable farming unit.
5. The land suitable for agricultural development consists of a discontinuous narrow strip of land which is not economic in terms of development e.g. irrigation and fencing.

5. MITIGATION for the construction of tented camp sites

The erosion hazards related to the construction of permanent tented camp sites on the different soil types are provided in Table 3. Erosion hazards range from moderate to low, while internal drainage classes, which will affect french drain functionality, are generally well drained but range from well drained to imperfectly drained (Schoeman *et. al.* 2002).

Table 3. Erosion hazard and internal drainage

Soil unit	Erodibility index	Erosion hazard	Internal drainage class*
Hu 1 Bo 1 Va 1	5 8 8	Mod.low Low Low	W2 W2 W3

*W2=well drained: W3=imperfectly drained

Erosion preventative measures should be taken particularly on the Hu1, Hu2 and Gs 1 soil units. Carefully constructed shallow surface ditches can be designed to cater for storm events to prevent the development of gullies and/or topsoil sheet erosion.

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APPENDIX 1. SOIL PROFILE DESCRIPTIONS

OBS	FORM	FAMILY	TSD	ESD	ASD	LTN	W	LITH	HOR	DPTH	COL	Clay	SG	CON	STR	STO	PERM
1	Va	1112	120	40	60	str;d	0	S	A	25	DB	26	f	3	mfb	0	mr
									B1	60	SB	50	f	4	sfb	0	mr
									B2	120	SB	65	f	4	smb	0	m
2	Va	1112	120	40	60	str;d	0	S	A	25	VDB	65	f	4	sfb	0	mr
									B1	80	VDB	75	f	4	sfb	0	m
									C	120	B	30	f	3	mfb	0	mr
3	Sd	3110	120	60	90	str;d	0	S	A	35	VDB	60	f	3	sfb	0	m
									B1	90	DRB	70	f	4	sfb	0	m
									B2	150	DRB	60	f	3	wfb	3r	m
4	Hu	3200	120	80	100	d	0	S	A	30	VDB	40	f	3	sfb	1s	mr
									B1	70	DRB	60	f	4	wfb	2r	mr
									B2	150	DRB	65	f	4	sfb	2rs	r
5	Sd	3110	150	50	60	str;d	0	S	A	20	VDGB	40	f	4	sfb	0	m
									B1	60	DRB	45	f	4	sfb	0	mr
									B2	150	DRB	50	f	4	sfb	0	mr
6	Hu	3200	150	80	150	d	0	S	A	20	VDB	45	f	4	wfb	0	r
									B1	80	RB	45	f	3	wfb	2s	r
									B2	150	RB	45	f	3	a	1r	r
7	Se	1110	150	40	60		0	S	A	25	DB	35	f	4	sfb	0	m
									B1	100	DB	60	f	4	sfb	0	m
									B2	150	MYGB	70	f	5	sfb	0	s
8	Va	1111	150	30	60	str;d	0	S	A	20	DGB	40	f	4	sfb	0	m
									B	60	DGB	70	f	4	sfb	0	m
									C	150	GB	25	f	2	a	0	mr
9	Va	1112	120	40	60	str;d	0	S	A	30	VDGB	55	f	4	sfb	0	m
									B	60	VDGB	65	f	4	sfb	0	mr
									BC	120	DB	20	f	3	smb	0	mr
10	Sd	2110	120	90	120	str;d	0	T	A	35	VDB	50	f	4	sfb	0	mr
									B	90	DRB	60	f	4	smb	0	mr
									B2	120	DRB	35	f	2	m	7r	mr

KEY TO CODES

	Soil observation	
OBS	No.	
FORM	Soil form	
FAMILY	Family	
TSD	Total soil depth - cm	
ESD	Effective soil depth - cm	
ASD	Ameliorated soil depth	
LTN	Depth limitation	d=dense; str=strong angular blocky structure; R=hard rock
W	Wetness class	0=no wetness;
LITH	Lithology (Geology)	A=alluvium; S=shale
HOR	Horizon (soil layer)	
DPTH	Depth in cm	
COL	Munsell colour	D=dark; Y=yellow;B=brown; R=red; G=grey V=very; S=strong; M=mottled
Clay	clay %	
SG	sand grain	f=fine; m=medium; c=coarse
CON	consistency	1 = soft/friable; 2= slightly firm; 3= firm 4=hard
STR	Structure	a=apedal; w=weak;m=moderate; s=strong; SIZE: f=fine; m=medium; c=coarse TYPE: c=crumb, b=blocky, m=massive
STO	% stone	5=50%; s=stone; r=rock; g=gravel
PERM	Permeabilty	r=rapid; mr= moderately rapid; s=slow

SOIL MAP OF AFRICAMPS
TENTED CAMPSITE PROJECT AREA

Hu 1
0.47
H

S 2
1.68

Va 1
1.39
MH

S 2
0.2

Bo 1
0.42
M

Hu 1
0.94
H

S2
2.2

Va 1
2.49
MH

R 1
4.65

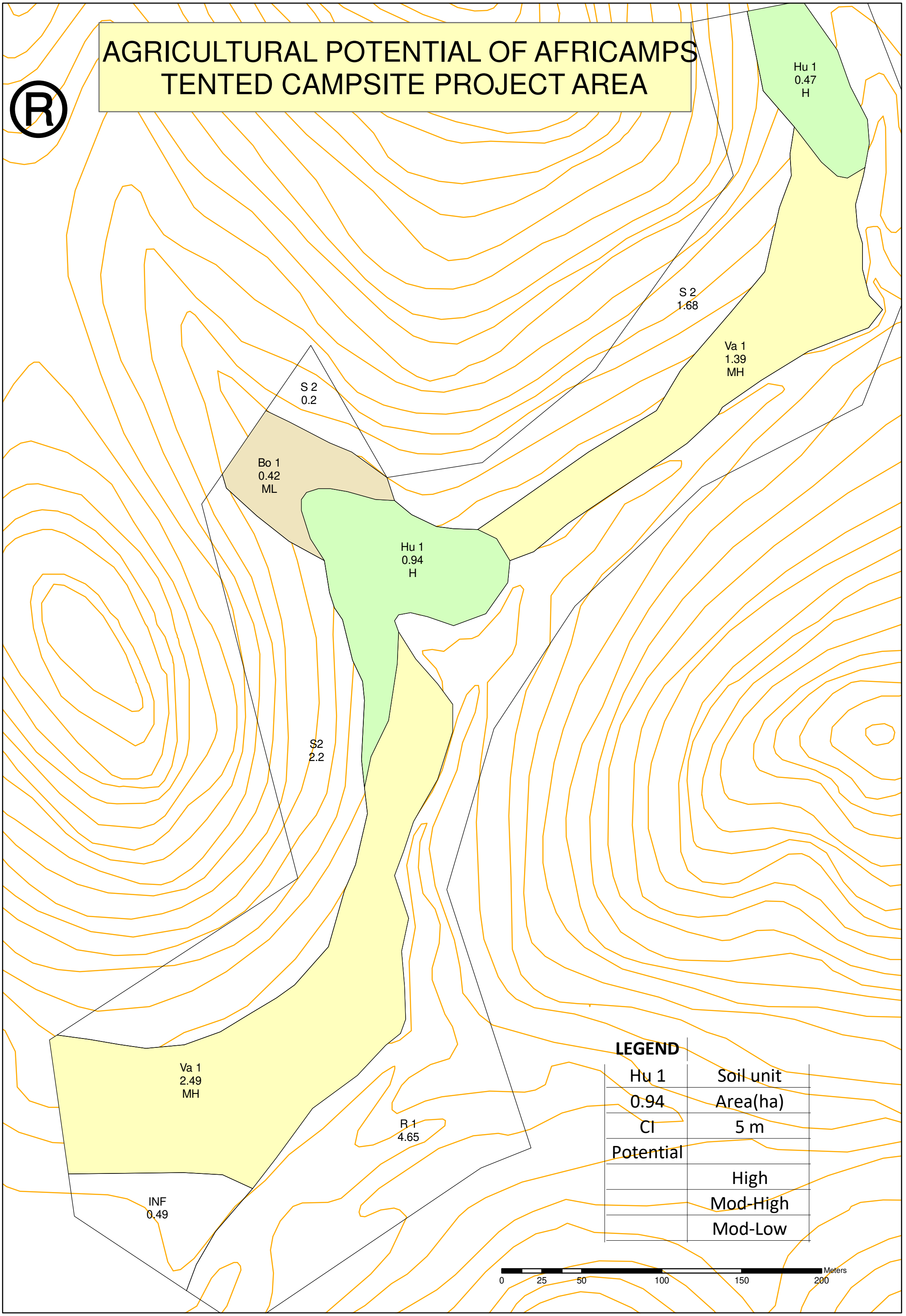
INF
0.49

LEGEND

Hu 1	Soil Unit
0.94	Area in ha
CI	5 m
• 2	Soil pit
INF	Infrastructure
R 1	Watercourse
S 2	Steep slopes

0 30 60 120 180 240 Meters

AGRICULTURAL POTENTIAL OF AFRICAMPS TENTED CAMPSITE PROJECT AREA



Appendix D6: Level 1 Archaeological Impact Assessment

EASTERN CAPE

HERITAGE CONSULTANTS CC

REG. NO: 2006/088345/23

P.O.BOX 689♦JEFFREYS BAY♦6330♦ FAX: 042 296 0399♦CELL: 072 800 6322
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Encephalartos longifolius

29 January 2019

CEN Integrated Environmental Management
36 River Rd
Walmer
Port Elizabeth
6070

For attention: Ms. Belinda Clark

INITIAL ARCHAEOLOGICAL SITE VERIFICATION AND REPORT FOR THE PROPOSED ESTABLISHMENT OF A TENTED CAMP RESORT FACILITY WITH ACCESS AND SERVICES ON PORTION 0 OF THE FARM HAYTERDALE NO. 406 NEAR ADDO, SUNDAYS RIVER VALLEY MUNICIPALITY, EASTERN CAPE PROVINCE.

CEN Integrated Environmental Management appointed Eastern Cape Heritage Consultants cc to do an initial site verification for the above project.

The site has been classified as having a high archaeological/cultural sensitivity by the DEA on-line screening tool. No specific protocol has been developed for archaeology, and the "General Requirements" protocol applies. In summary, the protocol indicates that the following must be done:

1. Step 1: initial site verification – confirm sensitivity rating (or indicate otherwise)
2. Step 2:
    a. If site verification confirms high sensitivity, do specialist study and comply with Appendix 6 of the EIA Regulations (i.e. requirements for specialist studies)
    b. If site verification shows that the site is not high sensitivity, compile an **Archaeological/Cultural Heritage Compliance Statement**

A site visit was conducted by 2 archaeologists on 12 December 2019 and it has been concluded that the site is of **low cultural sensitivity** - See attached Letter of Recommendation (with conditions).

Archaeological/Cultural Heritage Compliance Statement

Should any archaeological remains be exposed during the development all work must cease in the immediate area and it must be reported to the Albany Museum (Tel: 046 6222312) or to the Eastern Cape Provincial Heritage Resources Authority (Tel.: 043 7450888), so that a systematic and professional investigation can be undertaken.

Best Regards

Dr. Johan Binneman **Kobus Reichert**

A LETTER OF RECOMMENDATION (WITH CONDITIONS) FOR THE EXEMPTION OF A FULL PHASE 1 ARCHAEOLOGICAL IMPACT ASSESSMENT FOR THE PROPOSED ESTABLISHMENT OF A TENTED CAMP RESORT FACILITY AND ASSOCIATED INFRASTRUCTURE ON PORTION 0 OF FARM HAYTERDALE NO. 406 NEAR ADDO IN THE SUNDAYS RIVER VALLEY LOCAL MUNICIPALITY OF THE EASTERN CAPE PROVINCE

Prepared for: CEN Integrated Environmental Management Unit
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Tel: 041 5812983/5817811
Fax: 041 5812983
Contact person: Dr Belinda Clark
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On behalf of: Eastern Cape Heritage Consultants
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jnfbinneman@gmail.com

Date: January 2020

PROJECT INFORMATION

Type of development

The project includes the establishment of a tented camp resort facility and associated infrastructure. The plan is to establish 20 tents in 2 phases, 12 in the first, and 8 in the second phase.

Proponent

Hayterdale Trails Pty Ltd

Consultant

CEN Integrated Environmental Management Unit
36 River Road
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Tel: 041 5812983/5817811
Fax: 041 5812983
Contact person: Dr Brenda Clark
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Purpose of the study

The purpose of the study was to conduct a Phase 1 Archaeological Impact Assessment (AIA) of the proposed establishment of a tented camp resort facility and associated infrastructure on Portion 0 of farm Hayterdale No. 406 north of the town of Addo in the Sundays River Valley Local Municipality of the Eastern Cape Province, to establish;

- the range and importance of possible exposed and *in situ* archaeological sites, features and materials,
- the potential impact of the development on these resources and,
- to make recommendations to minimize possible damage to these resources.

Site and location

The site for the proposed establishment of a tented camp resort facility and associated infrastructure is located within the 1:50 000 topographic reference map 3325BC Coerney (Map 1). It is situated on Portion 0 of farm Hayterdale No. 406, approximately 18 kilometres directly northeast of the town of Addo and east of the R355 main gravel road to Addo in the Sundays River Valley Local Municipality of the Eastern Cape Province (Map 1-2). A general GPS reading was taken at 33.23.517S; 25.43.363E. The development of the tented camp facility will take place along the bottom of a high hill with fairly steep gradients in all directions and is covered by dense thicket vegetation. The new entrance road will be constructed from the R355 gravel road southwest of the main development. It will be constructed through dense thicket vegetation before it passes over a flat plain covered by short dry grass en route to the tented camp resort development at the bottom of the hill.

ARCHAEOLOGICAL INVESTIGATION

Methodology, limitations and assumptions

The manager was contacted prior to the investigation to inform him about the survey and to gain access to the property. He was also consulted about the location of possible graves, old buildings and any archaeological sites on the property. He provided us with a guide to point out a grave (Map 2), the proposed camping sites and associated infrastructure. The grave (GPS reading: 33.23.29.31S; 25.43.26,81E) is hidden among the dense vegetation, but it is well removed from the proposed development. No further action is needed.

The investigation was conducted on foot by two archaeologists. A Google Earth aerial image investigation and a literary search were conducted of the area prior to the investigation. GPS readings were taken with a Garmin and all important features were digitally recorded. It was not possible to do a complete survey of the property due to the dense grass and thicket vegetation. There were some exposed areas but no sites/materials were observed. However, it is possible that archaeological sites/materials may be covered by soil and vegetation.

Notwithstanding the poor visibility, the experience and knowledge gained from other investigations in the wider surrounding region provided background information to make assumptions and predictions on the incidences and the significance of possible pre-colonial archaeological sites/material which may be located in the area, or which may be covered by the soil and vegetation. It is assumed that occasional Middle Stone Age stone tools may be exposed during the development, but that these will be in secondary contexts and not related to any other archaeological site/materials. No further action is needed.

Figure 1. General views of the proposed site for development. The new entrance to the development is illustrated in the main image and top row of inserts. The bottom two rows are examples of the terrain where tented sites will be constructed.

Figure 2. General views of the pipeline route east (top row inserts), west (middle row inserts) and the area for the placement of water tanks and other infrastructure (bottom row of inserts)

DISCUSSION AND CONDITIONS

No archaeological sites/materials were observed during the investigation and it would appear that the proposed site for the establishment of a tented camp resort facility and associated infrastructure on Portion 0 of farm Hayterdale No. 406 north of the town of Addo is of low cultural significance. Although it is unlikely that archaeological remains will be found *in situ,* there is always a possibility that human remains and/or other archaeological and historical material may be uncovered during the development. Should such material be exposed then work must cease in the immediate area and it must be reported to the Albany Museum (Tel: 046 6222312) or to the Eastern Cape Provincial Heritage Resources Authority (Tel.: 043 7450888), so that a systematic and professional investigation can be undertaken. Sufficient

time should be allowed to remove/collect such material (See Appendix B for a list of possible archaeological sites that maybe found in the area). The developer must finance the costs should additional investigations be required.

LETTER OF RECOMMENDATION

It is recommended that the proposed establishment of a tented camp resort facility and associated infrastructure on Portion 0 of farm Hayterdale No. 406 north of the town of Addo in the Sundays River Valley Local Municipality of the Eastern Cape Province is exempted from a full Phase 1 Archaeological Heritage Impact Assessment. Although the proposed development appears to be of low cultural sensitivity, it is possible that significant archaeological remains may be exposed during the development. The proposed development may proceed as planned.

Note that this letter of recommendation only exempts the proposed development from a full Phase 1 Archaeological Heritage Impact Assessment, but not for other heritage impact assessments. It must also be clear that this letter of recommendation for exemption of a full Phase 1 archaeological heritage impact assessment will be assessed by the relevant heritage resources authority. The final decision rests with the heritage resources authority, which should issue a permit or a formal letter of permission for the destruction of any cultural sites.

The National Heritage Resources Act (Act No. 25 of 1999, section 35) (see Appendix A) requires a full Heritage Impact Assessment (HIA) in order that all heritage resources, that is, all places or objects of aesthetics, architectural, historic, scientific, social, spiritual linguistic or technological value or significance are protected. Thus any assessment should make provision for the protection of all these heritage components, including archaeology, shipwrecks, battlefields, graves, and structures older than 60 years, living heritage, historical settlements, landscapes, geological sites, palaeontological sites and objects.

GENERAL REMARKS AND CONDITIONS

It must be emphasized that this letter of recommendation for exemption of a full Phase 1 archaeological heritage impact assessment is based on the visibility of archaeological sites/material and may not therefore, reflect the true state of affairs. Sites and material may be covered by soil and vegetation and will only be located once this has been removed. In the unlikely event of such finds being uncovered, (during any phase of construction work), it must be reported to the archaeologist at the Albany Museum (046 6222312) or to the Eastern Cape Provincial Heritage Resources Authority (Tel.: 043 7450888) immediately. The developer must finance the costs should additional studies be required as outlined above. The *onus* is also on the developer to ensure that this agreement is honoured in accordance with the National Heritage Act No. 25 of 1999. The consultant is responsible to forward this report to the relevant Heritage Authority for assessment, unless alternative arrangements have been made with the specialist to submit the report.

APPENDIX A: brief legislative requirements

Parts of sections 35(4), 36(3) and 38(1) (8) of the National Heritage Resources Act 25 of 1999 apply:

Archaeology, palaeontology and meteorites

35 (4) No person may, without a permit issued by the responsible heritage resources authority—

(a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;
(b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;
(d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.

Burial grounds and graves

36. (3) (a) No person may, without a permit issued by SAHRA or a provincial heritage resources authority—

(a) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;

(b) destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or
(c) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b)any excavation equipment, or any equipment which assists in the detection or recovery of metals.

Heritage resources management

38. (1) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorized as –

(a) the construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
(b) the construction of a bridge or similar structure exceeding 50m in length;
(c) any development or other activity which will change the character of the site –
(i) exceeding 5000m^2 in extent, or
(ii) involving three or more erven or subdivisions thereof; or
(iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or
(iv) the costs of which will exceed a sum set in terms of regulations by SAHRA, or a provincial resources authority;
(d) the re-zoning of a site exceeding 10 000m^2 in extent; or
(e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must as the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

APPENDIX B: IDENTIFICATION OF ARCHAEOLOGICAL FEATURES AND MATERIAL FROM INLAND AND ADJACENT COASTAL AREAS: guidelines and procedures for developers

Shell middens

Shell middens can be defined as an accumulation of marine shell deposited by human agents rather than the result of marine activity. The shells are concentrated in a specific locality above the high-water mark and frequently contain stone tools, pottery, bone and occasionally also human remains. Shell middens may be of various sizes and depths, but an accumulation which exceeds 1 square metre in extent should be reported to a museum/archaeologist.

Freshwater mussel middens

Freshwater mussels are found in the muddy banks of rivers and streams and were collected by people in the past as a food resource. Freshwater mussel shell middens are accumulations of mussel shell and are usually found close to rivers and streams. These shell middens frequently contain stone tools, pottery, bone, and occasionally human remains. Shell middens may be of various sizes and depths, but an accumulation which exceeds 1 m^2 in extent, should be reported to an archaeologist.

Human skeletal material

Human remains, whether the complete remains of an individual buried during the past, or scattered human remains resulting from disturbance of the grave, should be reported. In general the remains are buried in a flexed position on their sides, but are also found buried in a sitting position with a flat stone capping or in ceramic pots. Developers are requested to be on alert for these features and remains.

Fossil bone

Fossil bones may be found embedded in deposits at the sites. Any concentrations of bones, whether fossilized or not, should be reported.

Stone artefacts

These are difficult for the layman to identify. However, large accumulations of flaked stones which do not appear to have been disturbed naturally should be reported. If the stone tools are associated with bone remains, development should be halted immediately and archaeologist notified.

Stone features and platforms

These occur in different forms and sizes, but easily identifiable. The most common are an accumulation of roughly circular fire cracked stones tightly spaced and filled in with charcoal and marine shell. They are usually 1-2metres in diameter and may represent cooking platforms for shell fish. Others may resemble circular single row cobble stone markers. These occur in different sizes and may be the remains of wind breaks or cooking shelters.

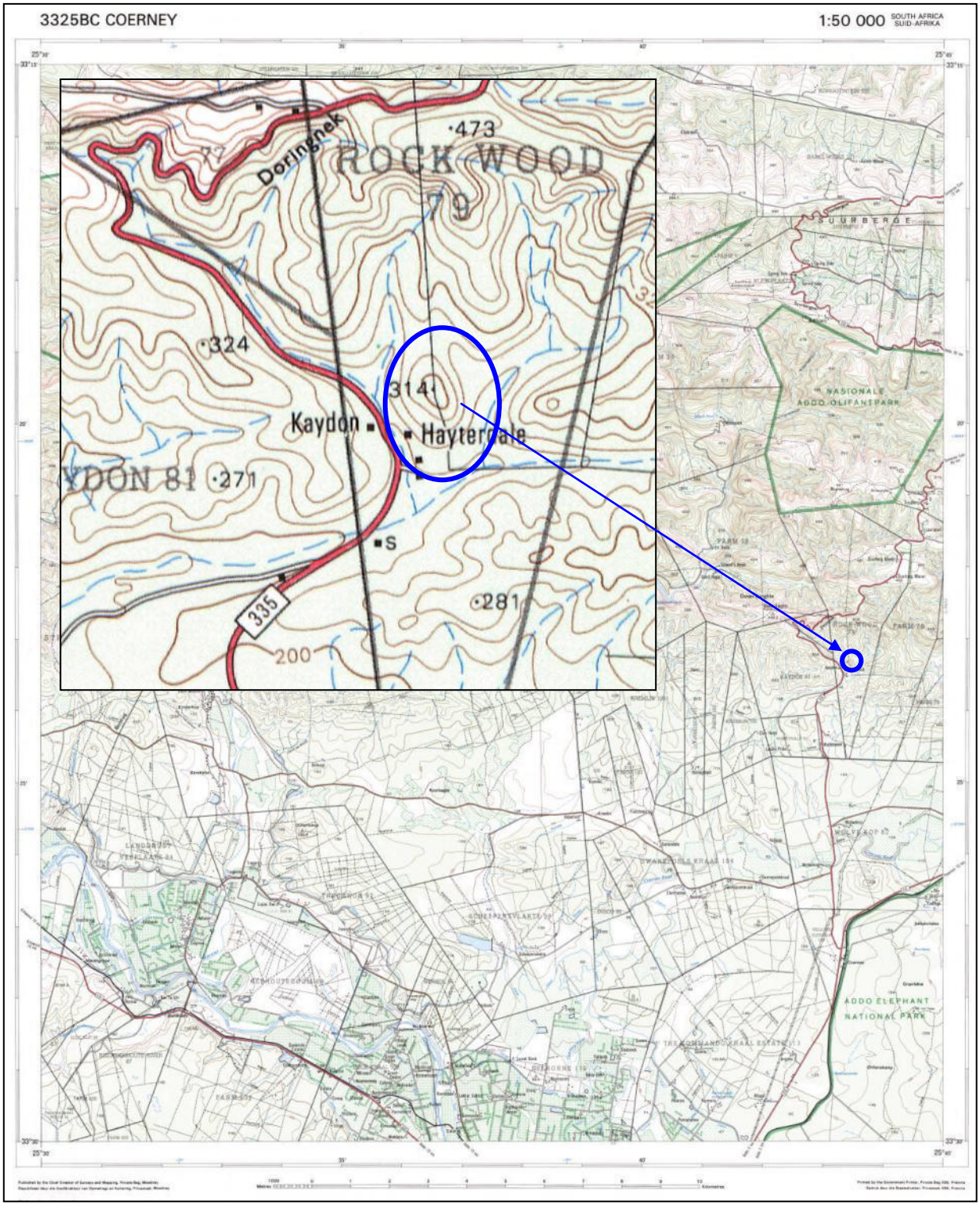
Large stone cairns

The most common cairns consist of large piles of stones of different sizes and heights are known as *isisivane*. They are usually near river and mountain crossings. Their purpose and

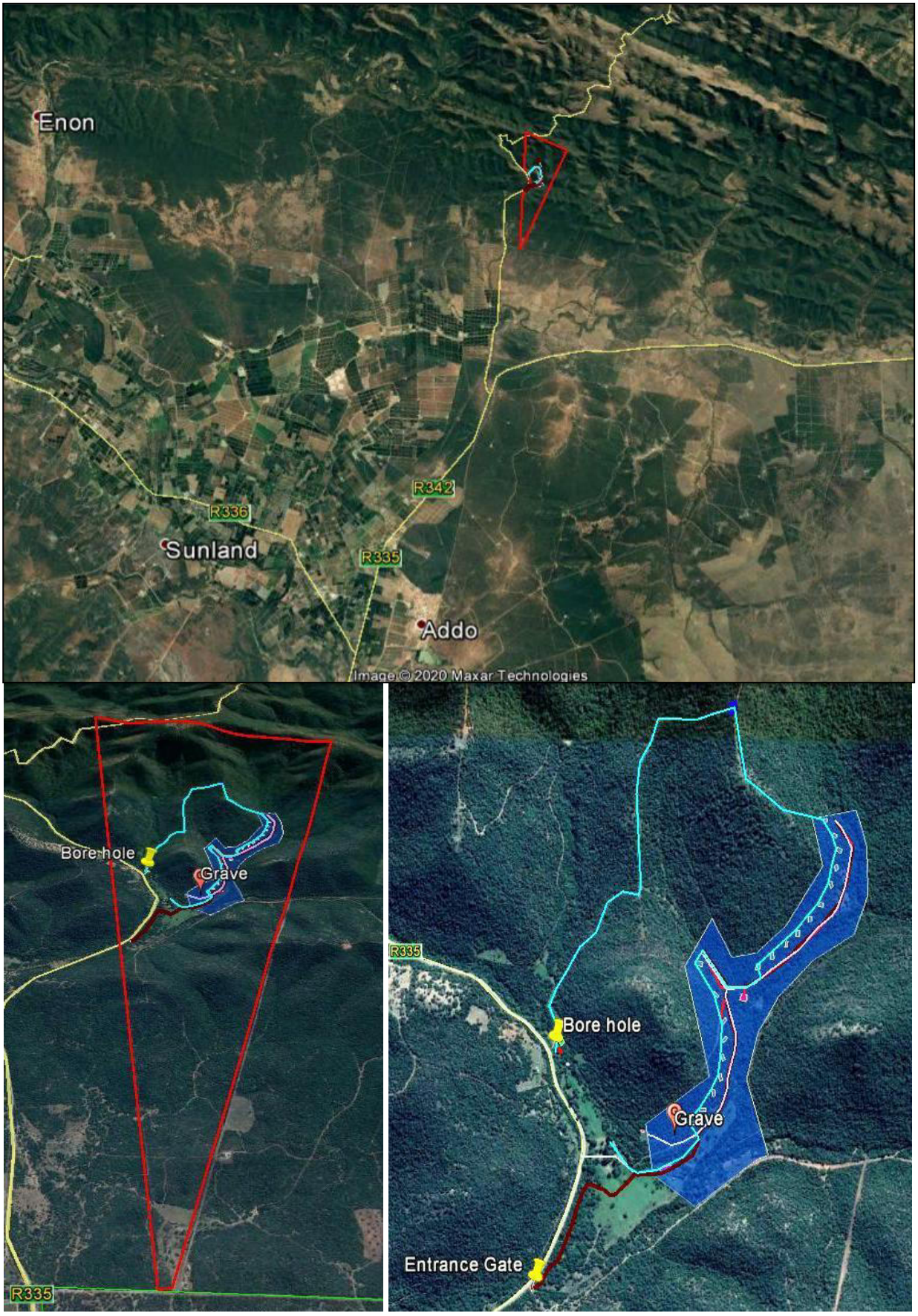
meaning is not fully understood, however, some are thought to represent burial cairns while others may have symbolic value.

Historical artefacts and features

These are easy to identify and include foundations of buildings or other construction features and items from domestic and military activities.



Map 1. 1:50 000 Topographic maps indicating the location of the proposed development of a tented camp resort facility and associated infrastructure on Portion 0 of farm Hayterdale No. 406.



Map 2. Aerial images indicating the location of the proposed development of a tented camp resort facility and infrastructure on Portion 0 of farm Hayterdale No. 406. Water supply indicated with blue line and access road indicated with maroon line. Grave indicated with red polygon.

Appendix D7: Paleontological Study

Paleontological heritage: combined desktop & field-based study

PROPOSED ESTABLISHMENT OF A TENTED CAMP RESORT FACILITY ON PORTION 0 OF FARM HAYTERDALE NO. 406 NEAR ADDO, SUNDAYS RIVER VALLEY MUNICIPALITY, EASTERN CAPE

John E. Almond PhD (Cantab.)
***Natura Viva* cc,**
PO Box 12410 Mill Street,
Cape Town 8010, RSA

January 2020

Executive summary

Hayterdale Trails PTY Ltd in partnership with 'AfriCamps' is proposing to establish a tented camp resort facility with access and services on Portion 0 of Farm Hayterdale No. 406, situated c. 15 km north of the town of Addo and east of the R335 in the Sundays River Valley Municipality, Eastern Cape.

Hilly terrain within the greater part of the AfriCamps project area is mantled with quartzitic colluvial gravels and gravelly sands. These unconsolidated deposits are probably derived from underlying bedrocks of the Enon Formation (Uitenhage Group) (not seen *in situ*) but may also have a younger, terrace gravel provenance. The Early / Middle Jurassic to Early Cretaceous fluvial Enon Formation is of low palaeontological sensitivity. The northern margins of the project area are underlain by the Early Jurassic Suurberg Group, including massive mudrocks of possible lahar (volcanogenic mudflow) origin and possibly also amygdaloidal basalts of the Mimosa Formation, though the latter were also not observed *in situ*. Occasional fossil bones (possibly dinosaurian), petrified wood and other plant material (including fossil pollen) have been recorded from sedimentary or tuffaceous intercalations within the Suurberg Group in its type area along the northern margins of the Algoa Basin, between Paterson and Kirkwood, However, these macrofossils are apparently very rare within the Suurberg beds and the succession as a whole is of low palaeosensitivity. Thick alluvial soils on valley floors in the southern sector of the project area are likewise of low palaeosensitivity. No fossils were recorded during the short palaeontological site visit to the AfriCamps project area and several bedrock exposures in the region (*e.g.* quarry along the R335 Suurberg Pass road).

It is concluded that the proposed AfriCamps tented camp resort facility, including the associated access road and services, is of LOW palaeontological significance. Pending the potential discovery of significant new fossil remains (*e.g.* bones, teeth, petrified wood) during the construction phase of the development, no further specialist palaeontological studies or mitigation are recommended for this project. During the construction phase all major clearance operations and deeper (> 1 m) excavations should be monitored for fossil remains on an on-going basis by the ECO. Should any substantial fossil remains be encountered at surface or exposed during construction, the ECO should safeguard these, preferably *in situ*. They should then alert the Eastern Cape Provincial Heritage Resources Agency, ECPHRA (Contact details: Mr Sello Mokhanya, 74 Alexander Road, King Williams Town 5600; smokhanya@ecphra.org.za) as soon as possible. This is to ensure that appropriate action (*i.e.* recording, sampling or collection of fossils, recording of relevant geological data) can be taken by a professional palaeontologist at the proponent's expense.

Provided that the Fossil Finds Procedure tabulated in the Appendix is fully implemented in the possible event of significant new fossil finds during construction, there are no objections on palaeontological heritage grounds to authorisation of the proposed development.

1. Project outline and brief

The company Hayterdale Trails PTY Ltd in partnership with 'AfriCamps' is proposing to establish a tented camp resort facility with access and services on Portion 0 of Farm Hayterdale No. 406, situated *c*. 15 km north of the town of Addo and east of the R335 in the Sundays River Valley Municipality, Eastern Cape (Fig. 1). The property is *c*. 254.2 hectares extent, is currently zoned for Agriculture and is used for recreational purposes *(i.e.* Hayterdale trails).

The tented camp resort will comprise 20 tents to be established in 2 phases – 12 in the first and 8 in the second phase, with the timing of phase 2 being dependent on occupancy rates. The footprint of a tent is typically 55 m^2, and accommodates 2 to 5 people. Supporting infrastructure will include an access road, reception and laundry, sewerage and grey water systems, water storage tanks and a borehole (See satellite image, Fig. 14).

The present combined desktop and field-based palaeontological heritage report for the AfriCamps tented resort project has been commissioned on behalf of the proponent by the CEN IEM Unit, Port Elizabeth (Contact details: Ms Belinda Clark. CEN IEM Unit, 36 River Road, Walmer, Port Elizabeth, RSA 6070. Tel: 041 367 4748. Cell: 072 725 6400. E-mail: bcalrk@telkomsa.net). It forms part of the Initial Site Sensitivity Verification process and will contribute to the Basic Assessment for the proposed development.

1.1. Information sources

The information used in this combined desktop and field assessment was based on the following:

1. A brief project description, maps, kmz files and other background documents provided by the CEN IEM Unit, Port Elizabeth;

2. A review of the relevant scientific literature, including published geological maps (1: 250 000 scale geology sheet 3324 Port Elizabeth) and accompanying sheet explanations (Toerien & Hill 1989);

3. The author's database on the geological formations concerned and their palaeontological heritage (*cf* Almond *et al*. 2008);

4. Google Earth© satellite imagery;

5. A short site visit to Farm Hayterdale No. 406 and other sites along the Suurberg Pass road on 18 November 2019.

1.2. Legislative context of this palaeontological study

The various categories of heritage resources recognised as part of the National Estate in Section 3 of the National Heritage Resources Act (1999) include, among others:

- geological sites of scientific or cultural importance;
- palaeontological sites;
- palaeontological objects and material, meteorites and rare geological specimens.

According to Section 35 of the National Heritage Resources Act, dealing with archaeology, palaeontology and meteorites:
(1) The protection of archaeological and palaeontological sites and material and meteorites is the responsibility of a provincial heritage resources authority.
(2) All archaeological objects, palaeontological material and meteorites are the property of the State.

(3) Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.
(4) No person may, without a permit issued by the responsible heritage resources authority—
(a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;
(b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;
(c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or
(d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.
(5) When the responsible heritage resources authority has reasonable cause to believe that any activity or development which will destroy, damage or alter any archaeological or palaeontological site is under way, and where no application for a permit has been submitted and no heritage resources management procedure in terms of section 38 has been followed, it may—
(a) serve on the owner or occupier of the site or on the person undertaking such development an order for the development to cease immediately for such period as is specified in the order;
(b) carry out an investigation for the purpose of obtaining information on whether or not an archaeological or palaeontological site exists and whether mitigation is necessary;
(c) if mitigation is deemed by the heritage resources authority to be necessary, assist the person on whom the order has been served under paragraph *(a)* to apply for a permit as required in subsection (4); and
(d) recover the costs of such investigation from the owner or occupier of the land on which it is believed an archaeological or palaeontological site is located or from the person proposing to undertake the development if no application for a permit is received within two weeks of the order being served.

Minimum standards for the palaeontological component of heritage impact assessment reports have been developed by SAHRA (2013).

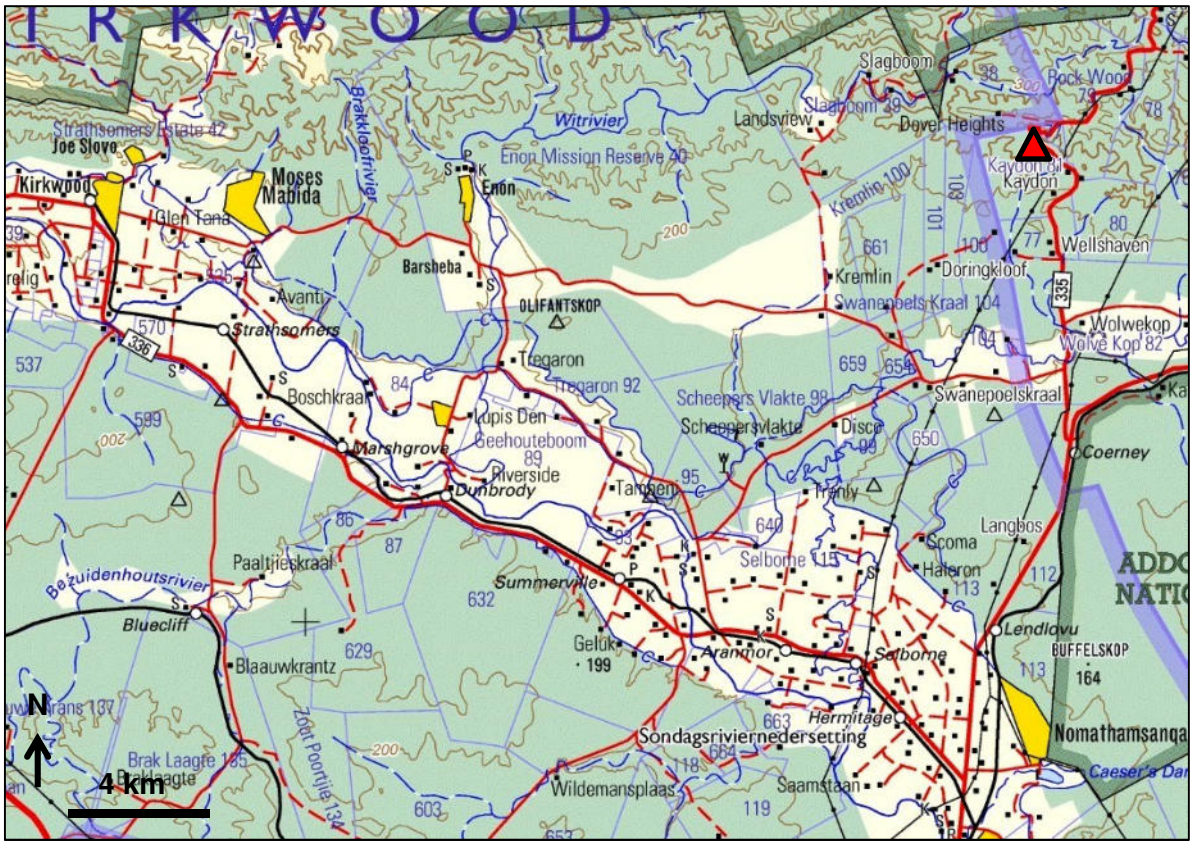


Figure 1: Extract from 1: 250 000 scale topographical sheet 3324 Port Elizabeth (Courtesy: The Chief Directorate – National Geo-spatial Information, Mowbray) showing the location of the proposed AfriCamps tented camp on Portion 0 of Farm Hayterdale No. 406 along the R335, *c.* 15 km north of Addo, Eastern Cape (red triangle)

2. Geological context

The AfriCamps tented camp project area lies between elevations of 200 and 350 m amsl on the dissected southern flanks of the heavily-vegetated, east-west trending Suurberg Range of the Eastern Cape (Figs. 1 & 14). The geology of the area is outlined on 1: 250 000 sheet 3324 Port Elizabeth (Toerien & Hill 1989) (Council for Geoscience, Pretoria; Fig. 2 herein). The mapping of the bedrock units here is necessarily provisional due to the comparatively inaccessible terrain and high levels of vegetation cover (Fig. 6). A more recent map of the Suurberg succession along the northern margins of the Algoa Basin has been provided by Muir (2018, his Fig. 4.1).

According to the published 1: 250 000 geological map and satellite images, Early Permian basinal mudrocks of the **Prince Albert Formation** (**Ecca Group**) probably crop out just outside the northern margins of the AfriCamps project area. Steeply-dipping and locally folded Prince Albert mudrocks as well as clast-poor Dwyka Group diamictites are well exposed in a sizeable roadside quarry along the R335 Suurberg Pass road *c.* 1.4 km WNW of the project area (Pa in Fig. 14) (Figs. 3 to 5). Here they can be seen to be highly deformed and are apparently unfossiliferous, so these Karoo Supergroup units will not be treated further in this report.

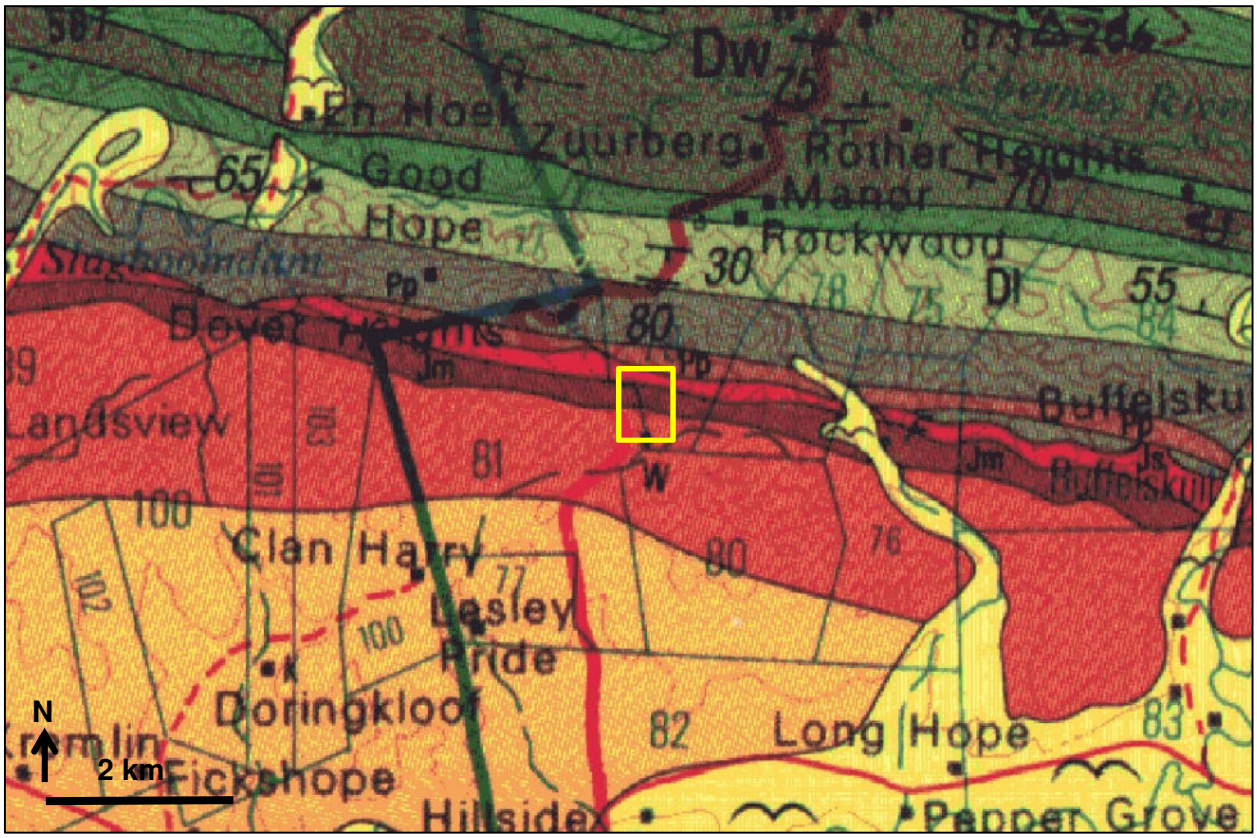


Figure 2: Extract from 1: 250 000 scale geological sheet 3324 Port Elizabeth (Courtesy: The Council for Geosciences, Pretoria) showing the approximate location of the AfriCamps tented camp project area on Portion 0 of Farm Hayterdale No. 406 along the R335, *c.* 15 km north of Addo, Eastern Cape. Key bedrock units mapped on the southern flanks of the Suurberg Range here include: DWYKA GROUP, Elandsvlei Formation (Late Carboniferous – Early Permian): grey (C-Pd); ECCA GROUP, Prince Albert Formation (Early Permian): brown (Pp); SUURBERG GROUP, Coerney & Slagboom Formations: red (Js), Mimosa Formation: purple-brown (Jm); UITENHAGE GROUP, Enon Formation (Middle Jurassic – Early Cretaceous): dark orange (Ke). Late Caenozoic superficial deposits such as alluvium and colluvium are not mapped at this scale.

The Ecca Group bedrocks are unconformably overlain to the south by Early Jurassic volcanics and possible minor intercalated sediments of the **Suurberg Group** whose type area lies between Kirkwood and Paterson. This second succession, less than 200 m thick, underlies the northern sector of the project area but outcrops of individual subunits are unclear due to very poor exposure levels. The Suurberg Group comprises basal volcanic breccias (**Slagboom Formation**), tuffs and tuffites (**Coerney Formation**) and basaltic lavas within minor tuff intercalations (**Mimosa Formation**). It is dated radiometrically and by palynology (fossil pollen / spores) to the Early Jurassic Period and is broadly correlated with the upper Drakensberg Group volcanics of Lesotho and elsewhere (Hill 1975, Marsh *et al.* 1979, Dingle *et al.* 1983, Toerien & Hill 1989, Hill 1992, Marsh 2016, Muir 2018). An Early Jurassic / Pliensbachian - Toarcian (187-191 Ma) age for theSuurberg succession is supported by the last author. Sedimentary interbeds include massive grey to brown mudrocks (possible volcanogenic mudflow / lahar deposits) as well as fine-grained, massive to thin-bedded, quartzo-feldspathic or tuffaceous sandstones. The Suurberg succession is in turn paraconformably overlain by thick, coarse fluvial conglomerates with minor sandstone lenticles of the **Enon Formation** at the base of the Late Jurassic to Early Cretaceous **Uitenhage Group** (Shone 2006, Muir *et al.* 2017). The Enon beds define the northern margin of the Algoa Basin and are mapped beneath the southern sector of the AfriCamps project area. To the north of the Algoa Basin the pre-Suurberg rocks of the Cape and Karoo Supergroups have been folded and faulted during the Permo-Triassic Cape Orogeny.

Figure 3: Deformed and faulted clast-poor Dwyka Group diamictite exposed in the roadside quarry along the R335, *c.* 1.4 km WNW of the project area (Pa in Fig. 14) (Hammer = 30 cm).

Figure 4: Highly-deformed contact between Dwyka diamictite / wacke with blackish mudrocks of the Prince Albert Formation, quarry *c.* 1.4 km WNW of the project area (Pa in Fig. 14).

Figure 5: Steeply-dipping, highly fractured beds of Prince Albert Formation mudrocks, quarry *c.* 1.4 km WNW of the project area (Pa in Fig. 14).

Figure 6: Typical steep, densely-vegetated hilly terrain within the project area on the northern flank of the Suurberg Range with hillslopes pervasively mantled by orange-hued, loose quartzitic colluvial gravels and gravelly soils.

Figure 7: Unconsolidated, poorly-sorted, angular to well-rounded quartzitic gravels exposed along pathways in the project area (Hammer = 30 cm). Consolidated Enon Formation conglomerates were not observed *in situ*. The gravels are probably Late Caenozoic in age and may in part be reworked from High Level terrace gravels.

Figure 8: Thick, orange-brown sandy soils with dispersed quartzitic gravels exposed in an excavation on the lower hillslopes in the southern sector of the project area (Hammer = 30 cm).

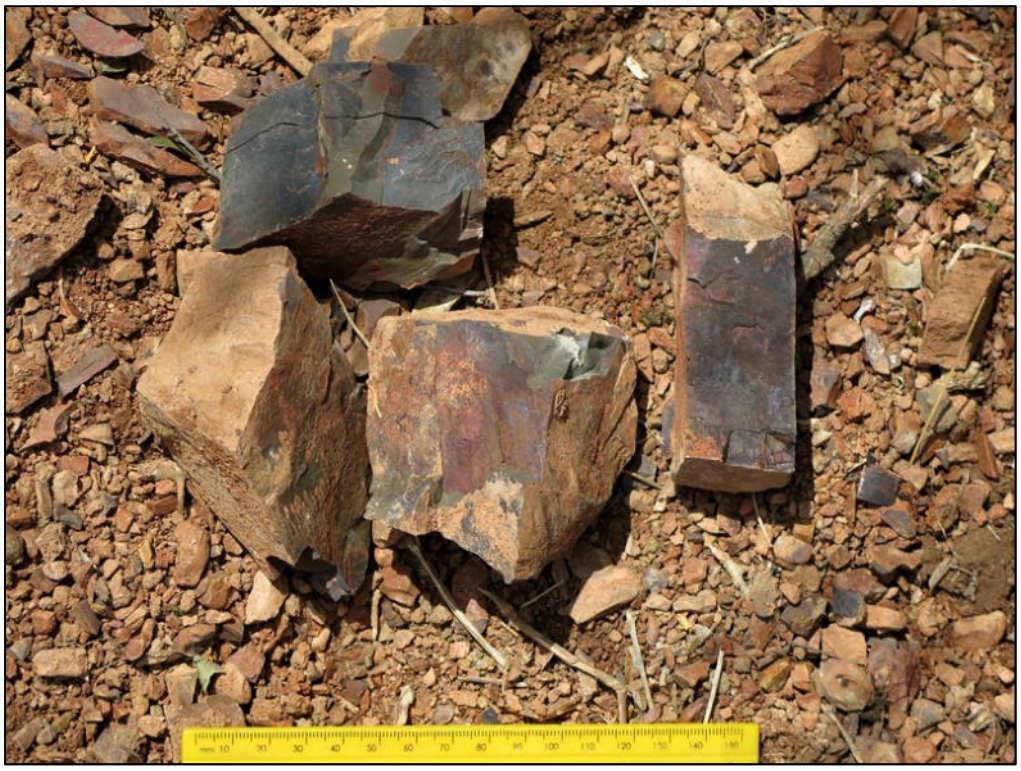


Figure 9: Blocks of brownish massive siltstone from a scraping near the northern edge of the project area (Scale in cm and mm). These might represent a sedimentary intercalation within the Suurberg Group (*cf* volcanogenic mudflow / lahar deposits).

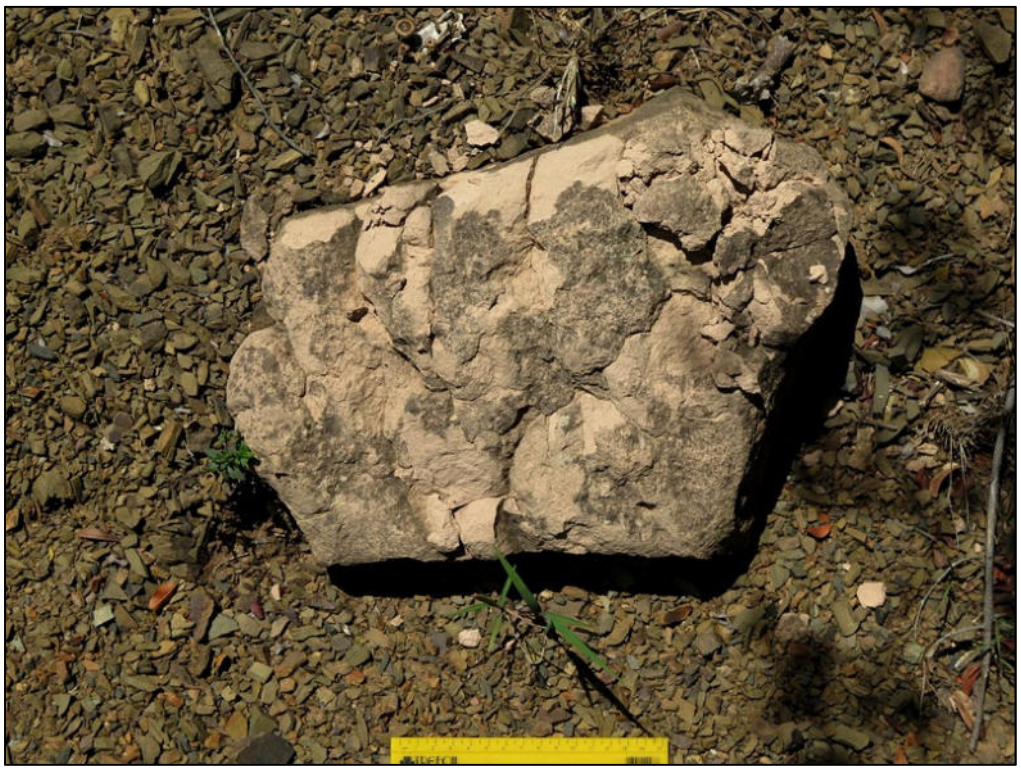


Figure 10: Float block of pinkish fine-grained sandstone of probable Suurberg Group provenance (Scale *c.* 15 cm long).

Figure 11: Float block of well-indurated, streaky greenish-grey tuff or tuffite from the Suurberg Group (Scale in cm and mm).

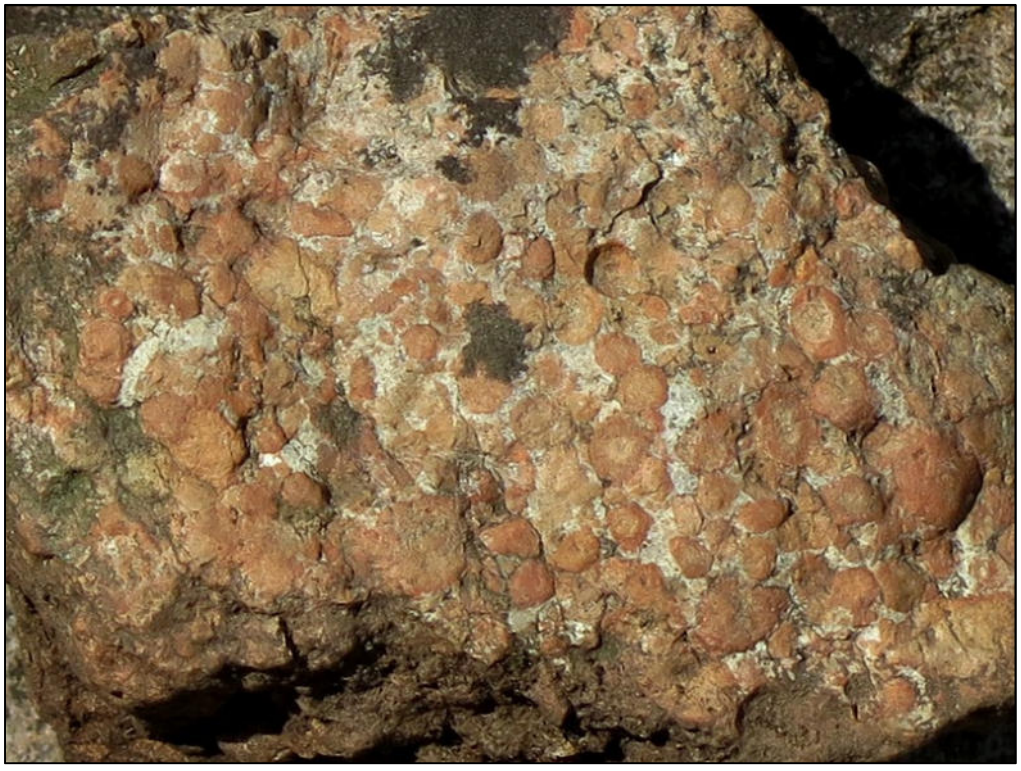


Figure 12: Detail of float block of pale spherulitic devitrified tuff, possibly from the Coerney Formation (Largest spherule *c.* 1 cm across).

Figure 13: Close-up of fractured float block of Mimosa Formation basalt showing typical amygdaloidal texture with mineral-infilled gas bubbles (Scale in cm and mm).

3. Potential palaeontological heritage

The fossil record of the Early Jurassic **Suurberg Group** is very sporadic and poorly-known (Haughton & Rogers 1924, Hill 1975, McLachlan & McMillan 1976, Dingle *et al.* 1983, Toerien & Hill 1989, Hill 1992 and refs. therein). Undescribed, and perhaps indeterminate bones of possible dinosaur affinity as well as silicified wood and other plant remains have been recorded from tuffs / tuffites within the Mimosa and Coerney Formations. Mudrocks within the Coerney Formation have yielded conifer pollen supporting an Early Jurassic age for the Suurberg Group (Millsteed pers. comm. *in* Hill 1992). It is noted that the few known fossil sites occur within the Suurberg Group type area close to the present study area.

In general, the proximal **Uitenhage Group** "red bed" sediments deposited in colluvial fans and energetic braided river systems such as the **Enon Formation** are fossil-poor. Shone (1976, 2006) as well as Muir *et al.* (2017) refer to sparse fragmentary, disarticulated, rounded bones, silicified wood and charred wood of indeterminate age in the Enon Formation. The palaeontological heritage of the coarse-grained facies (conglomerates, breccias) within the Uitenhage Group is currently unclear because of the uncertain stratigraphic position of many records with respect to currently accepted lithostratigraphy. Key references to the earlier literature are given by Du Toit (1954), McLachlan and McMillan (1976), Tankard *et al.* (1982) and Dingle *et al.* (1983). In the south-eastern Gamtoos Basin lignites, pollens and a range of plant compression fossils are recorded from the Uitenhage Group beds, but these appear to stem from the Kirkwood Formation rather than the Enon Formation proper (These two units were not distinguished by Haughton *et al*., 1937; the reference by Le Roux, 2000, to fossil wood from the Enon is therefore probably erroneous; *cf* also McLachlan & McMillan 1976, Dingle *et al.* 1983). According to Dingle *et al.* (1983, p. 117) no fossil wood has been recorded from the conglomerate ("Enon") facies in the Gamtoos Basin. Silicified wood has been recorded, however, from conglomerates of the Enon Formation near Worcester and Nuy in the Western Cape (Sönghe 1934, McLachlan & McMillan 1976, Gresse & Theron 1992). Charred wood

fragments are also reported as common within the Enon of the Algoa Basin (Rogers & Du Toit 1909, Haughton & Rogers 1924) while unidentifiable carbonized miospores from borehole cores in the same basin are mentioned by Scott (1976a, b).

4. Results of site visit

Bedrock exposure levels within the tented camp project area are very poor indeed. No Dwyka or Ecca Group bedrocks were encountered within the study area, but these can both be seen in the nearby quarry along the Suurberg Pass (Figs. 3 to 5).

Moderate to steep hillslopes within the area are almost entirely mantled with loose cobbly to bouldery colluvial gravels of angular to well-rounded, pale grey quartzite clasts that may be derived from the underlying Enon Formation bedrocks (Some of the clasts are anthropogenically flaked) (Figs. 6 & 7). Consolidated Enon bedrocks were not seen *in situ*, however. The colluvial gravels themselves are probably of Neogene to Holocene age. Given the presence of planed-off pediment surfaces at higher elevations within the Suurberg Range to the north, it is possible that some of these gravels are reworked from High Level terrace gravels of "Tertiary" age and not directly from Enon bedrocks.

On lower hillslopes and valley floors the gravels are covered by reddish-brown, gravel-rich sandy soils up to several meters thick, with darker loamy soils and calcrete nodules developed in some areas (Fig. 8). Surface gravels contain occasional blocks of spherulitic devitrified tuff, dense, pale grey-green streaky to laminated, crystal-rich tuff or tuffite, pinkish or orange-brown sandstone and grey-green to brown-weathering amygdaloidal basalt, all reworked from the Suurberg Group (*N.B.* At least some of the basalt blocks have been brought in by hand) (Figs. 10 to 13). Occasional scrapings into massive, pale brown to grey-green, blocky-weathering silty mudrock encountered along tracks towards the northern edge of the project area *might* represent sedimentary intercalations within the Suurberg Group (*cf* volcanogenic mudflow / lahar deposits) (Fig. 9).

No fossil occurrences were recorded within the project area during the site visit.

5. Conclusions and recommendations for mitigation

Hilly terrain within the greater part of the AfriCamps project area on Portion 0 of Farm Hayterdale No. 406 near Addo, Eastern Cape, is mantled with quartzitic colluvial gravels and gravelly sands. These unconsolidated deposits are probably derived from underlying bedrocks of the Enon Formation (Uitenhage Group) (not seen *in situ*) but may also have a younger, terrace gravel provenance. The Middle Jurassic to Early Cretaceous fluvial Enon Formation is of low palaeontological sensitivity. The northern margins of the project area are underlain by the Early Jurassic Suurberg Group, including massive mudrocks of possible lahar (volcanogenic mudflow) origin and possibly also amygdaloidal basalts of the Mimosa Formation, though the latter were also not observed *in situ*. Occasional fossil bones (possibly dinosaurian), petrified wood and other plant material (including fossil pollen) have been recorded from sedimentary or tuffaceous intercalations within the Suurberg Group in its type area along the northern margins of the Algoa Basin, between Paterson and Kirkwood, However, these macrofossils are apparently very rare within the Suurberg beds and the succession as a whole is of low palaeosensitivity. Thick alluvial soils on valley floors in the southern sector of the project area are likewise of low palaeosensitivity. No fossils were recorded during the short palaeontological site visit to the AfriCamps project area and several bedrock exposures in the region (*e.g.* quarry along the R335 Suurberg Pass road).

It is concluded that the proposed AfriCamps tented camp resort facility, including the associated access road and services, is of LOW palaeontological significance. Pending the potential discovery of significant new fossil remains (*e.g.* bones, teeth, petrified wood) during the construction phase of

the development, no further specialist palaeontological studies or mitigation are recommended for this project. During the construction phase all major clearance operations and deeper (> 1 m) excavations should be monitored for fossil remains on an on-going basis by the ECO. Should any substantial fossil remains be encountered at surface or exposed during construction, the ECO should safeguard these, preferably *in situ*. They should then alert the Eastern Cape Provincial Heritage Resources Agency, ECPHRA (Contact details: Mr Sello Mokhanya, 74 Alexander Road, King Williams Town 5600; smokhanya@ecphra.org.za) as soon as possible. This is to ensure that appropriate action (*i.e.* recording, sampling or collection of fossils, recording of relevant geological data) can be taken by a professional palaeontologist at the proponent's expense.

Provided that the Fossil Finds Procedure tabulated in the Appendix is fully implemented in the possible event of significant new fossil finds during construction, there are no objections on palaeontological heritage grounds to authorisation of the proposed development.

6. Acknowledgements

Ms Belinda Clark of the CEN IEM Unit, Port Elizabeth is thanked for commissioning this study and for providing the relevant background information. I would also like to thank Mr Rob Hayter and Mr Eksteen for facilitating the site visit to Farm Hayterdale No. 406 and sharing the local geology with me.

7. Key references

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8. Qualifications & experience of the author

Dr John Almond has an Honours Degree in Natural Sciences (Zoology) as well as a PhD in Palaeontology from the University of Cambridge, UK. He has been awarded post-doctoral research fellowships at Cambridge University and in Germany, and has carried out palaeontological research in Europe, North America, the Middle East as well as North and South Africa. For eight years he was a scientific officer (palaeontologist) for the Geological Survey / Council for Geoscience in the RSA. His current palaeontological research focuses on fossil record of the Precambrian - Cambrian boundary and the Cape Supergroup of South Africa. He has recently written palaeontological reviews for several 1: 250 000 geological maps published by the Council for Geoscience and has contributed educational material on fossils and evolution for new school textbooks in the RSA.

Since 2002 Dr Almond has also carried out palaeontological impact assessments for developments and conservation areas in the Western, Eastern and Northern Cape, Limpopo, Northwest, Mpumalanga, KwaZulu-Natal, Gauteng and the Free State under the aegis of his Cape Town-based company *Natura Viva* cc. He has previously served as a long-standing member of the Archaeology, Palaeontology and Meteorites Committee for Heritage Western Cape (HWC) and an advisor on palaeontological conservation and management issues for the Palaeontological Society of South Africa (PSSA), HWC and SAHRA. He is currently compiling technical reports on the provincial palaeontological heritage of Western, Northern and Eastern Cape for SAHRA and HWC. Dr Almond is an accredited member of PSSA and APHP (Association of Professional Heritage Practitioners – Western Cape).

Declaration of Independence

I, John E. Almond, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed water development projects, application or appeal in respect of which I was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.

Dr John E. Almond
Palaeontologist
***Natura Viva* cc**

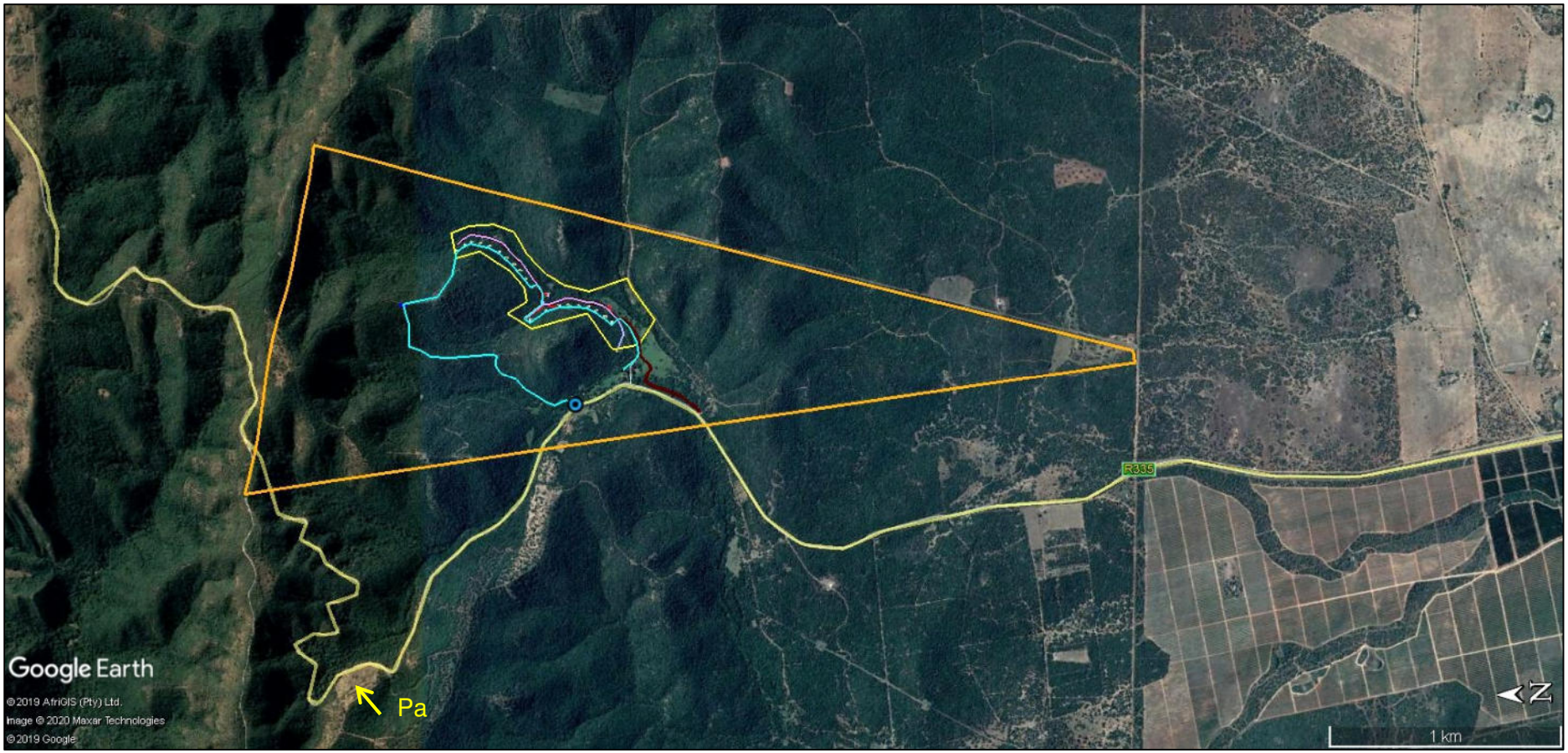

Figure 14: Google Earth© satellite image of the project area for the proposed AfriCamps tented camp situated on the eastern side of the R335 Suurberg Pass (Portion 0 of Farm Hayterdale No. 406 – orange polygon), *c.* 15 north of Addo, Sundays River Valley Municipality, Eastern Cape. Shown seen are the AfriCamps project area (yellow polygon), water pipeline (pale blue line), borehole (blue circle), grey water system (lilac line, closely following sewerage lines). Pa indicates the roadside quarry excavated into Prince Albert Formation mudrocks along the Suurberg Pass. N is towards the LHS of the image.

<table>
<tr><th colspan="3">APPENDIX: CHANCE FOSSIL FINDS PROCEDURE: TENTED CAMP RESORT FACILITY ON FARM HAYTERDALE NO. 406 nr ADDO</th></tr>
<tr><td>Province & region:</td><td colspan="2">EASTERN CAPE, Sundays River Valley Municipality</td></tr>
<tr><td>Responsible Heritage Resources Authority</td><td colspan="2">ECPHRA (Contact details: Mr Sello Mokhanya, 74 Alexander Road, King Williams Town 5600; smokhanya@ecphra.org.za)</td></tr>
<tr><td>Rock unit(s)</td><td colspan="2">Enon Formation, Suurberg Group, Late Caenozoic alluvium and colluvium</td></tr>
<tr><td>Potential fossils</td><td colspan="2">Rare dinosaur (?) bones, petrified wood and other plant fossils in Suurberg Group sediments / tuffs.
Rare reworked bone fragments, petrified and coalified wood in sandy intercalations within Enon Formation.
Fossil teeth, bones and horn cores of mammals in Pleistocene colluvial and alluvial deposits.</td></tr>
<tr><td rowspan="5">ECO protocol</td><td colspan="2">1. Once alerted to fossil occurrence(s): alert site foreman, stop work in area immediately (N.B. safety first!), safeguard site with security tape / fence / sand bags if necessary.</td></tr>
<tr><td colspan="2">2. Record key data while fossil remains are still in situ:
Accurate geographic location – describe and mark on site map / 1: 50 000 map / satellite image / aerial photo
Context – describe position of fossils within stratigraphy (rock layering), depth below surface
Photograph fossil(s) in situ with scale, from different angles, including images showing context (e.g. rock layering)</td></tr>
<tr><td>3. If feasible to leave fossils in situ:
Alert Heritage Resources Authority and project palaeontologist (if any) who will advise on any necessary mitigation
Ensure fossil site remains safeguarded until clearance is given by the Heritage Resources Authority for work to resume</td><td>3. If not feasible to leave fossils in situ (emergency procedure only):
Carefully remove fossils, as far as possible still enclosed within the original sedimentary matrix (e.g. entire block of fossiliferous rock)
Photograph fossils against a plain, level background, with scale
Carefully wrap fossils in several layers of newspaper / tissue paper / plastic bags
Safeguard fossils together with locality and collection data (including collector and date) in a box in a safe place for examination by a palaeontologist
Alert Heritage Resources Authority and project palaeontologist (if any) who will advise on any necessary mitigation</td></tr>
<tr><td colspan="2">4. If required by Heritage Resources Authority, ensure that a suitably-qualified specialist palaeontologist is appointed as soon as possible by the developer.</td></tr>
<tr><td colspan="2">5. Implement any further mitigation measures proposed by the palaeontologist and Heritage Resources Authority</td></tr>
<tr><td>Specialist palaeontologist</td><td colspan="2">Record, describe and judiciously sample fossil remains together with relevant contextual data (stratigraphy / sedimentology / taphonomy). Ensure that fossils are curated in an approved repository (e.g. museum / university / Council for Geoscience collection) together with full collection data. Submit Palaeontological Mitigation report to Heritage Resources Authority. Adhere to best international practice for palaeontological fieldwork and Heritage Resources Authority minimum standards.</td></tr>
</table>

Appendix D8: Faunal Screening Report

CEN INTEGRATED ENVIRONMENTAL MANAGEMENT UNIT

Environmental and Rural Development Specialist

Assessment and Reporting of Environmental Impacts on Terrestrial Animal Species

Development of tented camp facility on Portion 0 of Farm Hayterdale No. 406, near Addo, Sundays River Valley Municipality

PREPARED BY:

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Assessment and Reporting of Environmental Impacts on Terrestrial Animal Species

Development of tented camp facility on Portion 0 of Farm Hayterdale No. 406, near Addo, Sundays River Valley Municipality

1. Introduction

Hayterdale Trails PTY LTD proposes to establish a tented camp resort and supporting infrastructure on Portion 0 of Farm Hayterdale No. 406 situated north of the town of Addo, east of the R335 and approximately 3km west of the Greater Addo Elephant National Park (AENP) in the Sundays River Valley Municipality.

The proposed project requires an environmental authorisation to be issued by the Eastern Cape Department of Economic Development, Environmental Affairs and Tourism (DEDEAT) before the project may commence. This fauna screening assessment has been carried out as part of the application for environmental authorisation process to support an informed decision making process and to inform the applicant of any permits which may be required in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) and Provincial Nature Conservation Ordinance.

This fauna screening assessment report meets the requirements listed in the protocol for the assessment and reporting of environmental impacts on terrestrial animal species published for comment on 10 January 2020.

2. Methodology

An initial site sensitivity verification was carried out through use of the following tasks:

- Desktop analysis
- Preliminary on-site inspection to identify if there are any discrepancies with current use of land and environmental status quo versus the environmental sensitivity identified on national web based screening tool

The following resources were used to determine the terrestrial fauna that have been recorded within the quarter degree grid cell (QDGC) / pentad:

- Reptile Atlas of Southern Africa
- South African Bird Atlas Project 2
- Red Data List of Mammals of South Africa Swaziland and Lesotho, 2016
- The 2015 Eskom Red Data Book of Birds of South Africa Swaziland and Lesotho
- The International Union for Conservation (IUCN)'s Red Lists, 2018
- Fauna recorded on site

Threatened species are those that face a high risk of extinction in the near (or foreseeable) future and have been classified as Critically Endangered, Endangered or Vulnerable. The classification is based on a scientific conservation assessment (or Red Listing process), using a standardised set of criteria developed by the IUCN for determining the likelihood of a species becoming extinct.

Resources used:

- Species listed as threatened or protected in terms of Section 56 of the National Environmental Management: Biodiversity Act (Act 10 of 2004). Classified as critically endangered, endangered, vulnerable or protected. (TOPS-listed Species)
- Species listed in the Endangered or Vulnerable categories in the revised South African Red Data Books

- Threatened species listed on the IUCN Red List, 2018
- Protected / threatened species listed in terms of the Provincial Nature Conservation Ordinance (No. 19 of 1974) (PNCO)

Sensitive species include species not falling in the categories above but listed in:

- Appendix 1 or 2 of the Convention of International Trade in Endangered Species (CITES)
- Species endemic to the assessment region (South Africa, Swaziland, Lesotho)

Reporting:

- A comprehensive list of amphibians, birds, reptiles and mammals recorded within the QDGC is provided with an indication of threatened species, sensitive species and level of protection;
- An indication of invertebrate species of conservation concern is provided;
- A sensitivity rating (low, medium or high) is provided based on, the likelihood of the recorded species occurring within the development footprint / property, and, whether or not the proposed development is expected to have any significant negative impact (medium – high) on the terrestrial animal species;
- Recommendations are provided.

3. Description of Site

Portion 0 of Farm Hayterdale No. 406 is approximately 254.2 ha in extent. The site is accessed via the R335 which is immediately west of the farm. The approximate central co-ordinates: 33°23'19.38"S 25°43'29.39"E. The site falls within the 3325 BC Quarter Degree Grid Cell (QDGC) (Figure 1).

Figure 1: 3325 BC QDGC indicated highlighted in pink

The site is currently zoned as Agriculture. The site is situated within the Albany Thicket Biome and the vegetation is mapped as Sundays Mesic Thicket (National Veg Map, 2018) (Figure 2). In terms of endemism, the property is located within the Albany Centre of Floristic Endemism of the Maputaland-Pondoland-Albany Hotspot. The site is situated within a Critical Biodiversity Area in terms of the Eastern Cape Biodiversity Conservation Plan and the Addo Biodiversity Sector Plan (Figure 3).

Surrounding land uses include natural areas, protected areas, agriculture, and resort/hospitality industry. The Greater Addo Elephant National Park is located within 5km of the property in the north and east; the property borders the Addo National Park in the south. Natural area surrounds the farm and some resort/hospitality facilities are within the surrounding area. The area south west of the property, extending from Kirkwood in the west to the NMBM border in the south, is predominantly used for farming which is occupying a roughly estimated 30 000 ha of land (Figure 4).

During the site visit carried out, it was apparent that no agricultural activities are taking place on the property. The property is currently used for recreational purposes (i.e. Hayterdale trails).

The proposed development entails 20 tents and supporting infrastructure, including; parking areas, water supply and sewage management. The proposed layout is provided in Figure 5.

The area proposed for the development of 20 tents and supporting infrastructure is representative of mesic thicket vegetation (Photo 1).

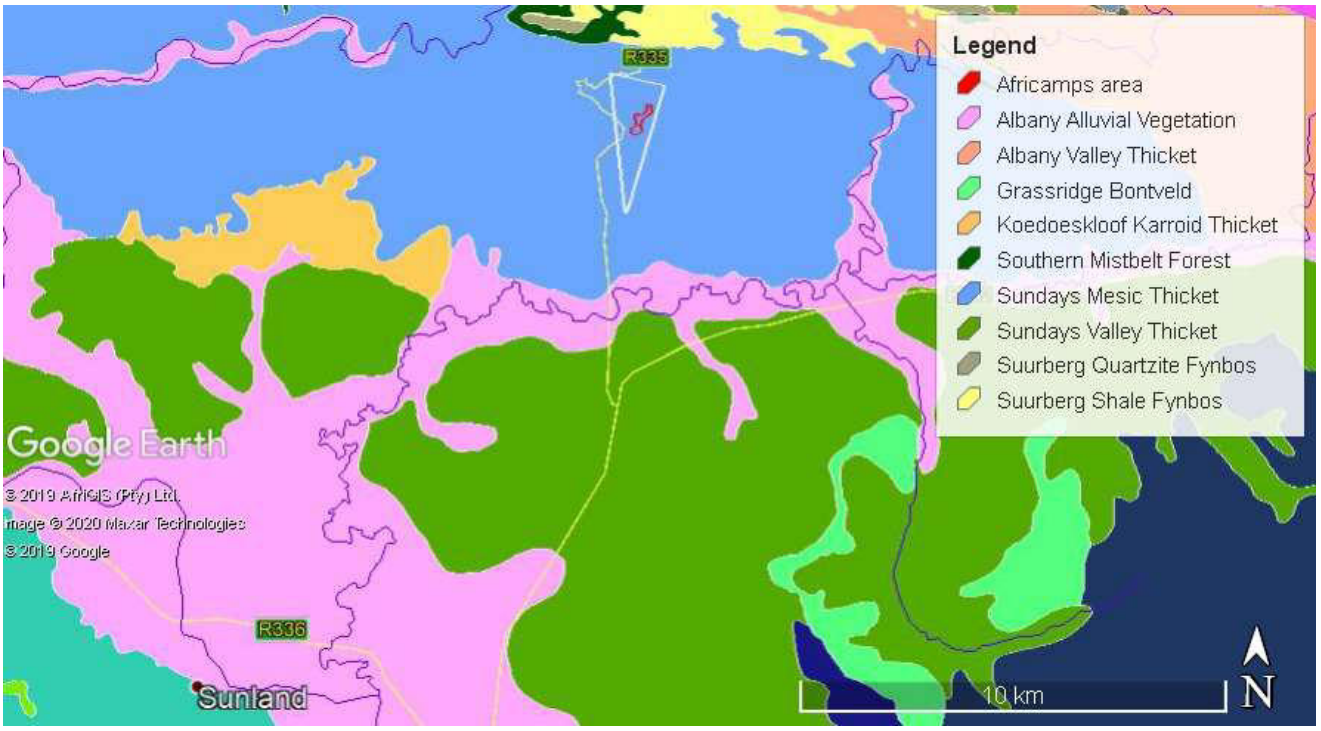

Figure 2: Site falls within Sundays Mesic Thicket (National VegMap, 2018)

Figure 3: Site falls within Albany Centre of Endemism

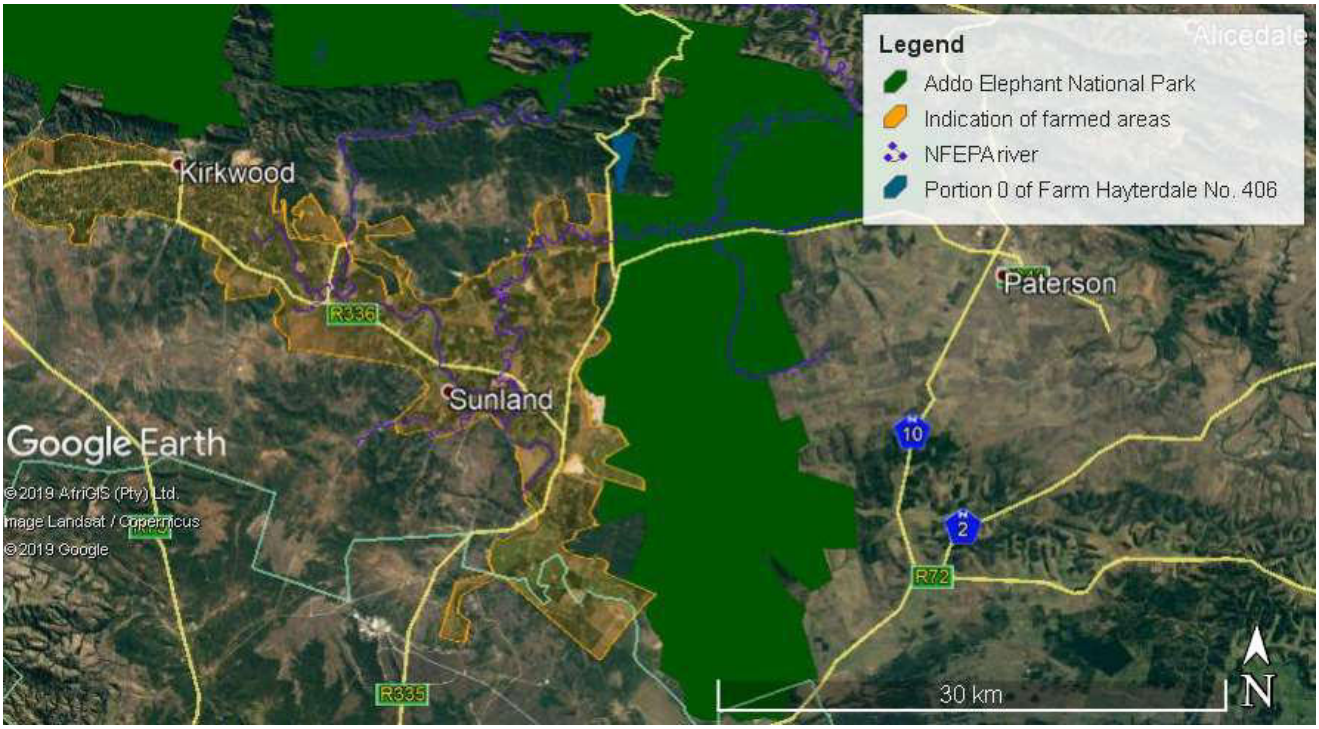

Figure 4: Surrounding land uses with indication of extent of area used for farming

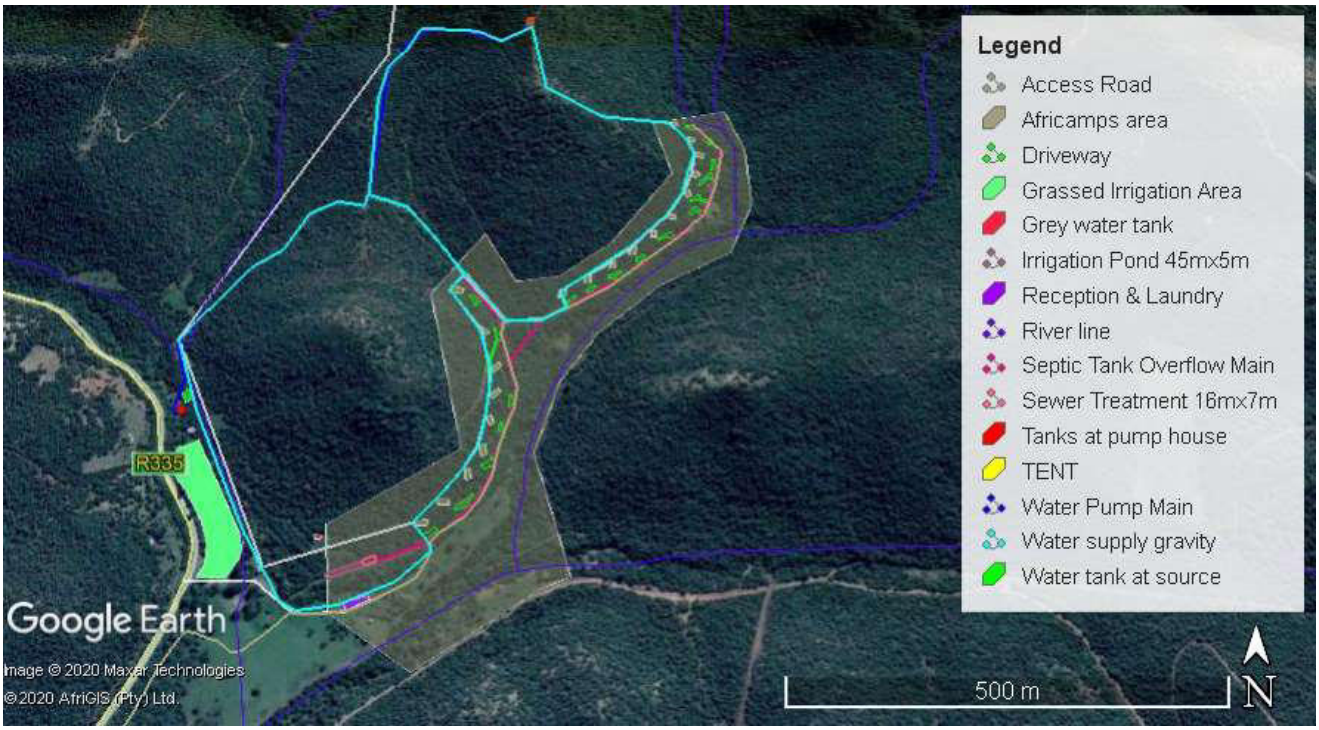

Figure 5: Proposed layout of tented camp

Photo 1: Photograph showing typical site conditions

4. Overview of fauna

The Albany Thicket is an important centre of floral endemism, with 61 endemic plant species, however its level of faunal endemism is comparatively low.

Within thicket, mosaics of vegetation are created by a combination of factors including geological processes and grazing by mega-herbivores. Approximately 48 species of medium to large mammals occur within this biome (26 herbivores, 16 carnivores, 4 omnivores, 2 insectivores).

Of the nine endemic bird species to South Africa, none are endemic to the Eastern Cape. The Albany Thicket biome has two near-endemic bird species, the orange-breasted sunbird (*Nectarinia violacea*) and the Cape siskin (*Serinus totta*), and neither of these species have been recorded in the QDGC of the proposed development.

Of the estimated 350 species of reptiles occurring in South Africa, the Eastern Cape is home to approximately 133 reptile species (Branch, 1998) with the majority of these are found in Mesic Succulent Thicket and riverine habitats. Six reptile species are considered to be strictly endemic, including Tasman's legless skink (*Acontias tasmani*), Tasman's girdled lizard (*Cordylus tasmani*), Albany Adder (*Bitis albanica*), none of which have been recorded within the proposed development site. There are no endemic amphibians to the Eastern Cape.

Little is known about the insect species associated with Subtropical Thicket, but it is estimated that for every one plant species, there are between 8 and 35 organisms dependent on this species.

a. Mammals

44 mammal species have been recorded within the range of the 3325BC QDGC and an additional 4 species have been recorded by landowners / specialists during field work (See Table 1). Of these mammals:

- Two species are endemic to assessment range (Cape Grysbok; Cape horseshoe bat)
- Two species are near endemic to assessment range (Sable, Mountain reedbuck)
- Five species are listed as vulnerable in the RSA Red List category, 2016 (Sable, Tsessebe Cheetah, Leopard, Blue Duiker)
- Five species are listed as vulnerable in the Global IUCN Red List (African Elephant, Cheetah, Black-Footed Cat, Leopard, Lion)
- Two species are listed as endangered on NEMBA TOPS list (Tsessebe,, Cape Mountain Zebra)
- Four species are listed as vulnerable on NEMBA TOPS list (Cheetah, Lion, Leopard, Blue Duiker)
- Five species are protected on NEMBA TOPS list (Bat-Eared Fox, African Elephant, Black-Footed Cat, Spotted Hyena, Aardvark)
- Twenty three species are listed as a schedule 2 species in the PCNO

Plate 1: Evidence of mammals within proposed development sites and surrounding area

The Southern African Tsessebe is native to South Africa, and formerly occurred within the grasslands of sub-Sharan Africa but has been eliminated from much of its former range. The Kruger National Park (KNP), Zimbabwe and Mozambique might offer dispersal routes. The natural distribution of this species does not include the Eastern Cape, but this species has been reintroduced and introduced to many parts of the country. This species is extra limital to the area as indicated in Table 1.

The Sable antelope occurs in Savanna woodlands and, in South Africa, naturally occurs in eastern Mpumalanga, Limpopo and North West. This species has been widely introduced outside their former range, in protected and private areas, and giving rise to extra-limital subpopulations in KZN, Free State, and the Northern, Western and Eastern Cape. This species is extra limital to the area as indicated in Table 1.

The blue duiker and nyala are not recorded within the QDGC however these antelope have been recorded on the site by the landowners and by specialists carrying out field work. The blue duiker is listed as vulnerable in terms of NEMBA TOPS and in terms of the Red List, 2016 (Regional and national). This species does occur within thickets or dense coastal bush and they are able to tolerate some modification to habitats. They are selective feeders and their diet consists mostly of fruit and dicots and therefore play an important ecosystem role as seed dispersers. If the blue duiker occurs on the property then it is recommended that landowners do not introduce / maintain high stocking rates of Bushbuck (*Tragelaphus sylvaticus*), or extra-limital species like Nyala (*Tragelaphus angasii*) as this could potentially negatively affect Blue Duikers through increased interspecific competition. Morevoer, Nyala are extralimital to the vegetation of Arid Mosaic Thicket and can cause species degradation and competes with bushbuck and blue duiker and therefore should not be introduced onto the property.

Free-roaming cheetahs occur along the northern borders of the country and on the western boundary of KNP. The Cheetah has been reintroduced to reserves in the Western Cape, Eastern Cape, Gauteng and Free State provinces. Cheetah have been recorded within the quadrant, but they should not naturally occur here. The recorded lions and elephants within the quadrant is likely due to the AENP (borders in the south with the development property). The spotted hyena have been reintroduced to the Greater AENP and the recorded species in this quadrant is likely to be due to the close vicinity of the AENP to the site. The black -footed cat is endemic to arid regions of southern Africa and its range includes the present day Eastern Cape extending westwards towards the southern regions of the Free state and Northern Cape. The recorded species in this quadrant is likely to be due to the AENP south of the property.

The Cape Grysbok is endemic to South Africa and widespread in its historic range within the eastern and western cape where it is largely confined to the Cape Floristic region and is also present in the Addo Elephant National Park.

The Mountain Reedbuck occurs throughout South Africa and lives on grass-covered ridges and hillsides in rocky areas and tend to avoid areas with no cover. The availability of drinking water is very important, and this animal will often inhabit lower slopes making use of moister cooler southerly aspects of the slopes. They are nocturnal and live in small groups (3 – 8 individuals). The proposed campsites are situated in an area which could offer suitable habitat / forage areas to the mountain reedbuck.

The bat eared fox is generally restricted to the western interior of the Eastern Cape. Their preferred food source is the harvester termite and their range overlaps almost completely with that of *Hodotermes* and *Microhodotermes* termite genera.

The leopard has high tolerance for a wide range of habitats with densely wooded and rocky areas as a preferred choice of habitat.

Wahlberg's Epauletted Fruit Bat has been recorded within Albany Thicket with roosting sites often under canopies of trees, in thick foilage. The species continually changes its roost site and is somewhat adaptable to habitat modification.

The Cape Horseshoe bat is endemic to the assessment region (Red List, 2016) and mainly restricted to the coastal belt (100 – 200 km wide) of the Eastern Cape, Northern Cape and Western Cape. They have been recorded in a range of habitats but are closely associated with fynbos and succulent karoo. They roost in suitable caves and often share caves. They are insectivores and important regulators of insect populations. The species is recorded with the AENP and there is a possibility of this species occurring on the property should there be suitable caves / roost areas.

The Aardvark occurs in a variety of habitats including thickets. They occur inside, and outside protected areas as fences are not always a barrier allowing them to move freely across their range. They feed mostly on ants and termites and are generally nocturnal. Aardvark are considered keystone species as their burrows create microhabitats for other species; as many as 39 species have been recorded to make use of aardvark burrows including the critically endangered blue swallow.

A full list of mammals recorded within the 3325BC is provided in Table 1 with an indication of threat and protection status, likelihood of occurrence and sensitivity rating.

Plate 2: Examples of microhabitats within proposed tented camp sites

b. Reptiles

Historical records indicates that 44 species of reptiles have been recorded within the 3325 BC Quarter Degree Grid Cell (QDGC) within which the project site is located. Of these, none are listed as threatened in terms of the IUCN Red List or regional list (SARCA, 2014) and one (geometric tortoise) is listed on the NEMBA TOPS list. Four species of snakes (Western Natal green snake, South African slug-eater, Yellow-bellied house snake, brown water snake) and the two species of tortoises (angulate tortoise, leopard tortoise) occurring within the grid cell are listed as schedule 2 species on the PNCO list and will require permits for their removal.

A full list of reptiles recorded within the 3325BC is provided in Table 2 with an indication of threat and protection status, likelihood of occurrence and sensitivity rating.

c. Amphibians

The 3325BC QDGC has a high amphibian species richness with 16 species recorded in the cell. All frogs are listed as a schedule 1 or 2 species on the PNCO list and therefore will require permits for their removal. However, the selected sites are not located very close to wetlands or watercourses and therefore minimal disturbance, if any, is expected on amphibians as a result of the proposed development.

A full list of amphibians recorded within the 3325BC is provided in Table 3 with an indication of threat and protection status, likelihood of occurrence and sensitivity rating.

d. Invertebrates

The Cape dung beetle is endemic to the area and is a schedule 1 species in term of the PNCO. Golden baboon spiders, horned baboon spiders, common baboon spiders, tiger beetles, burrowing scorpions and creeping scorpions occur within the area and all are protected in terms of the NEMBA. A list of sensitive invertebrates listed in NEMBA TOPS and PNCO is provided in Table 4.

Termites are an important food source for many animals, including the bat-eared fox and aardvark. Search and rescue should be carried out as close to construction as possible to ensure removal of sensitive species from the development footprint and any termite nests should not be disturbed.

Plate 3: Examples of invertebrates within proposed tented camp sites

e. Aves

The site is located within a natural area, adjacent to the Greater AENP and north east of the Sundays River agricultural (mostly citrus) land use area. Important habitats and forage areas are provided for birds on the property. The site is not part of the list of internationally important bird areas (BirdLife International). 155 bird species have been recorded within the 3320_2540 pentad (5 x 5 minute coordinate grid) within which the project site is located.

The **Martial Eagle** (*Polemaetus bellicosus*) (2015 regional status: endangered) is the largest eagle species in Africa and has recently been uplisted to 'Vulnerable' by IUCN and uplisted to regionally endangered within South Africa due to suspected population declines (BirdLife International 2016). Nests are always built in trees, and they favour the tallest tree in the area, growing on a steep hillside, where the bird has a clear flight path from the nest.

The Southern Ground-Hornbill is the largest hornbill species in the world and is widely distributed, occurring in north Namibia and Angola, to northern South Africa and southern Zimbabwe through to Burundi and Kenya. The Southern Ground-hornbill is listed as Vulnerable in terms of the IUCN Red List of threatened species, 2016. In South Africa, Lesotho, Namibia and Swaziland the species is listed as Endangered mainly because of the severe decline it its range. In South Africa the species range has declined by approximately 50% and species numbers have declined by 10% over the past 30 years. The species is well adapted for the terrestrial lifestyle and has a large distribution range but occurs in small densities across suitable habitats.

A full list of aves recorded within the 3325BC is provided in Table 5 with an indication of threat and protection status, likelihood of occurrence and sensitivity rating.

5. Conclusion and recommendations

The area assessed is characterised by natural indigenous thicket vegetation providing suitable conditions for a variety of faunal species. The biodiversity of the proposed tented sites is considered to be high. The proposed development is not very intrusive, and the development footprint will also be relatively small per tent (maximum 130 m2 per tent). Responsible management of environmental aspects associated with the tented facility and

supporting infrastructure during construction and operation is important to ensure minimal impact on the surrounding natural environment and biodiversity.

It is recommended that the tents be developed to fit in with surrounding area as far as possible.

The footprints of the supporting infrastructure (i.e. pipelines, parking etc.) is to be kept as small as possible.

It is recommended the tents be raised above ground and set on wooden stilts to allow passage for fauna.

It is recommended that the tents be located at a minimum distance of 32 meters from any natural watercourses.

Species listed on Schedule 1 and 2 of the PCNO and / or on the NEMBA TOPS will require permits to be issued by the DEDEAT before removal.

Search and rescue should be carried out (for each tent) just before construction of the tent commences to ensure safe removal of species of conservational concern from the development footprint. Rescued species are to be placed into similar habitat in the surrounding area of the property.

The development is to take note of any termite nests and aardvark burrows and other important microhabitats within / near the development footprint; the placement of tents should avoid these. Construction activities are not to disturb these important microhabitats.

The development is to take note of any nesting sites within / near the development footprint; the placement of tents should avoid these as far as possible.

No fauna should be intentionally harmed during construction or operation.

Strict speeding limits to be enforced to prevent collisions with fauna in the area (i.e. snakes, tortoises, antelope, dung beetles etc.)

Extra-limital species should not be introduced on the property. Populations of existing extra-limital species on the property should be monitored and managed accordingly with input from suitable specialists. Extra-limital species already on the property are recommended to be restricted to the proposed camp area.

Inspect surrounding area on ongoing basis for signs of poaching; remove any snares as and when required.

With mitigation in place, the proposed development is expected to have an overall low impact on fauna.

Table 1: Mammals recorded within 3325 BC between 2000 – 2020 (Virtual Museum of African Mammals)

Family	Scientific name	Common name	Endemic to assessment region (RSA, Lesotho, Swaziland)	Red list category, RSA, 2016	IUCN Red List 2019 (Global)	NEMBA TOPS	CITES	PNCO	RECORDED BY LANDOWNERS	Extra limital in E Cape	Likelihood of occurrence on property	Sensitivity rating
Bovidae	*Aepyceros melampus*	Impala	No	Least Concern (2016)	Least concern	Not listed	None		✓		Low	Low
Bovidae	*Alcelaphus buselaphus*	Hartebeest	No	Least Concern (2016)	Least concern	Not listed	None	**Schedule 2**	✓		Low	Low
Bovidae	*Antidorcas marsupialis*	Springbok	No	Least Concern (2016)	Least concern	Not listed	None	**Schedule 2**			Low	Low
Bovidae	*Damaliscus lunatus lunatus*	Southern African) Tsessebe	No	**Vulnerable (2016)**	Least concern	**Endangered**	None			✓	Low	Low
Bovidae	*Hippotragus niger niger*	Sable Antelope	Edge of range	**Vulnerable (2016)**	Least concern	Not listed	None			✓	Low	Low
Bovidae	*Kobus ellipsiprymnus ellipsiprymnus*	Waterbuck	No	Least Concern (2016)	Least Concern Population decreasing	Not listed	None				Low	Low
Bovidae	*Oryx gazella*	Gemsbok	No	Least Concern (2016)	Least concern	Not listed	None	**Schedule 2**			Low	Low
Bovidae	*Raphicerus campestris*	Steenbok	No	Least Concern (2016)	Least concern	Not listed	None	**Schedule 2**			Low	Low
Bovidae	*Raphicerus melanotis*	Cape Grysbok	**Yes**	Least Concern (2016)	Least concern	Not Listed	None	**Schedule 2**		✓	Medium	Low
Bovidae	*Redunca fulvorufula*	Mountain Reedbuck	Near	Least Concern (2016)	Least concern	Not listed	None	**Schedule 2**			High	Low
Bovidae	*Sylvicapra sp. Sylvicapra grimmia*	Common Duiker / Bush Duiker	No	Least Concern (2016)	Least concern	Not listed	None	**Schedule 2**	✓		Medium	Low
Bovidae	*Syncerus caffer*	African Buffalo	No	Least Concern (2008)	Near threatened	Not listed	None	**Schedule 2**			Low	Low
Bovidae	*Taurotragus oryx*	Common Eland	No	Least Concern (2016)	Least concern	Not listed	None	**Schedule 2**			Low	Low
Bovidae	*Tragelaphus scriptus*	Bushbuck	No	Least Concern	Least concern	Not listed	None	**Schedule 2**	✓		Medium	Low

Family	Scientific name	Common name	Endemic to assessment region (RSA, Lesotho, Swaziland)	Red list category, RSA, 2016	IUCN Red List 2019 (Global)	NEMBA TOPS	CITES	PNCO	RECORDED BY LANDOWNERS	Extra limital in E Cape	Likelihood of occurrence on property	Sensitivity rating
Bovidae	*Tragelaphus strepsiceros*	Greater Kudu	No	Least Concern (2016)	Least concern	Not listed	None	**Schedule 2**	✓		Medium	Low
Canidae	*Canis mesomelas*	Black-backed Jackal	No	Least Concern (2016)	Least concern	Not listed	None				High	Low
Canidae	*Otocyon megalotis*	Bat-eared Fox	No	Least Concern (2016)	Least concern	**Protected**	None				Medium	Low
Cercopithecidae	*Chlorocebus pygerythrus*	Vervet Monkey	No	Least Concern (2016)	Least concern	Not listed	Appendix II				High	Low
Cercopithecidae	*Papio ursinus*	Chacma Baboon	No	Least Concern (2016)	Least concern	Not listed	Appendix II		✓		High	Low
Elephantidae	*Loxodonta africana*	African Bush Elephant	No	Least Concern (2016)	**Vulnerable**	**Protected**	Appendix II with annotations	**Schedule 2**			Not likely	
Equidae	*Equus quagga*	Plains Zebra	No	Least Concern (2016)	Near threatened	Not listed	None				Not likely	Low
Equidae	*Equus zebra zebra*	Cape Mountain Zebra	No	Least Concern (2016)	Near threatened	**Endangered**	None	**Schedule 1**			Not likely	
Felidae	*Acinonyx jubatus*	Cheetah	No	**Vulnerable (2016)**	**Vulnerable**	**Vulnerable**	Appendix I	**Schedule 1**			Low	Low
Felidae	*Caracal caracal*	Caracal	No	Least concern (2016)	Least concern	Not listed	Appendix II		✓		Medium	Low
Felidae	*Felis nigripes*	Black-footed Cat	No	Least concern (2016)	**Vulnerable**	**Protected**	Appendix I	**Schedule 2**			Not likely	Low
Felidae	*Panthera leo*	Lion	No	Least Concern (2016)	**Vulnerable**	**Vulnerable**	Appendix II	**Schedule 2**			Not Likely	
Felidae	*Panthera pardus*	Leopard	No	**Vulnerable (2016)**	**Vulnerable**	**Vulnerable**	Appendix I	**Schedule 2**			Low	
Herpestidae	*Cynictis penicillata*	Yellow Mongoose	No	Least Concern (2016)	Least concern	Not listed	None				Medium	
Herpestidae	*Herpestes pulverulentus*	Cape Gray Mongoose	Near endemic	Least Concern (2016)	Least concern	Not listed	None				Medium	

Family	Scientific name	Common name	Endemic to assessment region (RSA, Lesotho, Swaziland)	Red list category, RSA, 2016	IUCN Red List 2019 (Global)	NEMBA TOPS	CITES	PNCO	RECORDED BY LANDOWNERS	Extra limital in E Cape	Likelihood of occurrence on property	Sensitivity rating
Herpestidae	*Suricata suricatta*	Meerkat	No	Least Concern (2016)	Least concern	Not listed	None				Low	Low
Hyaenidae	*Crocuta crocuta*	Spotted Hyaena	No	Near Threatened (2016)	Least Concern Population decreasing	**Protected**	None				Not likely	Low
Hystricidae	*Hystrix africaeaustralis*	Cape Porcupine	No	Least Concern	Least concern	Not listed	None				Medium	Low
Muridae	*Mastomys coucha*	Southern African Mastomys	No	Least Concern (2016)	Least concern	Not listed	None				Medium	Low
Orycteropodidae	*Orycteropus afer*	Aardvark	No	Least Concern (2016)	Least concern	**Protected**	None	**Schedule 2**			High	Low
Pteropodidae	*Epomophorus wahlbergi*	Wahlberg's Epauletted Fruit Bat	No	Least Concern (2016)	Least concern	Not listed	None	**Schedule 2**			Medium	Low
Rhinolophidae	*Rhinolophus capensis*	Cape Horsehshoe Bat	**Yes**	Near threatened (2016)	Least concern	Not listed	None	**Schedule 2**			Low	Low
Rhinolophidae	*Rhinolophus clivosus*	Geoffroy's Horseshoe Bat	No	Near threatened	Least concern	Not listed	None	**Schedule 2**			Low	Low
Suidae	*Phacochoerus africanus*	Common Warthog	No	Least Concern (2016)	Least concern	Not listed	None	**Schedule 2**	✓		Medium	Low
Suidae	*Potamochoerus porcus*	Red River Hog	No	Least Concern (2016)	Least concern	Not listed	None		✓		Medium	Low
Vespertilionidae	*Miniopterus natalensis*	Natal Long-fingered Bat	No	Near threatened	Least concern	Not listed	None	**Schedule 2**			Low	Low
Bovidae	Tragelaphus angasii	Nyala	No	Least Concern (2016)	Least Concern	Not listed	None		✓	✓	High	Low
Bovidae	Connochaetes taurinus	Blue wildebeest	No	Least Concern (2016)	Least concern	Not listed	None		✓		Medium	Low
Bovidae	Philantomba monticola	Blue duiker	No	**Vulnerable**	Least concern	**Vulnerable**	Appendix II		✓		High	Low

Family	Scientific name	Common name	Endemic to assessment region (RSA, Lesotho, Swaziland)	Red list category, RSA, 2016	IUCN Red List 2019 (Global)	NEMBA TOPS	CITES	PNCO	RECORDED BY LANDOWNERS	Extra limital in E Cape	Likelihood of occurrence on property	Sensitivity rating
Felidae	*Felis sp.*	Wild cats	No						✓		High	Low

Table 2: Reptiles recorded within 3325 BC (Reptile Atlas of Southern Africa)

Family	Scientific name	Common name	Red list category, RSA, 2014	IUCN Red List	NEMBA TOPS	PNCO	Likelihood of occurrence on property	Sensitivity rating
Agamidae	*Agama atra*	Southern Rock Agama	Least Concern (SARCA 2014)	Least concern			Low	Low
Chamaeleonidae	*Bradypodion ventrale*	Eastern Cape Dwarf Chameleon	Least Concern (SARCA 2014)	Least concern			High	Low
Colubridae	*Crotaphopeltis hotamboeia*	Red-lipped snake	Least Concern (SARCA 2014)	Least concern			High	Low
Colubridae	*Dispholidus typus typus*	Boomslang	Least Concern (SARCA 2014)	Least concern			High	Low
Colubridae	*Philothamnus occidentalis*	Western Natal Green Snake	Least Concern (SARCA 2014)	Least concern		Schedule 2	High	Low
Cordylidae	*Chamaesaura anguina anguina*	Cape Grass Lizard	Least Concern (SARCA 2014)	Least concern			High	Low
Cordylidae	*Cordylus cordylus*	Cape Girdled Lizard	Least Concern (SARCA 2014)	Least concern			High	Low
Cordylidae	*Karusasaurus polyzonus*	Karoo Girdled Lizard	Least Concern (SARCA 2014)	Least concern			High	Low
Cordylidae	*Pseudocordylus microlepidotus subsp. ?*	Cape Crag Lizard (subsp. ?)		Least concern			High	Low
Elapidae	*Naja nivea*	Cape Cobra	Least Concern (SARCA 2014)	Least concern			High	Low
Gekkonidae	*Goggia essexi*	Essex's Pygmy Gecko	Least Concern (SARCA 2014)	Least concern			High	Low
Gekkonidae	*Hemidactylus mabouia*	Common Tropical House Gecko	Least Concern (SARCA 2014)	Least concern			High	Low
Gekkonidae	*Pachydactylus maculatus*	Spotted Gecko	Least Concern (SARCA 2014)	Least concern			High	Low
Gekkonidae	*Pachydactylus mariquensis*	Marico Gecko	Least Concern (SARCA 2014)	Least concern			High	Low
Gerrhosauridae	*Gerrhosaurus flavigularis*	Yellow-throated Plated Lizard	Least Concern (SARCA 2014)	Least concern			High	Low

Family	Scientific name	Common name	Red list category, RSA, 2014	IUCN Red List	NEMBA TOPS	PNCO	Likelihood of occurrence on property	Sensitivity rating
Lacertidae	*Nucras lalandii*	Delalande's Sandveld Lizard	Least Concern (SARCA 2014)	Least concern			High	Low
Lacertidae	*Nucras livida*	Karoo Sandveld Lizard		Least concern			High	Low
Lacertidae	*Nucras taeniolata*	Albany Sandveld Lizard	Near Threatened (SARCA 2014)	Least concern			High	Low
Lacertidae	*Tropidosaura montana rangeri*	Ranger's Mountain Lizard		Least concern			High	Low
Lamprophiidae	*Aparallactus capensis*	Black-headed Centipede-eater	Least Concern (SARCA 2014)	Least concern			High	Low
Lamprophiidae	*Boaedon capensis*	Brown House Snake	Least Concern (SARCA 2014)	Least concern			High	Low
Lamprophiidae	*Duberria lutrix lutrix*	South African Slug-eater	Least Concern (SARCA 2014)	Least concern		Schedule 2	High	Low
Lamprophiidae	*Homoroselaps lacteus*	Spotted Harlequin Snake	Least Concern (SARCA 2014)	Least concern			High	Low
Lamprophiidae	*Lamprophis fuscus*	Yellow-bellied House Snake	Least Concern (SARCA 2014)	Least concern		Schedule 2	High	Low
Lamprophiidae	*Lycodonomorphus rufulus*	Brown Water Snake	Least Concern (SARCA 2014)	Least concern		Schedule 2	High	Low
Lamprophiidae	*Lycophidion capense capense*	Cape Wolf Snake	Least Concern (SARCA 2014)	Least concern			High	Low
Lamprophiidae	*Psammophis crucifer*	Cross-marked Grass Snake	Least Concern (SARCA 2014)	Least concern			High	Low
Lamprophiidae	*Psammophis notostictus*	Karoo Sand Snake	Least Concern (SARCA 2014)	Least concern			High	Low
Lamprophiidae	*Psammophylax rhombeatus*	Spotted Grass Snake	Least Concern (SARCA 2014)	Least concern			High	Low
Lamprophiidae	*Leptotyphlops nigricans*	Black Thread Snake	Least Concern (SARCA 2014)	Least concern			High	Low
Scincidae	*Acontias gracilicauda*	Thin-tailed Legless Skink	Least Concern (SARCA 2014)	Least concern			High	Low
Scincidae	*Acontias meleagris*	Cape Legless Skink	Least Concern (SARCA 2014)	Least concern			High	Low
Scincidae	*Acontias orientalis*	Eastern Legless Skink	Least Concern (SARCA 2014)	Least concern			High	Low
Scincidae	*Scelotes anguineus*	Algoa Dwarf Burrowing Skink	Least Concern (SARCA 2014)	Least concern			High	Low
Scincidae	*Trachylepis capensis*	Cape Skink	Least Concern (SARCA 2014)	Least concern			High	Low
Scincidae	*Trachylepis homalocephala*	Red-sided Skink	Least Concern (SARCA 2014)	Least concern			High	Low
Scincidae	*Trachylepis varia sensu lato*	Common Variable Skink Complex	Least Concern (SARCA 2014)	Least concern			High	Low
Scincidae	*Trachylepis variegata*	Variegated Skink	Least Concern (SARCA 2014)	Least concern			High	Low

Family	Scientific name	Common name	Red list category, RSA, 2014	IUCN Red List	NEMBA TOPS	PNCO	Likelihood of occurrence on property	Sensitivity rating
Testudinidae	*Chersina angulata*	Angulate Tortoise	Least Concern (SARCA 2014)	Least concern		Schedule 2	High	Low
Testudinidae	*Stigmochelys pardalis*	Leopard Tortoise	Least Concern (SARCA 2014)	Least concern	Endangered	Schedule 2	High	Low
Typhlopidae	*Rhinotyphlops lalandei*	Delalande's Beaked Blind Snake	Least Concern (SARCA 2014)	Least concern			High	Low
Varanidae	*Varanus niloticus*	Water Monitor	Least Concern (SARCA 2014)	Least concern			Low	Low
Viperidae	*Bitis arietans arietans*	Puff Adder	Least Concern (SARCA 2014)	Least concern			High	Low
Viperidae	*Causus rhombeatus*	Rhombic Night Adder	Least Concern (SARCA 2014)	Least concern			High	Low

Table 3: Amphibians recorded within 3325 BC

Family	Scientific name	Common name	Red list category, RSA,	IUCN Red List	NEMBA Protected species	PNCO	Likelihood of occurrence within development footprint	Sensitivity rating
Brevicepitidae	*Breviceps adspersus*	Bushveld Rain Frog	Least Concern	Least Concern		Schedule 2	Low	Low
Brevicepitidae	*Breviceps adspersus*	Plaintive Rain Frog	Least Concern	Least Concern		Schedule 2	Low	Low
Bufonidae	*Sclerophrys capensis*	Raucous Toad	Least Concern	Least Concern		Schedule 2	Medium	Low
Bufonidae	*Sclerophrys pardalis*	Eastern Leopard Toad	Least Concern	Least Concern		Schedule 2	Medium	Low
Hyperoliidae	*Hyperolius marmoratus*	Painted Reed Frog	Least Concern (IUCN ver 3.1, 2013)	Least Concern		Schedule 2	Low	Low
Hyperoliidae	*Kassina senegalensis*	Bubbling Kassina	Least Concern	Least Concern		Schedule 2	Low	Low
Hyperoliidae	*Semnodactylus wealii*	Rattling Frog	Least Concern	Least Concern		Schedule 2	Low	Low
Phrynobatrachidae	*Phrynobatrachus natalensis*	Snoring Puddle Frog	Least Concern	Least Concern		Schedule 2	Low	Low
Pipidae	*Xenopus laevis*	Common Platanna	Least Concern	Least Concern		Schedule 2	Low	Low
Pyxicephalidae	*Amietia delalandii*	Delalande's River Frog	Least Concern (2017)	Least Concern		Schedule 2	Low	Low
Pyxicephalidae	*Amietia fuscigula*	Cape River Frog	Least Concern (2017)	Least Concern		Schedule 2	Low	Low
Pyxicephalidae	*Cacosternum boettgeri*	Common Caco	Least Concern (2013)	Least Concern		Schedule 2	Low	Low

Family	Scientific name	Common name	Red list category, RSA,	IUCN Red List	NEMBA Protected species	PNCO	Likelihood of occurrence within development footprint	Sensitivity rating
Pyxicephalidae	*Cacosternum nanum*	Bronze Caco	Least Concern (2013)	Least Concern		Schedule 2	Low	Low
Pyxicephalidae	*Strongylopus fasciatus*	Striped Stream Frog	Least Concern	Least Concern		Schedule 2	Low	Low
Pyxicephalidae	*Strongylopus grayii*	Clicking Stream Frog	Least Concern	Least Concern		Schedule 2	Low	Low
Pyxicephalidae	*Tomopterna delalandii*	Cape Sand Frog	Least Concern	Least Concern		Schedule 2	Low	Low

Table 4: Invertebrate species of conservation concern

Class	Order	Family	Scientific name	Common name	NEMBA TOPS	PNCO	Likelihood of occurrence within development footprint	Sensitivity rating
Insecta		Scarabaeidae	*Circellium bacchus*	Cape Dung Beetle	Not listed	Schedule 1	Medium	Low
Insecta		Lucanidae	*Colophon spp - All species*	Stag beetles	Endangered	Schedule 1	No	
Udeonychophora	Euonychophora	Peripatopsidae	*Onychophora Genus Peripatopsis and Genus Opisthopatus All species*	Velvet worms	Peripatopsis alba (White Cave Velvet Worm) listed as vulnerable	Schedule 1	No	
Insecta	Lepidoptera	Lycaenidae	*Aloeides egerides* *Aloeides lutescens* *Argyrocupha malagrida malagrida* *Lepidochrysops bacchus* *Oxychaeta dicksoni* *Poecilmitis endymion* *Poecilmitis lyncurium* *Poecilmitis nigricans Aurivillius* *Poecilmitis rileyi* *Thestor dicksoni dicksoni* *Thestor kaplani* *Trimenia wallengrenii*	Butterflies		Schedule 2	*Aloeides egerides - No* *Aloeides lutescens - No* *Argyrocupha malagrida malagrida – No* *Lepidochrysops bacchus - Possible* *Oxychaeta dicksoni - No* *Poecilmitis endymion - Possible* *Poecilmitis lyncurium - Unlikely* *Poecilmitis nigricans - unlikely* *Aurivillius* *Poecilmitis rileyi - No*	
Arachnida	Araneae	Theraphosidae	*Ceratogyrus spp - All species*	Horned Baboon Spiders	Protected		Low	Low
Insecta	Coleoptera		*Graphipterus assimilis*	Velvet Ground Beetle	Protected		Low	Low

Class	Order	Family	Scientific name	Common name	NEMBA TOPS	PNCO	Likelihood of occurrence within development footprint	Sensitivity rating
Arachnida	Scorpiones		*Xadogenes spp - All species*	Flat Rock Scorpions	Protected		Medium	Low
Arachnida	Araneae		*Xarpactira spp - All species*	Common Baboon Spiders	Protected		Medium	Low
Insecta	Coleoptera		*Ichnestoma spp - All species*	Fruit Chafer Beetles	Protected		Medium	Low
Insecta	Coleoptera		*Manticora spp - All species*	Monster Tiger Beetles	Protected		Low	Low
Insecta	Coleoptera	Scarabidae	*Dromica spp - All species* *Megacephala asperata* *Megacephala regalis* *Platychile pallida* *Prothyma guttipennis*	Tiger beetles	Protected		Low	Low
Insecta	Coleoptera	Lucanidae	*Oonotus adspersus* *Oonotus interioris* *Oonotus rex* *Oonotus sericeus* *Prosopocoilus petitclerci*	Stag beetles	Protected		No	
Arachnida	Scorpiones	Hemiscorpiidae	*Opisthacanthus spp - All species*	Creeping scorpions	Protected		Medium	Low
Arachnida	Scorpiones	Scorpionidae	*Opistophthalmus spp - All species*	Burrowing scorpions	Protected		Medium	Low
Arachnida	Araneae	Theraphosidae	*Pterinochilus spp - All species*	Golden baboon spiders	Protected		Medium	Low

Table 5: Birds recorded within 3325 BC within 3320_2540 pentad (South African Bird Atlas Project 2)

Group	Common name	Genus	Species	IUCN Red List	Regional List 2015	NEMBA TOPS	PNCO	Likelihood of occurrence on property	Sensitivity rating
Apalis	Bar-throated	*Apalis*	*thoracica*	LC	LC		**Schedule 2**	Medium	Low
Apalis	Yellow-breasted	*Apalis*	*flavida*	LC	LC		**Schedule 2**	Medium	Low

Group	Common name	Genus	Species	IUCN Red List	Regional List 2015	NEMBA TOPS	PNCO	Likelihood of occurrence on property	Sensitivity rating
Barbet	Acacia Pied	*Tricholaema*	*Leucomelas*	LC	LC		**Schedule 2**	Medium	Low
Barbet	Black-collared	*Lybius*	*torquatus*	LC	LC		**Schedule 2**	Medium	Low
Batis	Cape	*Batis*	*capensis*	LC	**Near threatened**		**Schedule 2**	Medium	Low
Bishop	Southern Red	*Euplectes*	*orix*	LC	LC		**Schedule 2**	High	Low
Bokmakierie	Bokmakierie	*Telophorus*	*zeylonus*	LC	LC		**Schedule 2**	Medium	Low
Boubou	Southern	*Laniarius*	*ferrugineus*	LC	LC		**Schedule 2**	Medium	Low
Brownbul	Terrestrial	*Phyllastrephus*	*terrestris*	LC	LC		**Schedule 2**	Medium	Low
Bulbul	Cape	*Pycnonotus*	*capensis*	LC	LC			Medium	Low
Bulbul	Dark-capped	*Pycnonotus*	*tricolor*	LC	LC		**Schedule 2**	Medium	Low
Bunting	Cape	*Emberiza*	*capensis*	LC	LC		**Schedule 2**	Medium	Low
Bunting	Golden-breasted	*Emberiza*	*flaviventris*	LC	LC		**Schedule 2**	Medium	Low
Bush-shrike	Grey-headed	*Malaconotus*	*Blanchoti*	LC	LC		**Schedule 2**	Medium	Low
Bush-shrike	Olive	*Telophorus*	*olivaceus*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Bush-shrike	Orange-breasted	*Telophorus*	*sultureopectus*	LC	LC		**Schedule 2**	Medium	Low
Buzzard	Forest	*Buteo*	*trizonatus*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Buzzard	Jackal	*Buteo*	*rufofuscus*	LC	LC	Not listed	**Schedule 2**	Medium	Low

Group	Common name	Genus	Species	IUCN Red List	Regional List 2015	NEMBA TOPS	PNCO	Likelihood of occurrence on property	Sensitivity rating
Buzzard	Steppe	*Buteo*	*vulpinus*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Camaroptera	Green-backed	*Camaroptera*	*brachyura*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Canary	Black-headed	*Serinus*	*alario*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Canary	Cape	*Serinus*	*canicollis*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Canary	Yellow-fronted	*Crithagra*	*mozambicus*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Chat	Familiar	*Cercomela*	*familiaris*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Chat	Sickle-winged	*Cercomela*	*sinuata*	LC	LC		**Schedule 2**	Medium	Low
Cisticola	Grey-backed	*Cisticola*	*subruficapilla*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Cisticola	Lazy	*Cisticola*	*aberrans*	LC	LC		**Schedule 2**	Medium	Low
Cisticola	Wailing	*Cisticola*	*Iais*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Cliff-chat	Mocking	*Thamnolaea*	*cinnamomeiventris*	LC	LC		**Schedule 2**	Medium	Low
Coot	Red-knobbed	*Fulica*	*cristata*	LC (decreasing)	LC		**Schedule 2**	Medium	Low
Cormorant	Reed	*Phalacrocorax*	*africanus*	LC (decreasing)	LC		**Schedule 2**	Medium	Low
Crested-flycatcher	Blue-mantled	*Trochocercus*	*cyanomelas*	LC (decreasing)	LC	Not listed	**Schedule 2**	Medium	Low
Crow	Cape	*Corvus*	*capensis*	LC (increasing)	LC	Not listed		Medium	Low
Crow	Pied	*Corvus*	*albus*	LC	LC	Not listed		Medium	Low
Cuckoo	Black	*Cuculus*	*clamosus*	LC	LC	Not listed	**Schedule 2**	Medium	Low

Group	Common name	Genus	Species	IUCN Red List	Regional List 2015	NEMBA TOPS	PNCO	Likelihood of occurrence on property	Sensitivity rating
Cuckoo	Diderick	*Chrysococcyx*	*caprius*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Cuckoo	Jacobin	*Clamator*	*jacobinus*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Cuckoo	Klaas's	*Chrysococcyx*	*klaas*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Cuckoo	Red-chested	*Cuculus*	*solitaris*	LC	LC		**Schedule 2**	Medium	Low
Cuckoo-shrike	Black	*Campephaga*	*flava*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Dove	Laughing	*Streptopelia*	*senegalensis*	LC	LC	Not listed		Medium	Low
Dove	Red-eyed	*Streptopelia*	*semitorquata*	LC	LC	Not listed		Medium	Low
Dove	Tambourine	*Turtur*	*tympanistria*	LC	LC	Not listed		Medium	Low
Drongo	Fork-tailed	*Dicrurus*	*adsimilis*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Duck	African Black	*Anas*	*sparsa*	LC (decreasing)	LC		**Schedule 2**	Medium	Low
Duck	Yellow-billed	*Anas*	*undulata*	LC	LC			Medium	Low
Eagle	African crowned	*Stephanoaetus*	*coronatus*	LC	LC		**Schedule 2**	Medium	Low
Eagle	Booted	*Aquila*	*pennatus*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Eagle	Martial	*Polemaetus*	*bellicosus*	**Vulnerable**	**Endangered**	**Vulnerable**	**Schedule 2**	Medium	Low
Eagle-owl	Spotted	*Bubo*	*africanus*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Firefinch	African	*Lagonosticta*	*rubricata*	LC	LC		**Schedule 2**	Medium	Low
Fiscal	Common (Southern)	*Lanius*	*collaris*	LC	LC	Not listed	**Schedule 2**	Medium	Low

Group	Common name	Genus	Species	IUCN Red List	Regional List 2015	NEMBA TOPS	PNCO	Likelihood of occurrence on property	Sensitivity rating
Fish-eagle	African	*Haliaeetus*	*vocifer*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Flycatcher	African Dusky	*Muscicapa*	*adusta*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Flycatcher	Fairy	*Stenostira*	*scita*	LC	LC		**Schedule 2**	Medium	Low
Flycatcher	Fiscal	*Sigelus*	*silens*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Goose	Egyptian	*Alopochen*	*aegyptiacus*	LC	LC	Not listed		Medium	Low
Goose	Spur-winged	*Plectropterus*	*gambensis*	LC	LC	Not listed		Medium	Low
Goshawk	African	*Accipiter*	*tachiro*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Goshawk	Southern pale chanting	*Melierax*	*canonus*	LC	LC		**Schedule 2**	Medium	Low
Grassbird	Cape	*Sphenoeacus*	*afer*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Grebe	Little	*Tachybaptus*	*ruficollis*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Greenbul	Sombre	*Andropadus*	*importunus*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Ground-hornbill	Southern	*Bucorvus*	*leadbeateri*	Vulnerable			**Schedule 2**	Medium	Low
Guineafowl	Helmeted	*Numida*	*meleagris*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Heron	Black-headed	*Ardea*	*melanocephala*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Heron	Grey	*Ardea*	*cinerea*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Honeyguide	Greater	*Indicator*	*indicator*	LC	LC		**Schedule 2**	Medium	Low
Honeyguide	Lessor	*Indicator*	*minor*	LC	LC		**Schedule 2**	Medium	Low

Group	Common name	Genus	Species	IUCN Red List	Regional List 2015	NEMBA TOPS	PNCO	Likelihood of occurrence on property	Sensitivity rating
Honeyguide	Scaly-throated	*Indicator*	*variegatus*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Hoopoe	African	*Upupa*	*africana*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Hornbill	Crowned	*Tockus*	*Alboterminatus*	LC	LC		**Schedule 2**	Medium	Low
Ibis	Hadeda	*Bostrychia*	*hagedash*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Indigobird	Dusky	*Vidua*	*funerea*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Kestrel	Rock	*Falco*	*rupicolus*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Kingfisher	Brown-hooded	*Halcyon*	*albiventris*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Kingfisher	Malachite	*Alcedo*	*cristata*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Kite	Black-shouldered	*Elanus*	*caeruleus*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Lark	Rufous-naped	*Mirafra*	*africana*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Longclaw	Cape	*Macronyx*	*capensis*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Mannikin	Bronze	*Riparia*	*paludicola*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Martin	Rock	*Hirundo*	*fuligula*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Martin	Sand	*Riparia*	*riparia*	LC	LC		**Schedule 2**	Medium	Low
Masked-weaver	Southern	*Ploceus*	*velatus*	LC	LC	Not listed		Medium	Low
Moorhen	Common	*Gallinula*	*chloropus*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Mousebird	Red-faced	*Urocolius*	*indicus*	LC	LC	Not listed		Medium	Low

Group	Common name	Genus	Species	IUCN Red List	Regional List 2015	NEMBA TOPS	PNCO	Likelihood of occurrence on property	Sensitivity rating
Mousebird	Speckled	*Colius*	*striatus*	LC	LC	Not listed		Medium	Low
Neddicky	Neddicky	*Cisticola*	*fulvicapilla*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Nightjar	Fiery-necked	*Caprimulgus*	*pectoralis*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Olive-pigeon	African	*Columba*	*arquatrix*	LC	LC		**Schedule 2**	Medium	Low
Oriole	Black-headed	*Oriolus*	*larvatus*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Paradise-flycatcher	African	*Terpsiphone*	*viridis*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Pigeon	Speckled	*Columbra*	*guinea*		LC			Medium	Low
Pipit	African	*Anthus*	*cinnamomeus*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Pipit	Plain-backed	*Anthus*	*leucophrys*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Prinia	Karoo	*Prinia*	*maculosa*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Puffback	Black-backed	*Dryoscopus*	*cubla*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Raven	White-necked	*Corvus*	*albicollis*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Robin	White-starred	*Pogonocichla*	*stellata*		LC		**Schedule 2**	Medium	Low
Robin-chat	Cape	*Cossypha*	*caffra*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Robin-chat	Chorister	*Cossypha*	*dichroa*		LC		**Schedule 2**	Medium	Low
Rock-thrush	Cape	*Monticola*	*rupestris*	LC	LC		**Schedule 2**	Medium	Low
Rush-warbler	Little	*Bradypterus*	*baboecala*	LC	LC	Not listed	**Schedule 2**	Medium	Low

Group	Common name	Genus	Species	IUCN Red List	Regional List 2015	NEMBA TOPS	PNCO	Likelihood of occurrence on property	Sensitivity rating
Saw-wing	Black (Southern race)	*Psalidoprocne*	*holomelaena*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Scrub-robin	Brown	*Cercotrichas*	*signata*	LC	LC		**Schedule 2**	Medium	Low
Scrub-robin	White-browed	*Cercotrichas*	*leucophrys*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Seedeater	Streaky-headed	*Crithagra*	*gularis*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Sparrow	Cape	*Passer*	*melanurus*	LC	LC	Not listed		Medium	Low
Sparrow	House	*Passer*	*domesticus*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Sparrowhawk	Little	*Accipiter*	*minullus*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Spurfowl	Red-necked	*Pternistis*	*afer*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Starling	Black-bellied	*Lamprotornis*	*corruscus*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Starling	Cape Glossy	*Lamprotornis*	*nitens*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Starling	Common	*Sturnus*	*vulgaris*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Starling	Pied	*Spreo*	*bicolor*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Starling	Red-winged	*Onychognathus*	*morio*	LC	LC	Not listed		Medium	Low
Stonechat	African	*Saxicola*	*torquatus*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Sugarbird	Cape	*Promerops*	*cafer*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Sunbird	Amethyst	*Chalcomitra*	*amethystina*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Sunbird	Collared	*Hedydipna*	*collaris*	LC	LC	Not listed	**Schedule 2**	Medium	Low

Group	Common name	Genus	Species	IUCN Red List	Regional List 2015	NEMBA TOPS	PNCO	Likelihood of occurrence on property	Sensitivity rating
Sunbird	Greater Double-collared	*Cinnyris*	*afer*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Sunbird	Grey	*Cyanomitra*	*veroxii*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Sunbird	Malachite	*Nectarinia*	*famosa*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Sunbird	Southern Double-collared	*Cinnyris*	*chalybeus*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Swallow	Barn	*Hirundo*	*rustica*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Swallow	Greater Striped	*Hirundo*	*cucullata*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Swallow	Lesser Striped	*Hirundo*	*abyssinica*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Swallow	Pearl-breasted	*Hirundo*	*dimidiata*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Swallow	White-throated	*Hirundo*	*albigularis*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Swamp-warbler	Lesser	*Acrocephalus*	*gracilirostris*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Swift	White-rumped	*Apus*	*caffer*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Tchagra	Southern	*Tchagra*	*tchagra*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Thrush	Olive	*Turdus*	*olivaceus*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Tinkerbird	Red-fronted	*Pogoniulus*	*pusillus*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Tit	Grey	*Parus*	*afer*		LC		**Schedule 2**	Medium	Low
Tit	Southern Black	*Parus*	*niger*	LC	LC		**Schedule 2**	Medium	Low

Group	Common name	Genus	Species	IUCN Red List	Regional List 2015	NEMBA TOPS	PNCO	Likelihood of occurrence on property	Sensitivity rating
Trogon	Narina	*Apaloderma*	*narina*	LC	LC		**Schedule 2**	Medium	Low
Turaco	Knysna	*Tauraco*	*corythaix*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Turtle-dove	Cape	*Streptopelia*	*capicola*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Wagtail	Cape	*Motacilla*	*capensis*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Warbler	Willow	*Phylloscopus*	*trochilus*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Waxbill	Common	*Estrilda*	*astrild*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Waxbill	Swee	*Coccopygia*	*melanotis*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Weaver	Cape	*Ploceus*	*capensis*	LC	LC	Not listed		Medium	Low
Weaver	Dark-backed	*Ploceus*	*bicolor*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Weaver	Spectacled	*Ploceus*	*ocularis*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Weaver	Village	*Ploceus*	*cucullatus*	LC	LC		**Schedule 2**	Medium	Low
White-eye	Cape	*Zosterops*	*virens*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Whydah	Pin-tailed	*Vidua*	*macroura*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Widowbird	Red-collared	*Euplectes*	*ardens*		LC		**Schedule 2**	Medium	Low
Wood-dove	Emerald-spotted	*Turtur*	*chalcospilos*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Wood-hoopoe	Green	*Phoeniculus*	*purpureus*	LC	LC		**Schedule 2**	Medium	Low

Group	Common name	Genus	Species	IUCN Red List	Regional List 2015	NEMBA TOPS	PNCO	Likelihood of occurrence on property	Sensitivity rating
Wood-owl	African	*Strix*	*woodfordii*	LC	LC		**Schedule 2**	Medium	Low
Woodpecker	Cardinal	*Dendropicos*	*fuscescens*	LC	LC		**Schedule 2**	Medium	Low
Woodpecker	Knysna	*Campethera*	*notata*	**Near threatened**	**Near threatened**	Not listed	**Schedule 2**	Medium	Low
Woodpecker	Olive	*Dendropicos*	*griseocephalus*	LC	LC	Not listed	**Schedule 2**	Medium	Low
Wryneck	Red-throated	*Jynx*	*ruficollis*	LC	LC		**Schedule 2**	Medium	Low

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